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ABUNDANCE OF THE MOUNTAIN TAPIR IN PURACE NATIONAL PARK, COLOMBIA

Final Report
2009-2012

Grupo Tapir
CLP 2009

ABUNDANCE OF THE MOUNTAIN TAPIR IN PURACE NATIONAL PARK, COLOMBIA

Project 131709

Cauca Department, Puracé and San Sebastián municipalities
January to December 2010

Samanea Foundation, Puracé National Park,
Universidad del Valle

Main Goal:
To generate information on the mountain tapir population size and to make a record of the fauna associated to its habitat in the north and south of the Purace Natural Park

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We thank the Conservation Leadership Programme (CLP) for the support, the training, the funding and disclosure of this research; to Alba Marina Torres and Germán Corredor for being the references to this project and encourage us to work with tapir and its habitat; to Maria Teresa Amaya and Luis Alberto Sánches – managers of Puracé National Park- for allow us to work in the protected area; to the park's professional, Liliana Mosquera for her support; to the park rangers for their assistance, guidance in the field and work on the recovery of Huancayo Museum, specially to Pablo Páez, Alejandro Caldón, Juan Pablo Díaz, Rodrigo Sarria, Héctor Pizo, Gustavo Adolfo Papamija, Carlos Guerra, Wilson de Jesús, Diomar Castro and Hugo Collazos; to Liliana Patricia Paz – professional researcher at Territorial Surandina – for her accompaniment and follow-up in the meetings; to the Animal Welfare Unit at the Cali Zoo, specially to Carlos Galvis for allow us to develop ex situ testing of the camera traps with tapirs in captivity; to the Innovation and Development Center of the Cali Zoo, specially to Igino Mercuri, Orlando Salcedo and Diana Vivas for their continued advice and support; to professor Humberto Álvarez for his reviews and recommendations; to Wildlife Conservation Society - Colombian team, specially Carlos Saavedra and Robert Marquez, for invite us to participate in the camera traps' testing process; to PANTHERA Colombia, specially to Esteban Payan, Andrés Hernández, Angélica Díaz and Carlos Mario Wagner for take part of the training workshop in manage of camera traps and for their recommendations; to Aymer Andrés Vásquez, Noé Poliche, Fernando Ortega and Juan Carlos Salazar for their volunteer support in the field; to Fernando Sánches Fuenmayor for his support and recommendations.

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SUMMARY

The mountain tapir is restricted to the northern Andean mountains between Peru and Colombia. Although the species has been reported in several sites of the Puracé National Park, no population-spatial estimation of any kind had been made. We sought to determinate the relative abundance of the species by camera trapping approach. We deployed 12 cameras in northern and southern sites of the protected area, in a simple grid arrangement during seven months. A total of 57 photographs of the species were obtained and a relative abundance of 37 tapirs / 100 cameras-night. Three tapirs were identified individually from the records in an area of 3.5 km^2 which extrapolated to the area of the Purace Park gave us a basic estimation of population size. Other recorded wildlife was the cougar, spectacled bear, mountain paca, little red brocket, mountain coati, tapeti and tigrillo. We conclude that the protected area is an important habitat for the mountain tapir and other Andean wildlife and we strongly recommend its research and protection.

An educational strategy towards the awareness of the species and its habitat was developed with key actors as the Puracé Indigenous council's group of guides, students from the settlement school and the park rangers, who were provided with education tools and training for their own work.

INTRODUCTION

Mountain tapir (Roulin 1829) is one of the four species that represents the Tapiridae family in the world. It is distributed in the Ecuadorian, Peruvian and Colombian Andes (Lizcano et al. 2006) and is threatened by the advance of agricultural frontier, poaching and illegal trade of its body parts (Downer 2003). It is currently classified as an endangered species by IUCN red list (Lizcano et al. 2006), and for this reason the gathering of information contributing to the management of its populations is essential.

In Colombia there are studies that estimate the density of 1 individual per 400 ha, based on the estimate obtained during the same year in Ecuador by a radio-telemetry survey (Downer 1996 b) (Acosta et al. 1996). In later survey, a density of 551ha per individual was estimated through footprint measurements (Lizcano & Cavelier 2000b). However, there are remaining gaps regarding the population status of the species, which hinder to make decisions for its conservation (Lizcano et al. 2005; Lizcano et al. 2006). Currently there are action plans about the species in Colombia (Lizcano et al. 2005, Montenegro 2005) that gave us guidelines and research priorities to address this survey.

Some studies have been developed in the Puracé National Park to contribute to the knowledge on the biology of the mountain tapir. In the year 2005 the Cali Zoological Foundation (FZC) and the Cauca Regional Corporation (CRC) initiated a mountain tapir conservation project in the north of the protected area and in the central zone and its surrounding buffer-zone (Sandoval 2005). Within the framework of this project, Sanchez (2006) identified the vegetation present in spots used by the tapir and cattle incidence in the buffer zone of the protected area. In the same year, Acosta and Ramírez (2006) deployed circular plots and transects in places where they found tapir traces, identifying vegetation present at these plots. Diaz (2008) identified the plants consumed by the mountain tapir in a village near to park and Abud (2010) did the same inside the protected area, but also described the high Andean forest vegetation used by the species. Additionally, since 2007 the park ranger team gathers monthly tapir information in permanent plots and salt licks (Amaya et al. 2007).

The tapir project was an initiative of a local group of biology students interested in contributing to the knowledge about the mountain tapir, thanks to the development of two investigations between the years 2005 to 2010 in the protected area (Sanchez 2005, Abud 2010). We planned this survey through camera-trapping approach for contribute to population parameters and park management.

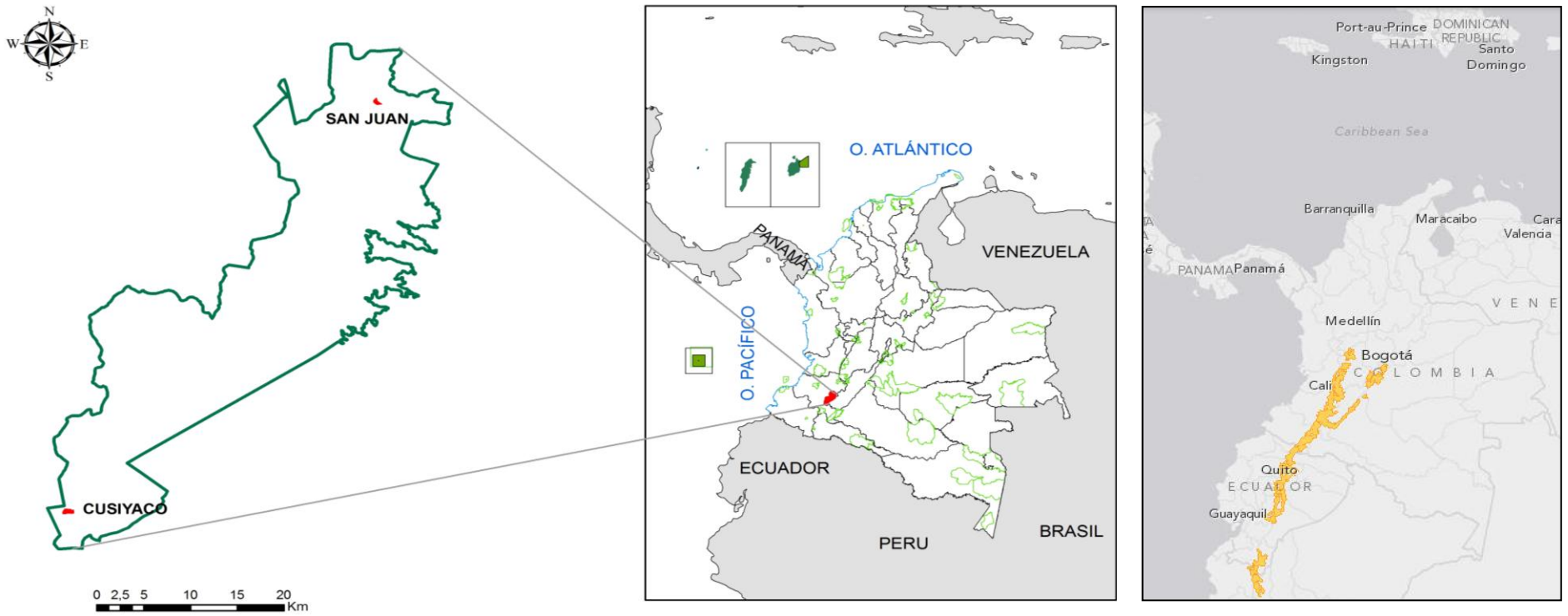

Figure 1. Location of Puracé National Park in Colombia and Southamerica. The right box shows the Mountain tapir range (orange) in the Northern Andes of Southamerica (From IUCN Red List). The middle box shows the National Parks of Colombia delimited by green lines and the study area with red fill. The left map shows in red the two sampling grids in south (Cusiyaco) and north (San Juan) of the park.

