



EXPEDITION REPORT

Expedition dates: 4 – 17 September 2016
Report published: February 2017

Icons of the Amazon: Jaguars,
pumas, parrots and peccaries in Peru





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Authors

Alan T.K. Lee
University of Cape Town

Matthias Hammer (editor)
Biosphere Expeditions

Abstract

Peru is currently experiencing record economic growth, accompanied by a high rate of deforestation, both of which threaten its biodiversity. This expedition conducted a survey of large, non-flying mammal species in one of the previously best-conserved remaining regions of the Amazon basin. The study site on the Las Piedras River, in the department of Madre de Dios, Peru, was last visited by Biosphere Expeditions in 2011. Monitoring was conducted through an array of 12 camera traps over a two-week period, with 75 km of line transects conducted over 10 days. The aim of the survey was to gain a better understanding of the current large cat population status and their prey species after a period of monitoring absence of five years.

During transects, we recorded all eight species of monkeys that had been recorded during the 2011 expedition. However, no white-lipped peccary were encountered and tracks of jaguar were encountered on only one occasion, with no jaguars recorded on camera traps. We are thus unable to confirm whether the jaguar individuals recorded in 2011 are still present on the study site. One of the jaguars recorded in 2011 had been previously recorded in 2009. The difference in encounter rates of these two iconic species is stark between expeditions, as they were both recorded multiple times in either 2009 or 2011. It is impossible to gauge from this short expedition the reasons for this difference, which may be related to seasonal differences in survey periods or longer-term natural cycles, but may well also be a result of hunting pressure from increased human presence all around the study site.

The study site is currently threatened by unsustainable activities including logging and land invasions, some of which were uncovered during this expedition. Migration from overcrowded regions of the Andes is also resulting in deforestation for agricultural purposes in very close proximity to the study site as people in search of land follow the Inter-oceanic Highway and newly opened logging roads radiating from it. It is likely that a substantial degree of Peru's economic growth has come through non-sustainable use of the rainforest, with colossal destruction of pristine rainforest as a result of open-cast gold mining activities, as well as unsustainable timber harvest of hardwood species. If Peru wishes to see long-term sustainable economic growth, it must protect its rainforest resources by investing in the people charged with its custody, including local and agroforestry police, concession owners and the education of upcoming generations.

Resumen

Perú está actualmente experimentando un crecimiento económico record, acompañado por una alta tasa de deforestación que amenaza su biodiversidad. Esta expedición lleva a cabo un estudio de las especies de grandes mamíferos terrestres en una de las últimas regiones mejor conservadas de la Cuenca del Amazonas. El área de estudio, en el río Las Piedras, en el departamento de Madre de Dios, Perú, fue visitada por Biosphere Expeditions por última vez en 2011. El seguimiento fue realizado mediante 12 trampas fotográficas durante un periodo de dos semanas y con 75 km. De transectos lineales realizados durante 10 días. El objetivo del trabajo era obtener un mayor conocimiento del status de la población de grandes felinos y sus presas después de un periodo de ausencia de seguimiento de cinco años.

Durante los transectos, registramos las ocho especies de monos que fueron detectados en la expedición del 2011. No obstante, no se detectó ningún pecarí de labios blancos y solamente una vez, se detectaron rastros de jaguar, y en ninguna ocasión se registraron imágenes a través de las cámaras trampa. Por lo tanto, no podemos confirmar si los ejemplares de jaguar detectados en 2011 están aún presentes en la zona de estudio. Uno de los individuos grabados en 2011, fue registrado en 2009. La diferencia en las tasas de encuentro de estas dos especies icónicas es muy grande entre las expediciones, ya que ambas fueron registradas varias veces en 2009 o 2011. Es imposible medir a partir de esta corta expedición las razones de esta diferencia, que pueden estar relacionadas con las diferencias estacionales en los periodos de prospección o a ciclos naturales de largo plazo, pero también pueden ser el resultado de la presión de la caza debido a una mayor presencia humana alrededor del área de estudio.

La región estudiada está actualmente amenazada por actividades insostenibles como la tala y las invasiones de tierras, algunas de las cuales fueron descubiertas durante esta expedición. La migración desde las regiones superpobladas de los Andes también está dando lugar a la deforestación para fines agrícolas en las proximidades de la zona de estudio, ya que las personas en busca de tierra siguen la autopista interoceánica y las carreteras recién inauguradas que se irradian de ella. Es probable que una parte del crecimiento económico del Perú haya sido obtenido a través del uso no sostenible de la selva tropical, con la colosal destrucción de selva virgen como resultado de las actividades de extracción de oro a cielo abierto, así como a la explotación insostenible de madera de especies de madera dura. Si el Perú desea ver un crecimiento económico sostenible a largo plazo, debe proteger sus recursos de la selva tropical invirtiendo en las personas encargadas de su custodia, incluyendo la policía local y agroforestal, los dueños de concesiones y la educación de generaciones venideras.

Contents

Abstract / Resumen	2
<hr/>	
Contents	3
<hr/>	
1. Expedition Review	4
1.1. Background	4
1.2. Research area	4
1.3. Dates	5
1.4. Local conditions and support	6
1.5. Expedition scientist	7
1.6. Expedition leaders	7
1.7. Expedition team	8
1.8. Partners	8
1.9. Expedition budget	9
1.10. Acknowledgements	10
1.11. Further information and enquiries	10
<hr/>	
2. Mammal monitoring and human impact at an Amazon rainforest site on the Las Piedras River, Peru	11
2.1. Introduction	11
2.2. Methods	12
2.3. Results	16
2.4. Discussion and conclusions	21
2.5. Literature cited	24
<hr/>	
Appendix I: Examples of wildlife caught on camera traps	26
Appendix II: Expedition diary and reports	33

1. Expedition review

M. Hammer (editor)
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 a survey of iconic wildlife species that ran from 4 to 17 September 2016 in the Las Piedras region of the Madre Dios Department of Peru. The river Piedras is a river system that connects the Tambopata and Manu areas, with little human presence compared to Tambopata. While timber extraction has always been intertwined with the history of the region, it has reached an all-new destructive level lately on the Las Piedras, impacting macaw population as ironwood trees, which are vital for macaw nesting, are cut down. Even so, the area is recognised as being one of the best-conserved remaining regions of the Amazon basin with a large portion of the area under various protection regimes and with vast areas of unbroken canopy. As such it represents an ideal site for ecological studies with limited but slowly increasing human influence.

