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Research Article

Diet and habitat use by maned wolf outside protected areas in eastern Brazil

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Abstract

The maned wolf has been studied in nature reserves, but few researches have been carried out outside protected areas. Since only about 2 % of the Brazilian Cerrado, the maned wolf's main habitat, has been set aside as parks and reserves, determining what is happening with the species in private and disturbed areas is important for an accurate assessment of its vulnerability to extinction. Here we investigated the trophic ecology of a maned wolf population inhabiting a 1610 ha section of the Calçada Ridge, an unprotected area located in the metropolitan region of Belo Horizonte, capital of the state of Minas Gerais, Brazil. The study site is in the buffer zone (< 10 km) of two protected areas, where anthropogenic (urban areas and roads) and disturbed areas (burned fields) total a third of the study landscape. The main disturbances are mining activities, unregulated ecotourism and road proximity. Fecal samples (n= 95) collected between 2006 and 2008 revealed that the maned wolf frequently used both natural and disturbed fields. The diet was composed mostly of small mammals (9 species, 16.2 % of items and 92.6% of scats) and the plant *Solanum lycocarpum* (12.2% of items and 89.5% of scats), similar to what has been found in less disturbed areas. Overall diet diversity was, however, lower than has been found elsewhere, probably reflecting the poorer resource base of the study area. These results, together with recent findings from other sources, highlight the importance of buffer zones. They also suggest that the maned wolf is an ecologically flexible species that might be prone to hunt, and perhaps even survive, in disturbed areas outside protected areas.

Key words: *Chrysocyon brachyurus*, Feeding habits, Habitat selection, Scat analysis

Resumo

O lobo-guará têm sido estudado em unidades de conservação, mas poucas pesquisas têm sido conduzidas fora de áreas protegidas. Uma vez que apenas cerca de 2% do Cerrado brasileiro, habitat principal do lobo-guará, está protegido em parques e reservas, verificar o que está acontecendo com a espécie em áreas privadas e degradadas é importante para uma avaliação precisa de sua vulnerabilidade à extinção. Aqui nós investigamos a ecologia trófica de uma população de lobos-guarás que habitam um trecho de 1.610 ha da Serra da Calçada, uma área desprotegida localizada na região metropolitana de Belo Horizonte, capital do estado de Minas Gerais, Brasil. A área de estudo está localizada na zona de amortecimento (< 10 km) de duas unidades de conservação, onde áreas antropizadas (áreas urbanas e estradas) e perturbadas (campos queimados) formam um terço do total da paisagem de estudo.Os principais impactos são as atividades mineradoras, o ecoturismo não regulamentado e a proximidade de estradas. As amostras fecais (n=95) coletadas entre 2006 e 2008 revelaram que o lobo-guará usou com freqüência tanto áreas naturais como impactadas. A dieta foi composta principalmente por pequenos mamíferos (9 espécies, 16,2% dos itens e 92,6 % das fezes) e pela planta *Solanum lycocarpum* (12,2% dos itens e 89,5% das fezes), de maneira semelhante ao que tem sido encontrado em áreas menos impactadas. Em termos gerais, a diversidade da dieta foi, porém, menor do que o encontrado em outros lugares, provavelmente refletindo a pobreza de recursos base da área de estudo. Estes resultados, juntamente com outras descobertas recentes, mostram a importância das zonas de amortecimento. Os dados também sugerem que o lobo-guará é uma espécie ecologicamente flexível e que pode ser propensa a usar, e talvez até mesmo sobreviver, em áreas perturbadas fora de áreas protegidas.

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Introduction

The maned wolf *Chrysocyon brachyurus* (Illiger 1815), the largest canid in South America [1] is listed globally as "Near threatened" [2].In Brazil, which contains the largest part of its geographic range, the species is considered "Vulnerable" [3] mainly due to habitat destruction and related disturbances. Although there are a relatively large number of ecological studies on the species, most of these have been carried out inside protected areas [4-20]. It is important, however, to evaluate how the species is enduring outside nature reserves, because only 2.2% of the Brazilian Cerrado, the typical habitat of the species, has been set aside as protected areas [21]. The overwhelming majority of the species' habitat therefore lies in private areas with no formal or legal protection. Outside the protected areas, the maned wolf faces a myriad of impacts and hazards, including habitat transformation, agriculture expansion, city sprawl, and road proximity, among many others. Understanding how the species reacts to these alterations allows us to determine its degree of ecological flexibility, which in turn, helps in planning the best conservation strategies.

