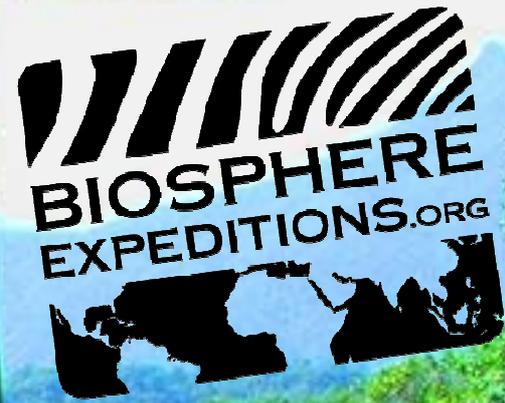


EXPEDITION REPORT

Expedition dates: 4 - 16 November 2007
Report published: May 2008

Studying jaguars, pumas and their prey in Brazil's Atlantic rainforest: the jaguar corridor.



WINNER
"Best
Volunteering
Organisation"



**HIGHLY
COMMENDED**
"Best for
Conservation of
Endangered Species"



BEST
"Best Holiday for Green-Minded Travellers"
& "Top Ten Outdoor Pureite"



www.projeto-puma.org

EXPEDITION REPORT

**Studying jaguars, pumas and their
prey in Brazil's Atlantic rainforest:
the jaguar corridor.**

**Expedition dates:
4 - 16 November 2007**

**Report published:
May 2008**

**Authors:
Marcelo Mazzolli
Projeto Puma**

**Matthias Hammer (editor)
Biosphere Expeditions**

Abstract

Expeditions to the southern Atlantic forest of Brazil were conducted with local students in July - August 2007 and Biosphere Expeditions in November 2007, particularly to the APA (Area of Environmental Protection of Guaratuba) in the Serra do Mar Mountain range. Prior to that only one local and one Biosphere Expeditions project had been conducted in 2006. The primary aims of the project are to elucidate the core habitats for jaguar and puma at their southern Atlantic Forest range and subsequently conserve these areas.

Sampling was conducted in the locality of Canasvieiras, 20 km from the 2006 sampling area, for 20 days, and consisted of sign surveys and the deployment of 12 camera traps. Data collected included species richness, frequency, composition and observed occupancy. Frequency of puma (n=2) was similar to that from the previous year, ocelot frequency was much higher (n=8) and, unlike the previous year, jaguar was not recorded despite several reports of its presence by locals.

This study concludes that the area may be considered of importance as potential habitat for jaguars due to the recurrent presence of tapir (*Tapirus terrestris*) and peccaries (*Tayassu pecari* and *Pecari tajacu*), the presence of private rangers and also due to the good general aspect of the forest, including widespread presence of adult stands of palm hearts (*Euterpes edulis*), which have become very rare elsewhere.

Resumo

Expedições para a Floresta Atlântica no sul do Brasil foram conduzidas com estudantes no período entre Julho e Agosto 2007 e Biosphere Expeditions em Novembro 2007, particularmente para a APA (Área de Proteção Ambiental de Guaratuba) localizada na cadeia de montanhas da Serra do Mar. Antes disso, apenas uma expedição local e uma Biosphere Expedition haviam sido conduzidas no ano de 2006. O objetivo principal do projeto é encontrar núcleos de habitat para a onça-pintada e o puma em sua área de distribuição na porção sul da Floresta Atlântica e produzir um trabalho de conservação nestas áreas.

A amostragem foi conduzida na localidade de Canasvieiras, 20 km distante em linha reta da área amostrada em 2006, estendeu-se por 20 dias, e consistiu em levantamento de vestígios e uso de 12 armadilhas-fotográficas. Dados coletados consistiram de riqueza de espécies, frequência, composição, e ocupação observada. Frequência de puma (n=2) foi similar à do ano anterior, a frequência de jaguatirica foi bem superior (n=8), e diferentemente do ano anterior, a onça-pintada não foi registrada, apesar de vários relatos de sua presença.

A área amostrada pode ser considerada de importância como potencial habitat para a onça-pintada, julgando pela recorrente presença de anta *Tapirus terrestris* e porcos-domato (*Tayassu pecari* e *Pecari tajacu*), a presença de patrulheiros, e também pelo bom aspecto geral da floresta, incluindo a presença generalizada de plantas adultas de palmito (*Euterpes edulis*), o qual tem se tornado muito raro.

Contents

Abstract / Resumo	2
-------------------	---

Contents	3
----------	---

1. Expedition Review	4
1.1. Background	4
1.2. Research Area	5
1.3. Dates	7
1.4. Local Conditions & Support	7
1.5. Expedition Scientist	9
1.6. Expedition Leader	9
1.7. Expedition Team	10
1.8. Expedition Budget	11
1.9. Acknowledgments	12
1.10. Further Information & Enquiries	12

2. Puma & Jaguar Survey	13
2.1. Introduction	13
2.2. Methods	16
2.3. Results	19
2.4. Discussion & Conclusions	25
2.5. Literature Cited	28

Appendix 1: Expedition diary	29
------------------------------	----

Please note: Each expedition report is written as a stand-alone document that can be read without having to refer back to previous reports. As such, much of this section, which remains valid and relevant, is a repetition from previous reports, copied here to provide the reader with an uninterrupted flow of argument and rationale.

1. Expedition Review

Matthias Hammer
Biosphere Expeditions

1.1. Background

Biosphere Expeditions runs wildlife conservation research expeditions to all corners of the Earth. Projects are not tours, photographic safaris or excursions, but genuine research expeditions placing ordinary people with no research experience alongside scientists who are at the forefront of conservation work. Expeditions are open to all and there are no special skills (biological or otherwise) required to join. Expedition team members are people from all walks of life and of all ages, looking for an adventure with a conscience and a sense of purpose. More information about Biosphere Expeditions and its research expeditions can be found at www.biosphere-expeditions.org.

This expedition report deals with an expedition to the Atlantic rainforest of Brazil, which aimed to initiate the first-ever concerted conservation project of Atlantic forest jaguar and puma populations and their prey in unstudied rainforest. The expedition's study site in the vicinities of the Saint Hilaire/Lange National Park is known for its outstanding beauty, with densely forested mountain ranges and mangrove lowlands reaching the Atlantic Ocean. It harbours one of the few jaguar populations surviving in broad-leaved Atlantic rainforest. Data collected by the expedition will form the basis for the management and protection of jaguars and pumas and their habitats within a highly threatened ecosystem.

Nobody knows how many jaguars and pumas there are in the Saint Hilaire/Lange National Park and surrounding areas (PNSH/L), an important refuge where these two cat species probably still survive in numbers. It is vital that this southernmost population of jaguars in the broad-leaved Atlantic rainforest is protected, as it contains the source population from which jaguar numbers could be re-established at an important area of its historical range. Biosphere Expeditions assisted local conservation efforts by initiating research in this unstudied area of forest, gathering key information vital for the protection of this highly endangered habitat and its resident species.

1.2. Research Area

Brazil is located on the Atlantic coast of South America and is the largest country on the continent. Two thirds of Brazilian territory is located within the Amazon basin. In addition to the Amazon, the Atlantic rainforest extends for about 3,500 kilometres along the coast with an area of over one million square kilometres. The Atlantic forest ecosystem is recognised as one of the most unique habitats on Earth, with numerous endemic species. It is one of the so-called world “hotspots” of biodiversity, with over 400 vascular plants per hectare, 50% of which are endemic. Animal diversity is also high: 215 species of mammals have been recorded, 73 of which are endemic; and out of a total of 183 species of amphibians, 91.8 % are endemic. Although biodiversity is very high, the status of many individual species is precarious. A recent estimate showed that 171 out of 202 species of vulnerable animals from Brazil are from the Atlantic forest.



Flag and location of Brazil and study site.