1.2. Research area

Peru is located on the Pacific coast of South America and is the third largest country on the continent. Two-thirds of Peruvian territory is located within the Amazon basin. The expedition base camp is within the department of Madre de Dios, internationally known as “the Biodiversity Capital of the World”. The department already contains two large national parks covering over half of its 78,000 km² area – Manu and the vast Bahuaja-Sonene (Tambopata) area. The Rio Piedras is located between the two.

In terms of biological diversity, the research area is amongst the richest in the world. The area’s ecosystems hold several world records in flora and fauna species numbers and are recognised as one of the planet’s biodiversity hotspots. Research conducted over the last 20 years in the Bahuaja-Sonene National Park has shown that it harbours more species of birds (587), butterflies (1,230) and many other animal taxa than any other location of comparable size.



Figure 1.2a Flag and location of Peru and study site. An overview of Biosphere Expeditions' research sites, assembly points, base camp and office locations can be found at [Google Maps](#).

It has recently also been identified as the largest uninhabited and untouched rainforest wilderness on Earth, covering about 1 million hectares (2.5 million acres) of undisturbed and un hunted habitat (the nearest rival, the island of New Guinea has about 100,000 hectares of uninhabited tropical forest habitat). The area is also home to a number of landmark animals listed in the IUCN's Red Data Book, amongst which are the giant river otter, giant armadillo, giant anteater, ocelot, jaguarundi, jaguar, harpy eagle, crested eagle, spectacled caiman, and black caiman. Over 150 different species of tree can be found within 100 m² alone, and the WWF and IUCN have identified the area as a 'Centre of Plant Diversity'.

1.3. Dates

The expedition ran over a period of two weeks divided into two one-week slots, each composed of a team of international research assistants, scientists and an expedition leader.

Slot dates were 4 -10 September and 11 - 17 September 2016.

This period was chosen to coincide with the dry season when there is less likelihood of daily activities being interrupted by rain and when trails are accessible.

1.4. Local conditions and support

Expedition base

The expedition was based in a remote region along the Las Piedras river at a jungle lodge/research station made from local materials. Single beds with bedding and mosquito nets were provided. There was a shared toilet block with showers and flush toilets. Team members paired up to share rooms. All meals were prepared for the team and special diets could be catered for.



Figure 1.4a The expedition base.

Weather

The research area lies within the confines of the Amazon basin with a sub-tropical climate and distinct wet and dry seasons. The dry season, during which the expedition took place, falls between May and September with temperatures reaching a high of 39°C and a humidity of around 80% inside the forest. This period is also free from the regular rainstorms that occur between November and April and is a good time of year to be in the forest. However, at this time of year, so-called friajes can also occur. Friajes are cold fronts that can drop temperatures down to around 10°C within hours and last a couple of days. There was one mild friaje during the expedition.

Field communications

There is no mobile phone coverage in the research area, but the research station has a radio for emergency communication with Puerto Maldonado. In addition, the expedition leader wrote an expedition diary which appeared on [Facebook](#), [Google+](#) and the Biosphere Expeditions [Wordpress blog](#).

Transport & vehicles

Team members made their own way to the Puerto Maldonado assembly point. From there they travelled by vehicle and boat to the research station. Once at the research site, studies were conducted on foot or by boat. All transport, boats and vehicles were provided from the expedition team assembly point for the outward and return journeys.

Medical support & insurance

The expedition leader was a trained first aider, and the expedition carried a comprehensive medical kit. Further medical support was provided through a medical post in the Sabaloyoc community, about three hours away by boat. The nearest hospital is in Puerto Maldonado, reached in about six hours by boat. Safety and emergency procedures were in place, but did not have to be invoked, as there were no incidents, medical or otherwise.

1.5. Expedition scientist

Dr. Alan Lee, the expedition's field scientist is an honorary research associate at the Percy FitzPatrick Institute of African Ornithology (University of Cape Town), editor of *Ostrich: African Journal of Ornithology*, and currently works for BirdLife South Africa surveying avifauna of the Karoo biome in South Africa. In 1996, he graduated from the University of Witwatersrand with an Honour's Bachelor's Degree in Botany and Zoology. While working and travelling from London he obtained a Diploma in Computing in 2001. He then commenced a period of seven years in Peru, first working for a volunteer project investigating the impacts of tourism on Amazonian wildlife, and then from 2005 to 2010 he undertook a Ph.D. on the parrots of the Peruvian Amazon. Biosphere Expeditions part-financed and contributed data to the Ph.D. resulting in various peer-reviewed publications. In 2011 Alan set up the Blue Hill Escape guest establishment on the Blue Hill Nature Reserve with his wife, Anja, and parents Chris and Elaine Lee. From 2012 to 2015 he was a post-doctoral research fellow at the University of Cape Town researching the status of the endemic birds of the fynbos.

1.6. Expedition leaders

Malika Fettak is half Algerian, but was born and educated in Germany. She majored in Marketing & Communications and worked for more than a decade in both the creative department of, but also in PR & Marketing for a publishing company. Her love of nature, travelling and the outdoors (as well as taking part in a couple of Biosphere expeditions) showed her that a change of direction was in order. Joining Biosphere Expeditions in 2008, she runs the German-speaking operations and the German office and leads expeditions all over the world whenever she can. She has travelled extensively, is multilingual, a qualified off-road driver, diver, outdoor first aider, and a keen sportswoman.