Mirroring the scheme of the Biosphere Reserves from UNESCO, the Brazilian environmental legislation stipulates that protected areas must be surrounded by buffer zones [22]. In theory, human activities in these buffer zones should be subjected to specific norms and restrictions, which would minimize the negative impacts of these activities [22]. Unfortunately, however, very few buffer zones have been implemented in Brazil, and the reality is that the immediate region surrounding the protected areas is not different at all from rural areas at large [23]. Part of the problem is due to a complex and rather confused legal basis for buffer zones[24], and part is due to the politically weak and poorly managed institutions responsible for their creation. Therefore, studies conducted in these buffer zones, particularly those confirming the occurrence of endangered species there, could be used to force a change in this scenario. Additionally, evidence demonstrating the use of these buffer zones or other degraded areas may indicate gene flow between animal populations throughout the rural environment.

In recent years, the maned wolf has been increasingly detected in disturbed places and in regions outside its original geographic distribution area, notably in eastern and southeastern Brazil. In fact, the maned wolf has been spotted even within the domains of the Atlantic forest [25-26], where the species was not known to occur originally [27]. Information about this recent "expansion," whether it is temporary or if it indeed represents adaptation of the species to a modified landscape, is lacking.

In this context the present study describes the diet and the habitat use of a maned wolf population inhabiting the buffer zone of two protected areas in the metropolitan region of Belo Horizonte, the 3-million people capital of Minas Gerais state in southeastern Brazil. The study region hosts a series of impacts, including massive iron ore extraction, abundance of roads and motorways, and ever-expanding neighborhoods, among many others. Additionally, local inhabitants visit the study area for hiking, mountain biking, motocross training and, occasionally, off-road driving. In other words, although the place still has a large share of native vegetation, finding the rather elusive and shy maned wolf there is rather surprising. The results are therefore important to improve our understanding about the adaptative ability of maned wolf to make use of anthropogenic landscapes.

Methods

Study area

The study site is a 2 x 8 km rectangular area (1610 ha; see below) located in Calçada ridge, which is part of the Moeda ridge in the municipalities of Brumadinho and Nova Lima, metropolitan area of Belo Horizonte, Minas Gerais [28] (Fig.1), southeastern Brazil. The area is bordered to the north by condominiums (Retiro das Pedras, Serra dos Manacás), to the south by an active iron mine (Mannesman Company), to the east by a two-lane national motorway (BR040) and to the west by the steep slopes of the Calçada ridge. Floristically, the area is a contact zone between Atlantic Forest and Cerrado biomes where vegetation of the latter predominates [29]. Altitudes vary between 805 and 1578 m [30]. The Calçada ridge is part of the “quadrilátero ferrífero”(“iron ore square”), a zone which contains large amounts of high quality iron ores and consequently has been intensively explored by mining companies for decades. As a result of this exploration, the “quadrilátero ferrifero” has been declared a conservation priority area in the state of Minas Gerais, requiring urgent conservation action [31]. Most native vegetation in this area has been already eliminated or disturbed by mining and related activities, and the majority of Cerrado and Atlantic forest remnants are also strongly affected by real estate expansion [28] (Fig. 1).

The study area is adjacent to two protected areas, the Rola Moça Ridge State Park (Parque Estadual da Serra do Rola Moça – PESRM) and the Fechos Ecological Station (Estação Ecológica de Fechos – EEF) (Fig. 1). The PESRM is an important remnant of Cerrado vegetation with 3940 ha [32], but Atlantic forest vegetation is also present in minor proportion. The EEF is smaller (603 ha) but also covered with Cerrado and Atlantic forest vegetation [32]. Both parks are important sources of potable water for the inhabitants of Belo Horizonte [32].

