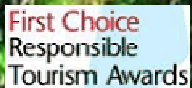


EXPEDITION REPORT

Expedition dates: 9 – 21 May 2010
Report published: July 2010



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



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Germany



EXPEDITION REPORT

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

**Expedition dates:
9 – 21 May 2010**

**Report published:
July 2010**

**Authors:
Marcelo Mazzolli
Projeto Puma**

**Matthias Hammer (editor)
Biosphere Expeditions**

Abstract

An expedition to the southern Atlantic forest of Brazil was conducted with Biosphere Expeditions in May 2010, to the APA (Area of Environmental Protection) of Guaratuba in the Serra do Mar mountain range. This was the fourth Biosphere Expeditions survey in the area and the sixth overall including local expeditions. The primary aim of the surveys is to locate core habitats for jaguar and puma at their southern range in the Atlantic broad-leaf rainforest, and develop conservation strategies and guidelines for these habitats and their resident species based on information gained locally.

Sampling was conducted in the locality of Canasvieiras, in the municipality of Guaratuba and consisted of sign surveys and the deployment of 11 camera traps. Data collected included species richness and observed occupancy. Large cats (jaguar and puma) were not recorded during this expedition, whereas ocelot was recorded relatively often, as well as deer and tapir.

Variations on the presence-absence of species are natural, and the fact that large cats were temporarily absent for a short period of time is perfectly normal. In the previous Biosphere Expedition to Brazil in 2008, ocelots, common during the 2010 expedition, were not recorded either.

During this expedition it was possible to develop a strategy, together with local guides, to sample further into areas where jaguars are believed to be present more often. These areas will be surveyed by future expeditions.

Resumo

Expedições ao sul da floresta Atlântica do Brasil foram efetuadas pela 'Biosphere Expeditions' em Maio de 2010, para a APA (Área de Proteção Ambiental) de Guaratuba, localizada na cadeia de montanhas da Serra do Mar. Esta foi o quarto levantamento da Biosphere Expeditions na área, e o sexto levantamento total se expedições locais forem contabilizadas. O principal objetivo do projeto é localizar áreas de habitat principal para a onça-pintada e o puma no limite sul da distribuição da Floresta Atlântica costeira, e desenvolver estratégias de conservação baseadas em informações obtidas localmente, de maneira a produzir diretrizes para conservação destas espécies e de seu habitat.

A amostragem foi conduzida na localidade de Canasvieiras, no município de Guaratuba e consistiu em levantamentos de vestígios de mamíferos e uso de 11 armadilhas-fotográficas. Dados coletados incluíram riqueza de espécies e ocupação observada. Os grandes gatos (onça-pintada e puma) não foram registrados durante esta expedição, ao passo que a jaguatirica foi registrada de maneira relativamente freqüente, bem como veados e antas.

Variações na presença e ausência de espécies são naturais, e o fato dos grandes gatos estarem temporariamente ausentes por um curto período de tempo é perfeitamente normal. Durante a expedição prévia (2008), as jaguatiricas, comuns durante a expedição de 2010, não foram registradas.

Durante esta expedição foi possível delinear estratégias, com guias locais, para amostragem em áreas mais remotas onde acredita-se sejam mais frequentadas por onças-pintadas.

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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 aims to continue the only jaguar and puma conservation project in the Atlantic broad-leaved rainforest. The expedition's study site in the APA (Area of Environmental Protection) of Guaratuba, in the Serra do Mar Mountain range, 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.

The APA (Area of Environmental Protection) of Guaratuba is 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 in 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 in the APA (Area of Environmental Protection) of Guaratuba, although much of the Serra do Mar mountain Range in the State of Paraná, as well as its bays, are of interest to this project. The Serra do Mar mountain range harbours the largest continuous patches of Atlantic rainforest of Brazil.

The Atlantic rainforest of Brazil is 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 9 to 21 May 2010 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, one Land Rover Defender kindly provided by Land Rover Brazil and one 4x4 from Projeto Puma.



Map showing study area including study bases, main road network, and major landmarks. © Google Earth.

Prior to the team members' arrival, staff prepared base camp from 3 May 2010. The facility is owned by a Mr. Simões who kindly provided access to it.

Base camp consisted of fourteen tents installed on wooden platforms and one jungle hammock, where the team slept, and a house where meals were served and other communal activities were conducted.



Base camp with tents installed on wooden platforms above the forest floor.

There was a dedicated cook to prepare main meals. Lunch often consisted of a snack taken to the field, whereas dinner was the main meal. There was 110V electricity at base.

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. Regular expedition diary updates were uploaded to www.biosphere-expeditions.org/diaries 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 serious medical incidents. There were some sore muscles and joints as well as some cuts, bruising and minor insect bites.

1.5. Expedition scientist

The expedition's field scientist is Dr. 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, England, and Peru, and has surveyed lions in Botswana. Marcelo has been working with Biosphere Expeditions since 2006 as scientist in Brazil, and has also participated as a Biosphere Expeditions consultant scientist on the Peru expedition and as a scientist on the Oman expedition. He is currently the coordinator of a post-graduate course in Sustainable Development and Environmental Management at a local university. He also claims to be a good cook and keeps dabbling with the meal plan on expedition!

