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PRIMATES OF THE LOWER URUBAMBA REGION, PERU, WITH COMMENTS ON OTHER MAMMALS

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Abstract

We present data on encounter rates and group sizes of primates in the Lower Urubamba Region of Peru, an unprotected area little represented in the literature. We censused a total of 467.7km on 10 transects during two seasons and documented nine primate species in the area. Compared to nearby protected areas, group encounter rates were lower and group sizes were smaller for all species except *Saguinus fuscicollis* and *S. imperator*. Relatively high abundance of *S. imperator* and low abundance of larger bodied primates is a possible example of density compensation resulting from hunting pressure. In addition to the primates, 23 other mammal species were observed or photographed by camera traps, including *Procyon cancrivorus*, which was not previously reported in the area.

Keywords: Lower Urubamba, Peru, primate densities

Resumen

Presentamos los datos de tasas de encuentro y tamaños grupales de especies de primates en la Región del Bajo Urubamba en Perú, un área no protegida poco representada en la literatura. Censamos un total de 467.7km a lo largo de 10 transectos durante dos estaciones y documentamos la presencia de nueve especies de primates en el área. Comparando nuestros datos con los de áreas protegidas cercanas, las tasas de encuentro fueron bajas y los tamaños grupales fueron menores para todas las especies a excepción de *Saguinus fuscicollis* y *S. imperator*. La abundancia relativamente alta de *S. imperator* y la abundancia baja de las especies de mayor tamaño corporal podrían ser un ejemplo de la compensación de densidad que resulta de la presión ejercida por la caza. Adicionalmente a los registros de primates, 23 especies de otros mamíferos fueron observados o fotografiados por cámaras trampa, incluyendo a *Procyon cancrivorous*, el cuál no ha sido reportado en el área previamente.

Palabras clave: Bajo Urubamba, Perú, densidades de primates

Introduction

Peru is one of the more active South American countries in primate research (PrimateLit, 1940-2010: 678 records), yet the Lower Urubamba Region (LUR, named for the Urubamba River) in the Department of Cuzco is underrepresented in the primate literature (PrimateLit, 1940-2010: 0 records). This is likely due to the lack of protected areas in the region and the LUR's many oil concession areas (Finer and Orta-Martínez, 2010), which can limit access. Primate records therefore come primarily from environmental consulting agencies and are in the form of environmental impact assessments (EIAs; Table 1). Because these reports are often the result of rapid assessments, species lists are produced primarily with indirect evidence (e.g. scat, vocalizations), and data on encounter rates and group sizes are limited.

Because the LUR lies at the base of the Andes Mountain Range, it exhibits high precipitation and great variation in elevation and topography (Alonso *et al.*, 2001) promoting floral and faunal diversity (Gentry, 1988; Pacheco *et al.*, 2009). There is much debate regarding the geographic distributions, names, and characteristics of the primate species likely to be found in the LUR and surrounding areas (e.g., for *Callicebus* spp. see Aquino *et al.*, 2008; Defler, 2004; Hershkovitz, 1990; Heymann *et al.*, 2002; van Roosmalen *et al.*, 2002, among many others). The purpose of this paper is to document the primate species present in the LUR, report their encounter rates and group sizes, and present observations of other large mammal species encountered.

Study site

Covering approximately 60,000 ha, the LUR is bordered to the west by the Vilcabamba Mountains and to the east

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Table 1. Summary of primate and mammal census data for the Lower Urubamba Region (LUR), Cordillera Vilcabamba (CV), and Manu National Park (MNP). The total number of mammal species registered in each study, both through direct (sighted or photographed) and indirect observations, are listed, as are the number of primate and other mammal species directly observed. The final column lists the primate species observed, and bold type indicates species also found at the study site. NR = not reported.