Catherine Edsell was born in the UK into a family of mountaineers, skiers and adventurers. With wanderlust in her blood she left England in 1997 and set off to the jungles of Central America and Indonesia, lived in the Himalaya with locals, trekked through the Namib desert in search of elusive elephants and dived the oceans surveying coral reefs. Her passion for conservation grew as she sought out and trained with expedition organisations that echoed her ecological beliefs, and for seven years straight, her feet barely touched British soil as she lived the expedition life in all manner of terrains. In 2014 Catherine was awarded a fellowship of the Royal Geographical Society for her continued contribution to conservation through expedition work. She is also a mountain leader, PADI Divemaster, coral reef ecologist and Reef Check trainer, and has led in the Azores, the Maldives and Musandam for Biosphere Expeditions. When not on expedition, Catherine teaches yoga, rock-climbs and dabbles in the flying trapeze.

Malika Fettak led group 1 and Catherine Edsell led group 2.

1.7. Expedition team

The expedition team was recruited by Biosphere Expeditions and consisted of a mixture of all ages, nationalities and backgrounds. They were (with countries of residence in parentheses):

4 – 10 September 2016

Janelle Bray (Australia), Dana Bridwell (USA), Richard Buss (USA), Louise Causbrook (Australia), Kat Hill (UK), Pauline Ho (USA), Gabriele Manok (Germany), Alison Parker (UK), Aldo Ramirez (Peru)*, Sabine Stransky (Germany), Ngoc anh Tran (France).

11 – 17 September 2017

Dana Bridwell (USA), Richard Buss (USA), Catherine Edsell (Biosphere Expeditions staff, UK), Pauline Ho (USA), Etienne Höra (Germany), Jürgen Meyer (Germany), Aldo Ramirez (Peru)*, Ngoc anh Tran (France), Sandra Wilcke (Germany).

*Assistant scientist and expedition placement kindly supported by the [Friends of Biosphere Expeditions](#) and a GlobalGiving crowdfunding campaign. The [Biosphere Expeditions placement programme](#) seeks to indentify, train and encourage the next generation of local conservationists.

1.8. Partners

Through our expedition base, the Las Piedras Biodiversity Station, the expedition was involved with the local community by creating jobs for local people and building capacity through training and creating assets. One such example is Aldo Ramirez, who has been involved with the various Biosphere Expeditions projects in Peru for several years. Aldo now runs his own tours independently, applying the lessons that he learnt through Biosphere Expeditions. Previous work and partners include the Tambopata Macaw Project, led by Donald Brightsmith at Texas A&M University; as well as Chris Kirkby of Fauna Forever, the organisation with which the lead scientist, Alan Lee, started his Amazonian career.

1.9. Expedition budget

Each team member paid towards expedition costs a contribution of £1,240 per person. The contribution covered accommodation and meals, supervision and induction, special non-personal equipment, and 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., or visa and other travel expenses to and from the assembly point (e.g. international flights). Details on how this contribution was spent are given below.

Income	£
Expedition contributions	23,735
 Expenditure	
Base camp and transport includes all board, lodging and transport to and from base camp	9,571
Equipment & hardware includes all research materials purchased or hired	1,521
Staff includes salaries, travel and expenses	6,731
Administration includes registration fees, visas, sundries, etc.	256
Team recruitment Amazonia as estimated % of PR costs for Biosphere Expeditions	6,430
 Income – Expenditure	 -774
 Total percentage spent directly on project	 103%*

*This means that in 2016, the expedition ran at a loss and was supported over and above the income from the expedition contributions by Biosphere Expeditions.

1.10. 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) 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 also to everyone who 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 members of the Friends of Biosphere Expeditions and donors for their support in terms of finance and equipment.

The main author would like to especially acknowledge the assistance of our guides, Aldo Ramirez Mejia and Holly O'Donnel. Harry Turner, a resident naturalist at the research base was also very welcoming, shared exciting encounters from his camera traps, and took expedition members on walks. Alan and Rolando Duran were especially helpful with a variety of logistical issues, especially boat transfers. Special thanks to JJ Duran for use of the expedition base, providing us with a variety of information, as well as undertaking some transect work. Roy Riquelme prepared the most excellent food. In addition, thanks to David Johnston of LPAC for providing permission to conduct surveys on their concession. Pauline Ho and Etienne Höra deserve special mention for their time dedicated to entering camera trap data, which went over and above the call of duty. I would like to thank expedition leaders Malika Fettak and Catherine Edsell for participating in monitoring and for ensuring a smooth and well run operation. Finally, thank you to Oriol Sagristà, Deborah Goodwin and anonymous reviewers for translating and reviewing, thereby improving this report.

1.11. Further information and 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.

Copies of this and other expedition reports can be accessed via www.biosphere-expeditions.org/reports. Enquires should be addressed to Biosphere Expeditions via www.biosphere-expeditions.org/offices.

2. Mammal monitoring and human impact at an Amazon rainforest site on the Las Piedras River, Peru

Alan T.K. Lee
University of Cape Town

2.1. Introduction

Increasing economic development is putting a strain on the natural resources of the Amazon. Unsustainable forms of land use including monocultural farming and logging are on the rise across the Peruvian department of Madre de Dios, an area renowned for its biodiversity. The Las Piedras River catchment connects the protected areas of Tambopata and Manu. While timber extraction has always been part of the history of the region, it has reached an all-new destructive level on the Las Piedras catchment. At this time, the area is still recognised as being one of the best-conserved remaining regions of the Amazon basin with a large portion of the area under various protection regimes and with vast areas of unbroken canopy. As such it represents an ideal site for ecological studies with previously limited but now increasing human influence. Previous research expeditions have found healthy wildlife populations at the study site about 60 km from the now busy departmental capital, Puerto Maldonado (Lee 2011, Mazzolli 2011).