1.6. Expedition leaders

Ronald Seipold graduated from the University of Berlin with a Masters Degree in Business Administration and then spent several years working in different branches of industries leading organisational and IT related projects. He then decided to go for a total change of career & lifestyle and focus on his passion for travelling, wildlife and the outdoors. After a 100 day intensive training course with COLT (Canadian Outdoor Leader Training) he qualified as an outdoor leader, radio operator, sea kayak and canoeing guide, backcountry first-aider, etc.. Ronald then began leading and instructing groups in the outdoors primarily in Scandinavia and Canada as well as working for outdoor camps and lodges. Ronald joined Biosphere Expeditions in 2007 and participated as staff in the expeditions of Oman and Azores. His favourite activities are mountaineering, canoeing and climbing.

Malika Fettak is half Algerian, but was born and educated in Germany. She majored in Marketing & Communication at the University of Frankfurt, which led her to jobs in PR & Communications. She has travelled widely, especially in Africa and Northern Europe. Her love of nature and the outdoors, and taking part in a few Biosphere expeditions, persuaded her that a change of career was in order and here she is since 2008, leading expeditions and desperately trying to make herself useful around the office :) Malika is a keen sportswoman - triathlon, skiing, volleyball, etc. and enjoys the outdoors.

1.7. Expedition team

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



From left to right and from back to front: Felicity Pidgeon (Australia), Sylvia Lawson-Brown (UK), Alan Russell (UK), Claire Moore (Ireland), Jacqui Hayes (Australia), Anne Neumann (Germany), Alister Lawson-Brown (UK), Gosia Korszla (Poland), Neuza dos Santos (cook, Brazil), Michael Hennecke (Germany), Frank Ihle (Norway), Martina Kuhls (Germany), Nancy Hoecker (USA), Marcelo Mazzolli (scientist, Brazil), Malika Fettak (Biosphere Expeditions, Germany), Ronald Seipold (expedition leader, Germany).

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	14,784
 Expenditure	
Base camp and food includes all meals, rent, building materials, base camp equipment	1,070
Transport includes fuel, vehicle maintenance, vehicle insurance, local travel	913
Equipment and hardware includes research materials, research gear	1,293
Biosphere Expeditions staff includes salaries, travel and expenses to Brazil	3,233
Local staff includes salaries, travel and expenses, Biosphere Expedition tips, gifts	1,606
Administration includes bribes, registration fees, sundries, etc	240
Team recruitment Brazil as estimated % of PR costs for Biosphere Expeditions	2,840
 Income – Expenditure	 3,589
 Total percentage spent directly on project	 76%

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, Swarovski Optik, Motorola, Cotswold Outdoor, Globetrotter Ausrüstung, Snowgum and Gerald Arnhold for their sponsorship.

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

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.

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2. Puma & Jaguar Survey

Marcelo Mazzolli
Projeto Puma

2.1. Introduction

Biosphere Expeditions began working in Brazil in 2006 with the first expedition conducted to Guaratuba bay with access by boat only. During this year, fourteen species of mammals were recorded, including jaguar *Panthera onca* and the puma *Puma concolor* (Mazzolli & Hammer 2007). The reduced presence of target species, difficult access, swampy trails and state of facilities present in the area forced us to change base camp site for the 2007 expedition. This new base camp was the same used during the 2008 and 2010 expeditions.

In this new location, the 2007 expedition added white-lipped peccaries (*Tayassu pecari*) to the list of recorded species, as well as other species uncommon elsewhere, such as ocelots (*Leopardus pardalis*) and tapirs (*Tapirus terrestris*), which are easily recorded in this new area.

During 2008, a jaguar track and several puma and ocelot tracks were recorded on the trails.

Study area

The area sampled during November 2008 by Biosphere Expedition was the same as that surveyed in 2007, except that the base camp location was not the same, and that the area sampled expanded a few kilometres northward. It 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, poaching, and illegal harvest of palm-heart *Euterpe edulis*.

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 and two rivers to reach the expedition base camp.

Although the surrounding mountains reach over 1,500 m in altitude, the area sampled was between 330 to 600 meters in altitude. The vegetation consisted mostly of montane and sub-montane broad-leaved Atlantic rainforest.

In addition to the localized study area, two large exploratory Land Rover-based expeditions were conducted to the Graciosa mountains to the north (where jaguars had been recorded prior to 1997 and a single recent record in 2005).

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 and other research and safety techniques, skills and procedures. The first excursions into the forest were done under the supervision of Biosphere Expeditions staff. After a few days, team members were quite confident to navigate in the forest, install camera traps and record tracks and signs of mammals.



Figure 2.2a. Team members being briefed in the base camp about data entry and other study protocols.

Ecological sampling

Data on mammalian presence were collected from field surveys in continuous quadrats 2 x 2 km, each coded by a combination of letters and numbers. Resampling of quadrats was carried out where possible, taking into account that 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 (Table 2.2a).

Table 2.2a. Quadrat resampling scheme showing quadrat codes. Numbered columns marked with X represent the number of sampled occasions. These represent quadrats where data were actually recorded.

Quadrat	Number of times resampled					
	1	2	3	4	5	6
9i	x					
9j	x					
10h	x					
10i	x	x				
10j	x					
10k	x	x				
11h	x	x				
11i	x	x	x			
12h	x					

Data collection procedures included camera trapping and recording 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 mud coverage to display prints of animal tracks. This made track recording possible in most circumstances without the need for track-traps. Track-traps were set in the few trails where tracks did not record naturally.