MOUNTAIN TAPIR PROJECT TEAM

Melissa Abud Hoyos, 26 years old. Cali – Colombia
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She is a biologist, graduated from Universidad del Valle – Cali in 2010. She has worked for three years as an environmental educator and as the science club's coordinator at the Cali Zoo. She was the main researcher in the Zoo's mountain tapir conservation project for 2 years, an activity with which she carried out her undergraduate project at Puracé National Park. She served as a technician at the tapir, spectacled bear and deer monitoring subprogram at the park for 3 years. She is currently working at a regional level for the Parks Unit – Pacific region as the Professional in Ecological Restoration and Sustainable systems for Conservation. Melissa enjoys and has a wide interest in working with human communities and conservation, features that contribute to her role as coordinator and researcher in this project

Sebastián Duque López, 25 years old. Cali-Colombia
gaiacarryon@gmail.com
He is a biologist graduated from Universidad del Valle in 2011. He is interested in the field of theoretical and applied ecology; he initiated his experience working in conservation with bird surveys at the Farallones National Park in Cali and afterwards, joined the Mountain Tapir photo-trapping research team at Purace National Park as a field investigator, secretary and translator. He has been co-author of an agroecology publication and as part of his undergraduate work, of a publication released about seed dispersion by ants. He had the opportunity of working as an environmental educator in the Cali Zoo for more than three years where he developed abilities to communicate with children and young people, which later became very useful in other jobs and investigations.

Humberto Calero Mejía. 24 years old.
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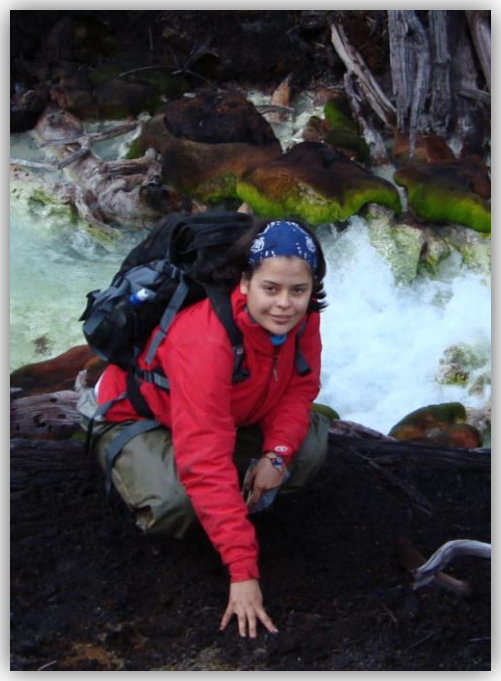
He is a biologist graduated from Universidad del Valle in 2012. He has more than 4 years of experience working in various aspects of environmental education. Inclined towards the conservation of diversity, he served as an investigator, graphic designer and logistic assistant in educational and field activities in the present project. He won scholarships from two institutions to develop a butterfly conservation project in Gorgona Island National Park, as part of assessment project of the wildlife conservation features of that area. At Universidad del Valle, he carried out teaching as a monitor for three years and was also a monitor in investigation for one year. He has a taste and ease for working with communities and makes them part of the research project.



Stephany Valderrama Carmona. 22 años. Cali- Colombia
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She is a last year undergraduate biology student at Universidad del Valle, has served as an environmental educator in and out of town since 2008 with institutions as Samanea Foundation, Rio Pance Ecopark, Cali Zoo and Rio Cali Foundation. She has served as the main investigator, secretary and logistic coordinator of the Mountain Tapir Project in the Purace National Park. She is very interested in research in the fields of ecology and conservation, and in working in education and conservation with communities.

Field staff:

Andrés Hernández. He is a biologist from Universidad del Cauca and researcher in Panthera-Colombia with expertise in photo-trapping due to the development of his undergraduate thesis with this technique in detecting cougars and its potential preys in the national park. He helped the team during training in photo-trapping and testing the equipment in the field. He currently conducts research related to the presence of jaguars (*Panthera onca*) and the identification of biological corridors that includes this species' habitat in Colombia.

Pablo Páez. He is a Park Ranger of the Puracé Natural Park northern sector with an extensive experience in protected area management, field skills and attention to visitors. He lives in the buffer zone of the park, where he contributes to conservation by creating awareness amongst his neighbors regarding the importance of the forests near to the settlement.

Alejandro Caldón. He is a park ranger of the Purace National Park northern sector, with knowledge about wildlife and relationships with communities. He was the deputy governor of the Puracé Indigenous council, where he remains an active member and contributes to the conservation of the territory.

Rodrigo Sarria. He is a park ranger in the Paletará sector located in the north of the Park with an extensive experience in protected area management, field skills and an affinity for working with wildlife. He contributed with the Andean Condor Conservation in the Purace National Park because of his past experiences with the species. He is also characterized by his interest in wildlife management and an active relationship with the indigenous community of Paletará regarding the subject on land conservation.

Juan Pablo Días. He is a park ranger at Purace National Park and a graduated biologist from Universidad del Cauca. He has managed to provide photographic records of deer and tapirs to national park officers.

Aymer Andres Vasquez. He is a graduated biologist from Universidad del Valle, who is currently doing a Master's degree at Universidad Nacional de Colombia. He has contributed by helping in the field and with the training section record of the group of guides of the indigenous council in Puracé.

Gustavo Adolfo Papamija. He is a park ranger of the national park's southern sector in charge of the Valencia sector, with an extensive experience in protected area management, field work and attention to visitors. He has managed to take pictures of the protected area wildlife in its natural habitat and has skills for editing and creating videos for conservation. He is also characterized by his charisma and good cheer.

Carlos Guerra. He is a park ranger of the Puracé national park southern sector, who performs mammal monitoring tasks.

Fernando Ortega. He is a biologist from Universidad del Valle who collaborated with the fieldwork in the Valencia region at the south of Puracé national park.

Francisco. He is a field assistant in the Valencia sector, an inhabitant of the region.

OBJECTIVES

Main Aim

To generate information on the mountain tapir population size and to make a record of the fauna associated to its habitat in the north and south of the Puracé National Park. Alongside we strengthened the social actors' awareness and assessment of mountain tapir and its habitat through workshops and delivering of educational tools.

Specific objectives

- To estimate the relative abundance of the mountain tapir in Puracé National Park.
- To identify the number of tapirs photographed.
- To record the hours with visitation of tapirs in the camera-trapping stations.
- To record the wildlife associated to mountain tapir habitat that has been captured by camera-traps.
- To develop a strategy towards the awareness of the species and its habitat with key actors of the Puracé National Park.

Changes of the original statement

We added to our original study area, another site in the south of the park to compare the relative abundance estimation. At the same time, we enlarged the sampling effort to cover not only the salt licks, but a representative area taking in account the home range estimations. This allowed us calculate relative abundances indices, a more useful data than frequency of records.

MATERIALS AND METHODS

Study area and deployment of camera-traps

The study was carried out in two sites inside the Puracé National Park. The first one called San Juan Hot Springs (2°20'36"N - 76°18'30.90"W) at the north and the second called the Cusiyaco Lagoon (1°54'52"N 76°37'30.90"W) at the south of the protected area. The features of each zone are detailed in the Appendix B.

Cameras were separated taking into account the half of the mountain tapir home range diameter (minimal estimated by Lizcano & Cavelier 2004b as a 2.5km^2 circumference with diameter 1783 meters), then there was an overlap of the areas covered by the cameras inside the home range of an individual, which ensures that tapirs have a detection probability greater than zero. An *a posteriori* buffer zone was calculated with a fixed width, using the average of the distance among neighbor stations, such as an individual would be re-captured in the nearer stations (see above, Figure 2).

