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Do we know how to reconcile preservation of landscapes with adaptation of agriculture to climate change? A case-study in a hilly area in Southern Italy

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Limited impacts of climate change on agricultural yields are unlikely to induce any significant changes in current landscapes. Larger impacts, unacceptable on economic or social ground, are likely to trigger interventions towards adaptation of agricultural production systems by reducing or removing vulnerabilities to climate variability and change. Such interventions may require a transition to a different production system, i.e. complete substitution of current crops, or displacement of current crops at their current location towards other locations, e.g. at higher elevations within the landscape. We have assessed the impacts of climate change and evaluated options for adaptation of a valley in Southern Italy, dominated by vine and olive orchards with a significant presence of wheat.

We have first estimated the climatic requirements of several varieties for each dominant species. Next, to identify options for adaptation we have evaluated the compatibility of such requirements with indicators of a reference (current) climate and of future climate. This climate – compatibility assessment was done for each soil unit within the valley, leading to maps of locations where each crop is expected to be compatible with climate. This leads to identify both potential crop substitutions within the entire valley and crop displacements from one location to another within the valley.

Two climate scenarios were considered: reference (1961-90) and future (2021-2050) climate, the former from climatic statistics, and the latter from statistical downscaling of general circulation models (AOGCM). Climatic data consists of daily time series of maximum and minimum temperature, and daily rainfall on a grid with a spatial resolution of 35 km. We evaluated the adaptive capacity of the “Valle Telesina” (Campania Region, Southern Italy).
A mechanistic model of water flow in the soil-plant-atmosphere system (SWAP) was used to describe the hydrological conditions in response to climate for each soil unit. Crop-specific input data and model parameters were estimated on the basis of local experiments and of scientific literature and assumed to be generically representative of the species. Time series of MODIS TIR data were used to downscale gridded climate data on air temperature for both the reference and the future climate.
The results indicate that no complete crop substitution will be required within this time frame, i.e. the Valle Telesina will preserve its typical landscape features of a vine – olive orchards dominated production system, typical of many regions in Mediterranean Europe. On the other hand very significant crop displacements will be necessary to grow each variety under optimal hydrothermal conditions, from the point of view of both quantity and quality of yield.

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