Camera trapping

Eleven cameras, three of which were digital, were placed in the study area. Total camera trap sampling effort was 67 camera trap nights (Table 2.2b) in six quadrats within the survey area as initially planned, and one outside it. The camera outside the survey area as initially planned was installed under a bridge, which is one of the few options for wildlife to disperse undisturbed either side of the BR 277 road, between the study area and the northern area of the Graciosa mountains northwards.

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 2010, the sampling period was short.

Table 2.2b. Sampling history of individual cameras (ID column), including date of installation and removal, quadrat installed and working period.

ID	Date installed	Quad-rat	X	Y	Date removed	Species	Total trap nights
D12	10/5/10	11i	0721495	7161812	20/05/10	Ocelot	10
A14	11/5/10	10h	0719408	7162074	22/05/20	—	11
D11	11/5/10	9j	0717434	7159593	Recorded as stolen in 18/05/10	Tapir, nine-banded armadillo, ocelot	4
A15	12/5/10	10i	0718767	7160815	17/05/10	—	5
A20	13/5/10	11j	0720683	7159255	18/05/10	—	5
A16	13/5/10	11j	0720580	7158992	18/05/10	—	5
A17	13/5/10	10k	0718510	7157572	18/05/10	—	6
D18	15/05/10	9j	0717125	7159387	19/05/10	—	4
A19	14/05/10	10k	0718590	7157270	18/05/10	—	5
A13	14/05/10	High-way	0713645	7168053	21/05/10	—	7
A21	15/05/10	11i	0721953	7161364	20/05/10	—	5
Total trap nights							67

2.3. Results

Training and performance

Training the expedition team on navigation through the forest was considered successful. After a few days, team members could report what they had observed in detail and provided evidence in the form of pictures and datasheets. Data entry and picture download was a task that was also accomplished, so that data analysis could be performed with relative ease (Fig. 2.3a).



Figure 2.3a. Two action snapshots of the 2010 expedition: data entry and picture download (top) and crossing a river during surveys (bottom).

Species occurrence

During the 2010 Biosphere Expeditions survey, the species that were identified accurately were the nine-banded armadillo, crab-eating fox, collared peccary, common opossum, racoon, and tapir (see below for Latin binomials). Brocket deer was recorded by tracks, the species being probably red-brocket, as the species has been recorded before and the habitat is typical for the species.

As in 2007 and 2008, tapir was the species most recorded, by number of quadrats (n=9). Deer was the second most recorded species, found in five quadrats and ocelot follows, being recorded in four quadrats (Table 2.3b).

Table 2.3b. Species recorded during the Biosphere Expeditions survey, with information on quadrat number and type of record (vestige, sighting, vocalization, camera trap).

Species	Latin name	Local name	Quadrats	Type of record
Armadillo	<i>Dasyus novemcinctus</i>	Tatu-galinha	9j, 11i, 11h, 11j	Track, camera-trap
Brocket deer	<i>Mazama sp.</i> (likely <i>americana</i>)	Veado-mateiro	10k, 11h, 10j, 10i, 11i	Track
Crab-eating fox	<i>Cerdocyon thous</i>	Graxaim	11h, 9j, 10i	Track
Collared-peccary	<i>Pecari tajacu</i>	Cateto	11i	Track
Ocelot	<i>Leopardus pardalis</i>	Jaguaririca	9j, 11j, 10j, 10i	Track, camera-trap
Opossum	<i>Monodelphis marsupialis</i>	Gambá	11h	Sighting
Racoon	<i>Procyon cancrivorous</i>	Mão-pelada	9i, 10i	Track
Tapir	<i>Tapirus terrestris</i>	Anta	10k, 11i, 9j, 10i, 9i, 12h, 11h, 11j, 10j	Track, camera trap

Only three species, nine-banded armadillo, tapir, and ocelot were recorded with camera traps, the remaining species were recorded by their tracks and one by sighting (common opossum) (Fig. 2.3b).



Figure 2.3b. From left to right and from top to bottom: nine-banded armadillo, common opossum, tapir, and ocelot.

There was a jaguar record in 2005 in the Marumbi State Park, a park located in the Graciosa mountains. Team members travelled to this location to get first-hand information on this record, and interact with a local researcher who had this information, Renata Leite. Renata had a jaguar track on plaster (Fig. 2.3.c). During this Land Rover survey, team members also visited a ranch to enquire about the presence of large cats and livestock depredation incidents in these mountains, but large cats had not been recorded recently by ranchers.



Figure 2.3c. Jaguar track recorded in plaster in the Marumbi State Park, next to the study site, in the year 2005.

GIS mapping

Two maps were produced. The first was limited to the 2010 base and surroundings, included quadrat coding and contained the trails and camera trap locations. It was extracted from Geopro maps produced by Pró-Atlântica in the background and overlaid with data obtained in the field and transferred with the software TrackMaker (www.gpstm.com).

