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Porto and New York: Different Expectations for Climate Change and Wine Tourism

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Abstract: This paper examines current research into the impact of climate change on wine production and wine tourism, as well as reporting on a set of interviews with wine professionals in the Douro valley of Portugal and the Finger Lakes region of the United States. The literature review and interviews are used to assess the likely impact of climate change on wine production in each region and the expected ability of wine makers to maintain traditional wine styles and grape choices in the face of changing climate. It also explores the possible relationship between traditional wine styles and wine tourism in new and old-world regions. This paper's conclusions suggest the possibility that changes in a traditional wine style would affect wine tourism in a given region. They also conclude that climate change is already affecting traditional wine styles, particularly in Old-world regions of Europe and that wine makers may eventually be unable to sustain a wone style in any region.

Keywords: climate change, wine tourism, regional brands, wine reputation, destination choices

1. Introduction

As the Earth's climate warms, it has an increasing impact on agriculture, including wine-grape viticulture. This then causes changes to the wines made from those grapes, which can potentially impact wine tourism. This paper explores the potential impact of climate change on regional wine tourism.

It does so by first assessing the relationship between traditional wine styles/characters and the choice of tourist destinations. This is accomplished using a literature search which suggests a possible difference in impact between "old-world" European wines and regions and "new-world" regions in other areas, including Latin America, Australia/New Zealand, and the United States. This analysis is designed to answer the paper's first research question "If climate change causes changes in wine styles in various regions, how will that affect the destinations chosen by wine tourists?"

Secondly, the paper explores the ability of wine regions and wine producers to compensate for climate change impacts on their wines. This research is designed to answer the second research question posed in this paper, "How resistant are regional wine styles to climate change?" This is addressed using existing literature and a set of 13 structured interviews with winemakers and wine experts, asking them to explain their understanding of climate change impacts on wine production and their ability to compensate for those changes by adjusting their wine-making approaches. These interviews were collected from wine makers and experts in the Douro Valley region of Portugal and the Finger Lakes region of the USA.

2. Climate Change and Wine Production

Global climate change clearly affects the production of wine in many areas of the world. These changes promise to affect where and how wine is made and the characteristics of the wine that is made. This may have significant impacts on the economies of wine-producing regions and, in particular, may change global patterns of wine tourism (Mozell & Thach, 2015). Climate change impacts on wine production are expected to include changes to growing seasons, precipitation patterns, and possible changes in vineyard pests (Robinson, Griffin, & Aguirre, 2019).

2.1 Old World Impacts

There are extensive studies into Europe's old-world wine regions' emerging and potential impacts. These impacts include changes to grape and wine flavor characteristics and reductions in total production from variable weather patterns, drought, and pests (Santos, et al., 2020). Climate modelling against grape production suggests that many European regions are at or near the optimum warmth for producing their specific grape varieties and wine styles, with increased climate warming likely to force significant changes (Jones, White, Cooper, & Storchmann, 2005).

Bordeaux, one of the most widely-recognized old world regions, is already facing the possible loss of the Merlot grape from its growing options, as warming climates make it hard to produce Merlot grapes with the adequate acid balance to maintain traditional wine styles in the region (Southam, 2016).

Research in 2013 using data from 17 modelling approaches for climate change concluded that, by 2050, the planet would see a 25 – 75% decline in grape production in current wine regions and increased production in more northern and higher-altitude regions that are currently unsuitable for wine production (Hannah, et al., 2013). While van Leeuwen et al (2013) did not support all of these conclusions, noting that wine production in three old-world regions continued using traditional grapes, they did agree that considerable adaptability would be required on the part of wine makers in these regions to continue that into the future (van Leeuwen, et al., 2013). Other climate change-modelled forecasts predicted significant increase in total grape yields in the Douro Valley (Santos, Malheiro, Karremann, & Pinto, 2011).