An overview of Biosphere Expeditions' research sites, assembly points, base camp and office locations is at [Google Maps](#).

The study area is situated on the edge of the PNSH/L in southern Brazil, a reserve comprising 25,000 hectares of protected Atlantic forest and named after the French naturalist Saint Hilaire, and the Brazilian environmentalist Roberto Ribas Lange. The name is expected to be changed to 'Serra da Prata' (Silver mountain range), as national parks in Brazil are no longer allowed to carry names of people or towns. Early settlers crossed the mountain range in search for silver mines, inspiring the new suggested name. The park was created quite recently (in 2001) and as such is not well known or studied.

The PNSH/L area is dominated by the Atlantic rainforest of Brazil, one of the most endangered ecosystems on Earth. It is hard to overstate the importance of this ecosystem in terms of conservation. Declared a UNESCO World Heritage Site in 1999, most scientists rank the Atlantic forest as one of the top three priorities for global conservation efforts. Very little of the Atlantic forest remains, and what does is highly fragmented. Despite this, it still maintains extremely high levels of diversity and endemism.



Map of the Atlantic forest showing estimated extent around 1500 (grey) and extent in 1990 (black).

The forest, which once spread along the Atlantic coast and much of southern Brazil, is now reduced to fewer than 8% of its original extent because of intensive human occupation, beginning with sugar cane plantation in the 1500s and later coffee plantations.

To address this lack of information, the expedition's research work also assessed which human occupation strategies are most compatible with the concurrent survival of large mammals, with special emphasis on the habitat quality for the jaguar and puma. Few areas are left, which have remained untouched and these are of high importance for their intrinsic value as a source of species, and as a model for recovering disturbed areas.

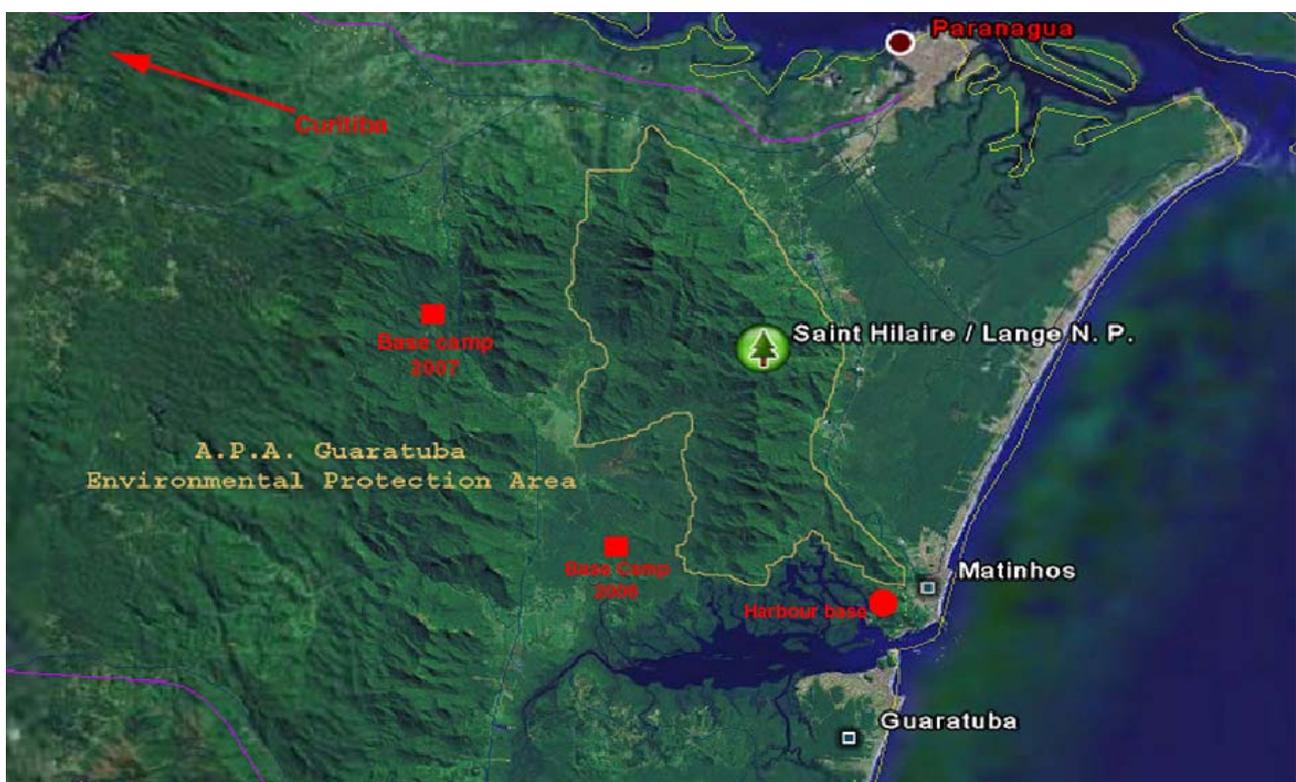
1.3. Dates

The expedition ran over a period of two weeks from 5 to 16 November 2007 and was composed of a team of international research assistants, guides, support personnel and an expedition leader (see below for team details).

1.4. Local Conditions & Support

Expedition base & transport

The expedition assembly point was Curitiba, where expedition team members were met by the expedition leader and by the local scientist to be taken directly to base camp (see map below) using two four-wheel drive trucks, including a Land Rover Defender kindly provided by Land Rover Brazil.



Map showing Saint Hilaire / Lange National Park encompassed by a larger, less restrictive protected area (APA).
© Google Earth.

Prior to the volunteers' arrival, staff stayed at the harbour base from 24 October to begin setting up the camp. This base is owned by the NGO Ecoplan, which kindly provided the facility. Located by the Guaratuba Bay and with its own harbour, the facility gave the expedition team easy access to the river during the previous year's expedition.



Biosphere Expedition's staff loading the expedition Land Rover with wood that would later be used to build the tent platforms. The truck was kindly provided by Land Rover Brazil.

Base camp consisted of ten tents installed on wooden platforms, where the team slept, and a house where meals were served and other common activities were conducted.



Tents were installed on wooden platforms above the forest floor.

The base camp house and surrounding land for tents were kindly provided by Mr. Adamy.

There was a dedicated cook to prepare main meals. Lunch often consisted of a snack taken to the field. There was electricity at base with supply at 110V.

Field communications

There was no telephone and mobile phones did not work at base. The nearest landline telephone was about one hour from base camp. However, this was found not to work well and a satellite connection could only be established very rarely. Regular expedition diary updates were put up on the Biosphere Expeditions website for friends & family to access.

Medical support & insurance

The expedition leader was a trained first aider, and the expedition carried a comprehensive medical kit. Further medical support was provided by hospitals in the towns of Matinhos, Guaratuba, Paranagua and Curitiba. All team members were required to be in possession of adequate travel insurance covering emergency medical evacuation and repatriation. Safety and emergency procedures were in place.

There were no medical incidents, although there were at least two cases of upset stomachs and one one-day long bout of gastroenteritis, all of which were dealt with at camp.

1.5. Expedition Scientist

The expedition's local biologist was Marcelo Mazzolli. Born in Brazil, he graduated in Biology in 1992, with a master's degree from the University of Durham, UK. His Ph.D. in ecology, obtained in Brazil, was on the effects of human occupation on the extinction of large mammals. He has devoted his career to the study of large mammals, particularly the puma and jaguar, but has had many other outdoors experiences. He was a professional jungle guide in the Amazon forest in 1986 at age 21. He has attended many national and international workshops, and published relevant articles. His studies have made his work well known, and early in his career he was invited to be a member of the International Union for Conservation of Nature (IUCN) Cat Specialist Group with one of his projects listed as a priority in the World Wide Cat Action Plan. He has travelled extensively, living in the United States and Peru, and has surveyed lions in Botswana.