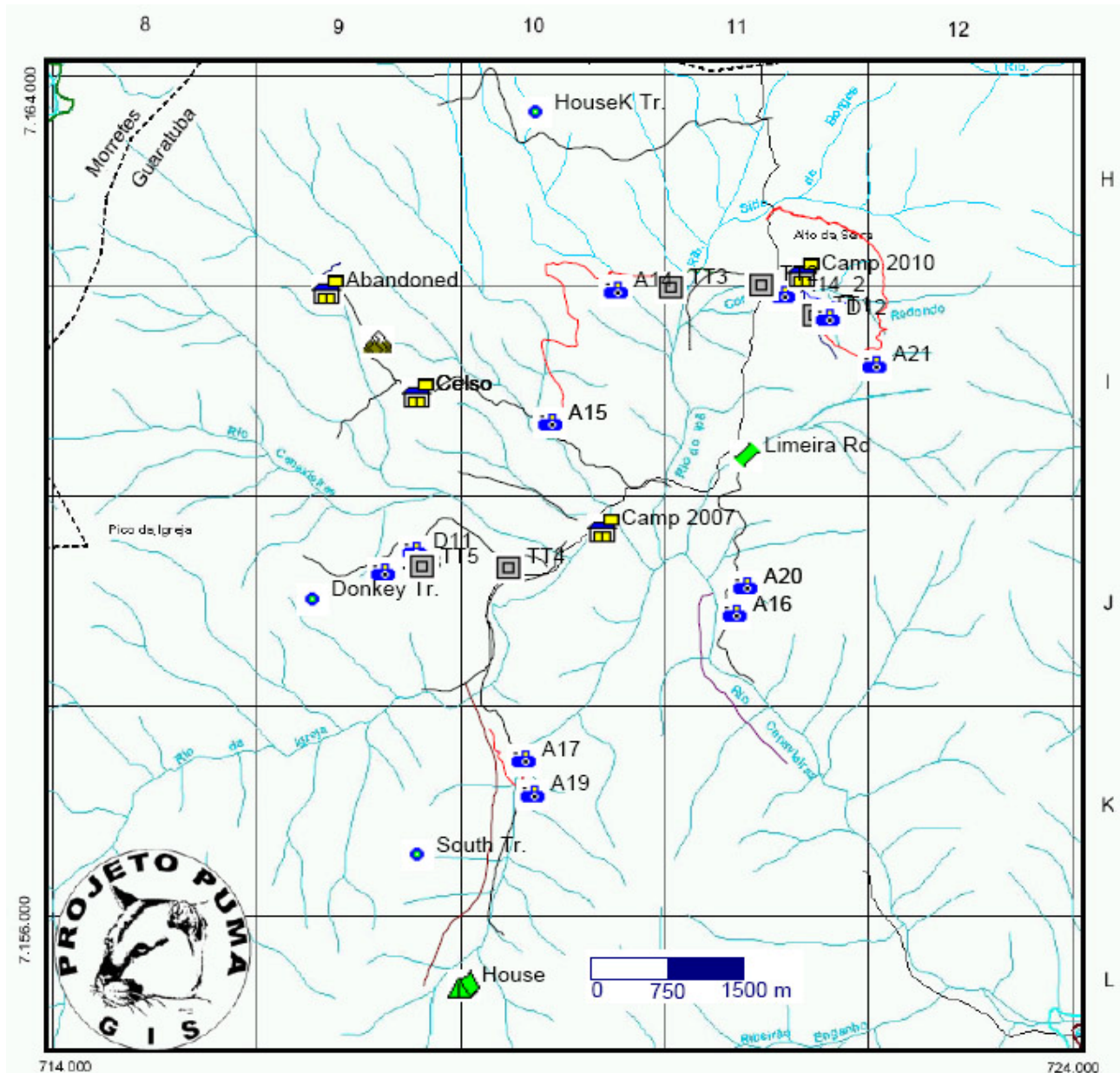


Figure 2.3b. Map of the study area. Map includes position of camera traps, river systems, quadrat coding (letter and number) and trails. Coordinates are in UTM, datum SAD 69. Red tracks are the new trails, not covered during previous expeditions.

The second map was produced by Projeto Puma displaying the entire 'Jaguar Corridor' study area. It displays the locations of the 2010 exploratory surveys to the Graciosa mountains and also summarises locations where jaguars have been found prior to 1997 and from 2006-2010, base camps, main roads, and contours of protected areas (Fig. 2.3c).