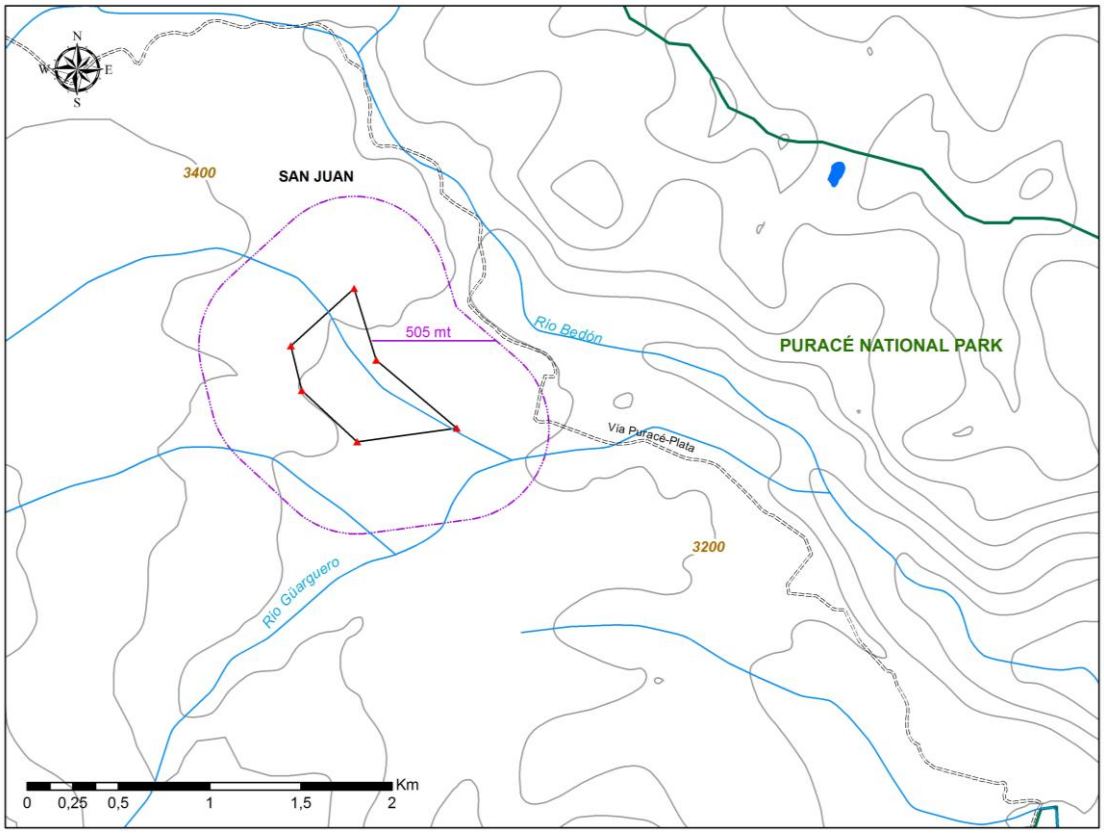


Figure 2. San Juan Thermal Springs map (2°20'36"N 76° - 18'30.70"W) showing the sampling grid (black line), the camera-trapping stations (red triangles) and a buffer zone of sampling area (purple interlined) calculated as the average of the distance between neighbor stations. The map also shows the Puracé-La Plata dirt road crossing the park, the main rivers in the area (Bedón and Guargüero) and the border of the park (green line).

Camera-trapping in San Juan Hot Springs: 12 camera-traps were mounted along tapir trails from February 16 to June 26 of 2010 (131 days, including a pilot period of 30 days), and deployed in a six point grid (area: 34 ha, including buffer zone 247.8 ha) with two cameras per point (station), one on each side of the tapir's trail and separated three meters from it. Six field trips each 20 days were made to change batteries, with daily walks from 8:00 to 17:00 to review cameras and change batteries (Figure 3).

Figure 3. Camera-trapping station in San Juan. During the installation of the cameras and change batteries, training in photo-trapping was provided to the park ranger's team in Puracé National Park.

Camera-trapping in the Cusiyaco Lagoon: This period took place from September 23 to December 20 of 2010 (87 days), in which 12 cameras were deployment in an array of 12 single-camera stations. After the first month a new array was made to enlarge the sampling area, moving to new position a total of six stations to covering an area of 55 ha (181.7 ha including buffer zone) (Figure 4). Three field trips were made every 30 days given the observed efficiency of the batteries, during a week each one.

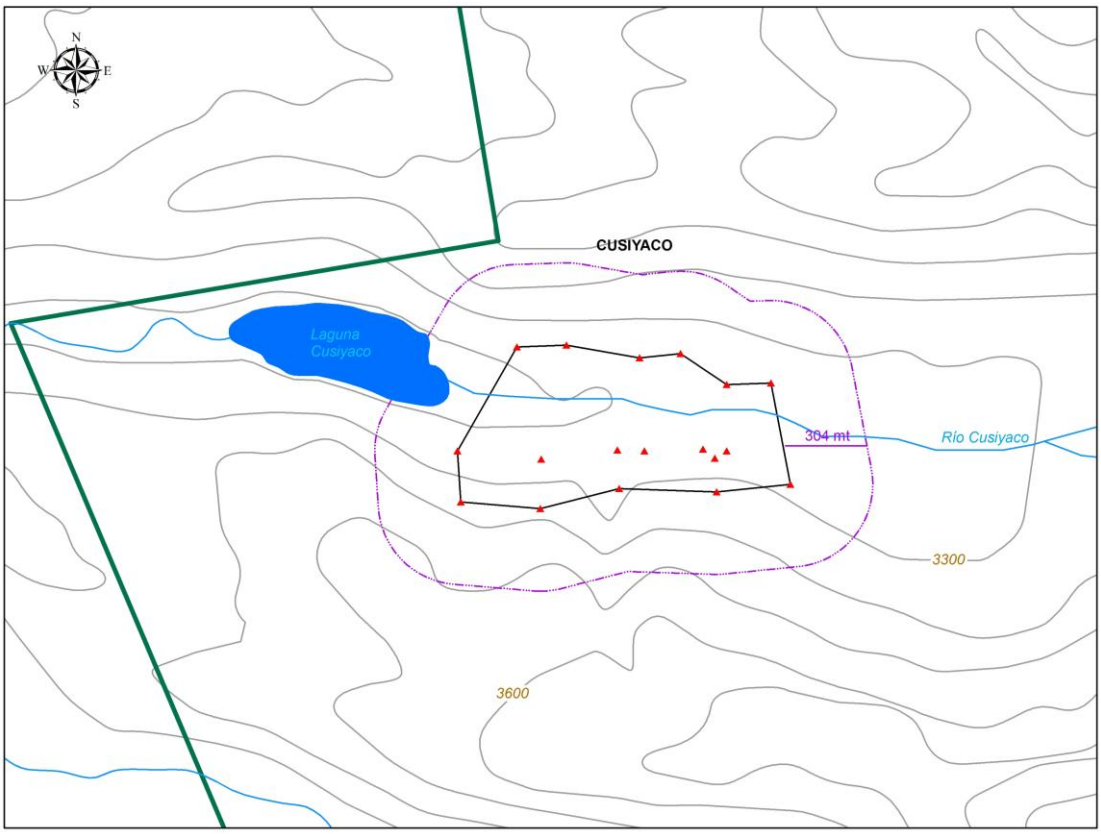


Figure 4. Cusiyaco Lagoon map showing the sampling grid (black line), the camera-trapping stations (red triangles) and a buffer zone of sampling area (purple interlined). The map also shows the Cusiyaco River across the sampling grid, the lagoon and the border of the park (green line).

Estimation of the relative abundance of mountain tapir, activity pattern and other wildlife recording

The effective photographs, namely with records of mammals, were classified as independent events following the criteria of O'Brien and colleagues (2003). The first relative abundance index (RAI_1) was the total number of nights needed to record the first mountain tapir event, which was then averaged among stations. The second abundance index is the average of independent events recorded in each station during a given sampling effort, in this case during 100 cameras/night (O'brien *et al.* 2003).

From the predetermined stamp in photographs of camera-tramps, we determine the time of the day and date in which the mountain tapir was recorded. It also allowed recognizing the moon phases in the nocturnal recordings. Besides the mountain tapir, all the photos of wildlife were identified using literature and added to a list.

Identification of tapirs by body features

Photographs were clustered according to the left or right animal's view side. The side with more pictures was selected and then was compared using the physical features of each individual such as the swirls of hair on the snout and the presence or absence of white spots on the top of the ear. Image was de-saturated and features were overexposed as proposed by Traeholt & bin Mohamed (2009). We also determined the sex of two individuals.

Educational Strategy

The team implemented an educational strategy among the Purace municipality social actors, based on communicating and taking actions in the environmental awareness and the reproduction of educational tools (Table 1 Appendix C and D). The actors involved are listed below.

