

## THE MANED WOLF IN THE ECOTONE BETWEEN FOREST AND GRASSLANDS AT THE LIMITS OF ITS DISTRIBUTION IN A SUBTROPICAL ENVIRONMENT

### *O LOBO-GUARÁ NO ECÓTONO ENTRE FLORESTA E CAMPO NOS LIMITES DE SUA DISTRIBUIÇÃO EM UM AMBIENTE SUBTROPICAL*

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**ABSTRACT:** The maned wolf (*Chrysocyon brachyurus*) is a neotropical canid that is considered near threatened by the IUCN, vulnerable in Brazil and critically endangered in the state of Rio Grande do Sul. The Araucaria High Plains have coverage of Atlantic forest mixed in with open areas and small wetland areas and are at one of the limits of the range of the maned wolf. The objectives of this article are to demonstrate that, although rare, the maned wolf does still occur in the Araucaria High Plains and to discuss the relevance of conservation efforts in areas in which the occurrence of threatened species is borderline. Data collection took place between March of 1999 and December of 2010 with a total sampling effort of 11,431 trap-days. After 10 years in which there were no corroborated records, the species was caught by camera traps in the São Francisco de Paula National Forest in November of 2009. This is a protected area with forest vegetation and is not considered the species' typical habitat. The open areas in this region are being taken over by agriculture and silviculture of exotic species.

**KEYWORDS:** *Chrysocyon brachyurus*. Canidae. Threatened species. Atlantic Forest. Brazil. Camera-trapping.

## INTRODUCTION

*Chrysocyon brachyurus* (Illiger, 1815) (the maned wolf) is not typically a forest-dwelling species (CABRERA; YEPES, 1960; DIETZ, 1985) and is generally considered an inhabitant of open areas, but it does also occur in forested areas in the South of Brazil (CÁCERES et al., 2007). It has been classified as near threatened by the IUCN because of drastic reductions in its habitat as a result of conversion to agriculture, causing fragmentation of habitats, isolation of subpopulations and road deaths. The presence of feral dogs inside Conservation Units (CU), exposes the maned wolf to the threats of hunting, increased competition and disease transmission (IUCN, 2008). Within Brazil the species is defined as threatened with extinction (CHIARELLO et al., 2008). Specifically in the state of Rio Grande do Sul (south Brazil), it is classified as critically endangered (INDRUSIAK; EIZIRIK, 2003).

The Brazilian Atlantic forest can be considered a "hotspot" on the basis of the great degree of biological diversity concentrated in relatively small areas. The most significant threats to conservation are deforestation, agriculture, silviculture of exotic species and hunting. This

region has a long history of exploitation which makes it highly relevant to understanding the long term effects of habitat fragmentation on other tropical regions that are under threat (LAURANCE, 2009). The Atlantic forest is a series of rainforest ecosystems that extends from the northeast to the south of Brazil (FONSECA et al., 2004). The Atlantic forest can be divided into at least eight sub-regions, one of which is the Araucaria Forest, in the south of the country (RIBEIRO et al., 2009). A large proportion of the work done on conservation in the Atlantic forest has been conducted in the southeast (VIEIRA et al., 2009; GALETTI et al., 2009) or northeast (LEAL et al., 2010) regions of Brazil, but the relevance to biodiversity of key areas in the south of the country has also recognised (PAESE et al., 2010).

The Araucaria High Plains have some vegetation containing species associated with the Atlantic forest mixed in with fields, forming a mosaic pattern (PILLAR et al., 2009). They are located in the northeast of the state of Rio Grande do Sul, (RS), and are considered to represent the limit of the current range of the maned wolf (IUCN, 2008; CHIARELLO et al., 2008). The species has been considered rare in RS since the beginning of the twentieth century. In the 1970s it was recorded

in larger areas in the centre, west and southwest of the state and in smaller areas in the northeast, north, south and southeast, the coastal plains and in the environs of the state capital Porto Alegre (INDRUSIAK; EIZIRIK, 2003). Specifically in the Araucaria High Plains, scats and sightings were reported at the end of the 1990s and start of the 2000s, in the Aparados da Serra National Park (SANTOS et al., 2004).

Recently, studies conducted using camera traps in the northeast of RS and the southeast of the state of Santa Catarina (SC) did not detect the maned wolf which makes the reports from the last decade inconclusive (FREITAS et al., 2009).

The top priority for conservation projects focussed on the maned wolf was to conduct surveys of populations within and around protected natural areas throughout its geographical distribution (SILLERO-ZUBIRI; MacDONALD, 2004). The methods applied to determine where the species occurs include satellite habitat mapping, interviews with local people who spend a considerable time in the field (and who are capable of recognizing the species unequivocally) and camera trap images (SILLERO-ZUBIRI et al., 2004).

