

# Preface

Climate change is a reality to which mankind must respond urgently in many sectors. However, current political initiatives on a global scale are not sufficient for a significant change to protect the climate and support sustainability. We as individuals have only limited options (but yes, we can make a contribution), and in a larger context, infrastructural, organizational and legal changes are necessary to move towards a low-carbon lifestyle to avoid continuous warming on the planet. Many initiatives to reduce carbon emissions are doomed to fail or cannot achieve the goals set as long as at the same time policies on a global scale subsidize fossil energy use with approximately USD 1 trillion per year! The questions of renewable energy use, sustainable building construction or water conservation and access to water are pertinent to the entire global population and it becomes more and more clear how dependent humans are on nature and weather (and on a longer timescale, climate).

Of all sectors that need to implement changes, agriculture is one of the most important ones because it is the basis for food production. Climate is a decisive factor for the cultivation of agricultural crops, from the geographical suitability to the effects on yield and quality. Throughout human history, these strong ties determined the cultural and economic development of regions, created local identities and have influenced migration and settlements. In the field of agriculture, these connections have their most intense expressions in the production of grapes and wine. Grapevines have been cultivated for several thousand years and during this long history specific growing regions were established, whose climatic conditions played a decisive role in the formation of specific wine characteristics from certain varieties. Over time, climate parameters (such as temperature) were used to delimit the boundaries of wine regions and to develop legal frameworks that are still present in the current definition of wine regions throughout the European Union for example. The "European experience" has been used as a model, in that climatic indices of different European wine regions were applied to non-European regions to determine general suitability and the choice of cultivars.

In the context of climate change, agriculture and therefore also viticulture are also contributing to greenhouse gas emissions and environmental pollution through cultivation practices but there is a potential for mitigation because soils can have substantial carbon storage capacities. At the same time it is also important to recognize that the grape and wine industry needs to reduce its environmental footprint well beyond mere field cultivation practices, including processing, packaging, logistics and many more areas.

The French grape and wine industry is unique among all global wine industries because of its economic value, the social impact, the tight regulations, the diversity of meso-climatical (regional) conditions, its terroir-based production idea, regional

specifications with respect to varietal use, cultural methods and product type conferring regional and local identities with a long history. Preserving this closely intertwined system in a changing climate under rapidly changing environmental, social and economic conditions is an enormous challenge. Contrary to previously managed crises such as phylloxera or the introduction of fungal diseases (powdery and downy mildew), where causal agents could be relatively fast identified and responded to, the current challenge (i.e. climate change) is global, occurs relatively slow (timescale of decades or longer), is for many not immediately evident (despite more and more signs of acceleration) and will develop most of its impact in the “distant uncertain” future. This makes it the more challenging to convince the entire industry including all stakeholders and the consumers, that an immediate reaction is required. And reacting now is of larger importance for the grape and wine industry than for other agricultural sectors because of the longevity of plantations, thus largely defining a product for 2050–2070 and may be beyond, by planting now.

Adaptation has such a regional, varied, social and economic diversity, as well as an array of institutional and regulatory (thus political) facets which need to be addressed to devise something like a national strategy including all stakeholders which comprises to some extent even the general public (like in grape-producing areas).

The current compilation from the LACCAVE initiative (it is more than a project) with different climatic analyses, definitions of regional environmental limitations and characterization of specific regional conditions, plant genetic, physiological and cultural systems adaptation studies, identification of disease threats, oenological responses to the observed and expected changes, consumer expectations, perceived socioeconomic consequences in different regions and the formulation of adaptation measures on different levels in the regional production chains including members of the industry and around is as unique as the French viti-vinicultural system.

This collection of initiatives around one large topic is special because it includes bidirectional knowledge transfer from science to the industry and back, which is very important to secure acceptance of results. LACCAVE is a unique and very comprehensive “pilot study” and in many ways can become a role model for grape- and wine-producing areas around the world in the methodological array of tools used, from climate and physiological models (natural sciences) to behavioural models and “Climathons” (socio-economic sciences) to educational concepts. It is an example for how science in all dimensions can act together with authorities (local, regional, national), industry members and local populations to come up with a coherent plan for the future. And of course, the process is not finished yet.

System transformation to form the basis of resilience of an entire industry towards future environmental conditions is a task which needs to include all the facets of human anxiety and innovation. “Will viticultural areas have to move outside of their current boundaries (nomads)?”, “should we change anything at all (being conservative)?”, “let’s be innovative”, to “liberate the system completely (which would be equal to destroying the current “French connective system”)”. LACCAVE succeeded to devise a common strategy in a “democratic” system.

The goal is not to adapt and survive for a certain time with a traditional product for a certain price. The goal is to show ways for a long-term survival including concepts such as “agroecology”, soil conservation, disease tolerant varieties, innovative water and energy management, etc. and, most importantly, implement the outlined strategies and solutions into educational formats at all levels. Because if we are not able to plant the need to change and the necessary tools to achieve change in the heads of the next generations, we will not succeed in managing the climate crises.

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