- Puracé National Park.
- "Andulvio y Vida" indigenous group.
- Students of Manuel María Mosquera school (3rd,4th,5th,9 th,10 th,11 th levels).

Table 1. Summary of activities and educational tools delivered along the project.

Date - Activity or Tool	Actors Receiving	Details
June 2010 – Environmental interpretation workshop.	Indigenous group "Andulvio & Vida"	Theoretical - practical experience in order to straighten the abilities in environmental interpretation.
April 2011 – Awareness workshop.	Manuel Maria Mosquera Puracé School – Campamento Village Headquarter.	Awareness about Tapir and its habitat inside the Puracé National Park.
April 2011 – Awareness workshop.	Manuel Maria Mosquera Puracé School.	Scientific Method to solve research questions and problems, the approach of camera trapping to survey wildlife.
May 2011 – Project Arise and Problems Tree.	Indigenous council guides group "Andulvio & Vida".	Methods and procedures to elaborate a project in conservation.
Huancayo Museum restoration.	Puracé National Park Office and San Juan sector.	Support to park rangers in the recovery and restoration of the lightning in the museum exhibitions.
Reproduction of tools.	Indigenous group "Andulvio & Vida" Manuel Maria Mosquera Puracé School – Campamento Village Headquarter. Puracé National Park Office and sectors.	Set of tools for awareness of mountain tapir and its habitat, as well as the welfare and environmental protection.

RESULTS

During the development of the entire study, 57 photographs of the mountain tapir (*T. pinchaque*), 11 of little red brocket (*Mazama rufina*), seven of mountain coati (*Nassuela olivacea*), one of tigrillo (*Leopardus tigrinus*), four of mountain paca (*Cuniculus taczanowskii*), four of cougar (*Puma concolor*), eight of the spectacled bear (*Tremarctos ornatus*) and two of the tapeti (*Sylvilagus brasiliensis)* were obtained. The photos and list of animals recorded in every site is showed in the Appendix E.

Relative abundance estimation of mountain tapir in Puracé National Park

No photographic records of the mountain tapir were obtained in San Juan Hot Springs, being the reason of why relative abundance couldn't be estimated for the north of the park. Nevertheless in the Cusiyaco Lagoon, 57 photographs of the tapir were obtained, from which 37 independent records were differentiated.

Using the results of the sampling period, the RAI_1 for the mountain tapir was of 12 days/individual ± 18.1 (n = 17), which means that it took an average of 12 days for a mountain tapir to be detected by all the camera traps. The RAI_2 was scaled to a sampling effort of 100 cameras/night, yielding a mean value of 3.7 individuals/100-night cameras ± 2.5 (n = 10), which is interpreted as the record of four individuals per 100 cameras per night.

Identification of tapirs by body features

In the Cusiyaco Lagoon three individuals were differentiated using the hair swings and the white spots in the earlobe as diagnostic features (Figure 5).

Figure 5. Features of individuals of mountain tapir in the Cusiyaco Lagoon. The right image shows an individual identify by black tip ears and swirl hair between the eyes. The middle one shows black tip ears and a circular hair swirl in the snout. The left one was characterized by white tip ears and a zig-zag mark in the snout.

Recording of daily activity

In the Cusiyaco Lagoon the tapirs were detected by the cameras in daylight and night in 57 independent events. The most frequent hour of the day was at 08:00 and at 15:00 hours, with five records each. The remaining time there were approximately one to three records between each hour (Figure 6).

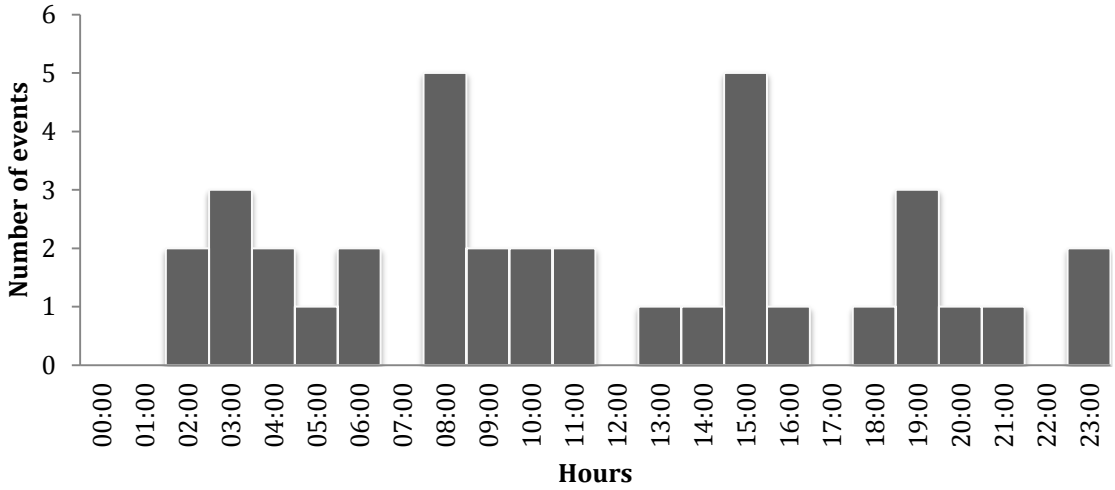


Figure 6. Mountain tapir records at different times of the day.

For the lunar cycles the highest records were obtained during the waning and rising phases of the moon (Figure 7).

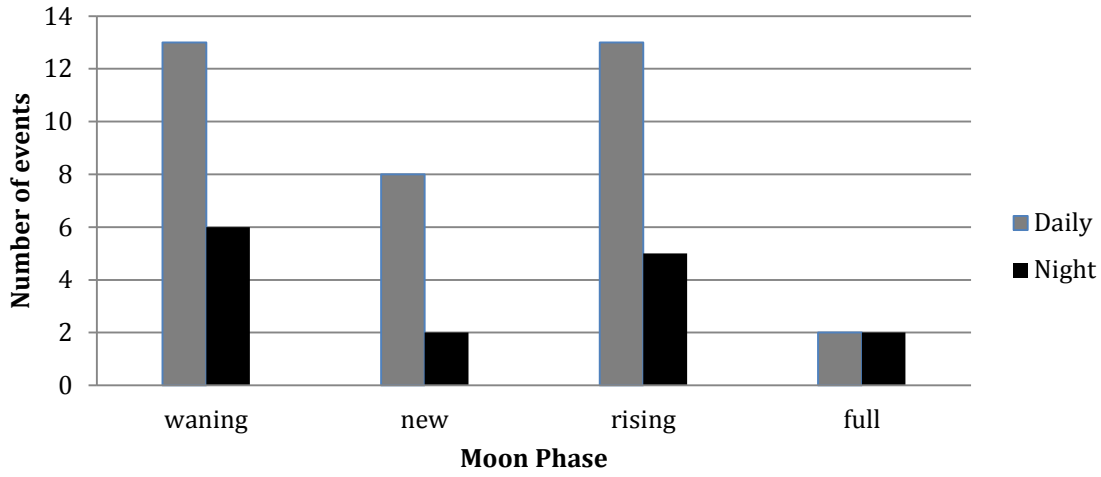


Figure 7. Records of the mountain tapir during the lunar phases between September and December of 2010 in Cusiyaco Lagoon.

Educational Strategy

The outcomes of the educational strategy including activities and tools are summarized in the Table 2.

Table 2. Indicators of the educational strategy impact.