Old-world wines and wine regions are typically characterized by legally-regulated restrictions to specific traditional grape varieties and growing/wine-making practices as part of the European Appellation Protégé system. These restrictions are based mostly on tradition and the recognition of terrior, the relationship of geographic factors such as weather/climate, soil, aspect, water access, and the growing of traditional grape varieties and the production of traditional wine styles. Climate change, forcing wine makers in these protected old-world regions to change locations, grape varieties, or other significant aspects of wine styles, may threaten this system's operation with impacts on wine tourism in these regions (Ballantyne, Terblanche, Lecat, & Chapuis, 2019). Prata-Sena et al (2018) concluded that these restrictions and traditions in the production of Port Wines from the Douro Valley were significant in the maintenance of the global brand and demand for Port wines and were a vital element in maintaining the quality and value of these wines (Prata-Sena, Castro-Carvalho, Nunes, Amaral, & Silva, 2018).

The Appellation Protégé has been adopted by the European Union to protect consumers from fraud and limit the imitation of protected products by producers in other regions. These restrictions typically include specifications of quality, typicity, production methods, and geography. As climate change shifts the regions in which particular grapes can grow or retain their typical character, the Appellation Protégé restrictions may become barriers to continued production (Barnea, 2017).

2.2 New World Impacts

There have been fewer studies of climate change impacts on new world regions, but some analysis is available.

In Canada, Shaw (2016) used 45 years of climate data to assess the impacts of climate change, concluding that climate change was allowing the growth of more *Vitis Vinifera* grape varieties and was benefiting some growers in the Ontario wine regions. These patterns also suggested a threat to the production of ice wine. This specific wine style is closely associated with these Ontario regions and represents a significant wine value and regional image element (Shaw, 2017).

Similar conclusions were reached in the Quebec wine regions of Montereigie and Estri, where *Vitis Vinifera* grape varieties have been impossible to grow, and the region has concentrated on cold-hardy hybrids. Climate change is warming the regions, reducing periods of extreme cold during the winter and allowing the growth of more *Vitis Vinifera* varieties (Jones N. K., 2012). Similar experiences were reported in the Northern New York region of the United States, which has a similar pattern of winter climate as in Quebec. (Robinson, Griffin, & Aguirre, 2019), and in the Okanagan Valley in British Columbia, suggesting that the region's climate will increasingly resemble that of areas in France and Spain (Rayne & Forest, 2016).

Interviews among farmers in Australia's McLaren Vale region demonstrated that wine producers were being forced to abandon grape production in some regions, but were finding themselves able to grow grapes in new areas, as local weather patterns shifted (Bardsley, Palazzo, & Putz, 2018). As early as 2008, a comparison of all Australia wine regions using a different climate model predicted the decline in quality and the suitability of certain grape varieties in 12 of the 62 regions studied (Hall & Jones, 2009).

The United States has significant wine-producing regions on/near both its East and West coasts. Both coastal areas are subject to climate change impacts, and both are expected to experience a decline in wine quality and total production by 2050 (White et al, 2006). Similar conclusions were found for cool-climate regions in Oregon, New York, and Michigan States, with the forecast that all four would no longer be cool-climate regions by 2050 (Schultze & Sabbatini, 2019).

Similar changes and impacts have been forecast for Chile (Hadarits, Smit, & Diaz, 2010), while other researchers found that the impact of climate change on new-world wine regions was less clearly defined than for old-world counterparts (Jones, White, Cooper, & Storchmann, 2005).

While most New-World wine-producing nations employ a version of the EU's Appellation Protégé approach to delimiting specific wine regions, these legally-described regions seldom include the same prescribed styles, grape varieties, and approved processes that are common in the European Union. As a result, the economic and branding impacts of these regions are less valuable, and wine makers producing in them have more freedom for adaptation in the face of changing climate conditions (Giacomarra, Galati, Crescimanno, & Vrontis, 2020).