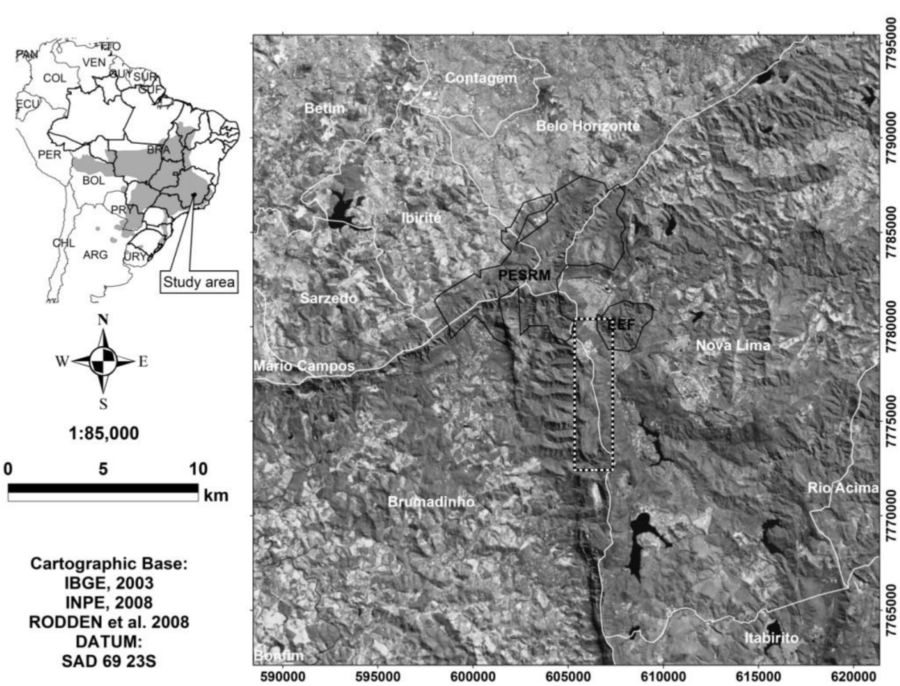

Fig. 1. Location of the study area (rectangle, main figure) in Serra da Calçada, state of Minas Gerais, eastern Brazil. White lines are municipalities divisions; dark grey are natural vegetation areas, light grey are antropogenic disturbance area; black contours are the protected areas closest to the study area. The urban area of Belo Horizonte is the large light grey area in the north. The geographic distribution of the maned wolf is shown in the insert (grey area).

Data collection and analysis

From October 2006 to January 2008 we searched monthly for maned wolf scats in two fixed routes composed of several unpaved roads existing within the 1610 ha study area (Fig. 2). A total of 423.15 km and 205.39 km were searched, respectively, from the first (20.15 km in length) and from the second route (10.81 km in length). The resulting sampling effort (628.54 km) was equally distributed between the dry season (April – September: 307.6 km) and the wet season (October-March: 320.9 km). All scats found were mapped with a Garmin GPS (SAD 69 Datum). In the lab the scats were cleaned under running water in fine mesh sieves and then dried for 48 hours under 60°C.All items found were separated, identified to the lowest possible taxonomic level and counted [5]. Teeth of small mammals were used to identify species of rodents. The guard hairs of maned wolf found in feces had their microstructure compared to a reference collection [33-34]. Fecal samples lacking maned wolf hairs (few samples n=5) were identified on the basis of associated tracks and characteristic odor. The few unidentified samples (n=10) were discarded from analysis. The sample sufficiency was assessed graphically plotting sample size (scats) against the randomized (n=100) number of observed prey items found in feces (S_{obs}, Mao Tau). We also estimated the total richness of prey items using two estimators which are indicated for incidence (presence/absence) data, the Incidence Based Coverage Estimator (ICE), and Chao 2 [35]. All three estimators were generated by the program EstimateS [36].

