Measuring impact and sustainability of Amazon hunting in Colombia

Interim report

Esteban Payan
University College London
Institute of Zoology,
Zoological Society of London

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Collaborators:
Institute of Zoology, Zoological Society of London; Idea Wild; Instituto Alexander von Humboldt; Instituto Amazonico de Investigaciones Cientificas – SINCHI; Unidad de Parques Nacionales de Colombia; Universidad Nacional – El Zafire Biological Research Station-, Borugo ecotourism (Col.) and Organizacion Aviatur (Col.).

Dr. S. Durant (ZSL-WCS), Dr. C. Carbone (ZSL), Dr. K. Homewood (UCL), Dr. M. Kelly (Virginia Tech).

Other staff:
Volunteer assistants: Jenny Gallo, Juliana Berrio, Sandra Escudero, Jane Guerrero and Angélica Díaz. Jenny and Juliana are doing the BSc Biology thesis with data from the Project.

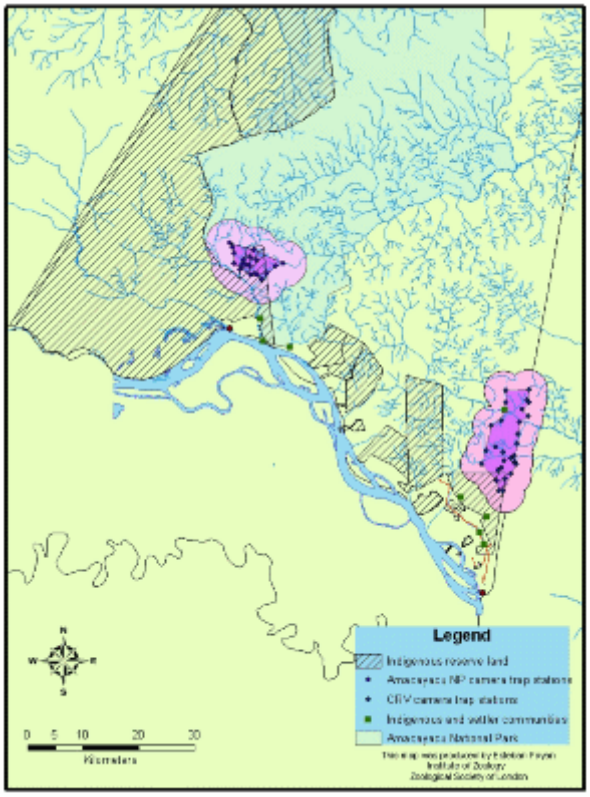
Field staff:
Amacayacu NP: Mr. G. Sanchez, head guide – full time, Mr. J. Vargas – full time, guide, Ms. L. Gragorio camp cook – full time, Mr. G. Murayari, boat driver – part time, Mr. E. Gutierrez, guide – part time, all from the Tikuna village of San Martin de Amacayacu.
Calderon river valley: Mr. A. Pijachi, head guide – full time, Mr. Alirio Arevalo, guide – full time, F. Florez, guide – full time, J. Carijona, guide – half time, E. Pijachi, north camp cook – full time, M. Gomez, south camp cook – half time, A. Packy, C. Gomez, Edilberto "El Mono", Celimo, Panero, Chirui porters.

Colombian Amazonia has an area of 403,000 km^2, which represents 35.4% of the whole country's extension; the Amazon department has an area of 109,665 km^2 and 70,489

inhabitants (in 1993). Amacayacu National Park was gazetted in 1975 and contains 2,930 km² of Amazonian forest. The dry season runs from April-October, field work will be carried out on the dry season. The study area consists of different landscape units such as unflooded forests (hereafter *terra firme*, which include sedimentary lightly undulated plains) forests, predictably flooded on a seasonal basis (hereafter *varzea*) and black water flooded plains with medium dense forest (Etter 1998). Forest types in lowland Amazonia can be associated to soil types which evidence differences in seasonal influx of alluvial sediments, which in Amazonia are the primary sources of exogenous soil macronutrients that may affect large-scale forest productivity (Duivenvoorden and Lips 1995, Peres 2000). Terra firme forests can be classified as oligotrophic soils and alluvial-floodplain as eutrophic according to nutrient concentrations (Peres 2000). This is relevant, since it has been found that the total vertebrate density at different forest types (e.g. terra firme vs varzea) is significantly different, eutrophic forest appear to be more productive and to sustain a greater vertebrate biomass than oligotrophic forest (Peres 2000).

