Patterns of Native and Domesticated Predator Distribution in an Urban Nature Preserve

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Introduction

Urban nature preserves face many challenges to their ecological integrity, including pollution of their waterways, replacement of native by invasive species, and the reduction of native bird and small mammalian populations by non-native domesticated predators such as cats and dogs (Pickett, et al. 2001). Several studies have shown that the presence of domesticated predators and the potential for increased predation on native bird and small mammal populations (Mey and Norton 1996, Kaye, et al. 1998, Cresko and Soeleveld 1999, Lacerda, et al. 2009). In Australia, domestic cats have even been credited with causing the extinction of several species of small, native mammals (Johnson et al. 1999). Such predators of domesticated species also create competition with native predators for prey (Marks and Duncan 2009).

Several factors contribute to the negative impact that non-native predators have on native wildlife in urban forests, the amount of fragmentation within a preserve (Jiye, et al. 2009), the size of habitat fragments within urban forests (Cresko, 2002, Frew and Duford 2007), and edge effects (Marcia, 1995 and Lacerda, et al. 2009). Most urban preserves are small and surrounded by urban and suburban matrices. This has the effect of reducing the forest interior, making these preserves more vulnerable to edge effects (Harper, et al. 2005). Consequences of these increased edge effects resulting from fragmentation include damage to vegetation and soil, greater dispersal of pollen and seeds of invasive plants, and changes in humidity and nutrient cycling (Harper, et al. 2005).

The purpose of this study was to examine if hiking trails in an urban preserve have created an edge effect by effectively fragmenting the forest into smaller patches. We also examined if trails provided predators increased access to forest interior by examining the relationship between distance to these trail edges and the presence/absence of native and non-native mammalian predators in an urban nature preserve.

Methods

This study occurred at Blackacre State Nature Preserve, located approximately eighteen miles east of Louisville, Kentucky (38.195 N, 85.53W). Blackacre SNP is an urban nature preserve, comprising 113 hectares of mixed habitat, including two tracts of secondary growth forest, restored tall grass prairies, meadows, and wetlands. A network of hiking trails allows visitor access. State law prohibits bringing pets onto the preserve, but the forest trails are bordered by suburban subdivisions with resident cats and dogs nearby and neighbors do not always confine their pets.

Forest patches were mapped and quantified using Google Earth. We then selected 52 random locations inside forest patches and measured the shortest straight-line distance of each point from a forest edge twice, once for patches defined by forest edge and a second time for patches defined by both forest and hiking trail edges.

Thirteen Scout Guard camera traps (Model SG550) were placed at each of the random points on a rotating schedule between 9 March and 11 April 2009. Each camera deployment lasted 72 hours, with our camera programmed to record 30 second videos for each event. A locking cable secured each camera trap to a tree at one and one half meters from the ground, with the camera facing the direction of the nearest edge.

We used an ANOVA to compare the size of forest patches defined only by forest edges versus forest patches defined by both forest and trail edges. We compared the distance to forest and trail edge for locations in which each species was observed and not observed through the use of independent t-tests in which unequal variances were assumed. We accounted for multiple tests for each species by adjusting the p-values using Bonferroni corrections (significance = $\alpha =$ 0.05/6 = 0.008).

Results

There was no relationship between raccoon presence and distance to hiking trails. (Table 1.) Our results suggest that hiking trails allowed access to forest interior as cats and opossums were found at significantly shorter distances from hiking trails in comparison to locations in which the species were not recorded.

Discussion

Our study suggests that hiking trails do increase fragmentation of forest patches and this fragmentation has an effect on the distribution of both cats and opossums within the preserve. Hiking trails create breaks in the forest canopy and new boundaries within the forest. These new boundaries can be considered soft edges allowing native and non-native predators increased access to the forest interior (Collinge, 2009).

Cats and opossums were found most frequently within the vicinity of a trail suggesting that the trails are allowing these species to penetrate the interior of forest patches. Domesticated cats often hunt within the vicinity of forest edge habitat and prefer to hunt areas more than 10 m into the forest (Kaye and Dwan 2004). Opossums are edge-utilizing predators and this utilization of edges has helped opossums adapt to human-altered landscapes (Zegers, et al. 2008). Prange and Lasher (2004) the distribution of raccoons, on the other hand, was not related to distance to forest edges or to hiking trails. The ubiquitous raccoon distribution suggests that raccoons are able to use forest and edge habitat.

Hiking trail systems that fragment the forest of urban nature preserves and potentially allow increased access to domesticated predators create a management and conservation concern. We believe that the potential of hiking trails to fragment forests and allow predator access is dependent upon reserve size. Hiking trails in larger nature preserves probably have minimal impact because trail density in relation to reserve area is lower than in smaller reserves, which therefore preserves more forest interior habitat (McKinney 2005).

Management Recommendations

In small urban nature preserves, trails that bisect the interior may allow access by cats and native edge predators. We suggest that hiking trail development in urban or small forest nature reserves should occur on the periphery of the forest and not bisect the forest interior. This will help minimize the penetration of domesticated predators, such as cats, into the core of the forest fragments, thus helping to preserve the biodiversity of potential prey species and minimize competition between native and domesticated predators for these prey species. A trail system along the perimeter of small preserves would allow the conservation of the core zone and the protection of native bird and small mammal populations while still allowing passive human recreation (Alexander 2000).

References