3. Impact of Wine Styles and Regional Character on Wine Tourism

There is considerable research into the processes used by wine tourists to select wines and wine destinations to visit. Giacomrra et al (2020), in a comparison of Old and New-World regions and consumers, concluded that a number of factors contribute significantly to the selection of wines. Among these were the consumers' own wine knowledge and socio-demographic characteristics and specific wine labelling strategies and their ability to link a wine clearly to a region and reduce the consumer's perceived risks in making a choice (Giacomarra, Galati, Crescimanno, & Vrontis, 2020). They also noted that New and Old-World consumers may perceive geographic indicators differently.

Analysis of the value of *terrior*, tied to geography, among both New and Old-world winemakers, suggests that its value as a marketing/branding element varies significantly by region and is influenced by consumers' social environment (Ballantyne, Terblanche, Lecat, & Chapuis, 2019). Australian wine buyers were found to demonstrate a strong relationship between general wine knowledge and the selection of wines by region, as well as on their choices as wine tourists (Famularo, Bruwer, & Li, 2010).

Wine consumers in California, USA, were found to value wine brand and grape variety over region of origin regarding New World wines (Johnson & Bruwer, 2007). Wine regions' importance in decisions about wine selection increased significantly as consumers' general wine knowledge increased (Atkin & Johnson, 2010). In 2015, Chinese consumers were found to be heavily influenced by regional origin in their selection of wines, with origin being either the first or second most important element in the choice (Williamson, Lockshin, & Loose, 2016). The difference in use of region in selecting wines among buyers with differing levels of wine expertise was echoed by surveys of Australian wine experts, who placed region as being of much higher importance in wine selection than did lay consumers (Nallaperuma, Bandyopadhyay, & Lockshin, 2017).

Research in the Tuscany region of Italy demonstrated a relationship between wine tourism levels and both landscape and wine quality of the region. Modelled predictions of the future impact of climate change led to forecasts of a decline in tourism flows to this old-world region as both wine quality and landscape was affected (Nunes & Loureiro, 2016).

Clearly, region of origin is important in consumers' selection of wines, especially from the old-world areas and among consumers with higher general wine knowledge levels. However, the role that wines from specific regions play in tourists' selection of wine tourism destinations is much less clear. Brown and Getz (2005) concluded that Canadian wine tourists were heavily influenced by preferences for wines for specific regions in their decisions to visit those regions as wine tourists. These decisions, however, were also influenced by several other factors such as distance and different perceptions of the regions (Brown & Getz, 2005). Similar results were found among visitors to wineries in Aragon, Spain, who reported various factors as influencing their destination decision, including a preference for the wines the region is known for (Marzo-Navarro & Pedraja-Iglesias, 2009).

Wine tourists in Napa Valley, California, were influenced heavily by both the region's brand image and the awareness of its production of specific wine styles and grape varieties (Singh & Hsiung, 2016). Other researchers reported similar results in the importance of regional brands and associations with specific wine styles to their selection as a destination by wine tourists (Madeira, Correia, & Filipe, 2019). Surveys of New-World wine tourists identified additional regional branding elements and the "winescape" beyond the wines themselves (Bruwer & Lesschaeve, 2012) (Pratt & Sparks, 2014).

This research generally supports the conclusion that wine tourists' wine preferences can be expected to have a significant, although perhaps not dominant, influence on their selection of specific wine destinations. It also suggests that New and Old-World regions and their visitors may place differing levels of importance on wine region brands and the association of specific wine styles and grape varieties to the region's significance as a wine tourism destination. The perceived value of a region on the selection of tourism destination and wine for consumption appears to be consistently influenced by consumers' level of wine knowledge.

This supports a prediction that changes in wine styles or grape varieties will have potentially significant impacts on wine tourism levels and nature in such a region. As climate change affects wine production, it will have corresponding implications for wine tourism.