1.6. Expedition Leader

David Moore was born and educated in England and now lives in the UK and France. He graduated in French and German and studied Japanese while working for two years in Tokyo. His expedition/group leading experience began with Japanese educational trips in Australia and he has since worked in the Caribbean and throughout Europe for companies such as P&O, Explorica and Alyson Adventures. David joined Biosphere Expeditions in 2003 and has led expeditions to the Azores, Namibia, Peru and Brazil. He is also active in running the Biosphere Expeditions operations in France.

1.7. Expedition Team

The expedition team was recruited by Biosphere Expeditions and consisted of a mixture of all ages, nationalities and backgrounds.

5 - 16 November: Elodie Buard (France), Helge Eek (Norway), Robert Hussey (UK), Simon Madzinger (Austria),

5 - 9 November: journalists/photographers Martin Amanshauser (Austria), Rodrigo Baleia (Brazil), Mark Capon (UK), Sharon Flloyd (UK).

9 - 16 November: Aline Izapeo, Débora Zancanaro (local assistants from Brazil engaged in the course of Environmental Management - Federal University of Curitiba).

Throughout the expedition: Neusa (cook), Erin McCloskey (staff).



From left to right: Elodie Buard, Simon Madzinger, Helge Eek, Mark Capon, Sharon Flloyd, Martin Amanshauser, Bob Hussey, Marcelo Mazzolli, Erin McCloskey, Rodrigo Baleia.

1.8. Expedition Budget

Each team member paid towards expedition costs a contribution of £1190 per two week slot. The contribution covered accommodation and meals, supervision and induction, a permit to access and work in the area, all maps and special non-personal equipment, all transport from and to the team assembly point. It did not cover excess luggage charges, travel insurance, personal expenses like telephone bills, souvenirs, etc., as well as visa and other travel expenses to and from the assembly point (e.g. international flights). Details on how these contributions were spent are given below.

Income	£
Expedition contributions	4,910
 Expenditure	
Base camp and food includes all meals, base camp equipment	1,032
Transport includes fuel, vehicle maintenance	392
Equipment and hardware includes research materials, research gear	536
Biosphere Expeditions staff includes salaries, travel and expenses to Novosibirsk?	2,023
Local staff includes salaries, travel and expenses, Biosphere Expedition tips, gifts	2,325
Administration includes bribes, registration fees, sundries, etc	431
 Income – Expenditure	 - 1,829
 Total percentage spent directly on project	 137%*

*This means that in 2007, the expedition ran at a loss and was supported over and above the income from the expedition contributions by Biosphere Expeditions.

1.9. Acknowledgements

This study was conducted by Biosphere Expeditions which runs wildlife conservation expeditions all over the globe. Without our expedition team members, who are listed above and who provided an expedition contribution and gave up their spare time to work as research assistants, none of this research would have been possible. The support team and staff, also mentioned above, were central to making it all work on the ground. Thank you to all of you and the ones we have not managed to mention by name (you know who you are) for making it all come true. Biosphere Expeditions would also like to thank Land Rover, Motorola, Buff[®], Cotswold Outdoor, Globetrotter Ausrüstung and Gerald Arnhold for their sponsorship.

Projeto Puma, Biosphere Expeditions' local partner for this project, and its founder Dr. Marcello Mazzolli were crucial to the success of the expedition. Thank you also to Daniel Contrucci of Biosfera Brasil who initiated the whole project by establishing contact between Projeto Puma and Biosphere Expeditions and still gives support to the expedition from São Paulo.

Base camps were kindly provided by Instituto Ecoplan and Mr. Adamy.

1.10. Further Information & Enquiries

More background information on Biosphere Expeditions in general and on this expedition in particular including pictures, diary excerpts and a copy of this report can be found on the Biosphere Expeditions website www.biosphere-expeditions.org.

Enquires should be addressed to Biosphere Expeditions at the address given below.

Please note: Each expedition report is written as a stand-alone document that can be read without having to refer back to previous reports. As such, much of this section, which remains valid and relevant, is a repetition from previous reports, copied here to provide the reader with an uninterrupted flow of argument and rationale.

2. Puma & Jaguar Survey

Marcelo Mazzolli
Projeto Puma

2.1. Introduction

Biosphere Expeditions started working in Brazil in 2006 with the first expedition running to Guaratuba bay with access by boat only. The reduced presence of target species, difficult access, swampy trails and state of facilities present in the area encouraged us to change base camp site for the 2007 expedition.

The 2006 base camp site was located to the south and outside of the Saint Hilaire-Lange National Park (PNSH/L, see above), a reserve of strict protection (but still not fully implemented) with 250 square km maintained by the federal government. This reserve is fully encompassed by the APA (APA - *Área de Proteção Ambiental* or Environmental Protection Area) de Guaratuba, a less restrictive type of reserve, and both are within the influence of the Serra do Mar mountain range, the most important stronghold of the jaguar in the Atlantic broadleaved forest. However, the wildlife in the Serra do Mar mountain range faces many threats, as it is surrounded by many roads and by towns and villages with high human density.

During the 2006 expedition (Mazzolli & Hammer 2007), fourteen species of mammals were recorded: agouti *Dasyprocta azarae*, two species of brocket deer *Mazama* spp., capybara *Hydrochaeris hydrochaeris*, capuchin monkey *Cebus nigrinus*, crab-eating fox *Cerdocyon thous*, howler monkey *Alouatta* sp., nine banded armadillo *Dasypus novemcinctus*, ocelot *Leopardus pardalis*, various peccary species, racoon *Procyon cancrivorus*, and tapir *Tapirus terrestris*. Both the jaguar *Panthera onca* and the puma *Puma concolor* were recorded from their tracks, and a jaguar was heard in two occasions. Photographic records from camera traps were only obtained for armadillo, ocelot, and red-brocket deer.

Permits that allowed a local team to research within PNSH/L were obtained from IBAMA (*Instituto Brasileiro do Meio Ambiente E Dos Recursos Naturais Renováveis* or Brazilian Institute of Environment and Renewable Natural Resources) (number 02017,000269/06-36). Permits for the APAs of Guaratuba and Guaraqueçaba were obtained from the Directory of Biodiversity and Protected Areas of the Institute of Environmental Protection – State of Paraná (DIBAP-IAP number 35/06).

In July 2007 a local expedition with students from Brazilian universities surveyed the vicinities of the Harbour Base (see map below for locations), one trail in the PNSH/L, and a trail in the Limeira location connecting PNSH/L to the neighbouring mountain ranges of Serra do Mar.

Two camera traps (Tigrinus www.tigrinus.com.br) were installed for a very short period near the Harbour Base, resulting in a surprising record of a collared-peccary *Pecari tajacu*, a species that had not been recorded during the previous year.



Figure 2.1a. Collared peccary camera trapped near Harbour Base during the July 2007 survey with local teams.

At the end of the local expedition, a new Biosphere Expeditions Base Camp was found in the 'Canasvieiras' locality. The presence of abundant tracks of white-lipped peccaries *Tayassu pecari* and tapir, species that are increasingly rare in the Atlantic Forest, indicated that the area was relatively rich in wildlife, increasing the chances that it was also a good habitat for the puma and jaguar.

Furthermore, during the local July 2007 expedition, contacts were made with the Environmental Police headquarters in Paranaguá to investigate an abandoned police post in the vicinity, said to hold good wildlife populations. The local team joined the police for a visit and the Biosphere Expeditions 2007 study site was then chosen based on an alternative route with better roads that led to the vicinity of the inactivated police station.

Projeto Puma is now negotiating with local stakeholders to install a new station for the environmental police to ensure the protection of the habitat and wildlife of this preserved area.