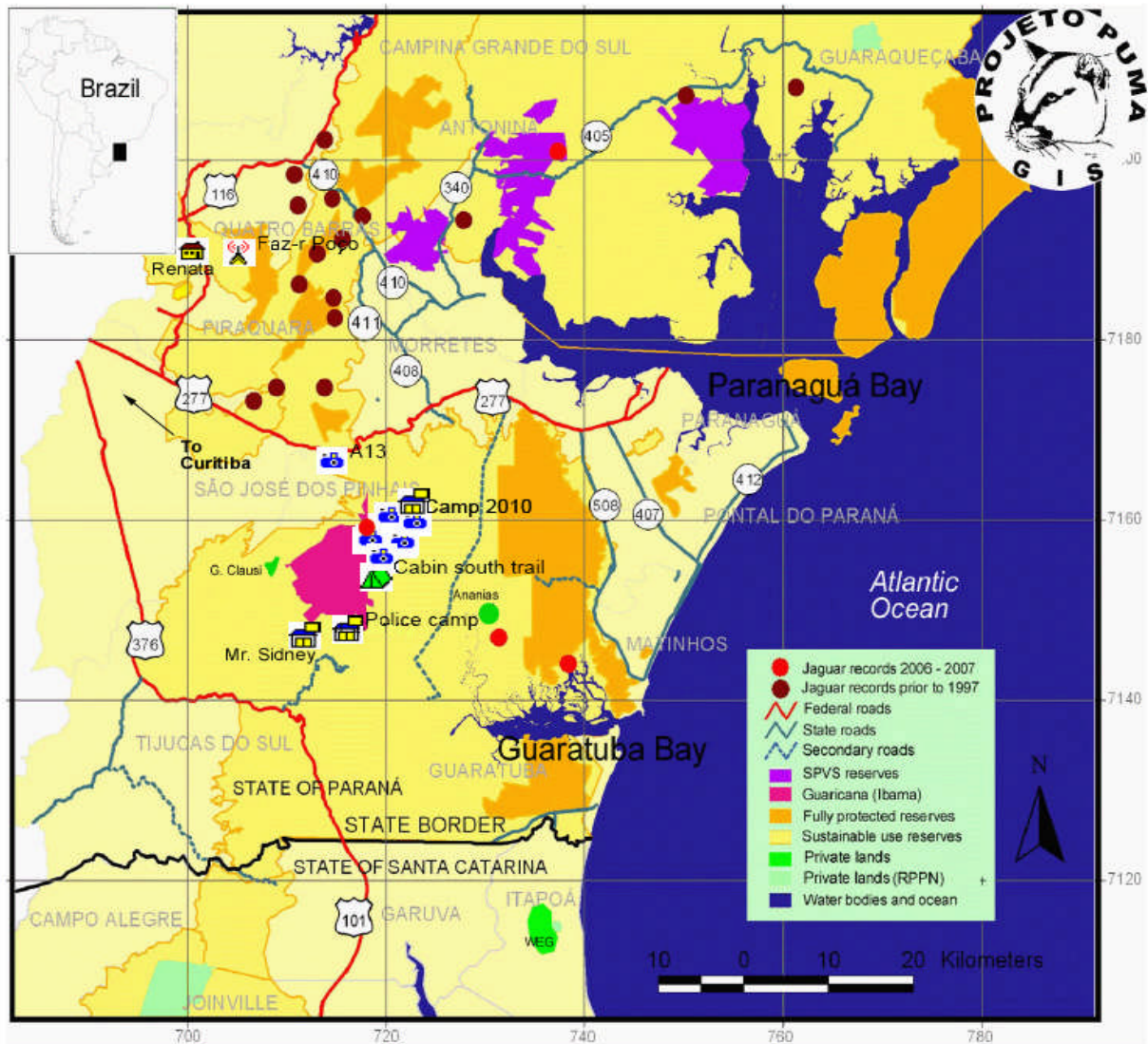


Figure 2.3c. The entire jaguar corridor area, extending from the State of Santa Catarina to the State of Paraná, with overlaid information from 2010 obtained during Biosphere Expedition's survey. This map was generated from GIS features kindly provided by several organizations, namely the Environment Foundation (Fatma - Santa Catarina), Paraná Institute of Environment (IAP), Brazilian Institute of Environment and Renewed Resources (IBAMA) and Society for Wildlife Research and Environmental Education (SPVS). Jaguar records prior to 1997 have been mapped by M.R. Leite (Leite M.Sc. thesis, 2000). Coordinates in UTM, datum SAD69.

2.4. Discussion & conclusions

Species presence and habitat integrity

During the 2010 expedition the larger cats, jaguar and the puma, were not recorded. This is natural, given the encroached condition of the Atlantic Forest ecosystem, meaning that densities of these cats are expected to be low and their vestiges only occasionally seen.

There is no definitive answer to explain the absence of the big cats in the area during this year's survey, but this is certainly a circumstantial phenomena - they are present, but went undetected - both jaguars and pumas range over wide areas and do not reach high densities in the study site, thus it is natural that they may be absent from part of their range during certain periods.

For instance, during the 2008 expedition, ocelots were the ones not recorded at all, for the same reason, while this year there were at least four different instances where this species was recorded.

During the 2007 expedition, the ocelot was recorded eight times, and the lack of ocelot vestiges in 2008 could either be the result of an increase in vehicle traffic or due to the presence of pumas in the area. It seems now that the increased traffic was not the reason for their absence, as the households at the far end of the road have continued to produce vehicle traffic as recorded in 2010. The variation in ocelot presence from 2007 to 2010 may then be also explained by how they use their home ranges or by the interference of the large cats, when they are present.

The temporary absence of the two larger cats during the 2010 expedition is likely to have contributed to give room to ocelots to feel more confident and wander on open roads and trails, and the result is that this species was recorded very often.

Several other species were recorded, which are rare elsewhere, such as the tapir and peccaries, which demonstrate the generally good condition of the environment in spite of habitat encroachment.

Tapir was found still to be relatively common in the area and widespread over the quadrats surveyed. This result is positive, as the species is not able to withstand hunting pressure at any level due to its slow reproductive rate. Any population crash would take many generations to recover densities to the current level.

Sampling and study design

Study design considerations should always take into account the relationship between the amount of data obtained and the effort spent during the survey. Ideally a greater number of quadrats should be surveyed more often (resampling). During the 2010 Biosphere Expeditions survey, nine quadrats were covered in contrast with only four in 2006, twelve in 2007, and also nine in 2008. This year the relatively low number of quadrats had to do mainly with poor maintenance of trails, and this may be fixed by marking the trails so that they can be more easily located during surveys in the future. In spite of this, sampling and re-sampling of quadrats may be considered satisfactory considering that less than a fortnight was available for sampling.

Management implications

This year it was possible, as in 2008, to extend the survey northward to the Graciosa mountains. It was also possible to obtain new insights from a local researcher, make inquiries regarding livestock depredation in a nearby ranch, and visit an environment office in the town of Morretes, thus involving other stakeholders in our project.

