

Community composition and activity of insectivorous bats in Mediterranean olive farms

J. M. Herrera¹, P. Costa^{1,2}, D. Medinas^{1,2}, J. T. Marques^{2,3} & A. Mira^{1,2,4}

¹ CIBIO/InBio-UE Research Center in Biodiversity and Genetic Resources, University of Évora, Évora, Portugal

² Conservation Biology Unit, Department of Biology, University of Évora, Évora, Portugal

³ Centre of Environmental Biology, Faculty of Sciences, University of Lisbon, Lisboa, Portugal

⁴ ICAAM – Institute of Mediterranean Agricultural and Environmental Sciences, University of Évora, Évora, Portugal

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Correspondence

José M. Herrera, CIBIO/InBio-UE Research Center in Biodiversity and Genetic Resources, University of Évora, Rua Dr. Joaquim Henrique da Fonseca, 2nd, Évora 7002-554, Portugal. Tel: +351 266740800 (ext. 24491)
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Abstract

Olive (*Olea europaea* L.) farming is one of the most widespread agricultural practice throughout the Mediterranean basin. Current trends even predict an increase in land area devoted to olive farms as well as the intensification of farming practices. However, knowledge of the effects of olive farming on animal species still remains elusive and conservation and management guidelines for the relevant stakeholders are therefore urgently needed. Here, we investigate community composition and activity patterns of insectivorous bats in Mediterranean olive monocultures in Southern Portugal. Bats surveys were carried out in three types of olive farms representing increasing levels of management intensity: (1) traditional olive farms, managed with few or no chemical inputs or manual labor; (2) semi-intensive olive farms, which share certain characteristics with traditional plantations, but are more intensively managed; (3) intensive olive farms, which are managed with high and frequent chemical inputs, and highly mechanized systems. We found differences in species richness and activity levels between farming practices. Both the number of species and foraging activity declined with increasing management intensity. However, olive groves as a whole showed a lower number of species compared with the regional species pool and extremely low activity levels, suggesting that large and homogeneous olive monocultures may serve more as commuting areas than true foraging habitats for bats. To our knowledge, this is the first study explicitly demonstrating the pervasive impact of olive farming on the community composition and activity levels of insectivorous bats. In the face of an even-increasing proportion of land surface devoted to olive farming in Mediterranean landscapes, our findings are therefore of great concern. We suggest that increasing habitat heterogeneity would contribute to preserve the community composition and ecological functionality of insectivorous bats in extensive olive monocultures.

Introduction

Land conversion for agricultural purposes is a major threat to global terrestrial biodiversity (Foley *et al.*, 2005). Globally, c. 40% of land has been converted to agricultural use and the scenarios of change for the next century suggest land-cover change will be the main driver of biodiversity loss in terrestrial ecosystems worldwide (Sala *et al.*, 2000). This being the case, the need to balance wildlife conservation and agricultural production has never been greater and, in consequence, the development of policies to guarantee food production under more environmentally friendly farming practices is urgent (Fischer, Hartel & Kuemmerle, 2012). However, knowledge of the ecological role of different types of land use and management intensities in produc-

tion landscapes is scarce, hampering efforts to understand their value for conserving animal species and planning their sustainable management (Vandermeer & Perfecto, 2007).

In Europe, particularly in countries around the Mediterranean sea, olive (*Olea europaea* L. 1753) farming represents a significant proportion of the agricultural sector, and is indeed one of the most striking landscape feature throughout this wide region (Nowicki *et al.*, 2009). Traditionally, olive farming was practiced on upland terraces, with relatively low impacts in terms of use of chemicals or extraction of water. However, over the last two decades, the Common Agricultural Policy (CAP) has motivated the expansion of olive farms in Europe through agricultural subsidies directly coupled with production levels. The appropriate management of landscapes devoted to olive growing has therefore