Study area

The area sampled was located 13 km westward of the PNSH/L border and was encompassed by the APA of Guaratuba, a reserve of sustainable use, where productive activities of low impact are allowed. The area surveyed comprised 11 contiguous cells 2 x 2 km in size, consisting mostly of large (over 5,000 ha) private (e.g. Simões land) and public properties (e.g. Ambiental Reflorestadora, Copel), which were patrolled by guards hired to protect the areas against invasion and the poaching and illegal extraction of palm-heart.

In contrast to other areas surrounding the PNSH/L, the study site still harboured good numbers of adult palm heart stands even far away from human habitation (Fig. 2.2b), an indication of the more preserved condition of the forest.



Figure 2.2b. Adult palm heart stands by the Limeira trail.

Base camp was located 12 km from the federal road BR-277 connecting the capital Curitiba to the harbour town of Paranaguá. It took approximately 1.5 hours using four-wheel drive vehicles on a track crossing several wooden bridges (Fig. 2.2c) and two rivers of 20 to 25 meters width to reach the expedition base.



Figure 2.2c. Land Rover crossing one of several wooden bridges to reach base camp.

Although the surrounding mountains reach over 1,500 m in altitude, the area sampled was between 150 to 450 meters in altitude. The vegetation consisted mostly of montane and sub-montane broadleaved Atlantic Forest.

2.2. Methods

Training of team members

For the first two days team members were given talks and practical lessons, learning the use of GPS (Global Position System) and general procedures. The first excursions into the forest were done under the supervision of Biosphere Expeditions staff. After a few days team members were able to navigate in the forest, install camera traps and record tracks and signs of mammals in small groups without direct supervision.



Figure 2.2d. Team members learning how to use GPS (Global Position System) to record coordinates.

Ecological sampling

Data on mammalian presence were collected from field surveys in twelve continuous quadrats 2 x 2 km each. An additional two quadrats were surveyed once to investigate a trail heading to a mountain range connection to the PNSH/L. In contrast to the 2006 expedition, when quadrats were chosen and named prior to sampling, the 2007 expedition gave quadrat names by numbers in the X coordinate and letters in the Y coordinate. This procedure allowed a standardised quadrat coding method and was a more flexible approach when sampling of additional areas not previously included in the sampling scheme was needed.

Resampling of quadrats is desirable in animal studies, as mobile species will be present in some instances and absent in others, thus the presence or absence of a species from a certain area can only be established with repeated sampling. The aim was to sample each quadrat at least three times, but in reality some were sampled more than others (Table 2.2a), mainly due to redundant surveys in the proximity of base camp.

Table 2.2a. Quadrat resampling scheme showing quadrat codes. Numbered columns marked with X represent the number of sampled occasions.

Quadrat	1	2	3	4	5	6	7	8	9	10
8i	X	X	X							
8j	X	X	X							
9i	X	X	X	X						
9j	X	X	X	X						
9k	X	X	X							
9L	X	X	X	X						
10i	X	X	X	X						
10j	X	X	X	X	X	X	X	X	X	X
10k	X	X	X	X						
11i	X	X								
11j	X	X	X							
11h	X									
11k	X	X								
12h	X									

Data collection procedures included camera trapping and recording of any mammal sign, vocalisation or sighting in the quadrats sampled. Data were recorded in pre-formatted data sheets taken to the field and animal signs were photographed and photos brought to camp for correct identification. Team members carried GPS pre-loaded with coded quadrat grids, which helped them to locate themselves and the areas where data had to be collected, avoiding aggregated sampling (spatial autocorrelation). Every animal sign was recorded along with the coordinate and quadrat code. This allowed for observed species' occupancy (number of quadrats present or absent) and frequency (also referred to as 'relative abundance' in the literature).

Most trails were 3 km in length and had sufficient stretches of mud that showed up animal tracks well. This made track recording without the need for track traps possible. Track traps were set in the few trails where tracks did not record naturally.

Camera trapping

Twelve cameras, five of which were digital, were placed in the study area. Total camera trap sampling effort was 119 camera trap nights (Table 2.2b) in 11 quadrats.

Cameras were not set or removed all at once, so the period they stayed in the field varied. As there was only one expedition slot in 2007, the sampling period was short. For that reason digital cameras were installed during camp set-up before team members arrived.

Table 2.2b. Sampling history of individual cameras (ID column), including date of installation, re-installation, removal, quadrat installed and working period. A hyphen (–) indicates that a camera was not re-installed.

ID	Date installed	Date removed	Quadrat	Trap nights	Date installed	Date removed	Quadrat	Trap nights	Total trap nights
D1	28/10/07	10/11/07	09j	13	12/11/07	14/11/07	10i	2	15
D2	29/10/07	08/11/07	11k	12	10/11/07	14/11/07	9i	4	16
D3	29/10/07	08/11/07	11j	12	10/11/07	14/11/07	10k	4	16
D4	30/10/07	14/11/07	08i	15	–	–	–	–	15
D5	01/11/07	13/11/07	09k	12	–	–	–	–	12
A11	5/11/07	14/11/07	10j	9	–	–	–	–	9
A9	6/11/07	14/11/07	10k	8	–	–	–	–	8
A10	6/11/07	14/11/07	9l	8	–	–	–	–	8
A8	8/11/07	14/11/07	9h	6	–	–	–	–	6
A6	08/11/07	14/11/07	8i	6	–	–	–	–	6
A1	10/11/07	14/11/07	9j	4	–	–	–	–	4
A3	10/11/07	14/11/07	9j	4	–	–	–	–	4
Total trap-nights									119

Community outreach activities

Besides the information collected during encounters with locals, team members performed a formal interview in the community near base camp. It consisted of several questions regarding the presence of species and personal perceptions of conservation of habitats and species.

Team members also participated in talks given in local schools three times and they once joined community leaders to inspect a sustainable development agro-industrial production unit.

2.3. Results

Training and performance

Training the expedition team on navigation through the forest was considered very successful. After a few days groups consisting of two to four team members went for long walks to perform their tasks by themselves. Some of the groups even explored trails that had not been visited before. The fact that they were able to return in the scheduled time was proof that their navigation skills were excellent. Camera traps installed by team members performed well, indicating that installation was good. Data recording and entry was also satisfactory.

Species occurrence

During the July survey with the local team a collared peccary was recorded near the Harbour Base (see Fig. 2.1a above); puma, ocelot and deer were recorded in the PNSH/L; and puma, tapir, peccaries, and ocelot were recorded at the mountain chain close to the Biosphere Expeditions base by the old police station road. These species were also found during this period in the Biosphere Expeditions study area.

During the Biosphere Expeditions survey, puma, ocelot, peccary, tapir, agouti, crab-eating fox, racoon, red brocket deer, white-lipped peccary were recorded. Tapir was the species recorded in most quadrats (n=8) and most frequently (n=23), followed by ocelot (quadrats=5, frequency=8) (Table 2.3a).

Only three species, namely puma, deer, and tapir were recorded with camera traps (Fig. 2.3b), the remaining species were recorded by their tracks. Tapirs were photographed often enough to build a table of activity pattern, indicating that the species is most active from 21:00 to 03:00 (Table 2.4b). Results in species composition from this year's base, in the locality of Canasvieiras, differed from last year's survey in the Guaratuba Bay area by the absence of jaguar, capibara, howler monkey and grey brocket deer.

Table 2.3a. Species recorded during the Biosphere Expeditions survey, with information on quadrat number, type of record (vestige, sighting, vocalisation, camera trap), and presence (1) or absence (0) during a given occasion.