The objectives of this article are to demonstrate that, although rare, the maned wolf does still occur in the Araucaria High Plains and to discuss the relevance of conservation efforts made in areas in which the occurrence of threatened species is borderline.

## MATERIAL AND METHODS

### Study area

The São Francisco de Paula National Forest – FLONASFP - is defined as a “Sustainable Use Conservation Unit” (*Unidade de Conservação de Uso Sustentável*) and is located within the municipal limits of São Francisco de Paula. It has a total area of 1,606.7 ha, at an altitude of 930 m and has canyons with depths of up to 100 m. The region’s climate is classified as Cfb according to the Köppen-Geiger system and is a humid subtropical zone (rains are well distributed and summers are mild) (CÁCERES et al., 2007). The native vegetation is either Mixed Rain Forest or Araucaria Forest. In addition to native forest, this CU also has managed stocks of native pine *Araucaria angustifolia* (Bert.) and exotic species (*Pinus elliotii*, *Pinus taeda*, *Eucaliptus* sp) (CADEMARTORI et al., 2002). The first studies of the mammals inhabiting the CU began in 1992 and by 2007 66 native mammal species and one exotic

had been detected and 30 of the native species were medium to large animals (MARQUES et al., 2011).

### Fieldwork methods

Records of medium and large mammals (body mass greater than 1 kg) were obtained on the basis of opportunistic direct observations (during the daytime and at twilight) and/or tracks and scats, which supplemented the primary method of using camera traps. Data collection with the traps took place between March of 1999 and December of 2010 with a total sampling effort of 11,431 trap-days. A total of 10 camera traps were set up in pairs in order to record both sides of animals and remained active twenty-four hours per day, during the daytime, at twilight and at night during all four seasons of the year.

Sampling stations were unbaited and set at 500 m intervals along trails between native forest and *Araucaria angustifolia* stands and off trail in the forest interior, covering an area of around 4.7 km<sup>2</sup>. The camera traps were equipped with active sensors and were triggered whenever an animal broke an infrared beam passing between an emitter and a receiver (MARQUES; RAMOS, 2001).

All fieldwork was duly authorised by the Brazilian federal environmental authorities (Authorization numbers 14 and 15/2001/RS, 14 and 15/2002/RS, 23 and 24/2003/RS, 25/2004/RS, 34/2005-NUFAU, 21 and 22/2006-DITEC IBAMA/RS, SISBIO 11848-2/2008 and SISBIO 26664-1/2011). Two security guards who worked at FLONASFP and reported having seen maned wolves were interviewed and asked to provide detailed descriptions of the animals they had observed to enable an assessment of whether or not they really were sightings of maned wolves.

## RESULTS

On the 1st of November of 2009 (which is spring in south Brazil) two traps photographed a maned wolf. The first picture was taken at 19:24 at coordinates 29°25'39.1”S 50°23'48.4”W and the second at 19:33 at coordinates 29°25'23.6”S 50°24'06.8”W. Sunset was at 18:45 and so the records were defined as taken at twilight (between 1 hour before and 1 hour after sunset) (THEUERKAUF et al., 2003). The animal appeared to be a healthy adult, with no obvious signs of worn teeth. Sex could not be determined (Figure 1). It had crossed the 500 m between the two traps in 9 min, at a velocity of around 0.93 m/s (3.33 km/h), apparently travelling without haste (Table 1). Around 15 days before, a partial maned wolf print

had been found on the same trail where the animal was photographed.



**Figure 1.** Maned-wolf caught on camera in November of 2009 in the Floresta Nacional de São Francisco de Paula, Rio Grande do Sul, Brazil.

**Table 1.** Records of recent occurrences of *Chrysocyon brachyurus* in the São Francisco de Paula National Forest, RS, Brazil

Records	Camera traps		Guards' reports	
Date	01/XI/2009		18/VIII/2010	12/X/2010
Season	Spring		Winter	Spring
Time	19:24	19:33	17:30	08:00
Period	twilight		twilight	daytime
Velocity	0.93 m/s (3.33 km/h)			
Environment	Road between <i>A. angustifolia</i> plantations		<i>Pinus</i> plantation and fields	Road inside <i>Pinus</i> plantation
Coordinates	29°25'39,1"S 50°23'48,4"W	29°25'23,6"S 50°24'06,8"W	29°23'36,9"S 50°22'49,8"W	29°24'41,7"S 50°22'55,9"W