Activities in 2006 and 2007																				
	2006										**2007**									
	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O
Relevance	Before Rufford				Rufford grant timescale															
Activities/Month no.					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Camera trap purchase	x						x				x									
Guide selection and hunter identification for interviews and harvest recording	x	x									x									
Project discussion with indigenous communities	x										x									
Camera trap set up			x									x								
Camera trapping in Amacayacu NP (protected area)			x	x	x	x	x	x	x											
Camera trapping in Calderon River Valley (unprotected area)													x	x	x					
Film development				x	x	x	x	x	x	x	x	x	x	x	x	x				
Village visits	x	x	x	x	x	x	x	x	x			x	x	x	x					
Tracking		x	x	x	x	x	x	x	x				x	x	x					
Wrap up meetings										x					x					
Analysis of photographs (software)							x			x	x					x	x	x	x	
Interim report																	x			
Final report writing																	x	x	x	x

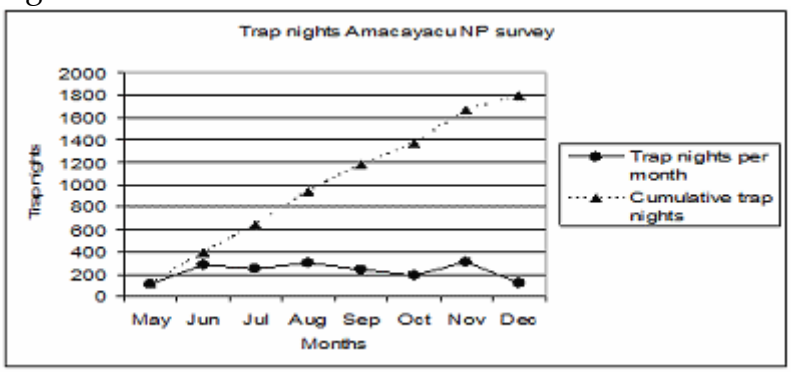
Map. 1 Study area



Camera trapping in Amacayacu National Park (ANP) protected area

Eighteen camera trap stations (two camera trap per station; facing each other 2-3m and 30-35 cm height) were set up hunting trails in Amacayacu NP, over the watersheds of the Agua Blanca and Agua Pudre river, both tributaries of the Amazon river. This included the hunting catchment areas of San Martin de Amacayacu and Palmeras towns of the Tikuna ethnic group.

Figure 1.

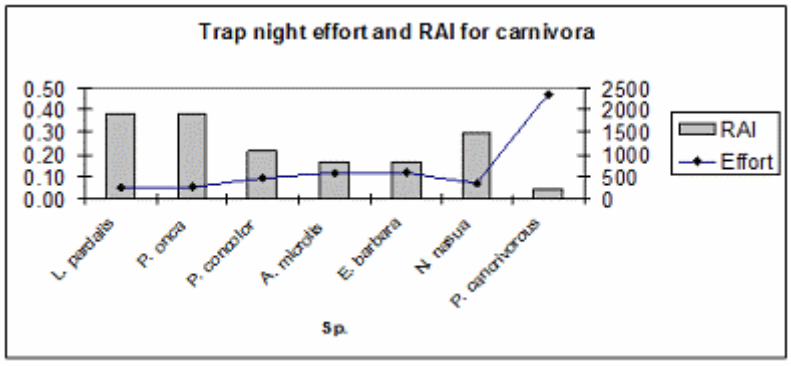


A total of 1,793 trap nights was obtained over eight months of camera trapping during the dry season, with an average of 224 trap nights per month, and average trap nights for complete months camera trapped only were 260 (n = 6).