Species	Latin name	Local name	Quadrats	Type of record	Number of records
Agouti	<i>Dasyprocta azarae</i>	Cutia	9l, 10j	Track	02
Armadillo	<i>Dasypus novemcinctus</i>	Tatu-galinha	10j	Track	02
Brocket deer	<i>Mazama sp.</i> (likely <i>americana</i>)	Veado-mateiro	10i, 8j	Camera trap	03
Crab-eating fox	<i>Cerdocyon thous</i>	Graxaim	10j, 11j	Track	02
Ocelot	<i>Leopardus pardalis</i>	Jaguaririca	10j, 10l, 10i, 11j, 10j	Track	08
White-lipped peccary	<i>Tayassu pecari</i>	—	8i	Track	01
Peccaries	<i>Inc.sp.</i>	—	8i, 9j, 10k	Track	03
Puma	<i>Puma concolor</i>	Onça-vermelha	10i, 10k	Track, camera trap	02
Racoon	<i>Procyon cancrivorous</i>	Mão-pelada	11h	Track	01
Tapir	<i>Tapirus terrestris</i>	Anta	9l, 9k, 9j, 10j, 10i, 10k, 11k, 11i	Track, camera trap	23

Table 2.3b. Tapir activity pattern inferred from camera trapping. All but a single record, from quadrat 10i, were from quadrat 9j.

Period of day	Number of events
00:00 to 03:00	4
03:00 to 06:00	1
06:00 to 09:00	1
09:00 to 12:00	1
12:00 to 15:00	0
15:00 to 18:00	1
18:00 to 21:00	3
21:00 to 24:00	5



Figure 2.3a. Species camera trapped during the expedition.
From to bottom: tapir, red brocket deer, puma.

GIS mapping

Two maps were produced. The first was limited to the 2007 base and surroundings, included quadrat coding and contained the trails and camera trap locations. It was produced using the Geopro maps produced by Pró-Atlântica in the background and overlaid with data from the software TrackMaker (www.gpstm.com).

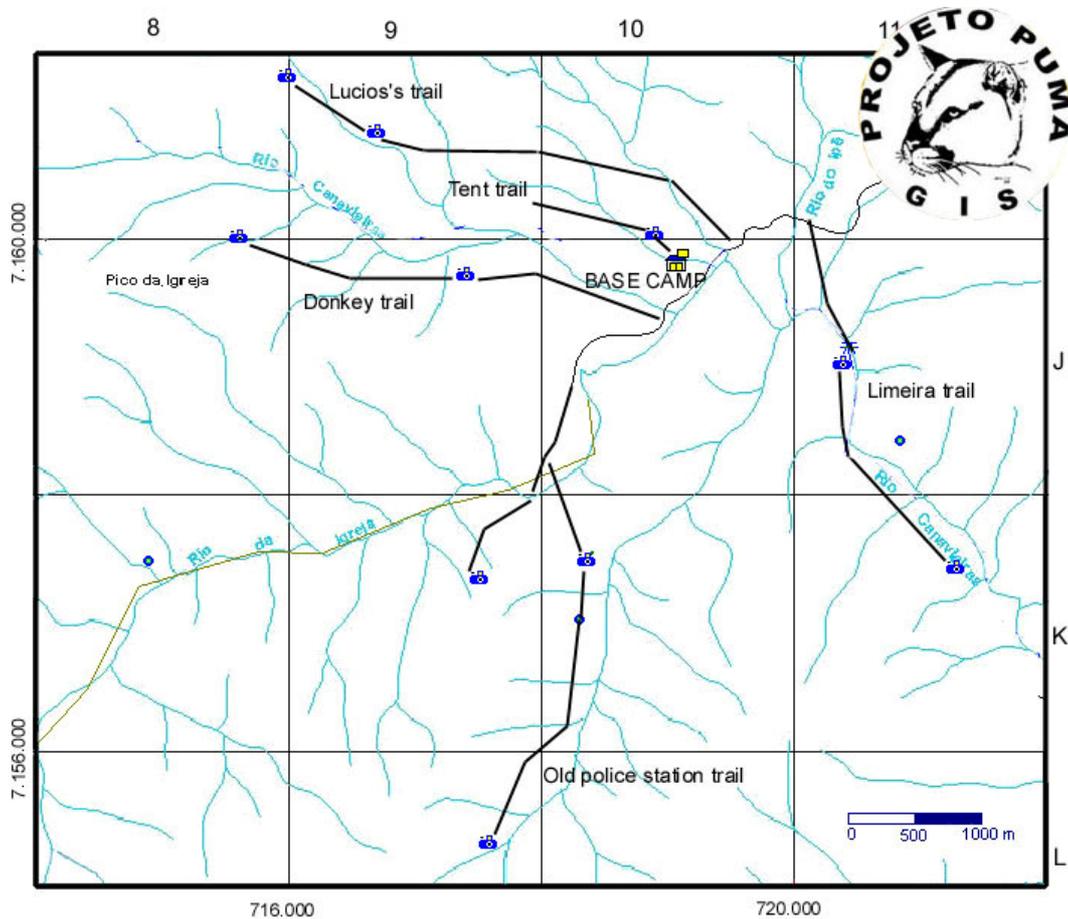


Figure 2.3b. Map of the study area around base that received most of the sampling effort. Map includes position of camera traps, river systems, quadrat coding (letter and number) and trails. Coordinates are in UTM, datum SAD 69.

The second map was extracted from a larger map that represent the entire 'Jaguar Corridor' study area, available from Mazzolli & Hammer 2007. It summarises the research accomplished in 2006/7 over a broader geographic area, shows 2006 records of jaguar, all base camps, trails surveyed in July 2007, camera trap locations, roads, location of the old police station, and contours of protected areas (Fig. 2.3c).

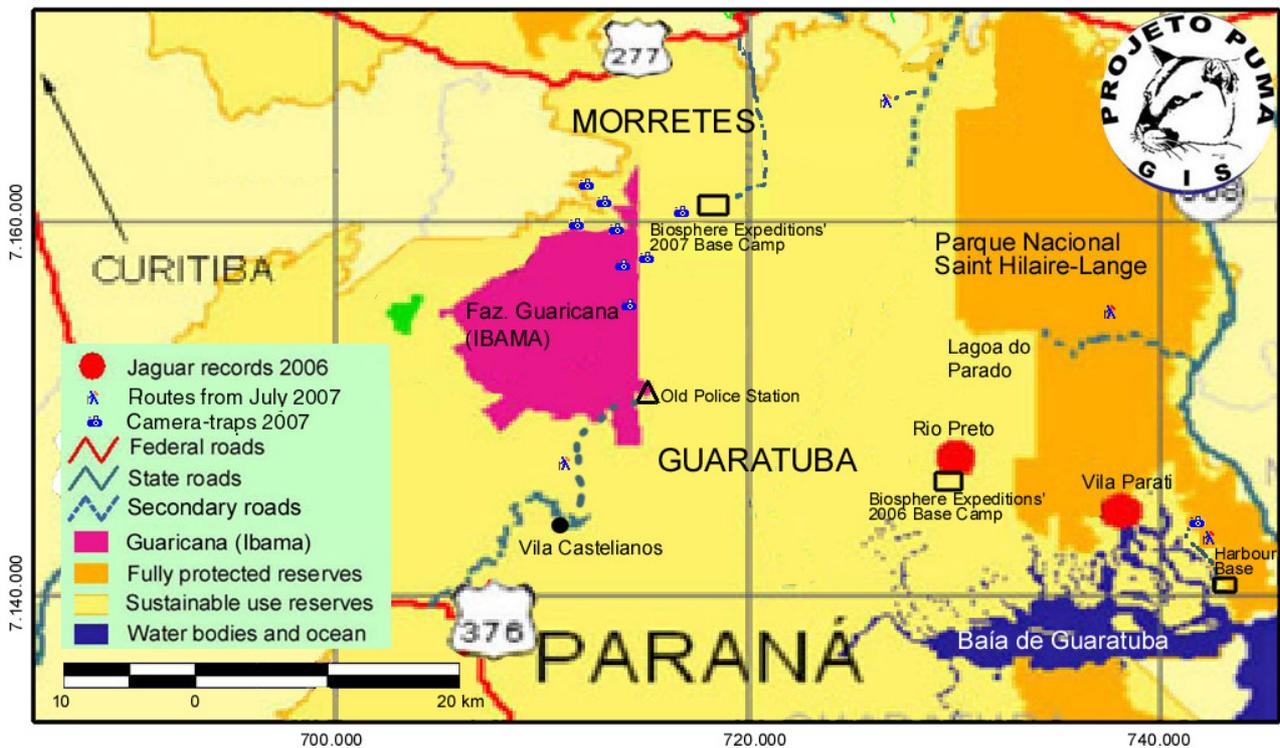


Figure 2.3c. This map was generated from GIS features kindly provided by several organizations, namely the Environment Foundation (Fatma - Santa Catarina), Paran Institute of Environment (IAP), Brazilian Institute of Environment and Renewed Resources (IBAMA) and Society for Wildlife Research and Environmental Education (SPVS). Coordinates in UTM, datum SAD69.

