

Scenarios for managing of European viticultural landscapes

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Abstract: Viticultural landscapes not only produce grapes and wine but also provide many other important ecosystem services such as an aesthetic landscape and habitat for pest-control species. However, many European vineyards are intensely managed, including high use of pesticides and often bare inter-rows, reducing biodiversity and increasing the risk of soil erosion. Winegrowers take decisions based on the complex relationships between, for example, pesticide use and its impacts on pests as well as their natural enemies, or vegetation in the inter-rows competing for water but providing habitat for natural enemies. To explore future scenarios leading to more effective agri-environmental policies and planning, we develop spatially explicit agent-based models on winegrowers taking decisions on pesticide use and inter-row management. In these models, winegrowers' decisions influence ecosystem services, which in turn affect future decisions. In this study, we conducted surveys in viticultural landscapes in Austria, France, Germany, Romania, and Spain to better understand the heterogeneity in winegrowers' behavior and driving factors behind their behavior. We used the survey outcomes to develop a generalized agent-based model that can be applied to all these landscapes. This generalized model, i) reflects commonalities across our European study areas regarding winegrowers' decision making on pesticide use and inter-row management; ii) includes feedback processes between economic, ecological, and social factors; and iii) uses climate change and policy interventions to simulate vineyard management scenarios. Using a cross-European generalized model means that landscape-specific characteristics are not taken into account. We argue that generalized models like ours have a use for discussing and exploring large scale agri-environmental policies, while location-specific heterogeneities should be considered for planning purposes. The local climate, edaphic, and social-economic factors may significantly affect viticultural decision-making, requiring locally-adapted models. We will develop these in the next step, based on the generalized model.

Keywords: biodiversity conservation; ecosystem services; survey; agent-based models; farm management