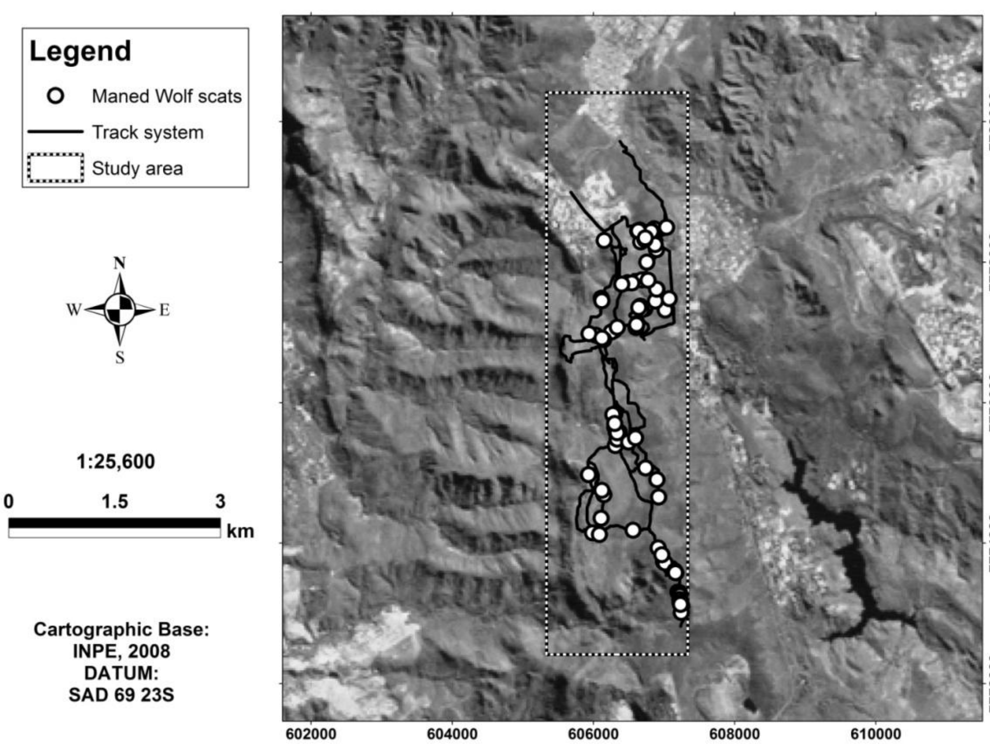

Fig. 2. Detail of the study area (rectangle) showing the track system (black lines) used for sampling maned wolf scats (white dots) during the study.

To calculate the minimum number of prey individuals consumed, the undigested hard parts such as remains of crania, mandibles, teeth and seeds were counted [37]. The complete ingestion of a prey was assumed when teeth, claws and bones of various body parts were found in the same scat [5]. Ingested biomass was estimated counting the number of individuals found in feces and multiplying this figure by the average body weight of the species [5,38-39]. Only items identified to genus or species levels were considered for the biomass analysis. When prey identification was possible only to genus level, we used the average body weight of all congeneric species that potentially occur in the study area [38-40]. The biomass of the most consumed fruit, *Solanum lycocarpum* A. St.-Hil (Magnoliopsida, Solanaceae) was calculated according to other studies [4,16,41], and the ingestion of a *S. lycocarpum* fruit was assumed when ≥ 300 seeds were found in a single scat. Below this threshold we assumed that only part of a fruit was ingested and the respective biomass was calculated proportionally. The average mass of a *S. lycocarpum* fruit was obtained from the literature [16,42-44]. We have no reason to believe that fruits of this plant are much different, regarding mass and size, from the same plant species found in other Cerrado areas, so we assumed that the literature figures are representative. We also calculated the frequency of feces containing an item (% feces) and the frequency of items in relation to the total number of items (% items) [4,10,45-46]. Seasonal changes in the frequency of consumed items were compared between seasons using the Chi-square test [47]. All statistical tests were run in the freely available software BioEstat 5.0 [48].

We mapped the soil cover types of the study area (2 x 8 km rectangle) through interpretation and classification of a Landsat 5 image, using the technique of supervised classification and maximum similarity algorithm of the program ERDAS Image 8.4 [49], following the methodology of other studies[50-52]. We used the G-test to compare the frequency of feces found in each class of soil cover type traversed by the study routes with the frequency expected based on sampling intensity. The expected number of scats was calculated multiplying the total number of scats by the proportion of sampling effort (km sampled/km total) accumulated in each class of soil cover type traversed by the two sampled routes. To obtain that, we first imported the coordinates where the scats were found as well as the sampled routes to a geographic information system ArcGIS 9.2 [53], overlaid with cartographic maps. As cartographic basis we used topographic charts (1:50000) of the Brazilian Institute of Geography and Statistics [54], ortophotocharts from the Energy Company of Minas Gerais (CEMIG) in the scale of 1:10000 (spatial resolution of 1 m) and a Landsat 5 image (07/July/2008) with spatial resolution of 30 m [55]. We were thus able to calculate the amount of km sampled in each soil cover type traversed by the sampling routes.

Results

We collected 95 maned wolf scats throughout the study and identified 24 different dietary items (17 animal, five plant and two garbage items) (Appendix 1). Scat number did not differ between dry (n=55) and wet (n=40) seasons (Chi-square with Yates correction; X^2=2.063; d.f.=1; p=0.150). Plants (*Solanum lycocarpum;* Class Magnoliopsida) were the most consumed item, followed closely by mammals (Class Mammalia; 10 species, mostly small rodents and marsupials). The frequency of items did not differ between dry and wet seasons (X^2=10.429; d.f.=5; p=0.064). The main prey among mammals was the rodent *Necromys lasiurus* (Appendix 1 Table1). Mammals were the top ranking item in terms of ingested biomass, particularly the rodent *Cavia* sp., followed by the plant *S. lycocarpum* (Appendix 2). The curve of accumulated prey items (Sobs Mao Tau) was still increasing, though at a slower rate, at the end of the study (Fig.3), indicating that the maned wolf are consuming other prey items in addition to those listed in Appendix 1 Table 1. In fact, the two estimators of total richness suggest the existence of 4 to 5 additional prey items in the study area (Chao2 = 28.2± 4.88 prey items and ICE = 29.5 ± 0.01 prey items) (Fig. 3).