Community outreach activities

Besides sampling of wildlife, team members worked with the local community. They performed interviews, participated during speeches performed by the local scientist to children at two different schools, and joined a visit with community leaders to an agro-industrial production unit (Table 2.3c).

Table 2.3c. Table summarizing community outreach activities.

Date	Location	Contact person	Activity	Organisation benefiting from activity	Persons benefiting from activity
6/11/07	Candongas, Morretes	–	Interviews	Community	–
7/11/07	Candongas, Morretes	–	Speech	Rural Municipal School of Candongas	20 children 1st grade
7/11/07	Candongas, Morretes	Profa. Anecy Oncken	Speech	Rural Municipal School of Canhembora	40 children 1st and 3rd grade
12/11/07	Candongas, Morretes	Mr. Rudolph	Visit agroindustrial production unit	Community cooperative	Community association
12/11/07	Candongas, Morretes	Profa. Anecy Oncken	Speech	Rural Municipal School of Canhembora	Group of women learning to read and write

Team members interviewed ten people of ages varying from 30 to 70 years in the Candongas community. Nine of them were aware of the presence of large cats and all of them were aware of the presence of large cats' prey. Eight acknowledged the benefits of the presence of large cats and all of them perceived the benefits of reserves. Two people reported they had seen tracks of jaguars and heard them near their houses.

Children, encouraged by their teacher, were very enthusiastic and happy to show their private archives of tasks performed in school to team members (Fig. 2.3d) and the community as a whole look forward to further interaction with Biosphere Expeditions in the future.



Figure 2.3d. Children with Biosphere Expeditions' team members.

2.4. Discussion & Conclusions

Species presence and habitat integrity

Species richness (number of species) and frequency recorded around the new base in Canasvieiras differed in many aspects from those recorded around the 2006 Guaratuba Bay location and southern PNHS/L, in spite of the fact that forest cover in both areas is extensive and that sites are only separated by 20 km. The jaguar, capibara, howler monkey and grey brocket deer were not recorded in 2007, but they were in 2006. Tapir and peccary were recorded only once during 2006, but frequently in 2007.

The most significant comparative results were the absence of jaguar, the repeated recording of tapirs and peccaries and the lower diversity of species compared to the 2006 expedition. Ocelot was also more frequent ($n=8$) and only recorded by tracks in 2007, whereas in 2006 it was recorded only by camera traps ($n=3$). Pumas were recorded twice in 2007 and three times in 2006.

Regarding the absence of jaguar, it can not be stated that the species was not present, even though it was not recorded. It is most likely that it occurs in such low numbers that it is very difficult to record. Indeed, the reduced presence of jaguars may be the reason why tapir and ocelot were recorded so frequently in 2007. Tapir offspring are known to be prime prey of jaguars (Nowell & Jackson 1996) and due to a phenomenon known as mesopredator release, in which smaller predators increase in number due to decrease in interference and competition, smaller felids are known to be more abundant when large ones are absent or reduced in numbers (Terborgh & Winter 1980, Rabinowitz 1986 & 1989, Palomares & Caro 1999).

In terms of factual results, the single jaguar record from 2006 is not statistically significantly different from the 2007 null record, as it may simply be a result of chance due to very low sampling numbers. The same can be said about the differences in puma frequency ($n=2$ for 2007; $n=3$ for 2006). It follows that other features must be used to judge habitat integrity and quality for jaguars and pumas, such as the presence of prey species and reduced human interference. Based on results collected during the surveys, these two qualities stand out in the vicinity of the 2007 base. The abundance of tapirs and peccaries support this inference, as did the higher protection of the area as a result of patrolling by private rangers and the presence of stands of adult palm-hearts. Reports of jaguars by locals indicate that the species is present.

As already stated in the 2006 report (Mazzolli & Hammer 2007), it is important in this context to mention that the rarity of jaguars does not reduce the importance of the study site for jaguar conservation, as it is part of one of the few remaining blocks of connected jaguar habitat in the Atlantic broadleaved forest and as such an important refuge for the species.

Sampling and study design

Study design considerations should always take into account the relationship between the amount of data obtained and the effort and cost of the survey. For analysis of species presence/absence it is recommended that sampling units (quadrats) should be surveyed at least three times when detection probability is high (> 0.5 survey⁻¹) and that for a rare species it is more efficient to survey more sampling units less intensively, while for a common species, fewer sampling units should be surveyed more intensively (Mackenzie & Royle 2005).

Previous expeditions have shown that signs of puma and jaguar are rare in the Serra do Mar - an indication that sampling would be more efficient, if a larger number of quadrats were sampled. Hence the current study aimed to sample a larger number of quadrats than in 2006. This was in fact accomplished, as in 2006 only four quadrats were sampled in contrast to twelve quadrats in 2007. Duration of sampling, however, reduced in 2007, because only one expedition slot of two weeks was recruited, so considerations regarding the higher effectiveness of track versus camera trap efficiency discussed in last year's report were also taken into account, resulting in a larger effort aimed at track sampling during 2007, rather than camera trap installation.

Management implications

The 2007 area was judged to be a very good research site due to a higher number of records of increasingly rare prey species, the presence of healthy stands of endangered palm-heat and intensive patrolling by rangers. As such it is an area that deserves further attention. Two significant achievements towards that end resulted from collaboration gained during the 2007 expedition, i.e. the willingness of two additional stakeholders to host further expedition camps and also to allow the environmental police to use their cabins as advanced research stations.

Management recommendations

The good conditions of the habitat in the study site are largely due to frequent patrolling by stakeholders, some of them companies that are owned or partially owned by the government of Paraná, such as Copel and Lavrama. And yet despite the good conditions of the habitat, and the fact that it is included in the APA of Guaratuba, there is no sustainable, long-term plan to monitor and protect the area. Stakeholders are willing to contribute to its conservation and are seeking assistance to formalise their procedures to do so. Perhaps the best solution is the extension of Private Reserves of the Natural Patrimony (RPPNs) that already encompasses several smaller private properties. This type of reserve is officially enshrined in Brazilian law, enabling the managers of such reserves to apply for public funds for environmental protection and management. Owners of RPPNs are also freed from the annual tax on rural areas (ITR), and may apply to an ecological fund from the 'Tax of Merchandise Exchange' (ICMs). The ICM tax is collected at state level and distributed to municipalities in accordance with a series of criteria. One of the criteria that enables the municipality to receive a larger share of this fund is to have protected areas. The more protected areas the municipality has, the more of this fund it is entitled to. Owners of RPPNs can increase the municipality's ICMs share, and may therefore negotiate to receive a percentage in turn to cover maintenance costs and for

general improvements to the reserve. Such agreements have been established successfully elsewhere in the State of Paraná (Loureiro & Martinez 2004).

