

**Climate Change and Viticulture**  
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**Vineyard Views**  
**By Cliff Ohmart**

When a former Vice President (Al Gore) wins an Oscar for a movie documentary on climate change (*An Inconvenient Truth*) and the same topic is also the cover story in *Sports Illustrated* within the same month (week of March 12) it is clear the topic has gone mainstream. I think this is a good thing given that climate change has to be one of the biggest, if not the biggest challenge facing humanity over the next century or more. The wine industry, in its usual proactive approach to things, is putting the topic front and center at venues such as the Unified Wine and Grape Symposium. I am not a climatologist so I do not have any new information to add to the conversation. However, I would like to present some observations I have made while listening to some of the things people connected to viticulture are saying about it. In doing so I hope I do not give the impression I disagree with the reality of climate change/global warming. However, as with many disturbing topics, there are constructive ways of discussing things and other ways that are not that helpful.

It seems that many people have come to the realization that the world is experiencing climate change. We have seen photo records of dramatically shrinking glaciers, have heard news stories about massive ice sheets breaking away from the polar ice fields, and read reports about the permafrost in Alaska melting in some places. One can still debate whether the short term variations in the weather are 'normal' or due to climate change but one cannot deny the fact that atmospheric CO<sub>2</sub> has increased dramatically; 40% since the industrial revolution and most of it since 1945. The physical principles of atmospheric warming as a result of an increase in CO<sub>2</sub> are simple and well understood. While there are still many that will debate the details and the magnitude of climate change, fewer and fewer people are denying it outright.

A study by White et. al. 2006 entitled "Extreme heat reduces and shifts United States premium wine production in the 21<sup>st</sup> century" has captured the wine industry's attention<sup>1</sup>. Using detailed analyses of past weather data, a high-resolution regional climate model, and assumptions about what conditions are necessary to produce high quality wine, the authors predicted that the premium winegrape production area could shrink by up to 81% by the late 21<sup>st</sup> century. Dr. Greg Jones, a geographer at Southern Oregon University and one of the authors of the study, has helped bring the study to the attention of many by appearing as an invited speaker at several winegrape meetings around the US in the last 2 years. His presentation is very provocative and, needless to say, has whipped some winegrowers into a frenzy.

I have been lucky enough to have heard Dr. Jones speak at several locations in the US and I find the reaction by some of the audience fascinating. Some growers from cooler climates smugly ask me "So what are you people in Lodi going to be growing 30 years

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<sup>1</sup> Available at <http://www.pnas.org/cgi/content/full/103/30/11217>

from now?" They say it in a superior yet sympathetic way like they were smart enough to turn down a ticket on the Titanic and felt bad that I had one and was already going down with the ship. On the other hand some growers in warmer growing regions say things like "Twenty years ago the University told me I could not grow these varieties in this hot climate but I sure showed them! This global warming thing is no different." In this case the grower talks sort of nervously, like something is bearing down on them. In my view both scenarios indicate that many growers are realizing that climate change is very serious and they are processing this realization by expressing relief on the one hand or denial on the other. Both of which are very natural and understandable given the seriousness of the situation.

The effects of climate change are going to be very complex, some very dramatic and others being very subtle. Because of its seriousness we of course want to do our best to predict what will happen in our vineyards so we can plan ahead. I think there are at least two ways to do this, one is to take a little bit of data and combine it with hyperbole to make gloom and doom predictions. The other is to be more conservative in one's approach but not to the level of being in denial. I will give a recent example to illustrate why we all need to be careful when we read or hear experts express their predictions about the effects of climate change in our vineyards.

A presentation was made at the January Unified Wine & Grape Symposium's session on climate change hypothesizing what might happen to pest populations as a result of climate change. According to the speaker, one of the ways scientists have tried to predict the effects of climate change is to grow plants at elevated levels of CO<sub>2</sub>. One result was that the concentration of nitrogen in plant foliage declined. He reported that research has shown if you lower nitrogen concentrations in foliage, insects have to eat more to reach maturity and therefore one of the outcomes of climate change might be that there could be a significant increase in foliage being consumed by insects.

