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# The impact of climate change on Ontario's wine regions



## Background on the research

Ontario's wine appellations comprise the Niagara Peninsula and the adjacent regions of Lake Erie North Shore, Pelee Island and Prince Edward County. Although cold winters are the norm for these regions, global warming threatens the stability of wine production. On one hand, our wine regions may benefit from a warmer climate that could extend the growing season and moderate the severity of winter temperatures, allowing the production of cold-sensitive varieties and the expansion of the industry into new areas. On the other hand, climate change could contribute to an increase in the variability of temperature during the dormant winter months with extended thaws followed by extremes in cold weather events, which could actually increase winter damage of grapevines and reduce productivity. In addition, production of internationally renowned icewines could be jeopardized by unpredictably warmer spells during the first half of winter when frozen grapes are typically harvested after having experienced a number of freeze-thaw cycles. This research will determine how the climate of these regions will evolve over the next 30 years in order to develop adaptation strategies related to climatically suitable grape varieties and management practices so as to reduce risks and optimize the growing conditions.

## Results to date

Preliminary analysis of growing season conditions (average growing season temperature, frost-free days, growing degree days, precipitation, and diurnal temperature) and the occurrences of winter freezing temperatures less than  $-20^{\circ}\text{C}$  for the 1970 to 2010 period showed a gradual change in the climate of the wine regions. For example, an increasing trend is noted in the total growing degree days, while a declining trend is observed for extreme damaging freezing temperatures. A common characteristic to all the trends is the high degree of inter-annual variability noted especially in the period beginning in the 1990s.

## Application of findings

This project will develop a prototype expert climate system to enable grape growers to adapt suitable vineyard management practices and grape varieties to projected changes in the regional climates of Ontario's main wine appellations. This will be an invaluable tool for growers when planning new vineyards, choosing suitable grape varieties and developing freeze protection strategies.

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# Potential use of weather contracts in viticulture



## Background on the research

Weather-related risks have been estimated to affect up to 30% of gross domestic product in the industrialized world and are predicted to increase with climate change. Weather derivatives are relatively new financial contracts in the form of options, swaps or futures that can provide opportunities to hedge or mitigate weather-related risk in many sectors of the economy, including viticulture. These contracts differ from weather insurance in several ways and are somewhat easier to use. Many weather-related risks influence viticulture and our research focuses on the design, pricing and use of weather contracts to mitigate the financial risks for grape producers in the Niagara region and other areas worldwide.

## Results to date

Our research projects have examined the design, pricing and use of weather contracts to mitigate the financial risks of: cold winter temperature resulting in injury to grapevines; suboptimal temperatures during the growing season; excessive rainfall during the harvest period; and warm winter temperatures that can inhibit the harvesting of Icewine grapes. In addition to exploring the value in using weather contracts for viticulture, our research has resulted in an examination of the behavior of several weather variables over time in the Niagara region. The results of this research appear to indicate some change in seasonal weather conditions in the Niagara region since the early 1990s, possibly due to climate change. Although some evidence of warming conditions is apparent there is also clear evidence of increased volatility of weather. This increased uncertainty of seasonal weather conditions adds to the potential value of using weather contracts in hedging the associated financial risks.

## Application of findings

Our research indicates that weather contracts may prove to be a valuable tool in mitigating the financial risks of grape production due to uncertain weather conditions. The findings also indicate that the volatility of weather-related risks critical to viticulture in the Niagara region appear to have increased in more recent years.

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