We have also gained further support from locals who keep the base camp, and they are willing to help us find and maintain the farther trails where private rangers have reported the presence of jaguars. This will certainly help to expand the network of trails and the quadrats sampled, and give results that reflect more accurately the presence of the large cats.

Management recommendations

Other reports have emphasized that the good condition of the study area (relative to the surrounding areas) is due to the frequent patrolling by rangers of several local landowners. Rangers by themselves cannot protect the entire forest. Instead it is necessary that the community as a whole begins to protect it, and this will only happen when the community benefits from the forest in a sustainable way so that the forest has a value to the community (the 'what pays, stays' principle).

Habitat quality is lacking when compared to other pristine ecosystems or if compared to its own past, historical condition. Much has to be done to bring it back to its best condition, and this can be done by involving local communities in best management practices of native resources. When forest resources are valuable and can be managed adequately, then there will be an interest to protect them.

The 2008 report also mentioned the ecological state tax that goes to the municipality of Guaratuba, due to the fact that a large portion of it is under legal protection, but also the fact that nothing is converted into environmental conservation. This is an issue that has to be solved, as these government funds are either not used or used for purposes other than conservation.

As mentioned during the 2008 expedition report, 'It is recommended that application of this fund should be revised and means should be implemented so that it can go towards payment of rangers and incentives for sustainable use of forest products, such as for the 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)'.

Priorities for next expedition

The 2011 expedition should incorporate other trails into the trail system to be surveyed and these trails will have to go further into the forest. This can be achieved by signalling better the trails so that more ground can be covered in less time.

Other trails by the State Park of Marumbi, in Morretes, can be covered also to expand the study area and increase the reliability of the jaguar and puma population study.

It is also desirable that other groups of species be incorporated into the survey, species that can be sampled near base camp. This tackles two issues. First, to increase the scope of the project and opportunistically investigate other biodiversity issues that may be important for the conservation of the area. Second, it will provide a chance for team members who find the long trails challenging to contribute to data collection through a less strenuous activity.

Regarding involvement of the local community into conservation of the study area, team members could help to start showcasing the sustainable use of the fruit of the palm heart, which is a valuable market product and has been under-explored. This initiative may help the community to give value to the forest, as this native species, the juçara palm-heart, grows only in shaded areas and particularly in the forest.

2.5. References

Leite Pitman, R. 2002. Relações entre a onça-pintada, onça-parda e moradores locais em três unidades de conservação da Floresta Atlântica do Estado do Paraná. Tese de mestrado. Universidade Federal do Paraná, UFPR, Brasil.

Mazzolli, M. & Hammer, M.L.A. 2008. Qualidade de ambiente para a onça-pintada, puma e jaguatirica na Baía de Guaratuba, Estado do Paraná, utilizando os aplicativos Capture e Presence. *Biotemas* 21 (2): 105 – 117.

Appendix 1. Expedition diary by Ronald Seipold and Malika Fettak

29 April

Hello everyone and welcome to the first diary entry for Biosphere Expeditions' Brazil expedition. I am Malika Fettak, Operations Manager of Biosphere Expeditions and Ronald Seipold will be your expedition leader. Working with us will be Marcelo Mazzolli, the scientist on this expedition.

At the moment I am still in Germany, preparing paperwork and equipment, but soon I will be meeting Ronald in Madrid and both of us will be flying to Sao Paulo for more preparation work and some extreme shopping for the expedition. Once we have picked up and packed the expedition Land Rover we will be driving to Matinhos, meet Marcello and hopefully find a beautiful spot to set up base camp.

I'll let you know our mobile phone number during the expedition once Ronald and I have purchased a new Brazilian SIM card. Remember that this is for emergency purposes only (such as being late for assembly, for example).

Best wishes for now & more news from the field in a couple of days...

Malika

P.S. This diary is now also on www.biosphere-expeditions.org/diaries, so you can pass this on to your families & friends for updates on what we are up to.

1 May

Nice & warm sunny weather in Sao Paulo since Ronald and I arrived two days ago. We picked up the expedition Land Rover - a shiny & brand new Defender showing no more than 15 km on the odometer! The rest of the time we spent with shopping, accompanied by Daniel (of an agency located in Sao Paulo) who did a great job being our guide and translator, consultant and driver in this unbelievably big & busy city - would have been completely lost without him ;).

We bought a Brazilian SIM card, so please note the expedition leader number (Ronald) for emergency calls (i.e. if you arrive late at the assembly): +55 41 92093731.

We are ready to leave tomorrow morning - the Land Rover fully packed with all the equipment. We can't wait for the morning to come to arrive at base camp .

You will be hearing from us again soon.

4 May

Base camp is a fantastic place to stay! We had to wake up Marcelo, our scientist on this expedition, having fallen asleep in the hammock set up on the veranda while waiting for us to arrive on late Sunday afternoon. The road up to base is an off-road experience: stony, bumpy & a bit muddy, but still good for driving as it has been dry during the last couple of weeks. And we no longer have to cross rivers as a couple of narrow wooden bridges have been repaired since the last expedition.

With the help of Mario, a local guy living close to our camp, we have been starting to build wooden platforms, which will be used as a base for our tents. The large wooden cabin had not been used for a while, so it urgently needed a complete clean-up as well as some construction work. But we hope to have everything ready in time....