The camera traps were left in place until the start of January 2010, but no more photographs of the species were taken on that trail. Later that year, two security guards who work at FLONASFP reported sightings of the species within the CU. On the 18th of August 2010, (winter), a single adult-sized individual was seen at 17:30 (twilight) entering the FLONASFP perimeter close to the gates at coordinates 29°23'36.9"S 50°22'49.8"W after having followed a stretch of unpaved road outside the CU (Personal communication from Mr. João Luiz Machado Brando). On the 12th of October of 2010 (spring), an adult individual was seen at around 08:00 (daytime) with a cub about half of its size crossing an access road between *Pinus elliotti* plantations in the CU at approximately coordinates 29°24'41.7"S 50°22'55.9"W (Personal communication from Mr. Valdemar Scalcon) The distance between the site where the animal was photographed is around 4 km as the crow flies from

the point where the individual was seen in the winter and the location of the third sighting is around 2 km from each of the first two.

## DISCUSSION

The historic distribution of the maned wolf encompassed the pampas region and the high plains in RS. Natural grasslands in became degraded in areas in the North and Northeast of Argentina, Uruguay and the South of Brazil in which human populations reached high densities, leading to the species' distribution limit reducing. There have been sporadic reports of maned wolves in the pampas and the high plains of RS between 1988 and 2008 (QUEIROLO et al., 2011). The last records of the species in the Araucaria High Plains were in the 1990s and the start of the 2000s (SANTOS et al., 2004) and these animals had not been detected in the region since then (FREITAS et al., 2009).

This long term data collection project in the field was designed to investigate forest-dwelling mammals and is not appropriate for species from open terrain. Despite this fact, the maned wolf was unequivocally recorded on camera, demonstrating that the species still exists in the Araucaria High Plains.

The study area is not the maned wolf's typical habitat, since it tends to inhabit open terrain with tall grass, followed by *cerrado* savannah vegetation with little forest cover (JÁCOMO et al., 2004). However, the lack of tall dense grass in the area, resulting from repeated burning (INDRUSIAK; EIZIRIK, 2003), means that there is a scarcity of sites that are appropriate for dens in which to rear young, whether above ground or sheltered below cracks in rocks, with bushy coverage, tall grasses or small dry hummocks surrounded by swamp or marsh (SILLERO-ZUBIRI, 2009).

The maned wolf is omnivorous and its diet consists of around 50% vegetable and 50% animal material, and in *cerrado* environments the fruit of the wolf *Solanum lycocarpum* St. Hil. is one of the species' principal food resources (SILLERO-ZUBIRI, 2009). This vegetable species does not occur in the Araucaria High Plains region (JARENKOW; BUDKE, 2009). However, Araucaria Forest does contain species bearing edible fruit (PAISE; VIEIRA, 2005). Dietary items of animal origin include small mammals, the majority rodents - sigmodontinae, guinea pigs and marsupials - some mammals with body mass over 1kg (armadillos and leporids), birds of the Tinamidae Family and eggs, reptiles (lizards and non-poisonous snakes), arthropods (ants, grasshoppers and crickets, beetles, ticks, spiders) (ARAGONA; SETZ, 2001; JÁCOMO et al., 2004). These groups of animals are present in the Araucaria High Plains, both in forested areas and in open spaces (CADEMARTORI et al., 2002; CADEMARTORI et al., 2004; CADEMARTORI et al., 2008; DALMAGRO; VIEIRA, 2005; PEDÓ et al., 2010; MARQUES et al., 2001; FONTANA et al., 2008; DEIQUES, 2009; OTT; LISE, 2009; DIEHL, 2009). However, food availability is limited in areas used for pasture and where fire has been used, since these areas have significantly reduced abundance, biomass and diversity of the small mammals than areas that have been protected from these impacts (PEDÓ et al., 2010).

In central Brazil, female maned wolves come into oestrus once a year, between April and June, and the majority of births occur between June and September (the dry season) after a gestation of

around 65 days. Litters range from one to seven cubs, but the average is three. Cubs are weaned after 15 weeks, but receive regurgitated food from their parents for 4 weeks. Juveniles remain with their mother for around a year before dispersing (SILLERO-ZUBIRI et al., 2004). There is a greater abundance of rodents in the Cerrado Biome during the dry season (MELO et al., 2007). There is no dry season in the Araucaria High Plains, since rain is well distributed throughout the year, while the greatest seasonal differences are the lower number of hours of light per day and lower temperatures during the winter (June to August) when compared with the summer (December to February) (CADEMARTORI et al., 2002). The greatest abundance of sigmodontinae rodents is during August (the end of winter) in Araucaria Forest (CADEMARTORI et al., 2004). In general, fields are burnt illegally to clear them at the end of winter. Vegetation will re-sprout resulting in cleared fields, reducing the quality of the habitat for maned-wolves (INDRUSIAK; EIZIRIK, 2003). This lack of hospitable areas in the species' preferred environments may be the reason why some individuals seek refuge in forest within a protected area, especially when rearing young.