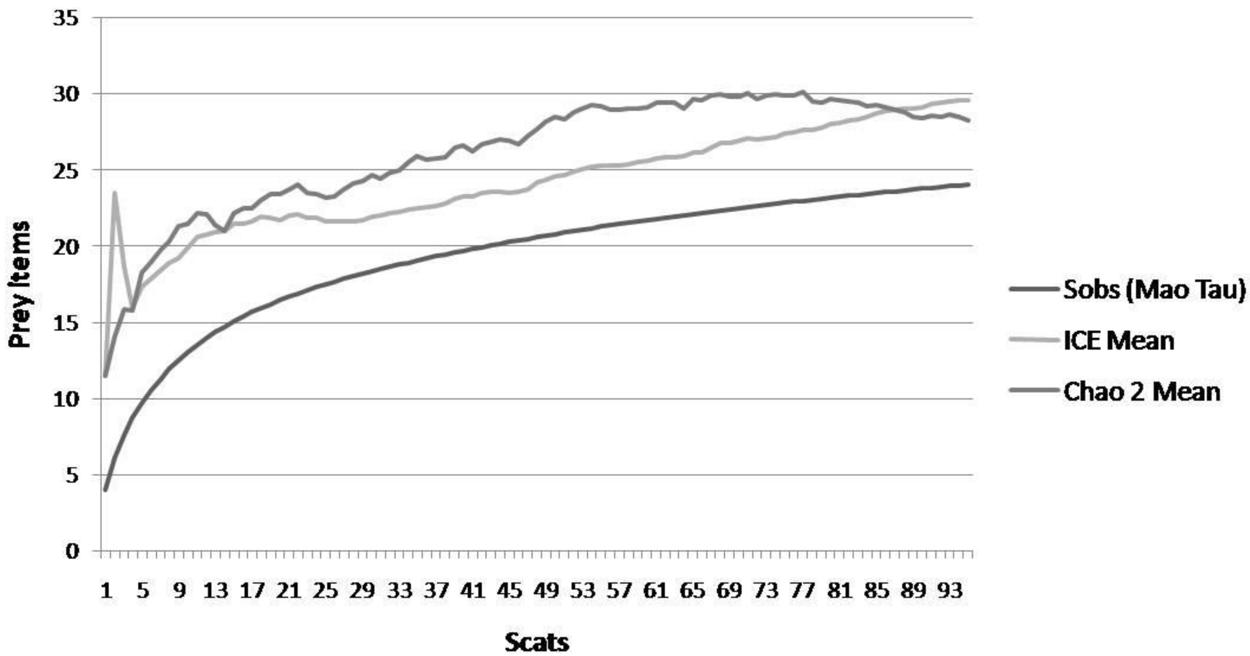

Fig. 3. Randomized number of observed prey items (Sobs Mao Tau; lower curve) and estimated richness of prey items (ICE; light grey curve and Chao2; dark gray curve) derived from maned wolf scats collected in Serra da Calçada between October 2006 and January 2008.

Native fields, including altitude (35.91%), rocky (23.71%) and open fields (0.49%), form the predominant soil cover type of the study area, followed by semideciduos forests (7.87%), urban areas (7.45%), recently burned areas (7.21%) and water courses (4.41%). Anthropogenic (urban areas and roads) and highly disturbed areas (burned areas) total almost a third of this landscape, but the actual degree of disturbance is greater than that, because most of the fields are composed of grassy vegetation heavily invaded by the exotic grass *Melinis minutiflora*, indicative of recurrent fires and past cattle ranching activity (Fig. 4).

The feces were found at distances varying from 312 to 6639 m from the perimeter of the two closest protected areas (EEF: mean= 2827 m; SD = ± 1839 m; PESRM: mean = 3731 m ; SD = 1669 m). Although sampled routes traversed six types of habitats, the feces of maned wolf were found solely in the three grassy habitats sampled with highest intensity (altitude fields, rocky fields and fields burned recently) . This distribution of feces did not differ, however, from the expected number based on sampling intensity (G test with Williams correction; G= 6.934; p = 0.226) (Fig. 5). Even after removing from this analysis the classes of soil types where no feces were found (urban areas, open fields and water courses), the difference was still not significant (G test; G= 3.391; p = 0.183).

