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## Original article

# Vertebrates respond differently to human disturbance: implications for the use of a focal species approach

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## ABSTRACT

Focal species are surrogates assuming that all species under consideration respond similarly to the threatening processes. Focusing management only on a small number of species would improve conditions for other species. However, the across-taxa congruency of the response to threatening processes, and the subsequent efficiency of focal species as surrogates, has seldom been tested. In this study, we evaluated the effects of recreational disturbance and wood structure on the communities of terrestrial vertebrates in the wood patches of a large urban park. We measured two effects of recreation: direct disturbance (people presence) and litter disturbance (effect of trampling). We used multiple techniques to assess the distribution of small mammals, birds, reptiles and amphibians in 44 wood patches. Disturbance and wood maturity influenced the distribution of some species and the species richness of amphibians and reptiles; however, the pattern was not consistent across species within classes or among classes. The performance of focal species as a multi species umbrella was poor. Our results suggest that species specific differences in the response to the same source of disturbance can be strong; these differences can hinder the usefulness of focal species as surrogates and as a management tool.

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## 1. Introduction

The planning of biodiversity conservation is a difficult task. Lambeck (1997) suggests that an ideal pathway would be as follows: first, the species occurring in the ‘focal area’ should be assessed; second, the threatening processes and the resources limiting the populations should be identified. The

identification of threats would then allow the planning of the management actions required for the conservation of the species present.

In practice, this approach is not feasible. Comprehensive studies on the status of biodiversity are time consuming and expensive. Lawton et al. (1998) estimated that the species inventory of a representative hectare of tropical forest would

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require 10–20% of the global workforce of systematists. The identification of threats may be a still more difficult task, since relationship between species and natural and anthropogenic processes are frequently hard to define. The difficulties associated with comprehensive studies have led to the use of ‘surrogates’, based on the assumption that a subset of species can be used as an indicator of the processes ongoing in the landscape, and that management actions aimed at their protection can be beneficial to a large proportion of the species (Caro and O’Doherty, 1999). The use of surrogate species (or taxa) relies on the assumptions that different components of the ecosystem respond similarly to the processes and threats. However, it is unlikely that the requirements of only one species may be able to capture those of the entire ecosystem (e.g., the ‘umbrella’ species): in response to this limitation multi-species or multi-taxa surrogates have been developed, such as the ‘focal species approach’ (Lambeck, 1997) or the ‘shopping basket approach’ (Sauberer et al., 2004 and references therein).

The ‘focal species approach’ assumes that all species under consideration respond similarly to the threatening processes. This is assumed because there are not enough data to demonstrate that it is the case, nor time to collect those data. The species that are most sensitive to each of the threatening processes (i.e., decline most rapidly as the intensity of the threat increases) are selected as the focal species. Management is focused on focal species, assuming that as conditions improve for the focal species they will also improve for other species (Lambeck, 1997). Focal species are an extension of the more classical ‘umbrella’ species, and are supposed to perform better than other surrogates, yet this approach has been only partially validated (reviewed by Roberge and Angelstam, 2004). Actually, very few studies tested a crucial assumption of focal species as surrogates, that is whether species respond similarly to the threatening processes (Roberge and Angelstam, 2004; but see Blair, 1999; Posa and Sodhi, 2006). It is thus critical to understand how different species or taxa respond to the threatening processes affecting the landscape, in order to evaluate whether the monitoring and the protection of a limited subsample of the biodiversity can be effective for understanding and managing the processes threatening the overall biota.

In recent decades, the demand by European and North American citizens for natural environments in which to spend free time has been rapidly increasing, and recreational activities become a major cause of ecosystem alteration and threat biodiversity (Cole and Landres, 1995; Christ et al., 2003). Recreational disturbance can have strong effects on animals, leading to behavioural modifications, a different use of habitats, and a reduction in survival or reproductive success of individuals (Liddle, 1997; Fernandez-Juricic and Telleria, 2000; Parent and Weatherhead, 2000; Rodgers and Cox, 2003; Rodriguez-Prieto and Fernandez-Juricic, 2005; Whittington et al., 2005). The recreational disturbance on natural environments can be particularly strong in human dominated landscapes, where only a few, small natural patches (such as woodlands) still persist. Unfortunately, these residual patches attract people living in urban areas, being therefore affected by multiple stressors, including small size and isolation, human exploitation, and the direct disturbance caused by large numbers of people (Liddle, 1997; Whittington et al., 2005). In the most exploited areas, there is therefore an urgency to protect the

biodiversity of residual patches, since for many species they represent the only available habitat. This urgency can be particularly strong in areas inhabited by rare or endemic species.

In this study, we compared the responses of different terrestrial vertebrates (small mammals, birds, reptiles and amphibians) to recreational disturbance and wood features in a large urban park, in order to investigate whether the abundance of a group of species might act as surrogate for the whole community. Vertebrates include attractive species and species requiring a large amount of habitats, thus they have frequently been used as flagship or umbrella species (see Roberge and Angelstam, 2004). In order to avoid the confounding effects of synanthropic opportunistic species living in open habitats (Watson, 1979; Cole and Landres, 1995), we focused our analyses on the communities living in woods. In detail, we investigated (1) how the distribution of terrestrial vertebrates within the park is related to the human disturbance; (2) how much the response to disturbance is consistent across taxa, and (3) whether a set of focal species can be used as a measure of the response of all vertebrates to the threatening processes. A positive answer to this latter question would mean that the monitoring of a limited number of species could be enough to trace the effects of different management action to sustain the biodiversity at local scale.

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## 2. Study area

The study was carried out from 1999 to 2004 in the Monza Park (45.35N, 9.16E), a 750 ha urban park north of Milan (Lombardy, Northern Italy) within the Lambro Valley Natural Park (Ronconi, 1998). The altitude was 162–200 a.s.l. Woods were highly fragmented and covered 50% of the park, while open grasslands accounted for 32%. The remaining 18% was represented by the Lambro river, by historical buildings and farmhouses and by the facilities of the National Motordrome of Monza and the Milano Golf Club. The composition of woods included species typical of the River Po Plain belonging to the hornbeam *Carpinus betulus* and pedunculate oak *Quercus robur* woods, but many ornamental and domestic species have been introduced in successive stages for reforestation. Mean wood age was 70–80 years. Underwood was dominated by elder *Sambucus nigra*, hazel *Corylus avellana*, hawthorn *Crataegus monogyna*, bramble *Rubus* spp. and North American blackthorn *Prunus serotina*, which recently colonized northern Italy.

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## 3. Methods

We collected data about human disturbance, environmental features, and vertebrate distribution within 44 wood patches, as defined by the forestry management plan of the park (Cereda, 1998).

### 3.1. Measure of disturbance and environmental features

Throughout the year, many people frequent the Monza Park for recreation, principally for walking, jogging, playing sports or riding. The network of pathways allows visitors to reach all the areas of the park and people usually stay very close

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