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Short communication

Corridor vs. hayfield matrix use by mammalian predators in an agricultural landscape

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ABSTRACT

Corridors are assumed to be an efficient conservation tool for reducing changes in local biodiversity induced by fragmentation and loss of natural habitats. The importance of corridors for the management of local biota has been previously demonstrated for a few single species; however, there has been little research on this topic for groups of animals, such as mammalian carnivores. In this paper, we test the hypothesis that linear strips (2–12 m wide) of shrubby vegetation and dense high grass are more likely to be exploited by diverse carnivore species than surrounding hayfields. For this purpose a scent station survey was employed. Scent stations placed in linear landscape structures were visited much more frequently than scent stations placed in the surrounding hayfield matrix. The probability of detection was higher in corridors than in the landscape matrix for all carnivore species detected. In addition, we tested if the use of a corridor by carnivores was influenced by the amount of shrub and tree cover and corridor width, but none of these variables affected the probability of carnivore detection. Our study suggests that the maintenance of corridors could be an efficient management practice for the preservation of carnivore populations in agricultural landscapes.

1. Introduction

The fragmentation of natural habitats and subsequent loss of connectivity can alter the structure of vertebrate populations, which often results in reduced viability and decreased diversity (Brown and Kordic-Brown, 1977; Didham et al., 1998; Crooks and Soulé, 1999; Fahrig, 2003). Corridors, i.e. narrow linear structures connecting preferred but isolated habitat patches that are spatially segregated by an unsuitable habitat matrix (Forman and Gordon, 1986), are often assumed to diminish the negative consequences of habitat fragmentation (Laurance and Laurance, 1999; Hilty and Merenlender, 2004; but see Simberloff and Cox, 1987). These landscape structures are believed to facilitate the exchange of individuals between isolated subpopulations (reviewed in Hilty et al., 2006), and this in turn reduces the negative effects of demographic stochasticity (Brown and Kordic-Brown, 1977; Gilpin and Hanski, 1991), and/or inbreeding depression due to low gene flow (Aars and Ims, 1999). Alternatively, corridors may enable effective dispersal between disconnected but preferred habitat patches within an individual home range (e.g. Dunning et al., 1992; Rosenberg et al., 1998), or provide extra habitat suitable for some species (e.g. MacDonald et al., 2004).

The intensification of agricultural practices in Europe during the past decades has resulted in an increase of intensively cultivated areas and, consequently, a drastic decline of semi-natural refuges suitable for native fauna, such as extensively used grasslands, small woodlots, and hedgerows (Arnold, 1983; Smith et al., 1993). A web of linear uncultivated margins separating particular field parcels has previously been shown to increase the abundance and diversity of various animal taxa (Arnold, 1983; Boatman and Wilson, 1988; Hassall et al., 1992) and could potentially maintain their dispersal (Aars and Ims, 1999; Haddad et al., 2003). Nevertheless, despite considerable research and conservation interest in this topic, empirical data are still, in many respects, insufficient and available only for a few model groups (Beier and Noss, 1998).

The population structure of carnivore species can be strongly affected by human induced landscape changes (Crooks and Soulé, 1999) and other human activities. Area-sensitive specialist predators often exhibit strong population declines in fragmented landscapes. Large carnivorous species such as the brown bear and wolf became extinct during the past centuries in the Czech

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Republic. There are attempts to restore a population of lynx; however, based on habitat suitability models (Schadt et al., 2002) most Middle European regions are unlikely to maintain a viable population due to a high degree of landscape fragmentation. On the other hand, generalist mesopredator species may benefit from agriculturally induced landscape changes due to their ability to exploit various food items in diverse habitats including ecotones (Crooks and Soulé, 1999; Crooks, 2002).

The maintenance of linear field margins in a landscape fragmented by intensive agriculture can have considerable conservation value for mammalian carnivores; however, despite some studies in North America documenting the importance of corridors for these predators (Gehring and Swihart, 2003; Hilty and Merenlender, 2004), surprisingly, preferences for these landscape structures have not yet been explicitly tested in Europe.

The basic aim of this paper is to test the hypothesis that narrow (2–12 m wide) strips of shrubby vegetation and dense long-stemmed grass leading through mowed hayfields are more likely to be used by mammalian predators than the surrounding hayfield matrix in Central European landscapes fragmented by intensive agriculture. To study this, a scent station survey based on a non-reward method with two temporal replications was used. The qualities of particular corridors, such as width or the character of vegetation cover, have previously been shown to affect the densities and diversity of species using them (Laurance and Laurance, 1999; Hilty and Merenlender, 2004). Therefore as an additional step, we analyzed the effect of corridor character on the probability of its use by various carnivore species.