Activity	Impact Indicator	Projection
June 2010 – Environmental interpretation workshop.	***Number of actors strengthened with the training:*** 1 ("Anduvio y vida" environmental interpreters Group) ***Number of people trained:*** 14	Keep strengthening the "Andulvio y vida" environmental interpreters group and other groups.
April 2011 – Awareness workshop.	***Number of people:*** 34 (16 elementary school students, 20 young high school students and two teachers). ***Number of benefited actors:*** 1 (Manuel María Mosquera School).	Increase the number of actors and beneficiaries. Changing the attitude and formation of groups thanks to the awareness process.
Reproduction of disclosure tools.	***Number of tools created or reproduced:*** 6. ***Number of actors benefited with the tools:*** 4 (Highschool Teenager from the Manuel María Mosquera School, Children from elementary school from "Campamento" headquarters, "Andulvio y vida" environmental interpreters group, Puracé National Park team).	*Created and reproduced more tools to strengthen the educational work of the social actors.*
May 2011 – Training in project arise and problems tree.	***Number of training sessions performed:*** 2 (Workshop and tree problem project). ***Number of actors strengthened with the training:*** 1 ("Anduvio y vida" environmental interpreters Group). ***Number of people trained:*** 5 ***Products:*** 1 Project profile approved by	To find funds for the project profile planned with the group. Replicate this training with other groups.

	the Puracé Indigenous council in order to strengthen "Andulvio y vida" environmental interpreters group.	
Huancayo Museum restoration.	***Number of strengthened actors:*** 1 (Puracé National Park team).	Continue to strengthen of Puracé National Park team in the use of scenarios of environmental interpretation such as the museum. Promote other scenarios for interpretation together with the Purace National Park team.
Reproduction of tools.	***Number of tools created or reproduced:*** 7. ***Number of actors benefited with the tools:*** 4 (Highschool young adolescents from the Manuel María Mosquera School, Children from primaryschool from "Campamento" headquarters, "Andulvio y vida" environmental interpreters Group, Puracé National Park team).	To count the number of actors and beneficiaries of the reproduction of tools implemented by measuring the use the actors who received them, gave to them.
Disclosure of results.	***Number of actors who know the project by direct information:*** 11 (CLP team, Puracé Natural Park team, Samanea Foundation, Cali Zoo foundation, PANTHERA Colombia, WCS Cali, Tapir Specialist Group (TSG), 24th and 25th SCB congress community, Tapir Network (Red Danta) and the Indigenous community of Puracé municipality).	Publish the project in the Tapir Specialist Group (TSG) journal. Oral presentation in the first Latin-American Congress of Tapirs in 2013 in Ecuador

ACHIEVEMENTS AND IMPACTS

Estimation of the mountain tapir relative abundance in the Puracé National Park

The mountain tapir is currently found both in the southern and the northern zones of Puracé National Park, as could be verified by this study, which suggests that the species could be continuously distributed throughout this protected area territory. However, the occurrence of the species in the north of the park (San Juan) was acknowledged only by indirect records such as footprints and scats through the monitoring activities carried out by the park rangers (Amaya *et al*. 2009), lacking any photographic record, which does not allow the estimation of the relative abundance of the species in the zone. On the other hand, in the southern zone (Cusiyaco) of the park, the camera trapping allows estimate a relative abundance of 3.7 individuals/100-night cameras with 12 days in average to obtain a tapir photo. Next studies could use this information to compare among populations, because the estimation of relative abundance is highly related with the density of the species (O'brien *et al.* 2003). Differences in the photo-capture among zones might be explained by the sampling design or by the physical characteristics and anthropogenic disturbance of every site.

An average of 12 days, with an effort of 27 cameras/night was needed to obtain a photograph of a tapir. When the relative abundance for Cusiyaco was scaled to the sampling effort, a total value of 37 individuals/1000 night-cameras was obtained. This was quite similar to the value of 36 individuals/1000 night-cameras found for the Baird tapir (*T. bairdii*) at 2400-2800m on a Costa Rican mountain (González-Maya *et al.* 2009). The authors of this study associated these results with the low anthropogenic intervention(hunting, vigilance, tourist visits) in the place, which was located inside La Amistad National park, a protected area of 401.000 ha, much less fragmented than the other sampling sites of their study.

The three stations with the highest number of records were located in natural tapir trails with presence of fresh footprints, close to or at the border of the forest adjacent to the paramo at the foothills of the valley. All the cameras were located in trails that had access to the main trail by which the wildlife moves through. These cameras were set up in strategic points where animals had to stop because of naturally fallen trunks which hindered their movement. For example, one of the stations was located in front of a muddy area that was unstable even for the animals and then it stopped their movement ensuring their photocapture. The presence of streams and other bodies of water were fundamental in the successful recording of the species, as has been noted by other studies in Ucumarí Regional Park (Acosta *et al*. 1996; Lizcano & Cavelier 2000a).

The photo-trapping technique was effective where the habitat is slightly disturbed without human presence. Currently, mountain tapirs have been registered with Cuddeback (in this study) and Bushnell (Tapia *et al.* 2011) digital camera traps. These are compact equipments of intermediate price and with a

shooting velocity around half a second, that therefore allowed the achievement of this sampling. The batteries duration was prolonged up to a month in the study area, without loss of the equipment function due to battery discharge. Additional protection against humidity, by the use of desiccant and the sealing of the camera with silicon, was quite effective in preventing equipment damage. However, one of the cameras, which by mistake didn't have desiccant, was found very wet and had to be changed during the study.

The absence of the species in San Juan during the survey, it could be related to migration, as suggest studies in Ucumari Regional Park, where the species has altitudinal movements from high areas at 3600 meters to lower areas at 3100 meters (Lizcano & Cavelier 2000a), while Downer (1996) suggested that the species wanders a lot to avoid predation or to optimize foraging specially in places where there is anthropogenic intervention.

Another hypothesis is that density of mountain tapir is greater in Cusiyaco, which allow the photo recording in a small area, not enough to record at least an individual in San Juan. Due to there is not density studies of this species in the park, we cannot refuse this hypothesis. Although the occurrence of individuals is widely documented in San Juan (Sandoval 2005, Sánchez 2005, Acosta & Ramírez 2006 & Abud 2010), however, little was known about Cusiyaco site (but see, Amaya *et al*. 2007) before our outcomes.

The tapir trails found in Cusiyaco were wider and larger and had a more defined shape suggesting a recent use. Meanwhile, in San Juan the trails were much older and branched out, which could decrease the capture probability of tapirs. Although the camera-traps mounted in edges and summit of hills were positive for other mammals, tapirs were not recorded, despite of that these locations worked well for footprint traps in Ucumari Regional Park (Acosta *et al.* 1996). In the other hand, the sampling grid in Cusiyaco was deployed six hours away walking from the park rangers cab and the nearest settlement, in a place without inflow of visitors. In this area, the park rangers also made visits one day a month to monitor the tapir and were even captured by the camera-traps while they moved to their points of observation. Their presence apparently don't chase away tapirs, even we obtained a photo record close to the noon just two hours before we arrived to the camera-trapping station to change batteries.

In San Juan the proximity to less than one kilometer from a road with active flow of heavy cargo vehicles, the park rangers cab, and the inflow of tourists to hot springs waters system (salt licks for animals) within the sampling grid, could have made tapirs more cautious and inconspicuous. Even though it is known that the species is attracted towards natural salt licks (Acosta *et al.* 1996; Lizcano & Cavelier 2004a), the tapir could avoid the San Juan salt licks due to the characteristics of high exposure and low cover of vegetation, but also the regular inflow of visitors. Nevertheless, months before, at the beginning of the survey in San Juan, a photographic record of tapir was obtained by direct observation of an individual on the border of the road, and from a heavy cargo vehicles (Guardaparques PNN Purace comm. pers). This might show that the animals move in the zone in spite of the regular anthropogenic presence.

Differentiating mountain tapir individuals: Consideration on the species density at Puracé National Park

In the southern of the park, three individuals were differentiated from the photographic records, although we guess there were at least two more in an area of 182 ha. This proved that overlapping occurred in the home range of the species taken into account the lowest estimate of 2.5 km^2 for an adult male made by Lizcano & Cavelier (2004b). In this relatively small area, one male, one female were identified. This information is relevant because it would imply that reproductive events are occurring in the study area. Although we were not able to observe offspring, it is possible that one of our pictures corresponds to a young individual. Downer (1996) found that the female partially shared the territory with one of the males: this becomes evident in our study by looking at pictures of a male and a female in separate stations just by 440 meters away.

The density suggested by our study is one individual every 61 ha, being this the highest density reported up to the moment for the species. The Puracé National Park satellite coverage monitoring (Latorre & Corredor 2011) reports an average area of 88492 ha covered by tapir habitat without disturbance, which by extrapolation would indicate that there are approximately 1450 individuals inside the protected area. The present study suggests that the amount of individuals in the central Andean mountain range region is greater than the one found in the Ucumarí-Nevados population. Hence, more detailed studies of the species are needed to achieve a real approximation of the number of mountain tapirs in the country.

The three individuals recorded were identified using the animals right flank physical features, common in all the photographs. There are no reports in the literature on useful features for recognition of *T. pinchaque* individuals in photographs. The white spots in the ears were useful, because they were observe in the majority of the photographs from both sides of the animal. Nevertheless, some bias such as the reflections of light caused by the fur, sunrays or the camera flash must be consider because they can affect the adequate image interpretation. Additional characteristics such, scars, spots on the face, stomach and on the tail were useful in the individual identification of lowland tapirs (*T. terrestris*) in Chaco (Noss *et al.* 2003), but without application in our study. A facial feature that helped in the differentiation of mountain tapirs was the presence of hair swirls. Scars or birth marks were difficult to observe due to fact this species has the densest fur of the Tapiridae family, added to the fact that it lives in zones of high humidity. In many photographs the wet fur observed simulated scars which made it difficult to define real marks. The sexual identification of the individuals was easy carried out in some photohgraphs with the back side.