4. New and Old-World Regions: The Comparison of New York's Finger Lakes and Portugal's Douro Valley Regions

This paper compares the experiences and profiles of two regions to illustrate the differences and similarities in expected tourism impact for new and Old-World wine regions. The Finger Lakes region in upstate New York State, USA, is a cool climate New-World region with emerging brand recognition and an expanding wine tourism industry. The region is located inside three Finger Lakes American Viticultural Areas (AVA) that legally define wines in the region. The Finger Lakes produces primarily European Vitis Vinifera whites and some reds and several native North American varieties and hybrids. Its climate is most commonly compared to that of Germany, and Riesling is its most popular grape variety (Finger Lakes Wine, 2017).

The Douro Valley in northern Portugal is a globally-famous Old-World wine region, best known for Port wine production. The region has been producing wines since Roman times and has been a producer and exporter of Port wines since 1678. The area is home to over 80 grape varieties that can be used to make Port wine, but only 30 are recommended (Livesey, 2015). The region has a continental climate with warm, dry summers and cool wetter winters. Wines are produced within the Douro Denominação de Origem Controlada (DOC), which is part of the European Union Appellation Protege system and is generally recognized as the oldest legally designated wine region in the world.

5. Comparison of Interview Results for Both Regions

The Douro Valley and Finger Lakes wine regions are both defined by legal appellations, but the Finger Lakes AVAs carry no restrictions on wine-making, or grape growing approaches, grape varieties, or wine styles. The Douro Valley DOC restricts grape variety selection, limits practices such as irrigation, and prescribes specific wine styles and wine-making processes in many cases.

A set of five interview questions for winemakers were developed, based on open-ended initial interviews with four winemakers in the Finger Lakes and Douro Valley regions. The initial four discussions were used to identify key issues and strategies that all winemakers would understand as regards climate change, and to identify specific questions and follow-ups that would produce useful and consistent results.

The questions were assembled into structured interviews which were administered to 6 wine professionals in the Douro Valley and 7 in the Finger Lakes. Douro Valley interviews were conducted in Portuguese by research assistants from Universidade Portucalense Infante D. Henrique in Porto, Portugal. Finger Lakes interviews were conducted in English by research assistants from the State University of New York, USA. Interviewees were selected randomly from lists of wineries in each region.

5.1 How aware are you of the potential impacts of global climate change on your winemaking?

5.1.1 Douro Valley Responses

All respondents from the Douro Valley were aware of the impacts of climate change on winemaking activities and expected these impacts to continue and possibly increase in the future, although there was some difference of opinion about the real severity of current or possible future impacts. These conclusions were driven by both personal experience with weather patterns in the region and by professional education and exposure to winemaking literature.

5.1.2 Finger Lakes Responses

All respondents in the Finger Lakes were aware of climate change impacts on their wine making and expected these impacts to continue and possibly worsen in the future. This awareness came from both personal experiences making wines in the region as well as professional education and exposure to winemaking literature.

5.2 What are the impacts you expect? When do you expect these to occur? (Have they already begun to occur?)

5.2.1 Douro Valley Responses

The most consistent changes noted were the earlier ripening of the grapes producing wines of higher alcohol or sugar. This was generally described in positive terms, as allowing them to produce wines that were consistently of higher quality. The second most common change involved fluctuations in water availability and water content of soils. This was seen as a negative in wine production and the quality of wines produced, especially in variability of acid levels and ripeness.

5.2.2 Finger Lakes Responses

The most consistent changes noted were shifts in rain and weather patterns, to include both an increase in extreme weather patterns and more temperature volatility. Winters were reported as becoming more severe, with more intense cold periods, and with more rainfall during late and early winter seasons. Summers were reported as warming, but drier in general with less rain in many years. The results of these changes were generally seen as negatives on wine production, requiring responses in the cellar as well as changes in the vineyard. There was some advantage seen in earlier harvests and ripening of grapes under warmer conditions, but this is offset by the effects of a warmer season in reducing acid levels in the wine.