Another recommendation that should be implemented to improve both wildlife and forest sustainability, as mentioned in the previous (2006) report, is the incentive for extraction of fruits of the palm heart to produce juice, rather than to cut down the tree (which is illegal and also detrimental for wildlife). The juice (açai) is appreciated and consumed in Brazil during the summer season and now increasingly in demand as Brazilian and international health food providers are discovering açai as a rich source of antioxidants. A rough estimate shows that the fruit and juice production over number of years is up to forty times more lucrative than the extraction of the palm-heart, which can be done only once and kills the tree in the process. Most of the Brazilian production of palm heart comes from the Amazon, and today there are several homogeneous plantations of a number of palm species that produce commercial palm heart, so the palm heart industry should not be affected.

The area already has an agroindustrial production unit, located in the Candongas district of Morretes. It is a community project that enables local families to use its facilities to process their products, such as jams, juices, etc., at an industrial scale. There is a potential to include the processing of açai juice at this facility. It is recommended that an investment in capacity building be applied for with the collaboration of the local people to increase sustainable management of the local environment.

Monitoring of jaguar presence and habitat conditions for jaguar should continue in the long term. Trained personnel should continue periodically to research the Serra do Mar range in search of jaguars. Jaguar depredation incidents, for instance, which were identified 10 years ago (Vidolin et al. 2004) are no longer an issue in the surveyed areas. This is thought to be a result of the reduction of the jaguar population, but the occurrence of such incidents in the future or in areas yet to be surveyed cannot be discarded. Regarding this issue, and as mentioned in the 2006 report, it is currently impossible to check every piece of information and gossip about jaguar attacking livestock. A solution for that would be to compel ranchers to produce a proof of jaguar depredation when it occurs, in exchange for compensation for jaguar livestock depredation. Without such measures, jaguars are likely to go extinct even if adequate habitat is increasingly available.

Priorities for next expedition

The 2007 base camp area should be sampled further in 2008 to guarantee that it will be given further attention due to its great potential as jaguar habitat. As the jaguar itself was not recorded, it is recommended that a jaguar caller be used as an additional means of recording the species. It is also recommended that team members go on short overnight camps to reach remote locations in order to maximise the chances of encountering jaguar signs, and also to attempt to get jaguar vocalisations in response to jaguar calls (playback).

2.5. Literature Cited

- Loureiro, W. & Martinez, A. 2004. ICMS ecológico como instrumento de apoio às RPPN no Paraná In Castro R. & Borges M.E, orgs., RPPN: Conservação em terras privadas – desafios para a sustentabilidade (*Conservation in private lands – challenge for sustainability*). Confederação Nacional de Reservas Particulares do Patrimônio Natural (CNRPPN), Paraná, pp. 57-78.
- Mackenzie, D.I. & Royle, J.A. 2005. Designing occupancy studies: general advice and allocating survey effort. *Journal of Applied Ecology* 42: 1105-1114.
- Mazzolli, M. & Hammer, M. 2007. Expedition Report 2007. Studying jaguars, pumas and their prey in Brazil's Atlantic rainforest. The jaguar corridor. Expedition report available via www.biosphere-expeditions.org/reports.
- Nowell, K. & Jackson, P. 1996. Status survey and conservation action plan: Wild Cats. The World Conservation Union (IUCN).
- Palomares, F. & Caro, T.M. 1999. Interspecific killing among mammalian carnivores. *The American Naturalist*, 153 (5): 492-508.
- Rabinowitz, A.R. 1986. Ecology and behaviour of the jaguar (*Panthera onca*) in Belize, Central America. *Journal of Zoology, London*, 210: 149-159.
- Rabinowitz, A.R. 1989. The density and behavior of large cats in a dry tropical forest mosaic in Huai Kha Khaeng wildlife sanctuary, Thailand. *Nat. Hist. Bull. Siam Soc.* 37 (2): 235-251.
- Terborgh, J.B. & Winter, B. 1980. Some causes of extinction. Pages 119-133 in M.E. Soulé & B.A. Wilcox (eds.). *Conservation Biology: an evolutionary-ecological perspective*. Sinauer, Sunderland, Mass.
- Vidolin, G. P.; Moura Britto, M.; Braga, F. G.; Filho, A. C. 2004. Avaliação da predação a animais domésticos por felinos de grande porte no Estado do Paraná: implicações e estratégias (*Evaluation of depredation of domestic animals by large felids in the State of Paraná: consequences and strategies*). *Cadernos da Biodiversidade (IAP)*, 4 (2): 50-58.

Appendix 1. Expedition diary by David Moore.

24 October

Here is the first diary entry for our 2008 puma and jaguar expedition to Brazil.

I'm David, your expedition leader, and have just arrived today at Biosphere's office where staff and I are getting the equipment ready and going over the details ready for my flight out to Sao Paulo tomorrow.

There I shall meet up with Daniel from Biosfera Brasil, our local partner, as well as Erin from our USA office, who is also flying in to participate in the expedition. We'll spend a couple of days in Sao Paulo whilst we pick up the Land Rover from their office and will then head down to Matinhos to meet up with Marcelo, our field scientist, to start getting the camp set up.

Hope your preparations are going well too – looking forward to seeing you soon!

David Moore
Expedition leader

28 October

Things went well in Sao Paulo. Land Rover had the vehicle ready for us (it's one of their bright orange G4 Challenge Defenders) and after sorting out the insurance and other bits and pieces, Erin and I drove down to the small coastal town of Matinhos. It took about 6 hours. We made it here by early Thursday evening and met up with Marcelo who had also arrived to prepare for arrival of the expedition team and get everything in place.

We spent Friday in the town, picking up the wood and supplies for constructing the tent platforms and signing all the official paperwork to be allowed to carry out research on the land. We then made our first trip out to base camp, about a one-and-a-half hour drive off the main road, to drop off the first batch of supplies. The road is pretty smooth at the start, but gets more challenging as we get further in to the forest. We went back down the next day to pick up the rest of the wood and supplies, and have now set ourselves up here at base, getting things in to shape. Our first task is cleaning the place from head to toe to eliminate as many of the spiders as possible – we're also trying to discourage the frogs from living in the toilet!

Marcelo has been down in the village recruiting some helpers to construct the tent platforms and this evening we'll drive down again to pick up our cook who will be with us for the duration of the expedition. Preparations are going well, but we're glad we still have a week before everybody gets here!

30 October

Even with plenty of set-up time, you're never sure if you'll have everything well ready in time, but you'll be pleased to hear that everything has been going well, so we're now really looking forward to meeting the team on Sunday and getting the programme under way.

You'll also be pleased to hear that the tent platforms are up and the wooden cabin no longer resembles a chicken coop (Erin's words)! The workers from the nearby village really helped us knock it in to place and the carpenter was a whizz. Tomorrow Erin and I will be down in Matinhos picking up the last supplies, printing, copying etc, but we'll be back up here late afternoon. Marcello is really enthused, familiarising himself with the surrounding terrain and keen to maximise this intense period of data collection. He already has a couple of cameras in the field, hoping we may have some photos before the team's arrival. Today he came back with great shots of a lizard and a red horned frog. Lots of tapir tracks and the local speak positively of jaguar and puma presence.

If you're doing your last minute shopping, try to pick up a pair of Wellington boots, as the location of our new camp means we no longer go past the Wellington boot shop like last year. We'll have a few spare pairs here, but you'll definitely be glad for them and might like them well-fitting in your size. We'll still be able to make a last-minute stop for any last-minute snacks or treats.

We've bought a special lime crusher for caipirinha production and designated a 'jungle bar' area so slipping an extra bottle of cachaça could be a good idea...oh, and don't forget the insect repellent...

5 November

After our set-up period we were glad to meet up with our team on Saturday night and share with them the last moments of luxury in the Holiday Inn Express in Curitiba. Fortunately the diary entries hadn't put anybody off, though Helge was relieved to hear of our transformations of the chicken coop. He was particularly impressed by the flamingo paint in our recently renovated bathroom suite. Bob had read last year's diary entries and considered ducking out at the last minute, but we bundled him in to the Land Rover and got him up to camp before he could make a run for it.

