



Hotter and drier conditions in the near future (2010-2035) might paradoxically improve the general adaptive capacity of a viticultural social-ecological system in Roussillon, southern France, exposed to long-term climatic and economic changes

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Background: Wine production in Roussillon, southern France, has been subjected to deep structural changes in cultural practices since the 1970's, due to changes in demand and market organization. In this Mediterranean region, temperature and rainfall parameters have long been adapted to fortified wine production, but might be less suited to dry wine production, which is nowadays prevailing. The wine industry in Roussillon can be studied as a social-ecological system where local economical and social characteristics are strongly linked to physical inputs. Thus changes in climate, especially warming and drying trends that have been detected and projected by the IPCC in the Mediterranean basin, may disrupt the local economy and social organization in the long term. The aim of our study is to assess the role played by recent (1956-2010) and near-future (2010-2035) changes in temperature and rainfall inputs in the evolution of the system's adaptive capacity to combined long term climatic and economic changes.

Methods: Our study combined quantitative and qualitative data. We first assessed recent exposure to climate change by analysing change in daily data of temperature and rainfall observed in Perpignan weather station from 1956 to 2010. Thirty-nine in-depth interviews with local producers and key stakeholders of the local wine industry helped us understand the impacts of recent climatic conditions in the system's adaptive capacity. Then, we measured future changes in temperature and rainfall based on daily data simulated by ARPEGE-Climat (SCRATCH10 dataset) at an 8-km spatial scale, for emission scenarios A2, A1B and B1, up to 2060. Based on the impacts of recent changes in the system, we inferred the possible impacts of future climate change on the system's equilibrium.

Results and discussion: Climate data analyses show that changes in temperatures and rainfall patterns have occurred in Perpignan since the mid-1980's, and that current (2001-2010) conditions are likely to remain the same until the 2040's, then followed by a second step of warming and drying trend. During the last ten years, local farmers have been experiencing difficulties to combine challenges from an increasing competition in markets and from hotter and drier conditions. Helped by public subsidies, almost one-third of the vineyard was pulled out during that period. Up until the 2040's, with similar conditions, the local viticultural system should continue its transformation, favouring dynamic, proactive and enterprising farmers. Thus the composition of the farming community might change gradually, and count in the 2040's a majority of producers with a higher individual adaptive capacity than now. The timing and intensity of near-future climate change as measured by the climate model, combined to regional economic change, might thus be an asset to prepare and facilitate adaptation in the longer term.