Study	Area	Loc.	Date[a]	Habitat	Effort[b] (days, hours, km diurnal monit.)	All mammals		Primates	Primate species[c]
						Total no. spp. reg.	No. spp. dir. obs.	No. spp. dir. obs.	
Present Study	LUR	Pagoreni A	D,W '11	1° lowland forest	80d; 370hrs 467.6km	27	27	9	**AC, ASA, AN, CB, CAL, CAP, PI, SF, SI**
Boddicker *et al.*, 2001	LUR	Pagoreni A	D '98	1° and 2° lowland forest	16d; 112 hrs; 80km	24	7	4	**AO, APC** (Vo), **AS, CAL**, PM
	LUR	San Martín 3	D '97	1° lowland forest with bamboo	12d; 84hrs; 42km	24	13	6	**APC, AS, CAL, CAP, SI**, SSB
	LUR	Cashiriari 2	D '97	1° lowland forest	13d; 91hrs; 65km	24	11	5	**CAL, CAP, CP, SF**, SM
	LUR	Cashiriari 3	W '97	1° lowland forest	20d; 140hrs; 100km	26	15	8	**AO, AS, CAL, CAP, CMB, LL, SI**, SSB
Emmons *et al.*, 2001	CV	Río Pomureni	D '97	Pampas	28d	4	1	0	No Primates
	CV	Río Poyeni		1° montane forest		7	3	2	**ABC** (Vo), AO (Vo), **CAL, CAP**
	CV	Río Picha	D,W '98	Mid-montane cloud forest	25d	10	8	4	**ABC** (Vo), AO, **AS** (Vo), **CAL, CAP**, LL
Rodriguez and Amanzo, 2001	CV	Llactahuaman	D '98	1° montane forest with bamboo	31d	12	5	0	No Primates
	CV	Wayrapata		Cloud forest		12	1		No Primates
ERM, 2010	LUR	Kinteroni	D,W '09, W '10	1° lowland forest with bamboo	12d; 85.5hrs; 50km	23	14	6	**AC, AL**, CA, **CAL, CAP, PI** (Vo), **SI**
	LUR	Mashira			12d; 87.1hrs; 59km	27	21	8	**AC, AL**, AN, CA, **CAL, CAP**, SB, **SI**
	LUR	Mapi			12d; 104.9hrs; 55km	21	14	6	**AC, AL, AN**, CA, **CAL**, LC
ERM, 2009	LUR	Kinteroni	W '09	1° lowland forest with bamboo	2d; 23.5hrs; 12.4km	20	6	3	**AN, AS** (Vo), **CAP**, CB, **SI**
ERM, 2006b	LUR	Yamihua (Coviri Alto)	W '05		6d; 34.5hrs; 37.6km	34	14	7	**AN, AS** (Vo), **CAP, CB, SA, SB, SF, SI**
ERM, 2006a	LUR	Kinteroni	W '06		5d; 15hrs; 7.5km	13	7	4	**AS** (Vo), **CAL, CAP, CB, SI**
ERM, 2005 in ERM 2006a	LUR	Miaría (Atalaya)	W '05	1° lowland forest	6d; 33.5hrs; 32.1km	22	6	2	**AN, AS** (Vo), **CAL** (Vo), **CB** (Vo), **SI**
	LUR	Sabetari (Coviri)	W '05	1° lowland forest	5d; 33hrs; 28.2km	26	10	5	**AN, AS** (Vo), **CAL, CAP** (Vo), **CB** (Vo), **SB, SI**
Leite Pitman *et al.*, 2003; Terborgh *et al.*, 1984	MNP	EBCC	D,W '73-'84; '00-'02	1° lowland and flooded forest, grassland	12 yrs	61	NR	14	AP, **AS**, AT, **CAL, CAP**, CG, CM, CP, LL, PM, **SF, SI**, SM, SS
Walsh Peru, 2010	LUR	Kinteroni, Block 57	D,W '10	1° lowland forest with bamboo	36d; 403.2hrs; 268.8km	38	NR	NR	**AC, AN, ASA**, AV, CA, **CAL, CAP, CB**, SB, **SI**

[a]D = Dry season; W = Wet season; [b]Camera and other trap time not listed; [c]**ABC** = ***Ateles belzebuth chamek***, **AC** = ***Ateles chamek***, **AL** = ***Alouatta* sp.**, **AN** = ***Aotus nigriceps***, AO = *Aotus* sp., AP = *Ateles paniscus*, APC = *Ateles paniscus chamek*, AS = *Alouatta seniculus*, **ASA** = ***Alouatta sara***, AT = *Aotus trivirgatus*, AV = *Aotus vociferans*, CA = *Callicebus* sp., **CAL** = ***Cebus albifrons***, **CAP** = ***Cebus apella***, **CB** = ***Callicebus brunneus***, CG = *Callimico goeldii*, CM = *Callicebus moloch*, **CMB** = ***Callicebus moloch brunneus***, CP = *Cebuella pygmaea*, **CPI** = ***Cebus pithecia***, LC = *Lagothrix cana*, LL = *Lagothrix lagothricha*, **PI** = ***Pithecia irrorata***, PM = *Pithecia monachus*, SA = *Saguinus* sp., SB = *Saimiri boliviensis*, **SF** = ***Saguinus fuscicollis***, **SI** = ***Saguinus imperator***, SM = *Saguinus mystax*, SS = *Saimiri sciureus,* SSB = *Saimiri sciureus boliviensis*

