Farming systems at local and landscape scales are stronger drivers of predator communities and biological pest control services than semi-natural habitats

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Abstract

Identifying landscape variables and farming practices that foster service-providing communities is an important topic for biodiversity conservation and the development of agroecological farming systems optimizing ecological processes. While organic farming practices at the local scale are known to enhance biodiversity, their effects on the delivery of ecosystem services, such as biological pest control, remain poorly explored. Moreover, how the spatial expansion of organic farming at the landscape scale modulates the relative effect of organic farming at the local scale on biodiversity and ecosystem functioning is still unknown. Here, using a multi-scale hierarchical design in southwestern France, we examined the effects of organic farming and semi-natural habitats at the local and landscape scales on natural enemy communities and the level of pest control services in 42 vineyards. We found that the proportion of organic farming in the landscape was a stronger driver of natural enemy abundance and richness than the proportion of semi-natural habitats. In addition, the responses of the different natural enemy communities were highly idiosyncratic and suggest spillover between organic and conventional vineyards. Organicfarming at the local and landscape scales were found to be beneficial to the mean and the temporal stability of biological control services, while the proportion of semi-natural habitats in the landscape reduced the level of biological pest control. Finally, we show that specific farming practices, such as pesticide use or crop productivity, were important variables affecting natural enemy communities and levels of biological control services independently of farming system type. Our study highlights the major importance of considering the diversity of farming practices within the landscape to design functional landscapes that optimize biological pest control services.

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