2. Materials and methods

Study area. The study site encompassed an agricultural landscape located in the České Budějovice basin (48.57°N, 14.28°E), Doudlebia, Czech Republic. The region has a gently rolling topography (with altitudes ranging from 350 to 550 m) and consists of a mosaic of agricultural fields, hayfields, fish ponds, small secondary coniferous or mixed forest patches, all connected by a web of corridors crossing through the hayfields. These hayfields are entirely drained and reseeded with species such as *Lolium* sp., *Phleum* sp., *Festuca* sp., *Dactylis* sp. and mowed twice a year, resulting in short vegetation cover (range: 15–40 cm) during our experimental treatment.

Corridors in our study area are linear and relatively narrow (2–12 m wide) strips of vegetation situated along ditches that drain the surrounding hayfields. The vegetation within corridors consists primarily of dense long-stemmed grasses (*Calamagrostis* sp., *Festuca* sp., *Arrhenatherum* sp., >60 cm high), that exceed the maximum height of hayfield vegetation. Also, they are usually covered by shrub or tree canopy dominated by species such as *Prunus spinosa* or *Salix* sp., although the proportion of corridors covered by woody vegetation varies considerably (range: 0–100% of corridor length covered by woody vegetation).

Scent station survey. We constructed scent stations by clearing 1 m × 1 m areas of debris and grass and covering them with a 2 cm thick layer of fine-grained masonry sand. A 1.5 ml microcentrifuge tube containing an attractant was attached to a wooden stick and placed in the centre of each scent station about 15 cm above the sand. Since our intention was to analyze predator responses to relatively fine landscape structures on a small spatial scale, domestic rabbit urine, a mild attractant (Linhart and Knowlton, 1975), was used to avoid luring animals from greater distances.

Mammalian predators were identified based on footprint dimensions and shape characteristics (Anděra and Horáček, 2005). We were unable to distinguish between the ermine (*Mustela erminea*) and least weasel (*Mustela nivalis*) in three cases. Due to similarities in habitat preferences and other aspects of their ecology (Johnson et al., 2000; Mitchell-Jones et al., 1999) these species were treated as 'small mustelids' in subsequent analyses. Domestic dog footprints (*Canis lupus familiaris*, four cases), footprints that did not allow us to distinguish between red fox (*Vulpes vulpes*) and domestic dog (two cases), and tracks which we were not able to specify to genus level (two cases) were excluded from the dataset; these deletions did not qualitatively affect the results (see Appendix 1 for further details).

Corridor vs. hayfield matrix preferences. To test the hypothesis that carnivores perceive and preferentially use corridors in comparison with the surrounding hayfield matrix, 20 pairs of scent stations were created (Fig. 1). For each pair of scent stations, one was placed within a corridor and the second in the adjacent hayfield, 50–150 m away from the corridor scent station. To minimize the visitation of multiple scent stations by a single individual the minimal distance between each pair of scent stations was 250 m (mean = 570 m, see Gehring and Swihart, 2003); consequently, the study area encompassed 35 km^2. We avoided placing scent stations in the immediate proximity of artificial water bodies that occur in the study area (fish ponds with size 0.5–20 ha, depth usually < 2 m, used for carp (*Cyprinus carpio*) production), as these could represent a movement barrier to carnivores. All experimental corridors were surrounded by hayfield patches on both sides, and thus carnivores were able to use both habitats for movement. Scent stations were exposed during 5 successive rainless nights in October 2005 and June 2006. The presence of tracks was checked every morning, resulting in a total of 400 station-nights.

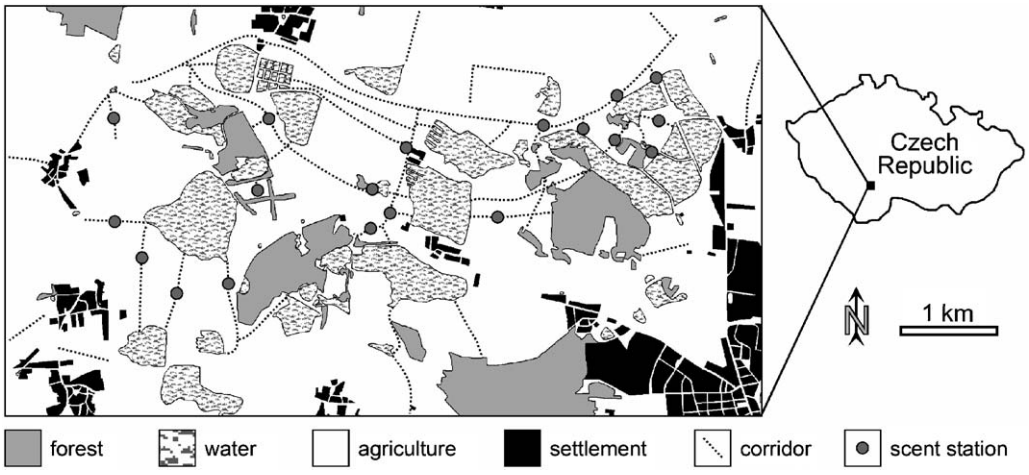

Fig. 1. Distribution of corridors and spacing of scent station pairs (corridor and hayfield) in the study area Doudlebia, the Czech Republic during the first experiment.