Average trap nights per station was 100, with a maximum of 160 and a minimum of 30 trap nights. Carbone et al. (2001) estimated that at least 1,000 trap nights were needed to successfully detect tiger (Panthera tigris) presence or absence in densely forested habitats at very low densities of individuals (0.4-0.7 tigers/100 km2). For ANP we obtained 9 independent jaguars captures of at least three jaguars (two confirmed males; several photos are still to be identified).

Using relative Abundance Indexes per 100 trap nights the most abundant carnivore was the ocelot followed by jaguar, puma and short eared dog (*Atelocynus microtis*). Result highlights include the very rare short eared dog. The presence of the short eared dog, the least known Amazonian canids is especially exciting in this carnivore guild data set, and appears to compose a significant category in the carnivore composition of Amazonia.

Figure 2.



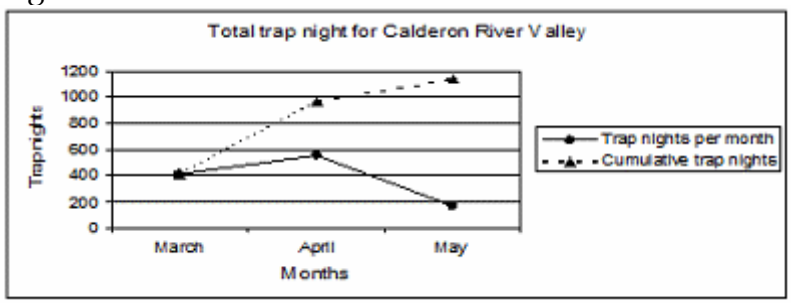
Graph. The RAI is calculated as number of pictures of the sp. per 100 trap nights and Effort is calculated as total camera trap nights divided the number photos (independent events) per species. This graph is still under construction, more data will be added from the ANP survey.

Prey species in PNNA were abundant and the most commonly photographed vertebrates were the trumpeter, lowland tapir followed by the black agouti. The high relative abundance for lowland tapir which is the largest mammal in the Amazonian forests, is surprising since smaller body size implies smaller home ranges and thus higher density, which is curiously not recorded here. But again, this might be influenced by the fact that the cameras are directed to cats or animals using trails cursorily.

Camera trapping in Calderon River Valley (CRV) unprotected area

Twenty eight camera trap stations were set up on hunting trails in CRV, over the watersheds of the Calderon and Tacana rivers, both tributaries of the Amazon River. This included the hunting catchment areas of four indigenous towns Km 6, Moniyamena, Km. 11 and Multietnia of Tikuna, Huitoto and many mixed ethnic groups.

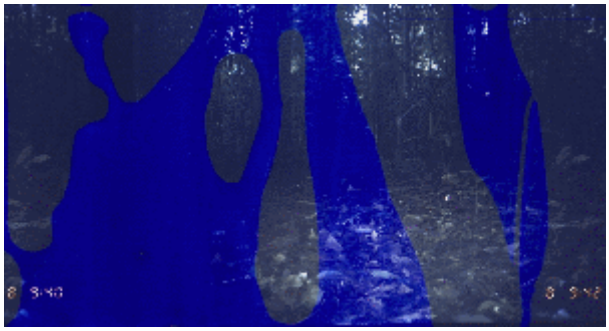
Figure 3.



A total of 1152 trap nights have been recorded in a 3 month survey. Since the survey was done in the rainy season, humidity affected the cameras and thus the quality of the

negatives was substantially affected, even though all camera traps were equipped with silica cushions and silicone seals on the outside. These aids were changed every 10 days. And the result is the first ever camera trap data in Amazonia covering the wet season.

Picture 1.