Fig. 4. The maned wolf photographed by one of the authors (AGC) in a large protected area in northwestern Minas Gerais (Grande Sertão Veredas National Park). The remaining photos illustrate some aspects of the study area, the Serra da Calçada ridge (clockwise from top right): the characteristic mountainous landscape with native fields (foreground) intermingled with Cerrado (background); patch of an exotic grass (the Molasses grass *Melinis minutiflora*; **foreground) invading a native field**

Discussion

All items found in the diet of the studied population, including the high consumption of the plant *Solanum lycocarpum* [5,16,56-57] and of small mammals [9,12-14,58] have been reported by other authors studying the species elsewhere. The same applies to other items consumed less frequently, such as birds [4-5,11,59] and invertebrates [4,8,57]. Similarly, the relative high frequency of grasses in maned wolf scats is not restricted to the present study [4,9,11,16,57]. Grasses are probably ingested to help digestion, as canids cannot digest nor extract nutrients from herbs [4,9]. The large extent of grassy fields present in the study area indicates that the structure of the vegetation has been greatly modified in the past, probably by decades of cattle grazing and recurrent fires. These field areas are, however, frequently used by the maned wolves, including the recently burned areas. Burned areas tend to present population explosions of some small mammals, particularly *Necromys lasiurus* and *Calomys* sp., which feed on seed and grasses [60-62]. Accordingly, these two rodents were the main mammal species found in the maned wolf diet in the study area.

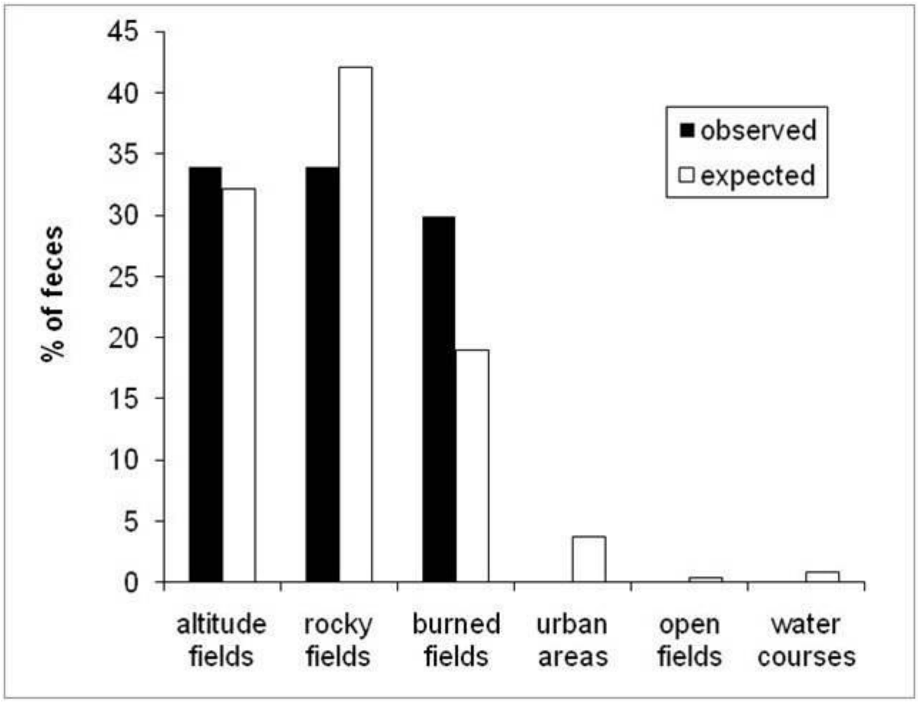

Fig. 5. Comparison of the observed number of feces found in six types of habitats of the study area, expressed as percentage, with the expected number based on sampling intensity. See methods for details.