Now we're all here and are felling pretty much settled in by this stage (even if the tents are only moderately waterproof, we've at least survived the first night. Sharon and Mark don't seem too ruffled by their tent being on an ant trail and find that DEET around the tent legs is a good deterrent). Arrival day yesterday went really well. All our contingency plans concerning bad weather proved unnecessary as we spent the day basking in glorious sunshine with rocketing temperatures. The tent platforms down by the river proved to be the most popular spots. After lunch and the usual risk assessment, Marcello lead us out for our first jungle experience. Conditions were good for spotting tracks and we saw really clear ocelot tracks as well as tapir and agouti tracks. With a strong journalist presence here and keen photographers, the first delicate river crossings felt like a photo shoot and Erin made the most of the opportunity to strike a pose (I'll get my hands on the evidence).

Today Marcello has given us a lot more detail on his project here and we've been through the equipment training and data sheet procedures etc. We were all itching to get back out under the canopy, so we headed out this afternoon to practise our new skills, setting the first of the analog cameras in the field. This site being new terrain for us all here, the trail we chose did not lead us west as we had hoped, but we located a good spot by a side animal trail to practise setting a trap. Loads of good bird sightings too.

7 November

Our first full day in the field yesterday. The journalists headed down to the village about an hour away to interview the locals regarding jaguar and puma presence in the area. Meanwhile we all headed out to lay two camera traps in virgin territory up along Old Police Station track. Steady progress in the morning, hampered a little when we struck the wasp nest (Bob came off worst, but luckily Helge was there to fight them off). Nevertheless we got beyond Banana Hut to lay the camera and navigated back well. Simon and Elodie are pretty hot with the GPS. Back at base camp Erin made herself useful photographing everybody's worst bite or sting. Luckily Marcello and Erin act as effective tick magnets (10 each), so the rest of us can walk easy. Fox, peccary and tapir tracks, but after about 15 km we were glad to arrive back and decided to pass a raucous evening. After a few caipirinha, we even started singing Lisa Stansfield.

Today we all went down to the village as Marcello gave three presentations to different classes at the local schools. It was a really worthwhile interaction and we hope to return next week for a community meeting.

8 November

A really hot day with blue skies and hardly a cloud in the sky. Two teams today with lots of tapir, ocelot and fox tracks. One group set new traps while the other retrieved two cameras we set last week. There are a pair of eyes glaring out of the darkness on one of the cameras which we are about to download to try to distinguish what it is. Tapir, fire flies or big cat, we're not sure yet....

11 November

Today is our rest day, so a chance to relax, catch up on jobs and repair the bamboo bridge to the far tents which was washed away by the rising river in last night's rains. We're also finishing the details for our plan of action for phase two of our expedition.

The journalists left on Friday and here at camp we reviewed all the data collected so far to be sure which quadrats we need to revisit. We also investigated further up the tent trail, set track traps and started hacking a new transect trail heading west. It was fairly easy-going to begin with, though we soon hit hilly tougher terrain.

Helge came within inches of our first snake, the jararaca. Yesterday we were back in groups out on our missions in the field. Elodie, Simon and Erin lay new cameras on the Old Police Station trail while I went with Bob and Helge along the donkey trail to set two more analog cameras and retrieve two of the digital cameras (one of them evaded us, though we got within 180 metres). D1 had really great photos of tapir with their young feeding on fruit by the camera. We also saw a coral snake and Aline caught a fleeting glimpse of a squirrel! Mark and Carol ventured up the tent trail with Marcelo to continue the machete work. They say there's a good trail now, so this may be our choice for tonight's planned night walk...hopefully Naosa, our cook, will be arriving back from the village any minute now...

13 November

Yesterday saw Elodie, Bob and Helge depart on a reconnaissance mission to find a linking corridor between this area and the St. Hilaire national park. Although they got four kilometres in, we'll have to get some local help to find the complete track through. Meanwhile Simon, Mark, Sharon and Erin set a digital camera up on the newly cut tent trail. Then it was down to the village for a committee meeting in the agro-industrial centre concerning the marketing of local artisanal food products. Marcello will be helping them out. Also a literary class for adults where Marcello gave a talk before the show was stolen by the lady we interviewed in the bar last week who recounted her lizard tales. Good food, they prayed for us and sent us on our way.

Today back out in the field in our groups. Mark, Sharon and Simon had quite an adventure retrieving an empty digital, wading half a kilometre down the river and Sharon managing to lose a Wellington.

They had lots of fun, but we have to be really careful of the rivers.

Lots of tracks. Same for our group, which went up along Lucien's trail and we've also brought back scat. There's lots of fur in it and crushed bones and skulls and things, so we have high hopes for it. Marcello will be back soon with Helga and Elodie (they've gone up the donkey trail to retrieve D4), so we'll see what he makes of it!

Elodie, Helge and Marcello had quite a day of it, with Marcello taking them on one of his short cuts so they didn't get back until really late. Good news though – they found a puma track, our first evidence of one of these big cats this year.

18 November

We actually brought all of the cameras in from their locations on the Wednesday, so we had plenty of time on the Thursday to get ourselves organised and enjoy our last day up at base camp. We thought it best to get the cameras in just in case any of the rivers became uncrossable on the last day. Another puma track was discovered on retrieval day, not far from the camp. We managed to pack up camp pretty effectively and had time to prepare for our last night celebrations. The awards ceremony was a dazzling success, though our departure song failed to make the impression we had hoped for, even if Sharon showed a flair for spontaneous dance moves. The Nepalese and Breton dancing went down well.

On the Friday morning we took down our tents and took up the wooden platforms and supports in good time. We were a little sad to leave the chicken coop behind, especially the verandah area which had really been transformed by the hammocks and mattresses in to a top-notch lounge area. Still it was nice to get to the Holiday Inn, do a last de-tick and dry out after the swampy humidity of base camp. We wished Simon and Bob all the best for their onward travels (Bob was a little concerned by reports of mosquitoes in the Pantanal) and Sharon and Mark also left late afternoon. That left Helge, Elodie, Erin and I for a fun evening in a charasscaria by the hotel.

We were lucky to have such a great team for the research this year, so thanks to everybody involved for your contribution. Nobody complained once about all the mosquitoes, wasps, mud and rain, though it does feature a lot in the comments in the journal. I think the guide to the different types of bites will be essential reading for next year's teams. I'm sure lots of us will be keeping in touch and exchanging photos or meeting again on other expeditions to reminisce about our unique time in the jungle. Just in case any of you are trying to forget, here's the copy of our poem (Bob has given us permission to use the lines he has under copyright):

Snag A Jag

(c) Slot 1 Brazil Expedition 2007

I'd like an awful lot to see an ocelot
But I'd be happier to see a tapir
My taste buds would be peppery with a barbecued peccary
Not later but sooner I'd like to see a puma ((c) Bob)

I dream on my pillow of a cuddly oncilla
Or even the cutie that's known as agouti ((c) Bob)

If I can't find a prowler, I'll settle for a howler ((c) Bob)

But to feature in your mag we must snag us a jag.
A margay would be OK, and a possum would be awesome
A fox would be tops, but a bush-dog would be full-hog.
Yet of all the beasties that live in this bush
The ones we like least bite us on the tush.

Mosquitos, wasps'n'ants in your pants
Reduce us to Nepalese dance and Stansfield Chants
The tick is a prick The horsefly a nag
Pass me the DEET and just snag me a jag.

It's always a big to-do when we see the golden tegu
And the swallow-tailed kite is a delightful sight
I would absolutely die to see a Jaguarundi
I'd give the 'dillo a try, but he's awfully shy

To tell you the truth, I think the big cat's a spoof
Should we tell Marcello or just let it mellow?
Well, he is a nice fellow and we don't mean to nag
But to get him in NAT GEO, we need to snag us a jag!

So long

David Moore
Expedition leader.