The weather has been great these last few days - around 20 degrees C and no rain so far. It is still pretty humid even when the sun is shining. The evenings are pleasant (it gets dark already at about 18:30) and even this time of year some mosquitoes are bugging us during dawn (definitely bring some repellent). Unfortunately we heard about some rain due within the next few days. We will see - anyhow the weather is changing very quickly during this time of year and we will have to face all kinds of different conditions. So, be prepared .

We are looking forward to meeting slot 1 in Curitiba soon.

18 May

Two days before the team arrived, the weather changed: heavy rain and a remarkable drop in temperature. We still managed to get everything prepared not taking into account a last minute "strike" by one toilet that we were not able to fix before leaving for Curitiba. Sunday stayed dry and all team members arrived on time and with all their luggage - at the assembly point. So, the start of this year's expedition couldn't have been a better one. After a brief inspection of our new home for the next two weeks we were served a warm meal by our cook (she was already part of the last expedition here in Brazil). Lunch was followed by the usual risk assessment and the first part of Marcelo's scientific introduction explaining the Brazilian governmental ideas and support of environmental projects in general. After a cold night in a tent (it was definitely below 10 degrees), Marcelo continued his talk in the morning, giving us a better understanding of our project in this area. We also did equipment training and data sheet procedures. Just as we were preparing for the first bush walk behind our cabin, it started to rain. This didn't prevent us from practising new skills: GPS handling, setting up a camera trap and making a mud track trap. I used the afternoon to check the level of rivers south of the cabin - rivers that have to be crossed by car or on foot to get to our trails in that area.

Tuesday was our first full day in the field. We split into two teams. Marcelo headed for a reconnaissance trail which starts close to Base Camp with a possible connection to so called Celso's trail, a trail south where we stayed overnight on our 2008 expedition. Unfortunately parts of the trail were not really visible anymore and the thick rain forest prevented any GPS signal reception. As the group worked its way through the jungle, it got later and later and finally dark. Everybody returned to the cabin late. And yes, we have to admit that some got scared and/or exhausted on this unexpected long and rainy "night walk". Sorry guys! Chapeau for your good spirits and sense of humour. I must mention that this team spotted a lot of tapir tracks and installed a camera and two track traps on their way back. The second team worked their way through two rivers in the Defender. A third river had to be crossed on foot to reach the start of the 'Donkey' Trail. We passed an abandoned cabin on a hill (unbelievably it still has a sign outside that indicates that it had been a kind of bar and barbeque house - who the heck came to this remote place for a grilled chicken ???). Shortly beyond this cabin I expected to find the start of the trail I remembered from last expedition. However, a new fence kept us out and the trail was reclaimed by the rain forest. With the help of our GPS, we bush whacked through the green and finally found the "lost" trail. One result of this new fence is that this trail is clearly not used by locals any more. We found many tracks of tapir as well as those of racoon and possibly ocelot. We left one camera trap and two mud track traps behind us. Let's see what results we get ...

Wednesday greeted us with clear skies. Given that Marcelo's team had such a long hike the day before, we decided to have a shorter day for those who felt tired. This team left the cabin a bit later that morning to continue the trail behind Base Camp. But again this trail kind of disappeared and they made their return earlier than expected. More tapir tracks led them to set up one more camera trap.

The second team with Al, Alastair, Sylvia, Gosia, Felicity, Martina, Frank, Anne and me headed towards Celso's trail. On our way we found two possible puma tracks (!), a cat scat with fur (has to be DNA analyzed to confirm), also possibly a racoon track, several deer tracks and a fox track. Next to an abandoned cabin on top of the hill we enjoyed our lunch in the sun. As it is more than difficult to dry any clothes in this humidity it was also a chance to dry some of the wet clothes. On the way back we installed a camera trap on a small side trail where we found a strange manmade construction nearby that looked like an animal trap. Not even a closer look gave us a clue about its functionality. What a sunny day makes a difference: the mood was much better and everybody was looking forward to new experiences. Later in the evening Marcelo heard the noise of an animal in the front yard and found an opossum sitting in a tree just 2.5 meters above ground. It was probably very scared as it almost didn't move - a chance to take some good pictures.

The weather stayed sunny on Thursday. One team installed two cameras on the Limeira Road trail as they had seen a lot of ocelot and tapir tracks as well as armadillo tracks. A second group accompanied me in exploring the southern trails. As we again managed our way to the far end of the dirt road our next challenge was to cross a wide river on foot. Afterwards we followed a stream bed to find the "entrance" of one of the major trails. Martina spotted an animal (size of a bigger dog, black with short fur) that rushed up the steep bank and disappeared within a second in the shrubs. Unfortunately we couldn't identify any tracks in this muddy area. As we struggled again with the reception of our GPS and no visible trail showed up, we returned to the river. The sun was really warm and it was difficult to go back to "work" after lunch. We walked another trail where we left one installed camera behind. Tracks of tapirs, fox and ocelot as well as sightings of a toucan, hummingbirds and parrots completed the day. Despite Anne's sore muscles, Sylvia's sore knee and Alastair's twisted ankle, the group was in a great mood.