5.3 How confident are you in your ability to compensate for these expected changes? Will you be able to make the same wines in the future?

5.3.1 Douro Valley Responses

All respondents recognized the need to adapt and address the issues of climate change but were generally confident in their ability to do so, while maintaining traditional wine styles at high quality levels. There was some concern that the need to make changes in both grape-growing and wine-making would require expensive investments that could raise the cost of wines and be unaffordable for some wineries. Future changes were expected to involve further warming as well as increasingly irregular rainfall and the possible increase in pests.

5.3.2 Finger Lakes Responses

All respondents recognized the need to adapt and address the issues of climate change but were generally confident in their ability to do so, while maintaining traditional wine styles at high quality levels.

Future changes were expected to include the number of severe weather events increasing, with vineyards facing flooding, increased frequency of summer hail events, and possible frost and drought. There was concern that warmer seasons would move the region away from a classic cool climate, to something that would not support the region’s flagship Riesling grapes. Irrigation was seen as increasingly necessary but the option of moving to higher altitudes was not seen as feasible as those plots would be cooler in the summer, but even more exposed to severe winter cold, rendering them unusable. Drainage and tillage of vineyards was seen as an important response to flooding. There was some concern that the costs of these responses would require higher prices for the wines, making them harder to sell.

5.4 What are some of the actions you can take or plan to take to compensate for the impacts of climate change?

5.4.1 Douro Valley Responses

The most common anticipated responses were changes in vineyard operations, the need for irrigation (One respondent noted that this was problematic in the region as rules within the DOC restricted the use of this practice), and the adoption of new grape clones and rootstock. Some respondents noted the possible relocation of some vineyards to higher-altitude plots with less impact from climate change.

5.4.2 Finger Lakes Responses

The most common anticipated responses included a shift away from Vitis Vinifera grapes in some cases and the growth of more hybrid grapes that included crosses with North American native grapes.

5.5 Do you see climate change as an important issue for winemaking in your region/country?

All respondents in both the Douro Valley and Finger Lakes region agreed that climate change was an important issue for them.

5.5.1 Comparison Analysis

Respondents in both regions shared an awareness and understanding of the impacts of climate change and both groups recognized it as a significant threat that would require both money and expertise to combat. They each saw increasing impacts from changes in rainfall as well as rising temperatures that would have an impact on their ability to make wines balanced in acid and retaining freshness and moderate alcohol.

They differed in their specific expectations of weather changes. The Douro Valley respondents were more focused on shifts in rainfall and warmer temperatures, while the Finger lakes respondents were more concerned with cold weather issues such as hail, early frost, and extreme cold periods in the winter. The Douro Valley does not have the cold weather extremes found in the Finger Lakes, so these concerns are different.

One of the most significant differences was in the operating restrictions faced by Douro Valley wineries, for things like irrigation and the addition of acid or sugar in the wine-making process. These were seen as rules that would need to be modified in the future to allow winemakers the flexibility needed to adapt to climate change. Winemakers in the Finger Lakes had no such concerns, as they faced no legal restrictions on how wines could be made or what grapes could be used in those wines.

Douro Valley respondents typically produce wines blended from a large variety of permitted grapes and several saw their ability to change blends as being a valuable tool in the response to climate change. Finger Lakes respondents also recognized their ability to change blends but, as they produce a large number of single varietal wines, they could not use this tool in all cases.

6. Continuing Research Recommendations

These interviews were conducted as a preliminary qualitative assessment of awareness of climate change and general expectations on the part of new and old-world winemakers. The next phase of the research will include a survey of winemakers in both regions to test the broader applicability of these conclusions and provide a model that can be extended to other wine-making regions of the world.

In parallel, a similar research effort will be launched to better understand the likely impact of climate change impacts on wine consumers and wine tourists. The literature suggests that changes in wine styles in destination regions could have a strong impact on wine tourism, but further work is required to assess and quantify this expected result.