Mountain tapir daily activity records

The mountain tapir showed a bimodal activity pattern, with peaks at 8:00 and 15:00 hours. These results were similar to the ones obtained by the study of Downer (1996), which analyzed *T. pinchaque* activity patterns in Ecuador through telemetry, obtaining peaks of activity between 15:00 - 21:00 and 06:00 - 09:00 hours. A study carried out in Ucumarí Regional Park during a year found a bimodal pattern of activity in this species (between 5:00 - 7:00 and 18:00 - 20:00h) (Lizcano & Cavelier 2000a), which did not coincide with the present study.

This might have been because of the short sampling duration at Cusiyaco (three months) or because the activity sensors used in Ucumarí were not able to discriminate between tapirs, Andean bears (*T. ornatus*) and white tail deer (*Odocoileus virginianus*), which might have added as tapir detections causing activity peaks around twilight hours (Lizcano & Cavelier 2000a). These authors also found that daily activity of a male adult was related to the environmental temperature, reason why tapirs rest during the hottest hours of the day. This individuals peak of activity was between 7:00- 8:00 hours and 13:00 -14:00 hours, with a reduction of activity at noon and towards nightfall, such as in this study (Lizcano & Cavelier 2004b).

Record of the associated wildlife to the mountain tapir habitat

Obtaining seven species offers the Puracé National Park team update information about the wildlife of the San Juan Hot Springs and the Cusiyaco Lagoon. Also it allows the confirmation of species that have been little observed in the park, such as the cougar (*P. concolor*), the mountain paca (*C. taczanowsky*) and the tigrillo (*L. tigrinus*) (Amaya *et al.* 2007).

In general terms, the presence of other mammals demonstrates that the paramo and the high Andean forest ecosystems are not scenarios with “the Empty Forest Syndrome” (Redford 1992). However, it is necessary to study the impact of anthropic pressures on the mammal populations in the protected area, by which inclusion of population parameters studies of the species observed in the research plan of the park is recommended.

CONCLUSIONS

A photo-trapping study must spent a minimal of 25 cameras/night to obtain the record of at least one mountain tapir, considering that the first record could take ± 12 days. By choose clearly defined main trails, next to water bodies and path from the paramo to the Andean forest with fresh tapir traces increased the probability of a successful photo-trapping. From an estimated density of one individual/117 ha, a population of at least 462 individuals in the Andean forest and sub-paramo zones was calculated, which should be verified with more rigorous studies, comprising an increased effort and area of sampling in order to estimate the population density.

The mountain tapir has an hourly activity throughout the day and night, with possible increase of activity early in the morning, between 7-9 hours, and in the afternoon, and presents a resting period between 12-18 hours, which could be related to the changes in the environmental temperature or to the behavioral characteristics of the individuals in the study area. The finding of mammals classified in different categories of endangered species and at different trophic levels confirms the importance of continuing population studies in the Purace Natural Park, while emphasizing on the importance of this protected area in the conservation of the Colombian wildlife.

As a result of the development of the sensitization/awareness and training strategy, the foundation of the relationship with actors directly involved and concerning to the natural resources of the northern zone of the protected area was created. We were committed to strengthening capacities of local actors ans stake-holders in the area trying to multiply the efforts and the activities realized during the project by snowball effect.

PROBLEMS ENCOUNTERED AND LESSONS LEARNT

The research and education activities had a good development due to the responsibility, dedication and commitment of the team. In field there was a positive attitude between the tapir team, the park rangers and field assistants to conducted fieldwork in the best way possible and to obtain the expected outcomes. The educational strategy workshops were presented with an attitude of sharing of knowledge between attendees and staff (mountain tapir team). They were designed according to the actors addressed, being successfully received by the people trained.

Funds from CLP were received late due to lack of experience in wire transfers as well as in policy of the local banks to receive money from international source. It was necessary to provide documents that certify the fund origin. Public order issue and park policies also delayed the start of the survey in Cusiyaco, we finally began activities as soon as the Puracé office allowed it. Although these setbacks decreased the survey time a few days, they did not greatly affect our methods. Delays in the realization of educational activities were by the processing of permits from the indigenous council of Puracé municipality, because a governor's council permission was needed to start any activity with the community. Despite these issues, activities were carried out having a good reception between school students and the group of guides.

The photo-trapping technique was effective where the habitat is slightly disturbed without human presence. Currently, mountain tapirs have been registered with Cuddeback (in this study) and Bushnell (Tapia et al. 2011) digital camera traps. These are compact equipments of intermediate price and with a shooting velocity around half a second. The batteries duration was prolonged up to a month in the study area, without loss of the equipment function due to battery discharge. Additional protection against humidity by the use of desiccant and the sealing of the camera with silicon was quite effective in preventing equipment damage.

Studies should be initiated in order to seek an absolute abundance estimate of the species in larger areas with higher sampling efforts that involve the use of enough cameras to get a better idea about the number of individuals present in those areas, allowing a solid data analysis through the use of capture-recapture techniques. Using appropriate mapping and spatial analysis programs will allow obtain a more accurate species density in the area. The recommendation is to locate the photo-trapping stations with paired cameras so that they are not separated more than three meters apart from the capture point, and following a waterproofing protocol, thereby minimizing the risk of mechanical damage. The selection of appropriate sites for the location of the cameras is fundamental, as well as trying to follow a grid sampling design, in the most compact way possible. To increase the chances of capturing the animal, trails with many deviations and old traces should be avoided. Because there are no features that enable the individual identification of tapirs with absolute certainty, investigators must achieve a large number of photographs of the species to make a proper characterization of an individual set of traits.

IN THE FUTURE

We hope to propose a project called “Density of *T. pinchaque* in the Puracé National Park, Colombia”, to contribute with the knowledge of the population status of the species in the protected area, as well as to continue with the awareness of human communities about the wildlife and its habitat. This project will have as specific objectives estimate de density of the Cusiyaco Lagoon population and to enlarge the records of wildlife in this area.

Alongside, this project will continue with the educational strategy, including Papayacta indigenous and farmers community in the south of the park. The environmental interpretation as economic alternative through ecotourism will be a recurrent issue, as well as the training, design and use of educational tools for the knowledge of the species and its habitat.

APPENDICES

A. Budget and Expenditures

Item	Item detailed	COP Expenditures
Office, communication, permits, maps and field guides	Printing documents for Puracé NP officers meeting, calls and folder, delivery of the printed project.	17,300
	Sending documents, printing of papers for research permits.	21,800
	Call phones	4,800
	Call phones	28,000
	Photocopying and printing.	5,100
	Authorized translation	75,000
	Authentication of signatures (content recognition letter to Bancolombia)	10,951
Training activities for the team	Food expenditures during PANHERA Workshop - Colombia	111,900
	Bus tickets (Cali - Popayán) for the team to assist to camera-trapping workshop	71,000
	Phone calls and taxies during camera trapping workshop in Popayán	20,000
Equipment purchase	Taxi service for transport and Laptop purchase	32,000
	Food during laptop purchase.	2,800
	Laptop.	1,399,000
	Laptop backing	23,900
	Taxi to pick up a pack from Miami with equipment	12,000
	Silica gel pack and two SD disk.	53,800
	GPS	217,683
	13 Cuddeback Capture	5,365,169
	20 SD targets	386,639
	Batteries D (30 packs)	783,125
	Batteries AA	23,904
	Shipping for equipments	666,338
	foreign exchange, fund transference and purchase	412,172
Camera-trapping materials purchase for fieldwork	Raincoats and flashlight	320,000
	Silica gel.	12,500
	Silicone glue	5,000
	Gas cylinder for cook during fieldwork	50,000
	rope and big bags purchase	4,800
	equipment movement	12,000
Camera-trapping fieldwork	Reconnnaissance San Juan and San Rafael.	74,000
	Reconnaissance Valencia.	160,000
	Camera-trapping test fieldwork.	134,000
	First review camera-trapping test in San Juán.	115,800
	Camera trapping grid deployment fieldwork in San Juán.	219,534
	Camera-trapping fieldwork San Juán.	166,900
	Camera-trapping fieldwork San Juán.	157,650
	Camera-trapping fieldwork San Juán.	159,262
	Camera-trapping fieldwork San Juán.	118,303
	Camera-trapping fieldwork San Juán.	181,450
	Camera-trapping desmounting fieldwork San Juan	175,872
	Camera trapping grid deployment fieldwork in Valencia	430,686
	Camera trapping review fieldwork in Valencia	349,313
	Camera-trapping desmounting fieldwork Valencia	432,043