Although the curve of accumulated prey items had not reached an asymptote, the rate of increase greatly diminished after approximately 20 samples, indicating that the amount of analyzed feces was probably enough to represent the most common prey items of the maned wolf diet in the study area. In fact, our sample size is larger than the minimum amount recommended by some studies to estimate the most-consumed prey items. According to Trites and Joy [63], for example, 59 scats are necessary to identify the main prey that occurs in more than 5% of the feces while ≥ 94 samples are needed for comparisons among areas or temporal comparisons. Notwithstanding this limitation and differences between our study and others regarding sample size and experimental design, the diet of the present study seems to be impoverished in comparison to other localities (Appendix 3), which likely reflects the disturbed nature of the study area. On the other hand, this also suggests that the study area, although disturbed and unprotected, can still provide natural food resources for the maned wolf. Of course, more data are necessary to show whether the study population is consuming prey solely from the buffer zone or also from the less disturbed nature reserves nearby. Given the distances involved and the fact that maned wolves are wide-ranging [4,10,19,59,64], it is possible that individuals defecating in the study area might be, in fact, foraging in a much larger region. But the relevant point here is that, despite the diversity of impacts and the constant presence of humans, vehicles, and domestic dogs in the study area, the maned wolves are there. If this impacted area were not important habitat for the maned wolf, we would not expect to find feces so frequently there. Further, the scats were found in all sampled months, indicating that the wolves are occupying the area throughout the year.

Although our study is limited by the absence of information on residence status and size of the study population, our data show that the maned wolf is able to occupy an area close to a large urban center and subjected to a diverse array of anthropogenic impacts. This result is very important because the maned wolf, like other species of large mammals inhabiting the Cerrado, might not be able to survive in the long term solely within nature reserves, as these cover no more than 2.2% of the original Cerrado area [21]. Even the largest Cerrado reserve in Brazil, the Emas National Park (132.000 ha) is not large enough to sustain genetically viable populations of maned wolves [18,65]. The presence of the species in less protected areas, and the real importance of those areas for the species' survival, therefore deserve more attention in the future.

Implications for conservation

Our data highlight the importance of buffer zones for improving the viability of maned wolf in rural environments, corroborating similar findings from other recent studies on this species [27;52;66-67]. This information is important also in a broader context. Ranging data from this species could be used, for example, to determine the size of a biologically meaningful buffer zone. Studies using real data on animal needs or on viability of population size are just beginning in Brazil. Alexandre and collaborators [68], for example, used the marsupial *Micoreus paraguayanus* as a model for planning the size of the buffer zones in Rio de Janeiro protected areas. According to the Brazilian system of protected areas [22], the size of the buffer zone must be defined by the management plan of each protected area. A previous resolution established, however, that these must encompass a buffer of 10 km from the perimeter [69], which was shortened to 3 km by yet another recent resolution [70]. Notwithstanding the difficulties these conflicting definitions might bring to the management of the buffer zones, these sizes may or may not be adequate for protecting species from the eternal external threat [71]. So the more real data we have, the closer we will get to a biologically relevant definition of buffer zone size.

Apart from increasing the potential habitat for wide-ranging species and helping to increase the viability of their populations, buffer zones of protected areas have a fundamental role in matrix permeability, allowing the dispersion of individuals throughout the landscapes [66;68;72]. Thus an adequate management of these is mandatory, since most remnants of natural vegetation are immersed in matrices greatly modified by human activities [73], where, nevertheless, several species have the potential to adapt to [66-67;73]. However, if nothing changes in Brazil regarding the creation and management of buffer zones, their role in conservation is not only compromised, but also they can have negative impacts such as the introduction of domestic animals and their associated diseases into protected areas [74-77].

Can we conclude that maned wolf is truly able to survive in these modified environments? The same conclusion could be drawn from recent sightings of this species [25-26,57;66-67] in places where deforestation and fragmentation have drastically transformed the landscape, from dense forests to open agricultural lands and cattle ranches. In fact, these recent sightings are not isolated records; rather, they seem to be the rule for a vast region of eastern and southeastern Brazil, into which the maned wolf has expanded its geographic distribution in the last decades [27]. Additionally, a recent genetic study indicates that individual exchange is still occurring among protected areas located near the urban environment of the Brazilian capital [72]. Further, the strong association of the species with man-made structures, even during the reproductive period [52], might be seen as another evidence of the species' ecological flexibility. This apparent plasticity makes us conjecture that the conservation of maned wolf might demand less in terms of intervention and management than previously thought. Though these findings are all encouraging, we prefer to adopt a cautionary skepticism about the potential of these modified environments as adequate habitats for the maned wolf, at least until more detailed information on gene flow, genetic health, population size, site fidelity and other parameters becomes available.

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Appendix 1. Frequency of items in scats (% Scats) and in relation to total number of items (% items) found in maned wolf scats collected in Serra da Calçada between October 2006 and January 2008.

