



# Generalities of vertebrate responses to landscape composition and configuration gradients in a highly heterogeneous Mediterranean region

José M. Herrera<sup>1†\*</sup>, Pedro A. Salgueiro<sup>1</sup>, Denis Medinas<sup>1</sup>, Pedro Costa<sup>1</sup>, Cláudia Encarnação<sup>1</sup> and António Mira<sup>1,2</sup>

<sup>1</sup>CIBIO-InBIO/UE, Research Center in Biodiversity and Genetic Resources, University of Évora, Casa Cordovil 2a Andar, Rua Dr. Joaquim Henrique da Fonseca, 7002-554 Évora, Portugal, <sup>2</sup>Conservation Biology Lab, Department of Biology, University of Évora (UBC-UE), Polo da Mitra, 7002-554 Évora, Portugal

## ABSTRACT

**Aim** To examine the distributional patterns of vertebrates (including birds, bats, carnivores and lagomorphs) along landscape composition and configuration gradients to better understand the effects of landscape modification on occurrence patterns at both species and community level.

**Location** The region of Alentejo, a forest-dominated area of southern Portugal.

**Methods** The study area was framed using 1647 hexagonal plots, each of 259 ha in size. Composition and configuration gradients were obtained for each plot by integrating the proportions of the main land cover types and their configuration patterns using multivariate analyses. Species-specific vertebrate responses were investigated using data from 75 plots in which carnivores, bats and lagomorphs were sampled, and from 135 plots in the case of birds. Community-level responses were investigated through changes in species richness and beta-diversity in 57 plots where all vertebrate groups were simultaneously sampled. At the species-level, an information-theoretic approach was used to determine the effects of landscape gradients on species' responses. At the community level, Mantel tests were used to determine between-plot differences in species composition using the Sørensen dissimilarity index.

**Results** We found that the occurrence patterns of most vertebrate species were best predicted by composition-related gradients, although configuration gradients were also frequently included in species-specific occurrence models. We also found a weak correlation between species richness and most landscape gradients suggesting a turnover in the identity of species, something that was corroborated by the stronger correlation between environmental gradients and beta-diversity measures. The amount of forest cover and landscape complexity (estimated as the heterogeneity in the size and number of land cover types) were the main composition and configuration gradients determining vertebrate responses at both species and community level.

**Main conclusions** Our work contributes to a more refined understanding of the mechanisms underlying species distributional patterns in real-world human-modified landscapes. By uncovering generalities of species with multiple ecological requirements and by describing the entire landscape mosaic through landscape gradients, we also suggest that our work greatly helps to fill the gap between existing conceptual landscape models aimed to understand species distributional patterns in human-modified landscapes.

## Keywords

agricultural countryside, conceptual models, environmental gradients, landscape modification, Mediterranean landscapes, *montado*, multi-species conservation, species distribution

\*Correspondence: José M. Herrera, CIBIO-InBIO/UE, Research Center in Biodiversity and Genetic Resources, University of Évora, Casa Cordovil 2a Andar, Rua Dr. Joaquim Henrique da Fonseca, 7002-554 Évora, Portugal.  
E-mail: herreramirlo@gmail.com

†Present address: Doñana Biological Station, Department of Integrative Ecology, Spanish National Research Council (EBD-CSIC). Avd. Américo Vespucio s/n, Isla de la Cartuja, 41092 Sevilla, Spain.