
Title: ***Effects of grazing pressure on activity and richness of bats in a Portuguese silvo-pastoral system***

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Abstract: **Abstract**

Background

High Nature Value Farmlands (HNVF) harbor species dependent upon habitats maintained by low-intensity farming. Among HNMF, the montado (dehesa in Spain) is a multifunctional system declining due to droughts, pathogens, and increasing grazing pressure. Specifically, grazing pressure leads to compact soils and hinders natural tree regeneration. Regrettably, there is a dearth of information supporting management decisions on the side-effects of high grazing pressure on HNMF-dwelling biodiversity. In particular, little is known about the impact of grazing pressure on bats, a group of species of special conservation concern that may provide key ecosystem services such as biological pest control.

Purpose

We investigated patterns of activity levels and community composition of insectivorous bats to test the hypothesis that there is a significant relationship between the level of livestock grazing pressure within montado HNMF parcels and patterns of insectivorous bats' presence and activity. Our specific aims were to (i) assess separately the effects of grazing pressure on bat activity and species composition, (ii) test the predictive significance of key covariates (e.g., insect availability).

Methods

We conducted this study in 2014 in the Natura 2000 network site "Monfurado", southern Portugal. This site is specifically acknowledged for its well-preserved montados providing feeding areas for bat species. We quantified acoustically bat flight activity and species richness in farm parcels dominated by cork oak trees. Per parcel, we selected two separate locations (high vs. low pressure grazing) based on landowners' interviews and grazing pressure indicators, totaling 42 sampling locations. We then used linear mixed-effects modeling to evaluate the effects of grazing pressure and covariates on activity and species richness.

Results

Bat activity and bat species richness peaked at low grazing pressure locations. Bat activity also increased with tree cover and in locations where livestock grazing signs were old or absent. Conversely, bat activity at low grazing pressure locations decreased with distance to the nearest standing water body.

Discussion

Our study clearly demonstrated that locations maintained under high grazing pressure within HNMF can have negative consequences for bats, which are acknowledged as good bioindicators of habitat quality. In order to promote better habitat for bats, practitioners should avoid favoring grazing-prone areas (e.g., rotating the location of livestock feeders, drinkers, and gates) across montado HNMF. Broadly, ecosystem services provided by bats for HNMF must be enhanced through sustainability oriented agro-environment schemes under the Economic Community Rural Development Program, including the reduction of stocking density.