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by the Urubamba Mountains. The study site is near the Pagoreni A natural gas well site, east of the confluence of the Camisea and Urubamba Rivers (11°42' S, 72°48' W; Fig. 1). Three habitat types—*terra firme*, riverine terrace, and mixed upland—have been described for the area, and Pagoreni A is in *terra firme* primary forest, dominated by *Iriartea deltoidea* (Araceae) and *Pentagonia parvifolia* (Rubiaceae) (Comiskey *et al.*, 2001). In the region, the local Matsigenka people cultivate manioc, maize, plantains, and bananas using swidden agricultural techniques (Shepard and Chicchón, 2001) along the Camisea River, and subsistence hunting is legally practiced. The study area is in traditional Matsigenka territory, within oil concession lots 56 and 58, controlled by Pluspetrol. Repsol Exploración Perú is building a second pipeline from Pagoreni A to the Malvinas processing plant. We studied a 9.2 km section of the northern part of this proposed pipeline (Fig. 1) under a collaborative agreement with Repsol, and results presented here are part of a larger study on the impacts of pipeline construction on primates.

Methods

Primates were censused along eight transect trails perpendicular to the route of the planned pipeline, between 1.2 and 1.5 km in length (opened in March-May 2011) and along two transects on the proposed pipeline route 4.0 and 5.2 km in length (Fig. 1) during the dry (28 May-3 July 2011) and wet (13 October-24 November 2011) seasons. Transects were sampled between 700-1200 and 1300-1700 h. In the dry season, perpendicular transects were walked a total of 8 times each and in the wet season 20 times each. The pipeline trail transects were sampled 20 and 18 times each during the wet season only. A total of 467.6 km (dry season: 84 km; wet season: 383.6 km) were sampled. An additional 668.2 km (dry season: 259.3 km; wet season: 408.9 km) were sampled opportunistically during transit time to, from, and between transects. There were two field teams, each consisting of a Matsigenka guide, a primatologist (TG or FCR), and a field nurse. The team members walked transects at approximately 1.25 km per hour and upon encountering a group of primates recorded the following data: species, group size, sex-age composition of the group, height of the group in the canopy, and the location with a hand-held Garmin Map CSx or Cx GPS unit. When possible, primates were photographed to confirm species identifications. Groups that were heard but not seen (particularly *Alouatta sara* and *Callicebus brunneus* groups) were not included in data analysis because their exact location and group size could not be confirmed. We used group size and composition data, combined with the spatial distribution of sightings, to estimate the total number of distinct groups observed (Table 2). Group encounter rates (# seen per 10 km walked) were calculated for each species and compared to adjacent documented localities.

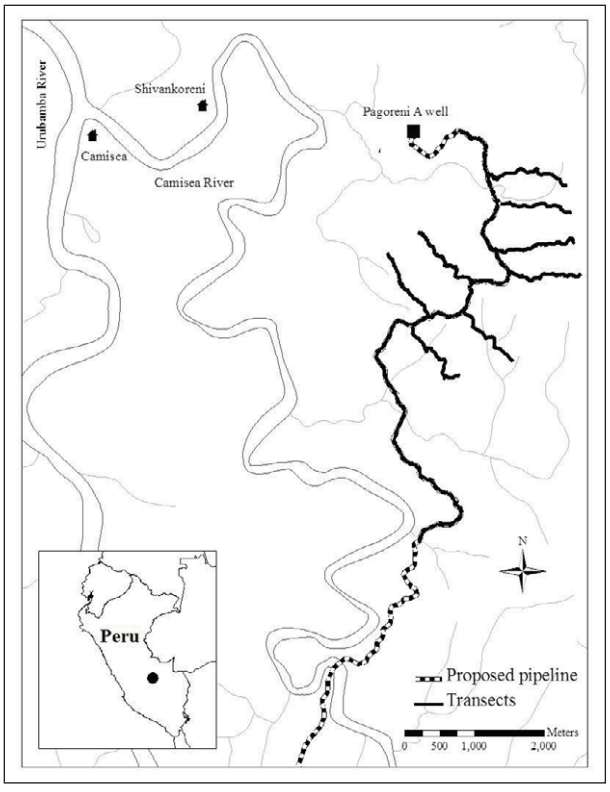


Figure 1. Map of study area. Solid black lines indicate the 9.2 km portion of the proposed pipeline that was monitored and eight perpendicular transects that are at least one kilometer in straight-line distance from the proposed pipeline.