Highlights include black jaguar, a pregnant female jaguar, puma cubs and also, the ubiquitous short eared dog. Four individual jaguars were photographed with seven recaptures. The CAPTURE data resulted best interpreted by the Mh model (which assumes heterogeneity of capture probabilities per individual) with a population estimate of 6 with s.e. of 1.82, a P-hat = 0.1944 and an approximate 95% confidence interval from 5-13. The area as estimated from the outermost camera traps polygon (see Map 1) is 75 sp km. And the area with an added buffer using the Mean Maximum Distance Moved (MMDM) method which results in a band of 3.5 km produced a total area of 272 sq km. This could be interpreted as 6 jaguars in an area of approximately 272 sq km, which gives 2.2 jaguars per 100 sq km. This first density estimate is similar to Silver's et al. 2004 of 2.8 jags/100 sq km found in the Bolivian Amazon, which interestingly, is the only jaguar camera trap density estimate for the whole Amazon basin.

Figure 4.

Study	**Density per 100 square km**	**Study site**	**Area required in sq km for n=650**	**Area required in km2 for n=500**	**No. in jaguars in 3,000 sq km**
Schaller & Crawshaw 1980	8	Pantanal, Brazil	8125	6250	240
Schaller & Crawshaw 1980	4	Pantanal, Brazil	16250	12500	120
Leite et al. 2002	3	Atlantic forest, Brazil	21667	16667	90
Crawshaw 1995	7.5	Pantanal, Brazil	8667	6667	225
Crawshaw 1995	3.7	Pantanal, Brazil	17568	13514	111
Rabinowitz 1986	8	Tropical moist rainforest, Belize	8125	6250	240
Aranda 1990	4	Calakmul Biosphere reserve, Mexico	16250	12500	120
Quigley & Crawshaw 1992	1.4	Pantanal, Brazil	46429	35714	42
Swank and Teer 1989	4	Chaco dry forest, Paraguay	16250	12500	120
Swank and Teer 1989	1.3	Chaco dry forest, Paraguay	50000	38462	39

Zuloaga 1995	2.6	Flooded lowland forest, North Central Colombia	25000	19231	78
Wallace et al. 2003*	1.68	Tropical dry forest, Bolivia	38690	29762	50.4
Silver et al. 2004*	2.8	Madidi NP, Bolivian Amazon rainforest	23214	17857	84
Silver et al. 2004*	8.8	Broadleaf tropical moist rainforest, Belize	7386	5682	264
Maffei et al. 2004*	2.57	Chaco dry forest, Bolivia	25292	19455	77.1
Maffei et al. 2004*	3.1	Chaco dry forest, Bolivia	20968	16129	93
Maffei et al. 2004*	5.11	Chaco dry forest, Bolivia	12720	9785	153.3
Maffei et al. 2004*	5.37	Chaco dry forest, Bolivia	12104	9311	161.1
Maffei et al. 2004*	2.27	Chaco dry forest, Bolivia	28634	22026	68.1

Alternatively, knowing that the demographic units of jaguars are composed by one male and two to three females (Rabinowitz and Nottingham 1986), and having captured on film at least two known males, we may expect to have at least 4 females around, which also gives us 6 animals.

Using our estimates we could venture to say that in Amacayacu NP within its 2930sq km may harbour some 66 jaguars. This is a very low number for long term population viability. Using the minimum viable population numbers estimated by viability analyses for jaguars (Robinson and Redford 1986, Quigley and Crawshaw 1992, Eizirik et al. 2002) the required coverage of protected areas for the long term conservation of jaguars can be calculated. Ideally, a long term conservation unit would include 500 jaguars which at the present estimated density would cover an area of 22,727 sq km. The largest park in Colombia is Chiribiquete NP with 12,090 sq km protected and it lies to the north of Amacayacu.

This data is thus, baseline information for conservation planning and action. For example, it could suggest (more analysis will clear this up shortly) that there are no large enough protected area to conserve jaguars for the next 200 years. Undoubtedly, this type of data is an essential tool for influencing public policy on conservation and promoting larger park or special management areas in Amazonia.