The majority of studies of the ecology and behaviour of the maned wolf have been conducted in the southeast and central regions of Brazil, with emphasis on the Cerrado. This canid shows a strong preference for rocky grasslands, avoiding the Atlantic forest, and follows roads at night to move about (COELHO et al., 2008). The species tends to use areas with dense vegetation during the day, whereas during the night, when it is more active, it prefers open areas (COELHO et al., 2007). Maned wolves have been found in areas with *cerradão*, *cerrado* and eucalyptus plantations in patchwork, demonstrating the behaviour of a generalist species (LYRA-JORGE et al., 2008). A 6-month study of three GPS-collared maned wolves in an area of *cerrado* in Minas Gerais state demonstrated that this species is predominantly active at night, peaking at twilight, and that the female's living area reduces drastically after cubs are born (MELO et al., 2007). They form monogamous pairs and share home ranges, but the pair maintain a mean distance of more than 500 m from each other when they are active, in order to avoid interfering with successful feeding (JÁCOMO et al., 2009). In canids, variations in home range size and sociability can be attributed to availability and dispersion of food and habitat resources (SILLERO-ZUBIRI, 2009). In a region that is borderline of distribution for the species and in the presence of impacts on its

primary habitat, it is to be expected that home ranges will be large and reports will be rare and sporadic. A subpopulation that has adapted to a different environment from that found in the centre of Brazil should be investigated with conservationist objectives, even if it is rare and population densities are low (SOULÉ; KOHM, 1989).

The maned wolf is considered a generalist species, because it can survive in altered environments, as long as there is natural vegetation mixed in among the agroecosystems (LYRA-JORGE et al., 2009). Notwithstanding, in areas used for livestock farming, domesticated dogs are left free and can be predators or disease vectors for maned wolves and poisoned bait is often laid in fields (SILLERO-ZUBIRI et al., 2004), intended for the crab-eating fox *Cerdocyon thous* (Linnaeus, 1766) and the pampas fox *Lycalopex gymnocercus* (G. Fischer, 1814) which are accused of killing lambs. In the Araucaria High Plains region, more than 20 years ago, some farmers used to order their farm workers to distribute small pieces of sausage containing strychnine to kill wild canids (Personal communication from Mr. Arcelino Pereira Moraes). Nowadays this poison is banned, as is its sale, but other toxic substances could have devastating effects of canids were they to be used.

The presence of the maned wolf in FLONASFP shows that protected and unprotected areas play complementary roles in nature conservation, since their boundaries are not absolute, but permeable. Strategies to achieve a compromise between human interests and conservation in unprotected areas are essential if

management plans are to be successful (PRIMACK, 2006). Small areas under cultivation, and silviculture in patchwork with fields could, in principle, allow the species to adapt as long as open areas are conserved. The following measures constitute some of the steps needed to restore the necessary conditions for survival for maned wolves and other species threatened with extinction. Legislation that enforces the responsibility of rural landowners to conserve a proportion of the natural ecosystems on their properties. Environmental licensing of high-impact activities that takes into account the need to maintain the permeability of environments for rare species. Publicity and implementation of alternative methods for avoiding predation of domesticated animals by the maned wolf (PAULA et al., 2008). Environmental education aimed at a range of different publics.

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**RESUMO:** Lobo-guará (*Chrysocyon brachyurus*) é um canídeo neotropical considerado quase ameaçado de extinção pela IUCN, vulnerável no Brasil e criticamente em perigo no estado do Rio Grande do Sul. Planalto das Araucárias tem vegetação de Mata Atlântica entremeada por campos e pequenas áreas úmidas, sendo um dos limites de distribuição do lobo-guará. Os objetivos desse trabalho são demonstrar que, apesar de raro, o lobo-guará ainda existe no Planalto das Araucárias e discutir a relevância dos esforços de conservação em áreas limite de ocorrência de espécies ameaçadas de extinção. A coleta de dados ocorreu entre março de 1999 e dezembro de 2010 com um esforço amostral total de 11.431 armadilhas-dia. Após dez anos sem registros inequívocos, essa espécie foi capturada fotograficamente na Floresta Nacional de São Francisco de Paula em novembro/2009. Essa área protegida apresenta formação vegetal florestal, não considerada hábitat típico dessa espécie. O ambiente aberto nessa região está sendo substituído por cultivos agrícolas e silvicultura de exóticas.

**PALAVRAS-CHAVE:** *Chrysocyon brachyurus*. Canidae. Espécie ameaçada. Floresta Atlântica. Brasil. Armadilhas fotográficas.

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