Additionally, we placed Reconyx RC55 digital infrared trail cameras (Reconyx Inc., Holmen, Wisconsin, USA) along the pipeline route and perpendicular transects to document the presence of primates and other mammals. During the dry season, there were four cameras in five locations on the ground (87 camera trap nights) and five cameras in six locations in the canopy (89 nights). During the wet season, we placed six cameras in seven locations on the ground (157 nights).

Results and discussion

During the dry season, we documented eight species of primates. These species were also confirmed in the wet season in addition to a single subadult female *Ateles chamek* (Fig. 2; Table 2). Encounter rates were highest for the two *Saguinus* spp. and the two *Cebus* spp. *Callicebus brunneus*, *Alouatta sara*, and *Pithecia irrorata* were seen relatively infrequently. *Aotus nigriceps* was only seen on four occasions; however, this low encounter rate is likely a byproduct of strictly diurnal sampling. Group sizes were similar to those reported from other sites for both *Saguinus* spp, *C. brunneus*, and *P. irrorata*. Groups of *Cebus* spp., however, were small compared to group sizes documented in the literature (Table 2). In either or both of the seasons, infants and/or juveniles were observed in groups of all species except *C. brunneus*.

More species of primates were observed during this study than in previous studies in the area (Table 1). However, with the exception of the two *Saguinus* spp., encounter rates

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Table 2. Primates observed during study period both on transect walks and during walks to reach sampling sites (total). Mean group size (with all age classes), range, and estimated number of groups observed are based on total sightings. Encounter rates (ER) are based only on transect walk sightings. References for species identifications include names of experts consulted. Group sizes and ER for nearby protected areas Manu National Park (MNP) and Los Amigos Conservation Concession (CICRA) are presented for comparison.

Species	No. of sightings on transects (total)	Mean group size (range)	Est. no. of unique groups obs.	Group ER/10km	MNP, CICRA[a]		References for species identifications
					Mean group size (range)	GroupER/ 10km	
Saguinus fuscicollis	28 (46)	4.8 (2-6)	10	0.60	5 (3-13)	0.43	Aquino and Encarnación, 1994
Saguinus imperator	34 (52)	6.0 (3-10)	9	0.73	4 (3-5)	0.37	Hershkovitz, 1977; 1979
Aotus nigriceps	2 (4)	2.8 (2-4)	4	0.04	4 (2-4)[b]	-	Fernández-Duque, 2011; Ford, 1994; Hershkovitz, 1983
Cebus albifrons	26 (41)	11.0 (8-16)	4	0.56	15 (8-16)	1.22	Silva Jr., 2001
Cebus apella	28 (36)	5.3 (3-8)	3	0.60	10 (4-12)	2.82	Aquino and Encarnación, 1994; Silva Jr., 2001
Callicebus brunneus	5 (7)	2.0 (2)	4	0.11	3 (3-4)[c]	1.04[c]	Hershkovitz, 1990; T. Defler, pers. comm.
Pithecia irrorata	5 (12)	2.4 (2-4)	9	0.11	4.7 (2-8)	-	Hershkovitz, 1987; L. Marsh and S. Palminteri, pers. comm.
Alouatta sara	7 (10)	4.2 (3-5)	6	0.15	6 (4-7)[d]	1.35[d]	Cortés-Ortiz et al., 2003; Groves, 2001; 2005; R. Cadenillas, pers. comm.
Ateles chamek	0 (1)	-	0	-	29.7 (18-44)	2.82	Quintana et al., 2009

[a] References: Gibson, 2012; Janson and Terborgh, 1980; Palminteri and Peres, 2012; Terborgh, 1983
[b] *Aotus trivirgatus*
[c] *Callicebus moloch*
[d] *Alouatta seniculus*