The camera set up included a Caatinga habitat enclave within the Amazon rainforest. This habitat has been identified as of maximum priority for jaguar surveys and is considered to be data deficient on jaguar use (Sanderson et al. 2002, Taber et al. 2002). In 20 trap nights a pregnant female, a puma, a spotted jaguar and a black jaguar used this area, suggesting a very high use of this habitat. Additionally, this, I believe is the first black jaguar camera trap photo in Caatinga.

Picture 2. Black jaguar in Caatinga habitat, Amazonas, Colombia.

The study area has strong human pressure from hunting and logging, but it is protected due to its isolation. The absence of effective penetration channels has protected this area from destruction. The presence of jaguars, pumas and ocelots confirm this. There are no roads to get there and the rivers drain to the Amazon River in Brazil, so boat access has to be done entering and leaving Brazil. Additionally there is no significant human population in the Brazil frontier.

It is believed that focal species such as tapir indicate good health of the ecosystem, nevertheless there was not one photo of tapir in the CRV survey. Contrasting to the results from ANP where tapirs were the second most common vertebrates (after trumpeters) in the photo data. This underlines the importance of comparing protected vs unprotected areas, and will aid in understanding threats to mammal conservation in the Amazonian matrix composed of indigenous groups, recent settlers and business loggers.

Hunting harvest records

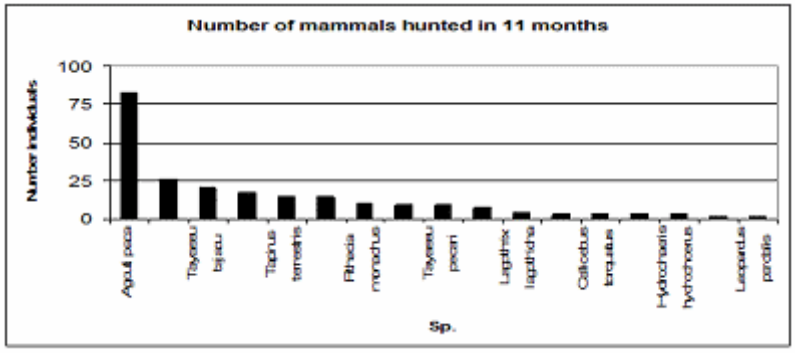
Meetings with the Village heads, as the study sites are both overlapped with indigenous reservation area, was necessary to ask for their project approval and that of the whole community. After identifying active hunters a trust relationship between them and my team had to be constructed. Although, indigenous subsistence hunting is legal for indigenous peoples, some are still reticent to disclose all hunting activities since they occasionally sell the meat, which is illegal. To promote cooperation I invented an incentives program which exchanged goods such as sugar, salt, batteries, flashlights etc. for information and cooperation. The "incentive" was given independently of hunting harvest amount and just asked for cooperation and truthful responses. They increased as interviewees continued to answer monthly.

San Martin de Amacayacu (SMA) was founded by Tikuna hunter gatherers in 1972. Amacayacu National Park was created in 1975, including two Tikuna villages. SMA has 25 active hunters out of a 500 populations. The hunting of this 5% of the population was recorded from January to November 2006. On average each hunter spent 147 hr hunting, that is the equivalent of approximately 18 nights (8hr hunting sessions) out hunting per year or once every 18 days.

In 11 months a total of 4390 kg of biomass (77% mammalian, 13% Avian, 11% Reptilian) was hunted from 303 from which at least 2635 people ate, plus those who bought. There is no data on the number of people who ate bought food. On average one hunter caught 13 individuals, averaging 183 kg of biomass and fed at least 110 people directly linked to him (i.e. who did not buy). The average prey weighted 14 kg.

Data is being analyzed at present and sustainability analyses will follow shortly.

Figure 5.



Calderon River Valley hunting data
Initial hunting harvest records (with the incentive program) were undertaken in two selected towns, out of 4 in the vicinity. Km 11 Huitoto ethnic group community and Multietnia village composed of different ethnic groups, including 28 hunters.