On Friday Felicity, Frank, Martina, Anne and Alan accompanied me on another try on one of these southern trails. In the first small river to be crossed on foot, Felicity and her rucksack took an unintentional bath. Frank offered to get her back to the cabin, where she quickly recovered and is in best condition! The others continued the "mission". We started with a search for the trail we wanted to take the day before but again were unsuccessful. Very likely this trail or this part of the trail was taken over by the rain forest. We explored one other trail leading up a hill to the east. Besides a few tapir tracks this trail didn't give us the expected findings. On our way back we turned into a different trail winding alongside a small river. We were rewarded by more tracks and finally installed one more camera. The second team worked on data entry in the morning and left afterwards with the cars for a place that was recommended to Marcelo by a local. It is located approx. 10km towards Curitiba where animals find a kind of transect from one side of the road to the other. It is also within a small area with very low density of humans. The group had to walk about 20 minutes, bush wracking down a steep and muddy creek. They found a lot of animal activity but the terrain didn't allow identifying any of the tracks. A camera was installed and on their way back several team members took the chance of picking up some beers in a small kind of shop next to the dirt road. In the evening most of us spent hours to find and remove ticks. These ticks are very small and hard to see. Martina, our tick master, helped to remove about 70 (!) ticks, mainly from other bodies. No question that the new trail was named 'tick trail'. By the way, day by day we created more and more nick names: Martina = 2 nd wife, Claire = Mrs. Livingstone, Felicity = Mrs. Darwin, Frank = Wickinger (German for Viking), Alastair = husband, Alan = Schotte (German for Scotsman) and Gosia = crocky. Please don't expect me to the background of these nick names in this diary J).

On Saturday (another sunny day) Alan, Gosia, Michael, Alastair, Sylvia and Marcelo followed the house-keeper who showed us a sort of trail that starts behind the house and leads north back to the dirt road. This trail led up the hill (highest point of the trail was over 600 meters) and was really steep. Parts of the path had to be cut to get through but many tracks such as armadillo, deer, tapir and peccary made it worthwhile. Again a camera trap was installed. Further on Alan spotted a Coral snake which took off pretty quickly. On the way down the group ran into a pristine waterfall with a height of more than 15 meters. Team two went back to check the digital camera trap and the mud track traps on the 'Donkey trail'. On their way they found a lot more tracks than a few days before: armadillo, deer, tapir racoon and several ocelot tracks. And believe it or not – the camera trap captured three animals on film: the head of a tapir, the tail and a part of the body of an ocelot and an armadillo ! For such a short period of time it was a fantastic result. The group managed to explore this trail a bit further on and installed a second camera trap. We have now set up 10 camera traps in total. Hopefully we will get more pictures. But we all have to be patient as most of the cameras are analogue cameras and therefore the films have to be developed after the end of the expedition. Of course we will let you know about the outcome.

Today is our day-off. We are staying in a little town called Paranagua next to the coastline. My next diary will be sent after the end of the expedition when we will be back to civilization ...
Greetings from all team members (who are all in an inspiringly good mood).

22 May 2010

Teams set out on monday to retrieve camera traps and explore trails further. Slippery, muddy trails due to rain, made progress on foot difficult. Vehicles had just as much difficulty, with the Defender getting stuck in a muddy ditch on the dirt road and having to be pulled out by a tractor.

The next day, a group accompanied Marcelo to meet Renata, a specialist in big cats for this part of Brazil. She also works on jaguars in Peru. Recently she has found prints of a jaguar in Serra da Graciosa, a mountain range that separates Parana state's coast from the interior. Its southern extension is one of the largest remaining areas of the Atlantic forest in southern Brazil. The Serra is rich in flora and fauna, ranging from lowland sub-tropical to cloud forest varieties and. This area is situated just on the other side of the highway of the area we are based in, but it still takes a long time to drive.

A sunny Wednesday saw, Anne, Alan, Felicity, Jacqueline and Marcelo heading for the southern trails to retrieve camera traps. The rivers caused no problems for the car to cross, as water levels seem to lower as quickly as they rise. Marcelo caught a glimpse of a cat-like shadow that disappeared in the bush - too short to identify the species. Anne, who likes snakes, was delighted to watch a Fer-de-lance snake cross their path. The team enjoyed the walk and returned to Base Camp with two cameras in their backpack.

The second team made it up to Donkey's Trail. Unfortunately, the team discovered that somebody had stolen one of the cameras! As we hadn't previously seen any human tracks of locals using this trail, we assume has been taken by a hunter. Bad news! At least the second camera had some shots

Sunny weather continued on thursday. One team retrieved the last of the cameras installed in the field. It had a clear picture of an ocelot! This is our second shot of an ocelot and helps a bit to overcome the disappointment about the stolen digital camera (including the memory card with the taken pictures). We also found some more tracks of tapir, peccary and cat (to be verified).

A second team headed out to explore a long trail north of Base Camp. On the way they found tracks of armadillo, racoon, deer and fox on the dirt road. The trail itself does not appear to be under permanent use any more, so they had to search and cut their way through the bush. Some more tracks of tapir and of a small cat (will be verified by Marcelo with the help of photos taken).

In the afternoon we finished all data sheets and data entry and Marcello gave a summary talk. After dinner we watched a BBC documentary film 'Planet Earth'. It's one of the best reports of worldwide experts about the environmental situation, threatened species and conservation work in general.

Our last day was spent packing up all the equipment and getting the tents and wooden platforms down. the cabin was filled with all the tents hanging up to dry.

Thank you for your contribution, work, team spirit, patience and sense of humour. Updates on the results of the camera traps will be sent. Please don't forget to upload your photos to www.biosphere-expeditions.org/pictureshare.

Ronald & Malika