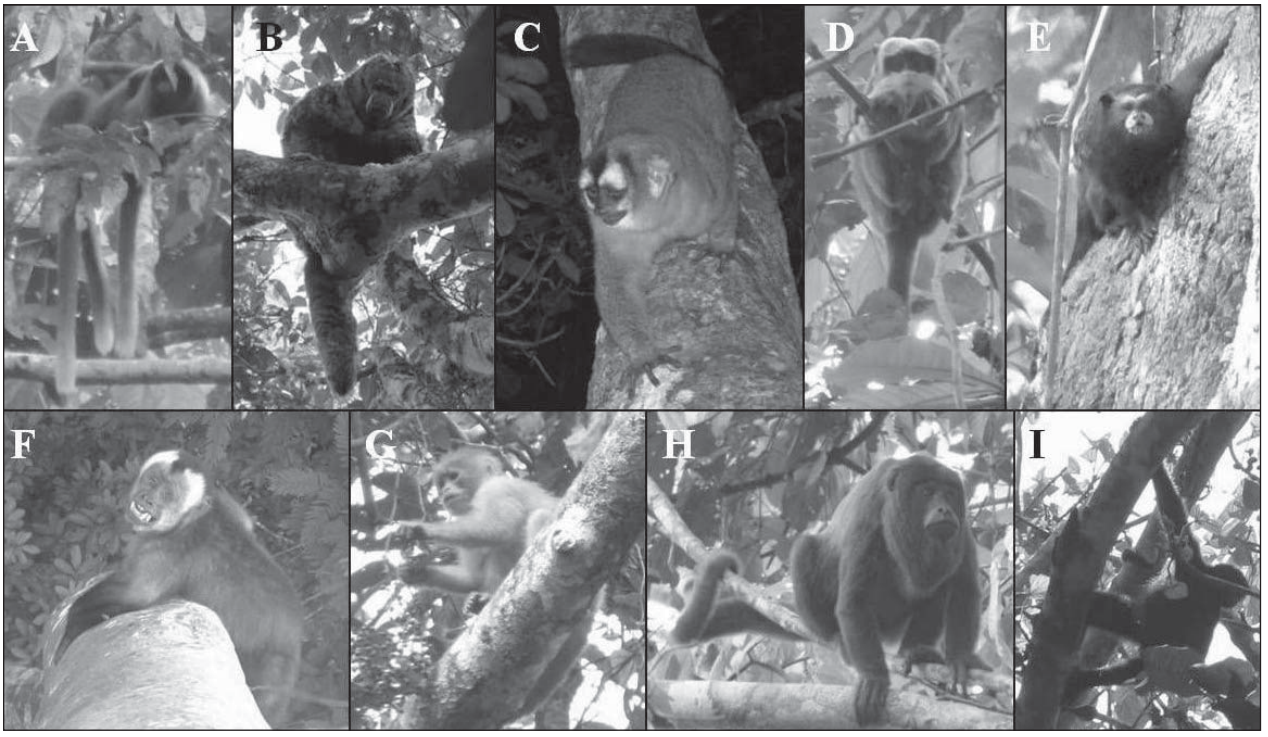


Figure 2. Images from Pagoreni A the nine species observed: A. *Callicebus brunneus* (sexes unknown), B. *Pithecia irrorata* (female?), C. *Aotus nigriceps* (sex unknown), D. *Saguinus imperator* (male?), E. *Saguinus fuscicollis* (sex unknown), F. *Cebus apella* (sub-adult male), G. *Cebus albifrons* (juvenile), H. *Alouatta sara* (male), and I. *Ateles chamek* (female). Photos: TG: A, B, D, G, H; FCR: E, I; Camera trap (taken 2013): C, F.

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were low compared to nearby protected areas (Table 2). Primate species not observed but considered potential inhabitants of the area include: *Cebuella pygmaea*, *Saimiri boliviensis*, and *Lagothrix cana*. Appropriate data were not gathered during this study to determine whether these species are absent for ecological reasons. However, given that sampling intensity was relatively high and data were gathered during two seasons, it is unlikely they simply went undetected. Low encounter rates and group sizes may be attributable to various causes including ecological factors and human impact. While these factors were not specifically addressed by this study, human impact is indeed a possibility. Although construction of the original Pluspetrol pipeline from Pagoreni to Malvinas was completed in 2008, maintenance of the pipeline and well requires the continuous presence of personnel along with associated frequent helicopter traffic, resulting in a notable human presence in the area. Separate from this disturbance, legal

Table 3. Non-primate mammal species registered during the study either through direct observations or photographs from camera traps.