Both of the two species of big cat that live in South America are found at the study site: the jaguar (*Panthera onca*) and the puma (*Puma concolor*). Both cats range over large territories and need large areas of habitat in order to maintain viable populations. As humans increasingly encroach on their habitat, conflict results as most of the animals eaten by jaguar and puma are also hunted by humans. The big cats are themselves the target of sports hunters. In many areas, overhunting and poaching by humans has reduced prey populations to very low numbers.

The large cats prey on both the collared peccary (*Tayassu tajacu*) and white-lipped peccary (*Tayassu pecari*). Both species of peccary are often observed at mineral licks (areas of clay that contain sodium and other elements) where they are vulnerable to hunters. Anecdotal evidence from several sources (e.g. Chris Kirkby and Paul Rosolie, pers. comm.) suggests the frequency of white-lipped peccary appears to have declined at the study site recently. As one of the important prey species for big cats, it is essential for us to understand the current status of the white-lipped peccary population.

Monkey populations can also be used as indicators of disturbance and hunting. Spider monkeys (*Ateles belzebeth*) are popular prey for subsistence hunters (Bennet and Robinson 2000). All monkeys are also popular tourist attractions, and have been the target of focal studies during previous Biosphere Expeditions projects (Rehman 2011).

Another important factor that can affect wildlife populations in the Amazon is the presence of claylicks, or “colpas”. A claylick is an area of exposed soil where animals come to consume soil, which usually has high clay content, as well has higher concentrations of several minerals, principally sodium (Lee et al. 2010). Claylicks probably compensate for mineral deficiencies or imbalances in the animals’ diets. They can also reduce the effects of secondary plant compounds, acidosis and intestinal infections (Johns and Duquette 1991).

Therefore, it is possible that the benefits of soil consumption can influence population density and structure and increase the carrying capacity of areas with claylicks (Klaus and Schmid 1998). In southeastern Peru, colpas are an important resource for tourists (Brightsmith et al. 2008), but these sites are also used by hunters (Blake et al. 2013).

The study aims were thus to compare encounter rates with target species now compared to five years ago; and to capture images of jaguar to compare the current individuals with known individuals five years ago.

2.1. Methods

Study area

The study area on the Las Piedras River is located in the department of Madre de Dios, in southeastern Peru, bordering with Brazil and Bolivia to the east. The study base was the Las Piedras Biodiversity Station (LPBS) located at GPS position S 12°05.663' W 69°52.852'. The site was a set of concessions managed for biodiversity, north of the 1.09 million ha Bahuaja-Sonene National Park, east of Manu National Park, and south of Alto-Purus community reserve. It is in the southwest Amazon moist forests ecoregion NT0166 (WWF 2010). Major forest types are floodplain and terra firme (Salmón et al. 2003). The Las Piedras River is a low-gradient river that meanders through a 2 km wide floodplain and is flanked by terraces up to 30 m high. The climate is classified as Afa (Kottek et al. 2006). Rainfall for the region ranges between 1,600 and 2,400 mm and temperature between 10°C and 38°C (Räsänen 1993).

Visual encounter surveys

55 km of transect were surveyed between 7 and 16 September 2016 during daytime surveys, initiated between 05:30 and 07:00, and 19 km of transect were conducted during nocturnal surveys conducted between 19:30 and 22:00 (Table 2.1a). Four transect lines ranging from 2 – 4 km in length were used, being lines surveyed on previous expeditions to this study site (Figure 1.2). The team used distance sampling techniques, as suggested by Buckland et al. (2005). One historic transect (A), was too overgrown to use, and instead surveys were conducted on a track (Brazil nut trail) running parallel and very close to the A transect. One day was dedicated to the reopening of the B transect on the eastern side of the river. Much time was spent clearing dead leaves off the paths to facilitate quiet observer passage, but the dry conditions and noisiness caused by leaf litter and other debris on the transect lines could have adversely impacted encounter rate with terrestrial mammals.

All transects were conducted with an experienced guide, as well as at least one, but usually two, Biosphere Expeditions citizen scientist participants, who assisted with sightings and recorded all data. We recorded all non-flying mammals of a size larger than and including squirrels, as well as encounters with four target species of large birds: Spix's guan (*Penelope jacquacu*), razor-billed curassow (*Crax mitu*), pale-winged trumpeter (*Psophia leucoptera*) and common piping-guan (*Pipile pipile*) (Table 2.3a). For each target species encounter, we recorded the name, group size, latitude and longitude (with Garmin etrex 20 GPS) perpendicular distance, height above ground in the canopy and composition of males, females and juveniles, and behaviour. Fresh tracks were also recorded. Transect surveys with bright flashlights were also conducted at night.