Item	Item detailed	COP Expenditures
Work meetings of the team	Work meeting planning educational strategy	30,070
	Meeting Popayan	228,000
	Food expenditures during PANTHERA Workshop - Colombia	28,300
	Working Meeting	12,000
	Work meeting planning educational strategy	5,000
	Work meeting planning educational strategy	5,000
	Work meeting planning educational strategy	38,738
Fieldwork of educational strategy	Environmental interpretation workshop expenditures carried out in Pilimbalá, Puracé	696,200
	Meeting with Purace indigenous council to obtain permits of work with the community	113,800
	Awareness Workshop for the Manuel Maria Mosquera School	700,000
	Project Formulation and Problem Tree	400,000
Environmental education tools creation and reproduction	DVD Conversion	24,000
	Environmental interpretation workshop sourvenir	144,000
	Wiring and switches purchase to museum recovery	373,650
	Museum working day expenditures	389,000
	Environmental education books	6,000
	Reproduction of coloring sheets,videos, books and other tools	950,000
	Delivering of Tools	300,000
Outcomes disclosure	Poster presentation SCB Congress Edmonton - Canada.	150,000
	Poster presentation SCB Congress Auckland - NZ.	250,000
Total expenditures		17,867,252
Total bank account management expenditures (Bancolombia comissions)		201,516
Total funds received in Colombia by wire transfer from CLP		21,752,970
Current funds in the bank account		3,684,201

B. Features of the study area

The Purace Natural Park has an area of 83.000 hectares, it is located in the southwest of Colombia, in the departments of Cauca and Huila, has a altitude between 2500 and 5000m, with temperatures between 3°C and 18°C and a bimodal precipitation pattern, being the months of May, June and July the wettest (San Juán station 2105712, IDEAM 2009). In this protected area is located the Andean forest, high Andean forest, paramo and super paramo ecosystems.

San Juán Hot Springs

It is an area frequently visited by tourists. It is crossed by a road transited by vehicles such as trailers, trucks, intercity buses, motorcycles and private cars. The presence of three hot springs can be distinguished, the largest being open to visitors. The hot springs are surrounded by extensive forests interspersed with paramo and scrubland in the flat zones. Human disturbance occurs around the road because the nearest town is 15km away. The forests on the slopes of the mountains and the paramo in the flatland have been little disturbed; however the presence of sulfide gases has defined the vegetation that grows in the area.

Cusiyaco Lagoon

This is an undisturbed area, which has high connectivity and is rarely visited by people, composed of two mountains with high Andean forest vegetation, a valley with paramo vegetation and a lagoon. In the forest a defined understory can be observed. Although the lagoon is usually visited by local residents and fishermen,

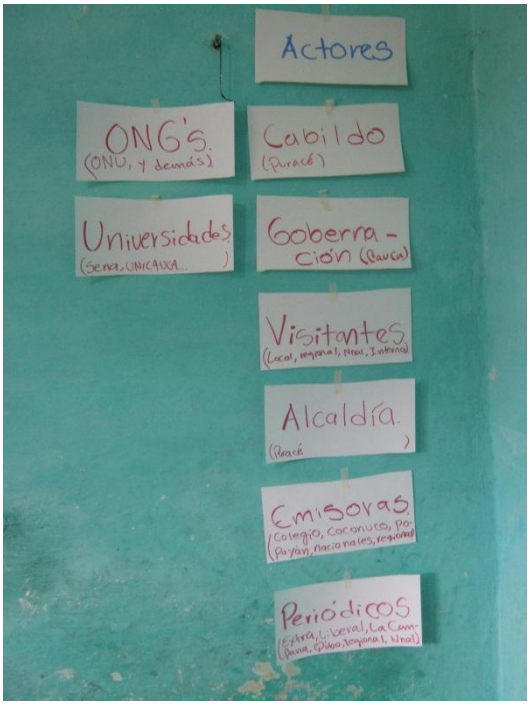
its highest places show no signs of human disturbance. To access this area five to eight hours of bus ride from the city of Popayán and seven to nine hours of walking are required.

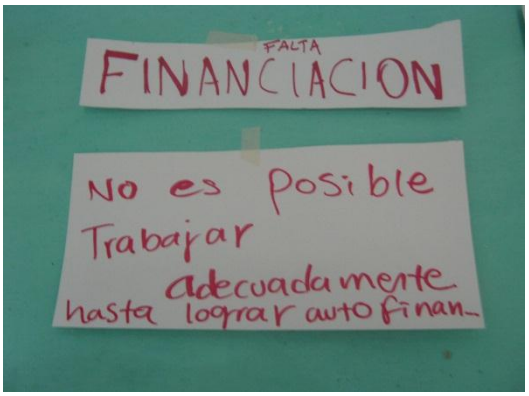
C. Educational activities

Awareness adressedded to school students towards target species and habitats and the well-use of natural resources