7. Conclusions

This paper attempted to answer two specific research questions.

1. "If climate change causes changes in wine styles in various regions, how will that affect the destinations chosen by wine tourists?" A review of existing literature showed distinct relationships between reputations and wine styles and tourists' selection of destination. This research suggests but does not specifically demonstrate that a change in wine styles in a region would produce a change in wine tourism in the region.
2. "How resistant are regional wine styles to climate change?" Both reviewed literature and the interviews with wine professionals in Portugal and the United States indicate that winemakers have some ability to compensate for climate change in maintaining a specific wine style, but there are limits to this ability. As climate change progresses, many wine regions are expected to see changes in traditional wine styles.

While many details remain unexplored, it appears clear that wine regions can expect emerging changes in levels and sources of wine tourism as a result of climate change impacts on wine production.

References

Anon., 2017. *Finger Lakes Wine.* [Online] Available at: https://www.wine-searcher.com/regions-finger+lakes [Accessed December 2020].

Anon., n.d. s.l., s.n.

Atkin, T. & Johnson, R., 2010. Appellation as an indicator of quality. *International Journal of Wine Business Research,* 22(1), pp. 42-61.

Ballantyne, D., Terblanche, N. S., Lecat, B. & Chapuis, C., 2019. Old world and new world wine concepts of terroir and wine: perspectives of three renowned non- French wine makers. *Journal of Wine Research,* April, 30(2), pp. 122-143.

Bardsley, D. K., Palazzo, E. & Putz, M., 2018. Regional path dependence and climate change adaptation: A case study from the McLaren Vale, South Australia. *Journal of Rural Studies,* August, Issue 63, pp. 24 - 33.

Barnea, R., 2017. Appellations and adaptations: Geographical indication, viticulture, and climate change. *Washington International Law Journal,* 26(3), pp. 605 - 634.

Brown, G. & Getz, D., 2005. Linking wine preferences to the choice of wine tourism destinations. *Journal of Travel Research,* February, Volume 43, pp. 266-276.

Bruwer, J. & Lesschaeve, I., 2012. Image perception and antecedents: Conceptualization of a winescape framework. *Journal of Travel & Tourism Marketing,* 29(7), pp. 611-628.

Famularo, B., Bruwer, J. & Li, E., 2010. Region of origin as choice factor: wine knowledge and wine tourism involvement influence. *International Journal of Wine Business Research,* 22(4), pp. 362-385.

Giacomarra, M., Galati, A., Crescimanno, M. & Vrontis, D., 2020. Geographical cues: evidences from New and Old World countries' wine consumers. *British Food Journal,* 122(4), pp. 1252-1267.

Hadarits, M., Smit, B. & Diaz, H., 2010. Adaptation in viticulture: A case study of producers in the Maule region of Chile. *Journal of Wine Research,* 21(2-3), pp. 167-178.

Hall, A. & Jones, G. V., 2009. Effect of potential atmospheric warming on temperature-based indices describing Australian winegrape growing conditions. *Austlaian Journal of Grape and Wine Research,* Volume 15, pp. 97-119.

Hannah, L. et al., 2013. Climate change, wine and conservation. *Proceedings of the National Academy of Science of the United States of America,* April, 10(17), pp. 6907 - 6912.

Johnson, R. & Bruwer, J., 2007. Regional brand image and perceived wine quality: the consumer perspective. *International Journal of Wine Business Research,* 19(4), pp. 276-297.

Jones, G. V., White, M. A., Cooper, O. R. & Storchmann, K., 2005. Climate change and global wine quality. *Climatic Change,* 22 March, Issue 73, pp. 319-343.

Jones, N. K., 2012. The influence of recent climate change on wine regions in Quebec, Canada. *Journal of Wine Research,* July, 23(2), pp. 103 - 113.

Livesey, T., 2015. *A 3 Minute History of Port Wine.* [Online] Available at: https://www.winerist.com/magazine/around-the-world/a-3-minute-history-of-port-wine [Accessed December 2020].

