

Hunting patterns and other threats to the conservation of terrestrial mammals of the Tamá National Natural Park, Colombia

Patrones de cacería y otras amenazas para la conservación de los mamíferos terrestres en el Parque Nacional Natural Tamá, Colombia

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Abstract

Objective: To document the hunting problem and, its current state and other threats for the conservation of mammal's species in the Tamá NNP. **Methodology:** We visited 13 localities during 34 months, in which we assessed the presence of medium and large terrestrial mammals, and through semi-structured interviews using a participatory approach we documented the communities hunting types and uses. We determined the types of hunting, the techniques employed, species used and other existing threats. To evaluate their relationships, we used the Bray-Curtis dissimilarity metrics and a heatmap through the Vegan 2.0. package on R. 3.0.2 software. **Results:** 21 species were recorded, 86% have hunting pressures. The hunting of subsistence, of tradition, of sport, and by conflict represented the highest percentages in the area with 67.5%, 17.5%, 10%, and 5%. The use of weapons and dogs was the most predominant hunting technique. Species as, *D. novemcinctus*, *M. rufina*, *N. nasua*, *N. olivacea*, *T. ornatus*, and *P. concolor* were of the greater use, either food, furs, trophies, or raw material for the elaboration of instruments and/or aphrodisiacs. Other treats as the deforestation and pollution which cover the 76 and 69% of the area followed by livestock 61%, arsons (23%) and feral species (8%). **Conclusions:** The hunting for conflict, the use of permanent traps, the presence of feral species and the burnings are presented in specific areas of the park, affecting mainly large felines and vulnerable species, thus imperative actions are necessary.

Keywords: Conflict, Feral species, Subsistence, Wild cats.

Resumen

Objetivo: Documentar la problemática y el estado actual de la cacería, y las otras amenazas que existen para la conservación de los mamíferos en el PNN Tamá. **Metodología:** Se visitaron 13 localidades durante 34 meses, donde se evaluó la presencia de medianos y grandes mamíferos terrestres, y a través de entrevistas semiestructuradas usando un enfoque participativo. Se determinaron los tipos de cacería, las técnicas empleadas, el uso de las presas, y otras amenazas existentes. Para evaluar sus relaciones, se usó el índice de disimilaridad de Bray-Curtis y un *heatmap* mediante el paquete Vegan 2.0 del *software* R. 3.0.2. **Resultados:** Se registraron 21 especies, 86% con alguna presión de cacería. La cacería de subsistencia, de tradición, deportiva, y por conflicto representaron los mayores porcentajes en el área con el 67,5%, 17,5%, 10%, y 5%. El uso de armas y perros fue la técnica de cacería más predominante. Especies como *D. novemcinctus*, *M. rufina*, *N. nasua*, *N. olivacea*, *T. ornatus*, y *P. concolor*, fueron las de mayor uso, ya sea como alimento, pieles, trofeos, o materia prima para la elaboración de instrumentos y/o afrodisíacos. Otras amenazas como la deforestación y la contaminación, cubren entre 76% y 69% del área, seguida de la ganadería (61%), quemas (23%) y especies ferales (8%). **Conclusiones:** La cacería por conflicto, el uso de trampas permanentes, la presencia de especies ferales y las quemas se presentan en áreas específicas del parque, afectando sobre todo a grandes felinos y especies vulnerables por lo que son necesarias acciones urgentes.

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Introduction

The loss of global biodiversity is happening at an unprecedented rate and few undisturbed areas remain, this has generated the need to create protected areas (e.g. natural national parks, wildlife sanctuaries) in order to ensure the conservation of the biodiversity and ecosystem services in the long term (Gaston *et al.* 2008, Benítez-López *et al.* 2017). This emerges as one of the few available mechanisms for preventing large vertebrate extirpation, however, different anthropogenic processes such as colonization and land use change are affecting the integrity of these areas (Ruiz-Gómez, 2006). Usually these processes are the result of different socioeconomic factors (i.e. lack of resources, food safety) and the absence of real and effective conservation strategies at different spatial scales (Milner-Gulland and Bennett 2003). For example, the intensity of hunting within the protected areas is one of the main problems affecting the species populations, community biomass and the ecosystems dynamics (Peres 2000, Milner-Gulland and Bennett 2003, Naughton-Treves *et al.* 2003, Kays *et al.* 2017), phenomenon that in the Tropics (Peres 2000, Benítez-López *et al.* 2017) and particularly in the Andean region would not be the exception. This particular threat is becoming an important obstacle for the biodiversity conservation, even more taking into account the constant increase of the human population and development processes occurring in this region, makes its management even more complex (Di Bitetti *et al.* 2013, Cáceres-Martínez *et al.* 2015). In this sense, protected areas are becoming the last refuges for ecosystem processes and biodiversity populations and communities' conservation (Laurance *et al.* 2012, Ramírez and Mendoza 2010).