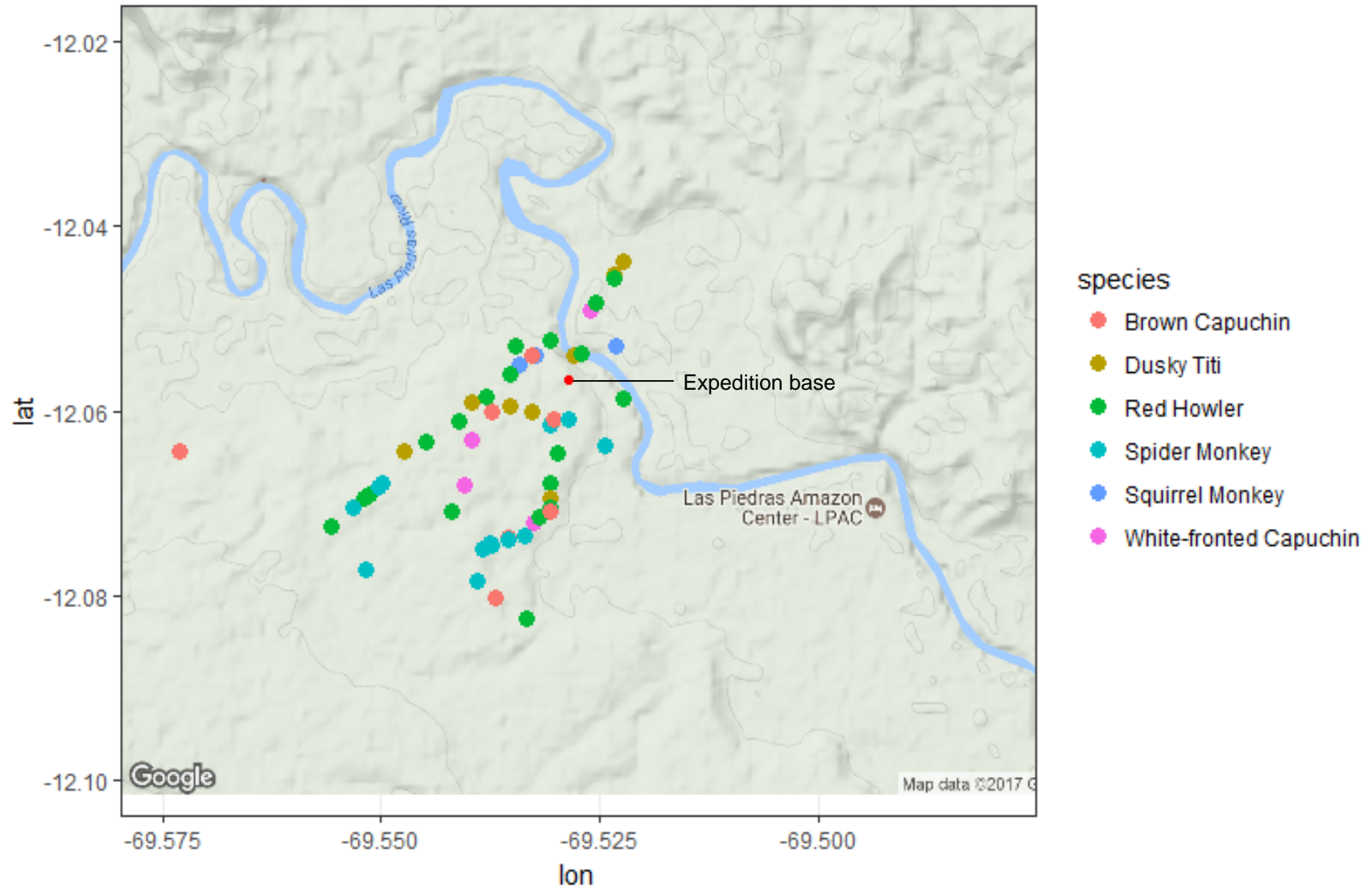


Figure 2.1a. The expedition base and transect locations indicated by encounters with monkey species.

Table 2.1a: Sampling effort, with date of survey, transect unique identifier (ID) and distance covered for each survey.

Date	ID	Distance covered (m)	
		DAY	NIGHT
07-Sep-16	28	4470	
	29		1400
	30		3160
08-Sep-16	31	3500	
	32	2540	
	33		622
	34		2280
09-Sep-16	35	2190	
	36	2725	
	37		1660
10-Sep-16	38	3260	
11-Sep-16	39	1810	
12-Sep-16	40	1860	
	41	3190	
	43		3100
	44		4190
	42	3180	
13-Sep-16	45	5460	
	46	3500	
14-Sep-16	47	2250	
	48	2020	
	49	1750	
15-Sep-16	50	2000	
	51	5050	
	52		1740
	53		1080
	54	1880	
16-Sep-16	55	2450	
	56		
	Grand Total	55085	19232

Human impact

On each transect, observers recorded any signs of human presence in the following categories: Snares or traps; people with guns; gun cartridges or other hunting signs; recent logging; woodcutters; people with chainsaws and/or carrying timber; and Brazil-nut collectors. If no signs were observed, this was also recorded.

Incidental encounters of the above during non-survey periods were also reported.