Madeira, A., Correia, A. & Filipe, J. A., 2019. Modelling wine tourism experiences. *Anatolia: An International Journal of Tourism and Hospitality Research,* August, 30(4), pp. 513-529.

Marzo-Navarro, M. & Pedraja-Iglesias, M., 2009. Profile of a wine tourist and the correspondence between destination and preferred wine: A study in Aragon, Spain. *Journal of Travel & Tourism Marketing,* Volume 26, pp. 670-687.

Mozell, M. & Thach, L., 2015. The impact of climate change on the global wine industry: Challenges and solutions. *Wine Economics and Policy,* January, Issue 3, pp. 81 - 89.

Nallaperuma, K., Bandyopadhyay, A. & Lockshin, L., 2017. A comparative analysis of experts' and consumers' perceptions of regionality in Australian wine purchase decisions. *Journal of Wine Research,* 28(3), pp. 194-215.

Nunes, P. A. L. D. & Loureiro, M. L., 2016. Economic valuation of climate-change-induced vinery landscape impacts on tourism flows in Tuscany. *Agricultural Economics,* Issue 47, pp. 365-374.

Prata-Sena, M. et al., 2018. The terroir of Port wine: Two hundred and sixty years of history. *Food Chemistry,* Issue 257, pp. 388-398.

Pratt, M. A. & Sparks, B., 2014. Predicting wine tourism intention: Destination image and self-congruity. *Journal of Travel & Tourism Marketing,* 15 May, 31(4), pp. 443-460.

Rayne, S. & Forest, K., 2016. Rapidly changing climatic conditions for grape growing in the Okanagan Valley region of Britsih Columbia, Canada. *Science of the Total Environment,* June, Volume 556, pp. 169 - 178.

Robinson, D., Griffin, P. & Aguirre, C., 2019. *Global climate change inlfuences wine production and tourism in northern New York.* Porto, Portugal, Academic Conferences and Publishing International Limited ACIPL, pp. 246 - 255.

Santos, J. A., Malheiro, A. C., Karremann, M. K. & Pinto, J. G., 2011. Statistical modelling of grapevine yield in the Port Wine region under present and future climate conditions. *International Journal of Biometeorology,* Issue 55, pp. 119-131.

Santos, J. et al., 2020. A review of the potential climate change impacts and adaptation options for European viticulture. *Applied Sciences,* 29 April, Issue 10, p. 3092.

Schultze, S. R. & Sabbatini, P., 2019. Implications of a climate-changed atmosphere on cool-climate viticulture. *Journal of Applied Meteorology and Climatology,* May, Volume 58, pp. 1141-1153.

Shaw, T. B., 2017. Climate change and the evolution of the Ontario cool climate wine regions in Canada. *Journal of Wine Research,* 28(1), pp. 13 - 45.

Singh, N. & Hsiung, Y., 2016. Exploring critical success factors for Napa's wine tourism industry from a demand perspective. *Anatolia: An International Journal of Tourism and Hospitality Research,* 20 April, 27(4), pp. 433-443.

Southam, H., 2016. Saving Bordeaux. *Geographical Magazine*, June, pp. 48 - 52.

van Leeuwen, C. et al., 2013. Why climate change will not dramatically decrease viticultural suitability in main wine-producing areas by 2050. *Proceedings of The Academy of Science of the United States of America,* August.17(10).

White, M. A. et al., 2006. Rxtreme heat reduces and shifts United States premium wine production in the 21st century. *Proceedings of the National Academy of Sciences of the United States of America,* 25 July, 103(30), pp. 11217-11222.

Williamson, P. O., Lockshin, L. & Loose, S. M., 2016. Influencing consumer choice: Short and medium term effect of country of origin information on wine choice. *Food Quality and Preference,* 24 February, Volume 51, pp. 89-99.