Training of young and adult guides in environmental interpretation

Workshop in project formulation and problem tree





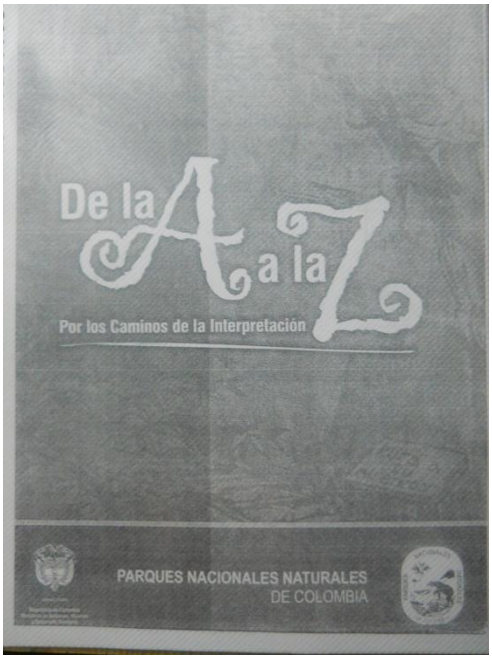
Restoration of Huancayo museum

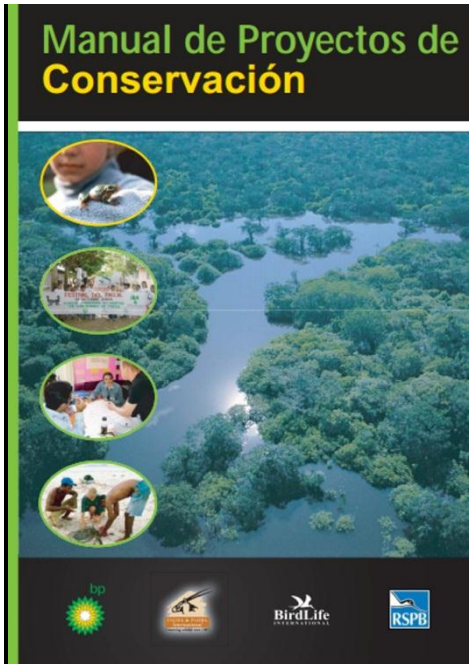
Script for the Huancayo Museum

D. Educational tools created and reproduced (Videos, Coloring Sheets, Environmental Calendar, Books)

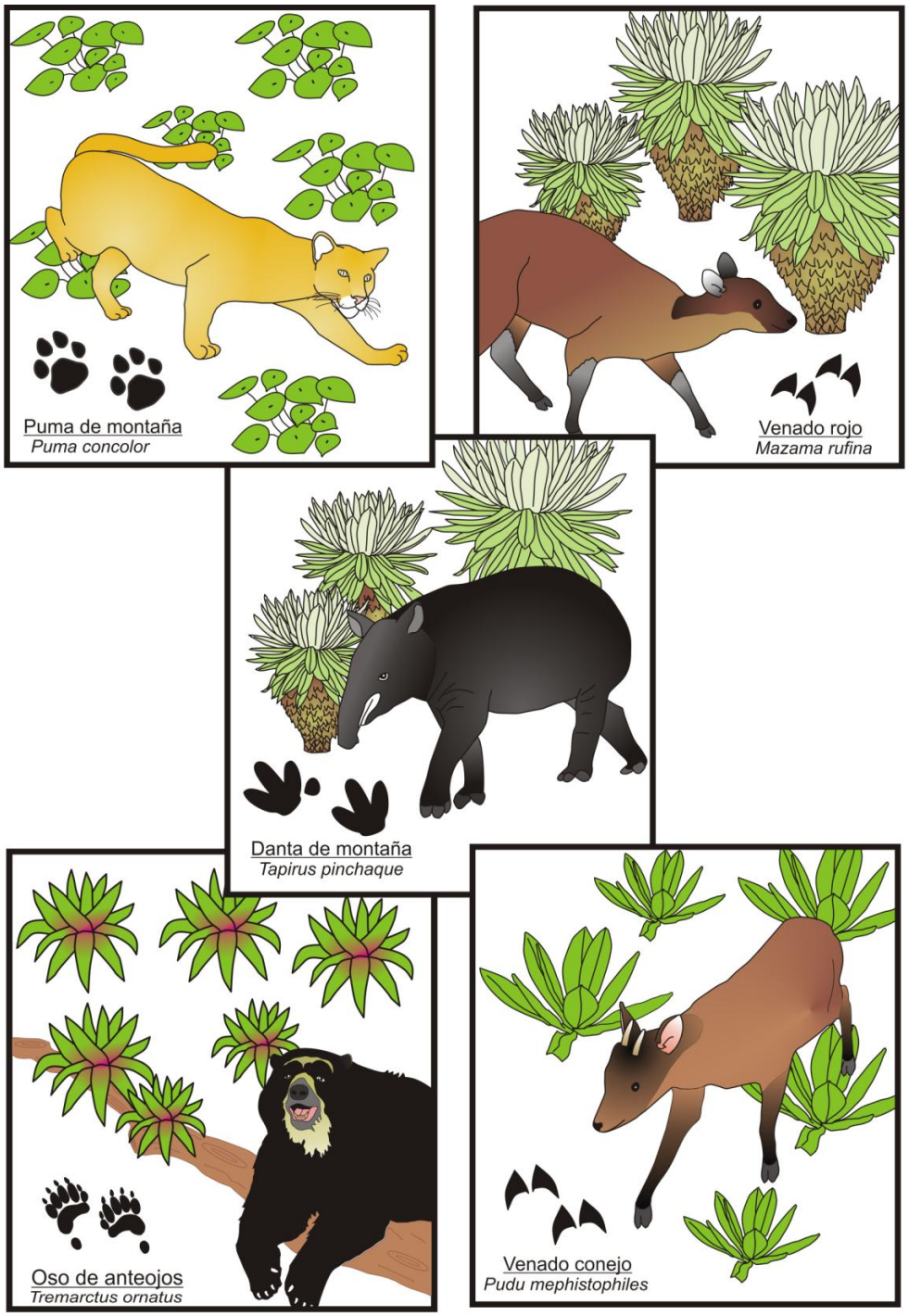
Videos

Books



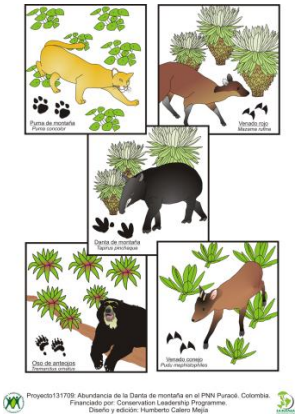


Coloring sheets



Proyecto131709: Abundancia de la Danta de montaña en el PNN Puracé. Colombia.
Financiado por: Conservation Leadership Programme.
Diseño y edición: Humberto Calero Mejía


Danta de montaña
Tapirus pinchaque
¡Hola!, soy la danta de montaña, me alimento de plantas y frutos, dispersando sus semillas por el bosque. Me encuentro en peligro de extinción debido a la destrucción de mi hábitat y la cacería. Ayúdame a vivir y protege mi hábitat.


Puma de montaña
Puma concolor
Venado rojo
Mazama rufina
Danta de montaña
Tapirus pinchaque
Oso de anteojos
Tremarctus ornatus
Venado conejo
Pudu mephistophiles


Danta de montaña
Tapirus pinchaque
¡Hola!, soy la danta de montaña, me alimento de plantas y frutos, dispersando sus semillas por el bosque. Me encuentro en peligro de extinción debido a la destrucción de mi hábitat y la cacería. Ayúdame a vivir y protege mi hábitat.

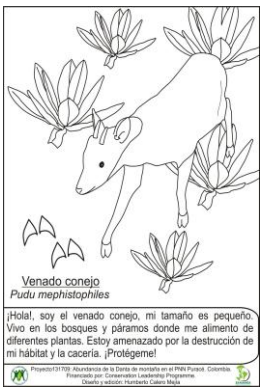

Oso de anteojos
Tremarctus ornatus
¡Hola!, soy un oso de anteojos, el único que vive en las montañas de los andes, necesito del bosque y el páramo para vivir. Me alimento de plantas como las bromelias, frutos y pequeños animales.
¡Recuerda! Protege mi hábitat y protégeme a mí.


Oso de anteojos
Tremarctus ornatus
¡Hola!, soy un oso de anteojos, el único que vive en las montañas de los andes, necesito del bosque y el páramo para vivir. Me alimento de plantas como las bromelias, frutos y pequeños animales.
¡Recuerda! Protege mi hábitat y protégeme a mí.

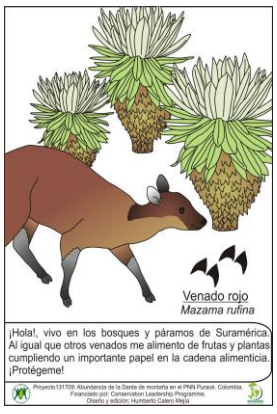

Puma de montaña
Puma concolor
¡Hola!, soy el puma o león de montaña, me alimento de otros animales como los venados. Tengo sentidos muy agudos que me permiten encontrar a mis presas. Ayuda a conservar mi hábitat y protégeme a mí.


Puma de montaña
Puma concolor
¡Hola!, soy el puma o león de montaña, me alimento de otros animales como los venados. Tengo sentidos muy agudos que me permiten encontrar a mis presas. Ayuda a conservar mi hábitat y protégeme a mí.


Venado conejo
Pudu mephistophiles
¡Hola!, soy el venado conejo, mi tamaño es pequeño. Vivo en los bosques y páramos donde me alimento de diferentes plantas. Estoy amenazado por la destrucción de mi hábitat y la cacería. ¡Protégeme!


Venado conejo
Pudu mephistophiles
¡Hola!, soy el venado conejo, mi tamaño es pequeño. Vivo en los bosques y páramos donde me alimento de diferentes plantas. Estoy amenazado por la destrucción de mi hábitat y la cacería. ¡Protégeme!


Venado rojo
Mazama rufina
¡Hola!, vivo en los bosques y páramos de Suramérica. Al igual que otros venados me alimento de frutas y plantas cumpliendo un importante papel en la cadena alimenticia. ¡Protégeme!


Venado rojo
Mazama rufina
¡Hola!, vivo en los bosques y páramos de Suramérica. Al igual que otros venados me alimento de frutas y plantas cumpliendo un importante papel en la cadena alimenticia. ¡Protégeme!

E. Camera trapping pictures

Mountain Tapir (*T. pinchaque*) in the Cusiyaco Lagoon.





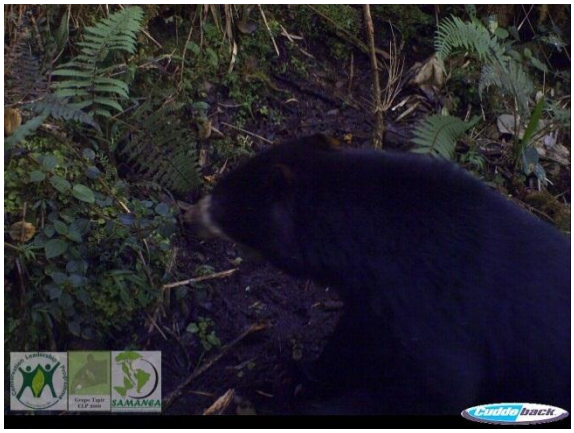

Cougar (*P. concolor*) in the Cusiyaco Lagoon.

Coati (*N. narica*) in the San juan Hot Springs and Cusiyaco Lagoon.

Mountain Paca (*C. taczanowskii*) and Tigrillo (*L. pardalis*) in the San juan Hot Springs

Red Little Brocket (*M. rufina*) in the San juan Hot Springs and Cusiyaco Lagoon.

Spectacled Bear (*T. ornatus*) and Tapeti (*S. brasiliensis*) in the Cusiyaco Lagoon.



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Tapir Specialist Group: http://www.tapirs.org/

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