Data collected on hunting for three months in both towns is being entered, organized and analyzed. There is much more sale of wild meat by these studied villages than from the ANP Village inside the park. This may be due to the proximity (between 6-17 km) of the department capital Leticia, with 35,000 inhabitants and an illegal wild meat market operating. Hunting for jaguar skins is not common, but occurs mainly by direct order of some interested person, but there is an active commerce of jaguar canines, skulls and paws.

Tracking data
Tracking data is being entered, organized and analyzed

Sensitization

- One day GPS workshop was carried out by the PI in San Martin de Amacayacu Tikuna Village. This workshop was part of an agreement with the indigenous leaders as counterpart from the project to work in their areas (the camera trapping in ANP in 2006).
- Two undergraduate Biology thesis were produced with my data.
- Four local indigenous people were trained in checking camera traps, collecting hunting data and recording spur. After 15 months of work with them they became multipliers of the conservation as do their families that end up involved

with the project. One of them built his house with payments for his work from the project.

- Wrap up meetings and presentations: 1. Presentation to ANP staff on preliminary results on the protected vs unprotected area camera trapping realized since last year. 2. Meeting with Village heads in their own villages. 3. General public meeting presenting preliminary data in Leticia at the Universidad Nacional auditorium. Assistants included Corpoamazonia (regional government environmental entity), University Nacional staff, particularly from the Masters in Amazonian studies degree, Sinchi (governmental Amazonian research institute), Village heads, general students and project staff. 4. In August a presentation followed by a meeting is schedule with the National Parks Director and at a University in Bogota, the capital of Colombia.

Problems and constraints

- High tax and importation costs to enter camera traps into Colombia.
- Camera theft by Israelita sect.
- The High humidity and heat is still a problem although, it is lessened by silica and silicone use.
- The study area requires the equipment to be taken on foot (from 6 km to 17 km depending on the camp), thus limits the amount and size of luggage and camp furnishing e. g. Gas cylinders.
- The PI fell of a bridge and had a soft tissue trauma injury in his left thigh, the PI and one assistant fell with an ear infection and two porters contracted Malaria.

Media activities

A popular press article was written on the project (PDF attached):
Cepeda, P. 2006. Tras la vida secreta del jaguar. Nota Uniandina 20:44-51. (Attached) and a documentary is being produced by Explora Films on the project.

References

Aranda, M. 1990. Ms Thesis. Universidad Nacional Heredia, Costa Rica. Capture program 1978.

Carbone, C., et al. 2001. Anim. Cons. 4:75-79.

Crawshaw, P. G. 1995. PhD thesis. University of Florida, Gainesville.

Leite, M. R. and Galvao, F. 2002. In El Jaguar en el Nuevo Milenio. Medellín et al. Comps. Fondo de Cultura Económica, Universidad Nacional, Autónoma de México and Wildlife Conservation Society, México.

Maffei, L., Cuellar E. and Noss, A. 2004. J. Zool. 262:295–304.

Peres, C. A. 2000. Cons. Biol.. 14(1):240-253.

Quigley, H. B. & Crawshaw, P. G. Jr. 1992. Biol. Cons. 61:149-157.

Rabinowitz, A. & Nottingham, B. G. Jr. 1986. J. Zool. Lond. 210:149-159.

Rabinowitz, A. 1986. Wildlife Society Bulletin14:170-174.

Robinson, J. G. and Redford, K. H. 1986. Am. Nat. 128:665-680.

Schaller, G. B. & Crawshaw, P. G. 1980. Biotropica 12:161-168.

Silver, S. C., et al. 2004. Oryx 38:148-154.

Swank, W. G. and Teer, J. G. 1989. Oryx 23:14-21.

Wallace, R. B., Gomez, H. Ayala, G. and Espinoza F. 2003. Mastozoología Neotropical 10(1):133-139

White, G. C., Burnham, K. P., Otis, D. L. and Anderson, D. R. 1978. Program Capture. Patuxent Wildlife Research Center, USGS.

Zuloaga, J. G. 1995 Tesis de licenciatura, Instituto de Ciencias Naturales, Universidad Nacional. Santa Fe de Bogota, Colombia.