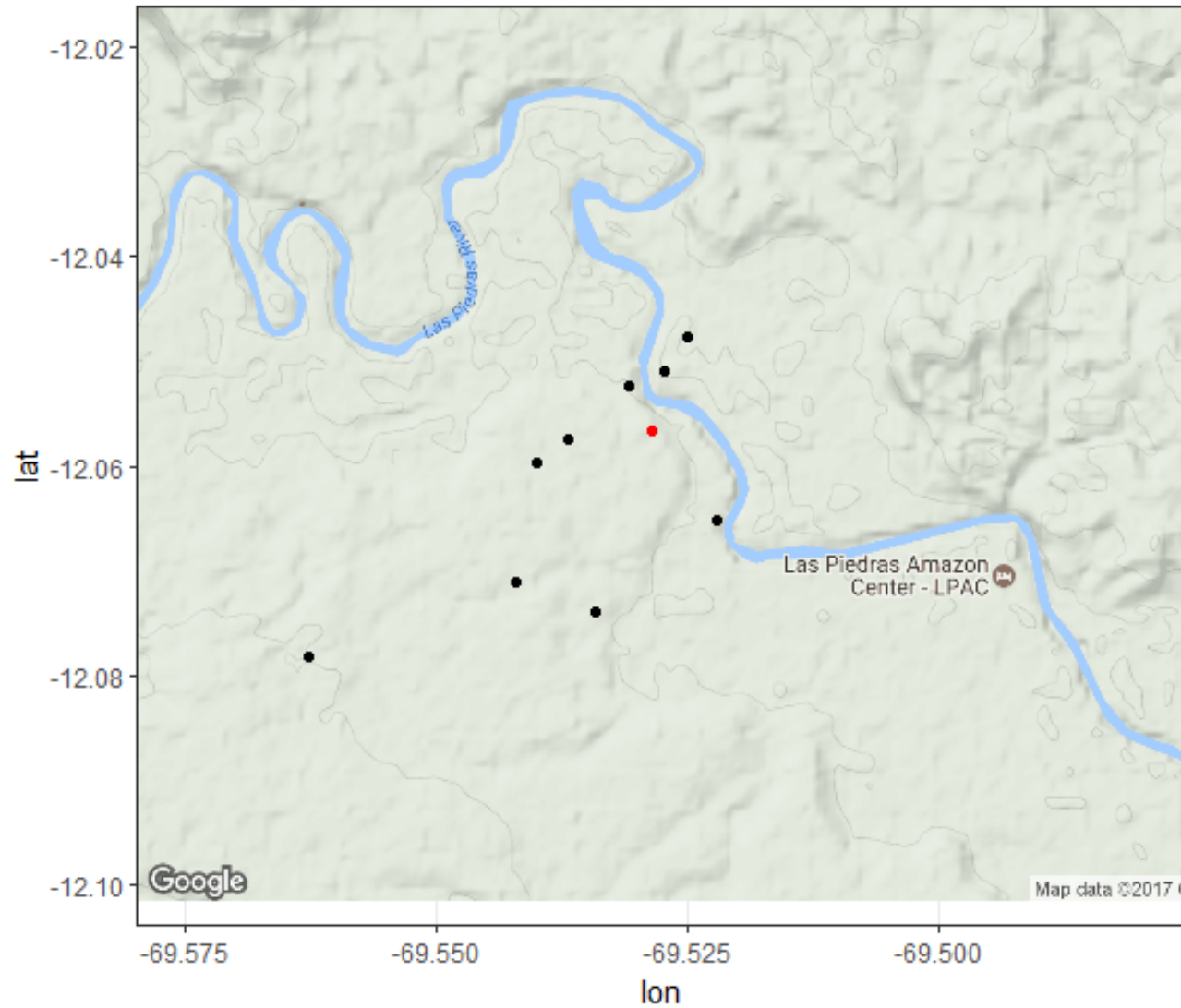


Figure 2.1b. The expedition base (small red dot) and locations of camera traps.

Camera trapping

The expedition deployed Bushnell HD cameras at various intersections across the trail system (Figure 2.1b). With the exception of two locations on the Brazil-nut trail and the mammal colpa (a place where animals consume soil), camera traps were generally placed singly to record species presence. At these two locations cameras were placed in pairs in anticipation of the capture of jaguar, so that both sides of the animal could be recorded to compare with previous photographic records. These locations were chosen as the route was previously heavily used by jaguars (Mazzolli 2011).

2.3. Results

Diurnal transects were very prolific in terms of encounters, with 144 wildlife registrations, as well as various track records (Table 2.3a). Nocturnal transects were not nearly as exciting, with only nine encounters. However, these did include one encounter with tapir, and a jaguar was heard roaring during another. This single encounter and tracks found in association with one of the logging tracks were the only sign of jaguar during the expedition. On the other hand, puma were encountered twice, both on the same day: once on transect and once while investigating the illegal logging road on the eastern side of the river.

As is to be expected, monkey species dominated the diurnal transects, with the most common being brown capuchin monkey, black spider monkey and red howler monkey. Monk saki monkey was encountered only once. All three of the large cracidae were recorded, as was a pale-winged trumpeter.

Somewhat surprisingly given their abundance during 2009, there were no records at all on transects, incidentally, or with camera traps, of white-lipped peccary. Collared peccary on the other hand, were relatively frequently recorded. Several generally uncommon species were not recorded, either on transect or camera traps: coati (*Nasua nasua*), tayra (*Eira barbara*), tamandua (*Tamandua tetradactyla*), giant anteater (*Myrmecophaga tridactyla*), bush dog (*Speothos venaticus*) or short-eared dog (*Atelocynus microtus*). Independent camera trap studies by other researchers in the area indicate that giant anteater, bush dog and short-eared dog are all still present at the study site. Tayra was observed on the road leading to Puerto Lucerna during the expedition.

Human impact

No signs of hunting were recorded by researchers while on formal transects, i.e. no hunters, shotgun shells, animal remains or traps and snares. However, signs of illegal logging activity on the eastern side of the Piedras River were innumerable. Heavy machinery and chainsaws could be heard operating day and night. The 2 km long B transect on that side crossed two old logging tracks, several felled trees, and an active logging arterial road that connected to a major logging road further east (Fig. 2.3a). Fresh signs of timber harvest were found on both of these roads. At an old logging site (2-3 years old) on the Las Piedras River, a shotgun shell was found, as were the remains of a large freshwater turtle. The logging camps were also associated with large amounts of plastic and non-biodegradable litter, volumes of which also appear to have increased along the river edge.

Table 2.3a: A table of group encounters with target species recorded during day and night transects. Type of encounter is indicated (heard, seen, or tracks including scat). Tracks were not recorded during night transects.

Common name	Scientific name	DAY			NIGHT	
		heard	seen	track	heard	seen
Armadillo species	<i>Dasyopus spp.</i>			2		
Brown agouti	<i>Dasyprocta variegata</i>	4	6	1		
Brown capuchin monkey	<i>Cebus apella</i>	1	10			
Brazilian rabbit	<i>Sylvilagus brasiliensis</i>					1
Black spider monkey	<i>Ateles belzebuth</i>	3	13			
Collared peccary	<i>Pecari tajacu</i>	1	6	2		
Common piping guan	<i>Pipile pipile</i>		5			
Deer species	<i>Mazama spp.</i>	2		1		
Dusky titi monkey	<i>Callicebus moloch</i>	7	2			
Green acouchy	<i>Myoprocta agouchy</i>	3	1			
Amazon and dwarf squirrels	<i>Sciurus spp.</i>		1			
Harpy eagle	<i>Harpia harpyja</i>		1			
Jaguar	<i>Panthera onca</i>	1			1	
Night monkey	<i>Aotus nigriceps</i>		1			1
Paca	<i>Agouti paca</i>					1
Possum species	<i>Didelphis spp.</i>					1
Puma	<i>Puma concolor</i>		1			
Pale-winged trumpeter	<i>Psophia leucoptera</i>		5			
Razor-billed curassow	<i>Mitu tuberosa</i>	1	2			
Red brocket deer	<i>Mazama americana</i>	1	3	1		1
Red howler monkey	<i>Alouatta seniculus</i>	14	7			
Southern Amazonian red squirrel	<i>Sciurus spadiceus</i>	1	9			
Saddle-backed tamarin	<i>Saguinus fuscicollis</i>	2	8			
Spix's guan	<i>Penelope jacquacu</i>	2	9			
Spiny rat	<i>Proechimys spp.</i>					2
Squirrel monkey	<i>Saimiri sciureus</i>	1	4			
Tapir	<i>Tapirus terrestris</i>			2		1
White-fronted capuchin monkey	<i>Cebus albifrons</i>	1	5			
Grand total		45	99	9	1	8