Scientific name	Common name (English)	Common name (Matsigenka)	Registration type	
			Camera trap	Direct observation
Cingulata				
Dasypodidae				
Dasypus novemcinctus	Nine-banded armadillo	Étini	x	
Priodontes maximus	Giant armadillo	Kinteróni	x	
Pilosa				
Myrmecophagidae				
Tamandua tetradactyla	Amazonian tamandua	Mántani	x	
Rodentia				
Sciuridae				
Microsciurus sp.				x
Sciurus spadiceus	Southern Amazon red squirrel	Méguiri		x
Dasyproctidae				
Myoprocta pratii	Green acouchi	Chochori	x	
Cuniculidae				
Cuniculus paca	Lowland paca	Samáni	x	
Lagomorpha				
Leporidae				
Sylvilagus brasiliensis	Forest rabbit	Tsíroni	x	x
Carnivora				
Felidae				
Leopardus pardalis	Ocelot	Matsónsori, maniti	x	
Puma concolor	Puma	Matsónsori, maniti	x	
Panthera onca	Jaguar	Matsónsori, maniti	x	
Procyonidae				
Procyon cancrivorus	Crab-eating raccoon	Kovéntsiri	x	
Potos flavus	Kinkajou	Kutsáni	x	
Mustelidae				
Lontra longicaudis	Neotropical otter	Parári		x
Eira barbara	Tyra	Oáti		x
Perissodactyla				
Tapiridae				
Tapirus terrestris	Brazilian tapir	Kémari	x	
Cetartiodactyla				
Tayassuidae				
Pecari tajacu	Collared peccary	Shíntori	x	x
Cervidae				
Mazama americana	Red brocket deer	Maníro	x	x

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subsistence hunting by local communities has been documented to have a significant influence on abundance and diversity of local primates in the Amazon (Naughton-Treves *et al.*, 2003) and this could be a factor in the LUR as well.

Ateles chamek and *Lagothrix cana* are the two most preferred edible primate species for the Matsigenka people in Manu National Park, followed by *Alouatta seniculus* (*sara* in the present study), *Cebus apella*, and *C. albifrons* (da Silva *et al.*, 2005; Shepard, 2002). In the present study, the absence of *L. cana* and encounter rates of the other species are consistent with this preference pattern of primate consumption. *A. chamek* and *A. sara* were seen infrequently, and while both *Cebus* spp. were among the four most frequently sighted, encounter rates and group sizes were lower than other sites, particularly for *C. apella*. In contrast to the larger bodied primates, both *Saguinus* spp. were relatively abundant and showed higher encounter rates than reported in Manu National Park (Table 2). Both small body size and high fertility (twinning every six months) likely contribute to this phenomenon. According to da Silva *et al*. (2005), Matsigenka hunters only take *Saguinus*, *Callicebus*, and *Pithecia* spp. on occasion because of their small body size. Abundances of *Saguinus* spp. may therefore be an example of density compensation, wherein abundances of smaller and medium-bodied species increase given an absence of larger-bodied species, a pattern that has been associated with hunting pressure (Barrera Zambrano *et al.*, 2008; Peres and Dolman, 2000). Alternatively, a preference among *Saguinus* spp. for disturbed and secondary habitat (Garber, 1993; Oliveira and Ferrari, 2008), such as that created by the nearby pipeline, may also explain higher numbers of these two species. Low encounter rates of *Pithecia irrorata* and *Callicebus brunneus* may be have to do with lack of habituation and a resulting cryptic anti-predator response (Gleason and Norconk, 2002; Terborgh, 1983), which likely reduced detectability for observers.

Regarding non-primates, eighteen additional large mammal species were documented in the area (Table 3). *Procyon cancrivorus* was recorded for the first time in the area, and both large felids (*Puma concolor* and *Panthera pardus*) were photographed, along with *Leopardus pardalis*. Other documented species of interest include *Priodontes maximus* and *Tapirus terrestris*, both of which are listed as vulnerable on the IUCN Red List (Naveda *et al.*, 2008; Superina *et al.*, 2010). *T. terrestris* and felid tracks were seen almost daily, and *Cuniculus paca*, *Myoprocta pratii*, *Mazama americana*, and *Pecari tajacu* were recorded frequently in the camera traps. This potentially high diversity and abundance of terrestrial large mammals, despite the low abundances of large bodied primates, requires further investigation.

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