Item	% Scats	n	% Items	n
Animal				
Class Mammalia				
Order Rodentia				
Necromys lasiurus	37.89	36	8.62	62
Calomys sp.	13.68	13	1.80	13
Cavia sp.	11.57	11	1.52	11
Oligoryzomys sp.	10.52	10	1.52	11
Oxymycterus sp.	7.36	7	1.25	9
Galea spixii	4.21	4	0.55	4
Hylaeamys megacephalus	2.10	2	0.27	2
Order Didelphimorphia				
Gracilinanus sp.	3.15	3	0.41	3
Didelphis albiventris	2.10	2	0.27	2
Order Carnivora				
Galictis sp.	1.05	1	0.13	1
Total Mammalia	93.63	89	16.34	118
Class Aves	66.31	63	8.90	64
Class Reptilia				
Subordem Lacertilia				
Unidentified Lacertilia	14.73	14	1.94	14
Ophiodes sp.	1.05	1	0.13	1
Suborder Serpentes				
Famíly Colubridae	10.5	10	1.39	10
Total Reptilia	26.30	25	3.46	25
Class Insecta				
Order Hymenoptera				
Unidentified ants	23.15	22	33.79	243
Order Coleoptera	18.94	18	11.68	84
Total Insecta	42.09	40	45.47	327

continued

Appendix 1. continued.

Class Arachnida				
Unidentified tick	14.73	14	4.31	31
Total Arachnida	14.73	14	4.31	31
Total animal	-	-	78.48	565
Vegetal				
Class Magnoliopsida				
Order Solanales				
Solanum lycocarpum	89.47	85	12.23	88
Solanum sp.	4.21	4	0.55	4
Order Gentianales				
Family Rubiaceae	1.05	1	0.13	1
Order Myrtales				
Family Myrtaceae	1.05	1	0.13	1
Total Magnoliopsida	95.78	91	13.04	94
Grasses	60.00	57	8.06	58
Total vegetal	-	-	21.10	152
Garbage				
Aluminum paper	1.05	1	0.13	1
Plastic	1.05	1	0.13	1
Total garbage	-	-	0.26	2
Overal total	-	95	100.0	719

Appendix 2. Weight and number of items and the corresponding ingested biomass of dietary items found in maned wolf scats collected in Serra da Calçada between October 2006 and January 2008.

			Consumed biomass	
Item	Mass (g)	n	g	%
Animal				
Class Mammalia				
Order Rodentia				
Cavia sp.	655.00	11	7205.00	18.97
Necromys lasiurus	60.00	62	3720.00	9.79
Galea spixii	321.00	4	1284.00	3.38
Oxymycterus sp.	80.63	9	725.69	1.91
Calomys sp.	21.35	13	277.55	0.73
Oligoryzomys sp.	19.40	11	213.40	0.56
Hylaeamys megacephalus	45.40	2	90.80	0.24
Order Didelphimorphia				
Didelphis albiventris	1625.00	2	3250.00	8.56
Gracilinanus sp.	29.25	3	87.75	0.23
Order Carnivora				
Galictis sp.	2400.00	1	2400.00	6.32
Total Mammalia	_	118	19254.19	50.69
Class Reptilia				
Suborder Lacertilia				
Ophiodes sp.	19.88	1	19.88	0.05
Total Reptilia	_	1	19.88	0.05
Total animal	_	119	19274.07	50.74
Plant				
Class Magnoliopsida				
Order Solanales				
Solanum lycocarpum	630	88	18687.90	49.22
Total plant	_	88	18687.90	49.22
Overall total	_	207	37961.97	100

Appendix 3. Comparison of diet diversity (number of items found in scats) between the present study and studies carried out in other areas of the Brazilian Cerrado. Sample size is the number of analyzed scats.

Source	Sample size	Number of items in diet		
		plant	animal	Total
[46] Bueno and Motta Junior (2004)	438	22	52	74
[17] Bueno and Motta Junior (2009)	614	18	52	70
[9] Bueno *et al*. (2002)	325	24	44	68
[16] Rodrigues *et al*. (2007)	328	24	39	63
[11] Silva and Talamoni (2003)	230	13	41	54
[8] Aragona and Setz (2001)	141	35	18	53
[5] Motta Junior *et al*. (1996)	105	10	34	44
[4] Dietz (1984)	740	21	21	42
[12] Jácomo *et al*. (2004)	1673	18	20	38
[56] Juarez and Marinho Filho (2002)	70	13	20	33
[58] Belentani *et al*. (2005)	46	5	25	30
[57] Santos *et al*. (2003)	150	11	18	29
Present study	**95**	**5**	**17**	**22**