Ongoing satellite imagery reveals year-on-year expansion of areas of forest cleared for agricultural purposes around Puerto Lucerna and what is now known as the 'South Road' to the south of the Las Piedras Amazon Center concession to the south of the expedition study site.



Figure 2.3a. Biosphere Expeditions participants on one of the major logging roads. A felled *Dipteryx micrantha* can be seen. This is evidence of large-scale active logging in a formerly pristine Brazil nut concession, which is in the process of being acquired by Jungle Keepers Foundation.

Lastly, while monitoring the macaw claylick one week into the expedition, a local man identified as belonging to the Monte Salvado community, was observed firing at macaws in the trees next to the claylick from a passing peke-peke boat (Fig. 2.3b). This activity is illegal, but as the boat was not registered, the incident could not be reported to any authorities. Conservationists in the area would be well advised to place a large 'No hunting' sign in proximity to the claylick.



Figure 2.3b. A shotgun is lowered after a shot was fired at red-and-green macaws at the macaw colpa being monitored by Biosphere Expeditions.

Camera trapping

Camera traps were deployed for a total of 122 trap nights at nine locations (Table 2.3b). During this time we recorded 1526 photos and videos of 735 events, of which 199 were researchers, leaving 536 camera setup or wildlife events. Fifteen wildlife species were recorded: 11 mammals and four bird species (Table 2.3c). The most prolific location was the mammal colpa with 238 wildlife events and eleven target species between two camera locations, i.e. at least 119 wildlife visits occurred here during the two-week camera deployment period. The most common species visiting the mammal colpa were Spix's guan, southern Amazonian red squirrel, brown agouti, red-brocket deer and collared peccary, all of which were observed consuming soil.

The large number of visits by Spix's guan at the mammal claylick meant this was the most frequently photographed species overall (Table 2.3c). Brown agouti, the most commonly recorded mammal, was captured at both the mammal claylick and along the trail systems. Interestingly, the second most commonly recorded mammal together with red brocket deer was ocelot, most likely due to multiple captures of a resident male cat using the trail system to patrol his territory.

Table 2.3b. Locations (including south and west in decimal degrees) and trap effort (trap nights) of camera traps deployed at Las Piedras, together with unique capture events (captures) of wildlife and number of species recorded. Locations with * had two camera traps deployed.

Location	S	W	Trap nights	Captures	Species
B 150	12.05095	69.52726	12	18	5
Brazil nut trail, intersection frog*	12.05743	69.53677	14	38	5
Brazil nut / mammal colpa trails intersect.*	12.05971	69.54005	20	94	9
C transect	12.07395	69.53423	11	37	1
Far end of Brazil nut trail	12.07821	69.56264	11	28	3
Waterfall / river trails intersection	12.06509	69.52199	6	15	4
Mammal colpa*	12.07104	69.54200	16	238	11
Start of Brazil nut trail	12.05227	69.5309	14	50	5
Trail B, 600 m	12.04767	69.52489	12	18	3
Grand Total			122	536	

Table 2.3c. Species captures by camera traps.

Common name	Scientific name	Unique capture events
Spix's guan	<i>Penelope jacquacu</i>	69
Brown agouti	<i>Dasyprocta variegata</i>	59
Ocelot	<i>Leopardus pardalis</i>	29
Red brocket deer	<i>Mazama americana</i>	29
Collared peccary	<i>Pecari tajacu</i>	21
Pale-winged trumpeter	<i>Psophia leucoptera</i>	17
Puma	<i>Puma concolor</i>	5
Paca	<i>Agouti paca</i>	4
Southern Amazonian red squirrel	<i>Sciurus spadiceus</i>	4
Grey brocket deer	<i>Mazama</i>	3
Razor-billed curassow	<i>Mitu tuberosum</i>	3
Tapir	<i>Tapirus terrestris</i>	3
Armadillo spp	<i>Dasybus sp</i>	2
Common opossum	<i>Didelphis marsupialis</i>	1
Tinamou spp.	<i>Crypturellus sp</i>	1

2.4. Discussion and conclusions

The forests of the Las Piedras River at this study site continue to host impressive numbers and diversity of arboreal mammal wildlife, with all species of primate recorded in 2011 recorded again in 2016, despite the shorter sampling period. However, this could not be said of the terrestrial mammal life, which appeared depauperate in comparison to previous years, with an apparent absence of white-lipped peccary, and no visual encounters of any jaguar. Straightforward comparisons between surveys are, however, confounded by both sampling window (nearly twice as long in 2011) and season (June 2011 vs September 2016).

The single greatest contribution of this expedition was the documentation of the encroachment of illegal logging on the boundaries of the conservation concessions in this area. The scale and extent of the human settlement and timber extraction was truly shocking, with major extraction roads having been bulldozed through what was once primary forest in order to facilitate heavy machinery and truck access to target tree species. Target trees include *Dipteryx micrantha*, a keystone ecological tree (Brightsmith 2005), *Ceiba pentandra*, a tree of cultural importance (Bowen-Jones and Entwistle 2002), as well as almost any other large emergent tree.