This seems very logical and sounds ominous. However, there are at least two problems with this scenario. First, and probably most importantly, we do not have any major vineyard pests in California that chew up grape leaves. Our major arthropod pests, like are leafhoppers, sharpshooters, and mealy bugs have sucking mouthparts and feed on plant sap, or are spider mites which do not chew on leaves either. Nothing was said about how elevated levels of CO<sub>2</sub> affect plant sap. Secondly, I have actually done research on the relationship between nitrogen in leaves and certain leaf-feeding beetles. I found that if the level of nitrogen was above a minimum threshold, fluctuations in leaf nitrogen concentrations did not affect how much foliage they ate. Moreover, if nitrogen concentrations in foliage got low enough the insect ate more but also took a longer time to mature. One could hypothesize that this increased development time increases their probability of getting eaten by a natural enemy and their mortality could increase thereby reducing their population. The take home message is that simple explanations are great but over simplification can lead to the wrong conclusions if one does not know the whole story, which we don't in this case.

The presenter then went on to talk about a bark beetle that is attacking and killing pine trees in the mountains in southern California. I could tell from the scenario being described the insect being discussed was a species called the mountain pine beetle. The presenter reported that recent drought has made the pine trees susceptible to being attacked and killed by the bark beetle resulting in thousands of acres of dead trees. The implication being that climate change is going to result in many more pine forests becoming susceptible to this insect. Moreover, he reported that it appears mountain pine beetle is expanding its range due to increased temperatures and described a scenario where this insect was moving into northwest Canada, could end up infesting the pine forests across Canada, attack the pine forests in the northeastern US and eventually make their way to the pine forest in the southeastern US where they could cause great devastation. Thus we are presented with another pretty grim scenario due to climate change.

The reality is not as simple as this, however. First, throughout recorded history mountain pine beetle populations have periodically gone into huge outbreaks where tens of thousands of acres of forest have been attacked and killed. Forest entomologists have hypothesized that these outbreaks were due to drought, over-stocked stands, over-mature trees, or a combination of these factors. The bottom line is large mountain pine beetle outbreaks are not new.

The scenario I had the most problem with, however, was the idea that because of its expanded range, mountain pine beetle was going to circle the North American continent and end up killing pine trees in southeastern US. There are at least two problems with this. First, the mountain pine beetle does not attack every kind of pine tree but, like other bark beetle species, has a limited host range. There is nothing to suggest it can successfully attack all of the species of pine it encounters in its march across Canada and down into the eastern US. The second thing is that if mountain pine beetle ever does get to the pine forests of the southeastern US it will have to out compete probably the most aggressive pine bark beetle in North America, the southern pine beetle. Historically, southern pine beetle has killed huge areas of southern pines and doesn't really need the help of mountain pine beetle. Again, the take home message is the situation is much more complicated than the speaker presented. It is very difficult if not impossible to try at this point in time to predict what pests will do in vineyards as a result of climate change.

So what can a winegrape grower do about climate change? When it comes to day to day activities in a vineyard I cannot think of anything specific a grower can do to deal with climate change other than what one already does to be a sustainable winegrower. For example, conserve water, grow cover crops in and around the vineyard which sequesters carbon, till the soil as little as possible which reduces soil respiration and release of CO<sub>2</sub>, if pesticides are used choose ones with little or no volatile organic compound components (e.g. no emulsifiable concentrates), and drive equipment through the vineyard as little as possible to consume less fuel. If you are contemplating replanting a vineyard it would be worthwhile to talk to your local farm advisor or a consultant about what varieties might do best on the site given that temperatures may rise over the next 20 to 30 years. And

finally, let's all try to be critical thinkers when hearing or reading predictions of what might happen in vineyards due to climate change.