At the same time, there has been unparalleled growth in the size and economic development of the regional capital, Puerto Maldonado. This growth has come at the expense of the safety and wellbeing of the original residents of the region, with increased violent crime and destruction of natural resources upon which many people have made a sustainable living in the past. An example of this is the Brazil-nut concessions. While the Brazil-nut tree (*Bertholletia excelsa*) is a protected species in Peru, our guide indicated that huts at the new village of Puerto Lucerna on the Las Piedras River were made from the wood of this tree species. These trees need primary forests to host their pollinators, but these are being rapidly cleared for cacao plantations, or for conversion into pasture for cattle and other livestock. The destruction of the primary forest decreases the yield of Brazil nut trees (Kainer et al. 2007). In addition, the son of the owner of the Brazil-nut concession where some surveys were carried out was murdered during 2015 in an altercation with wood-cutters.

While monkey populations in the surveyed sites seemed unchanged, the apparent disappearance of white-lipped peccary is a cause for concern. There may be natural causes for this apparent population slump, but this seems unlikely as this species ranges over very wide areas. For instance, a white-lipped peccary collared as part of the WWF-Areas project on the Los Amigos River system (two catchments west of Las Piedras) was shot by wood cutters on the Las Piedras River system (Lee, unpublished data). As such, if white-lipped peccary traverse human-occupied areas with hunters, they could suffer population effects observable even in protected areas. Reyna-Hurtado and Tanner (2007) compared the relative abundance of large ungulates in hunted and non-hunted tropical forests in Mexico and found that white-lipped peccary abundance declined in hunted areas and they suggest that this may be due to their increased sensitivity to habitat fragmentation, connected to their use of large home ranges. Collared peccary and brocket deer appeared to be less affected and Reyna-Hurtado and Tanner (2007) speculate that they are more resistant to hunting pressure due to their tolerance of fragmented habitat of hunted areas, as well as possible source-sink dynamics between hunted and non-hunted

areas. In any case, both puma and collared peccary were encountered frequently enough during our study to suggest currently stable populations.

Wild game is an important food source for subsistence hunters living in rural areas (Robinson and Bodmer 1999). In addition to meeting subsistence needs, hunting is also a major source of income for rural communities (Bennet and Robinson 2000). Hunting is one of the greatest threats to protected areas in the Neotropics, because it is the most geographically widespread form of resource extraction and can affect large and inaccessible areas (Peres and Terborgh 1995). Redford (1992) reviewed available data for game species and found that non-primate mammalian densities were 80–94% lower in hunted areas than similar, non-hunted areas. Hunting is greatly facilitated by the opening of timber extraction roads.

Red brocket deer, collared peccary, white-lipped peccary, and lowland tapir are important prey items for jaguar and puma (Weckel et al. 2006). Population declines in these predators may result from depletion of prey species. Game animals also play several important ecological roles including seed dispersal, seed predation and herbivory (Redford 1992). The loss of these species results in gradual yet profound shifts in the character of the plant community and a major loss of biodiversity (Terborgh et al. 2001).

The large prey mammal species mentioned above have all been recorded consuming soil in the southeastern Amazon rainforests of Peru. We monitored a mammal colpa as part of this expedition. This colpa has been known since the first visits to the area in 2003. It was part of the tourist attractions offered by Tambopata Expedition during the operation of the study base by that company, and a hide was built to watch visiting wildlife. This hide has now fallen apart and the mammal claylick itself has changed character dramatically: the face traditionally used by wildlife is now abandoned and instead feeding was concentrated at one small site slightly further off. The extent of the colpa thus seems much reduced (Fig 2.4a).

The reasons for the change in character of the mammal colpa are at this stage a matter of speculation. There are three possible contributing factors: 1. The sodium rich soil profile has all been consumed. This is considered unlikely; 2. Tourist and researcher presence has influenced visiting patterns. Although possible, this is unlikely due to the generally low presence of both at this site; 3. The number of primary herbivores responsible for keeping the clay exposed (white-lipped peccary) has reduced. Certainly, the fate of mammal colpas in relation to the disappearance of white-lipped peccary is worthy of further study.

While environmental change due to growing population and associated development activities are clear, on an encouraging note there has also been an increase in conservation activities in the areas around Puerto Lucerna. There are three organisations which are actively working to consolidate a buffer zone of protected areas, i.e. Las Piedras Amazon Centre (LPAC <http://conservetheamazon.org>), Fauna Forever (www.faunaforever.org) and Jungle Keepers (<http://junglekeepers.com>). Together these organisations are exploring a variety of avenues of projects and approaches towards Amazon rainforest conservation, including working with different agricultural crops, employment opportunities and economic development.



Figure 2.4a. Colpa change over time.

Top: A section of the active mammal colpa, 2008, being visited by red howler monkeys (Licona 2008).
 Bottom: Active mammal colpa, 2016, with razor-billed curassow.

Through its historic research and monitoring history on the Las Piedras River, Biosphere Expeditions has a unique role to play in demonstrating the changes currently taking place at this special Amazon biodiversity hotspot.

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Appendix I: Examples of wildlife caught on camera at Las Piedras research station during September 2016.



Brown agouti



Tapir



Red brocket deer



Collared peccary



M: Camera Name : 97F36°C ●

01-03-2014 02:05:23

Red howler monkey



M: Camera Name : 55F12°C ●

09-04-2016 09:36:53

Ocelot



Puma



Pale-winged trumpeter



Razor-billed curassow



Spix's guan

Appendix II: Expedition diary and reports



A multimedia expedition diary is available at <https://biosphereexpeditions.wordpress.com/category/expedition-blogs/amazonia-2016/>



All expedition reports, including this and previous expedition reports, are available at www.biosphere-expeditions.org/reports.