In the Andes region, some bird's species and medium and large mammals are one of the most hunted groups for meat, pelts, trophies, rituals, because of fear (e.g. fear to predators) and in some cases for unreal medicinal properties, causing adverse effects on their population's dynamics mainly outside of protected areas (Sánchez *et al.* 2004, Figueroa and Stucchi 2009, Castaño and Corrales 2010, Palacios-Mosquera *et al.* 2010). In Colombia little is known about the

hunting process and its possible effects on terrestrial mammals, particularly in surrounding areas or within protected areas (with the exception of the work of Martínez-Salas *et al.* (2016) in the Tuparro National Park). Some works have assessed its effects on the physiology of primate species as *Alouatta seniculus* and *Ateles hybridus* (Rimbach *et al.* 2013) and the effects on seed dispersal (Peres and Palacios 2007). Whoever, other approximations have documented briefly the use of wildlife by the communities (e.g. Antioquia, Sucre, Caldas, Chocó, Vichada, Córdoba, Cauca, Cundinamarca (Arias-Alzate *et al.* 2009, De La Ossa and De La Ossa 2011, 2012a, 2012b, Castaño and Corrales 2010, Ríos *et al.* 2007, Palacios-Mosquera *et al.* 2010, Cruz and Gómez 2011, Martínez-Salas *et al.* 2016, Racero-Casarrubia and González-Maya 2014, Chacón and González-Maya 2013, Aldana *et al.* 2006, Vélez 2004, Osbahr and Morales 2012) or have gave general considerations about this threat on mammals diversity (Sánchez 2000, Ballesteros-Correa and Jorgenson 2009, Ferrer-Perez *et al.* 2009, Ramírez-Chavez *et al.* 2010, Gómez and Montenegro 2012, Escobar-Lasso *et al.* 2014).

Particularly in the northern of Colombia, in the department of Norte de Santander, specifically in the Tamá NNP and its buffer area there are no studies that document about current hunting state and its different methods. Here we present the first approach to characterize the hunting patterns, species use and other threats that are affecting the mammalian species present in the Tamá National Park, and its buffer area. We expect that this information allows to improve or knowledge about these threats in order to generate more appropriate conservation strategies in the region.

Methods

From June 2012 to April 2015 we evaluated the presence of hunting, species uses and its different methods used and its possible effects on mammalian species and the presence of other threats (e.g. deforestation, pollution, presence of feral species and fires) in an area of 216 km² of the Tamá National Natural Park, and its buffer area which includes 13 localities from the 300 to 3450 masl (Figure 1, Table 1). This information was characterized through semi-structured

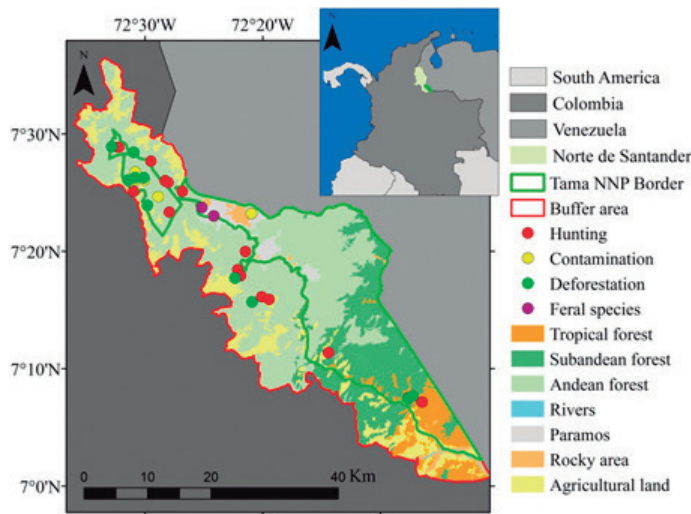


Figure 1. Study area and threats for terrestrial mammals in the Tamá National Natural Park and their buffer zone, Colombia.

interviews with a participatory community approach (White *et al.* 2005). We survey 39 local families, mainly adults and old hunters. The questions included about the hunting type and the use of local wildlife and other potential threats in the area. This process was supported and complemented with camera traps placed in the area, field guides, photographs and illustrations (Emmons and Feer 1997, Aranda 2012).

Hunting patterns were determined according to the species hunted, the reasons for hunting and their potential use by local communities. These were classified as follows: subsistence hunting (SH), conflict hunting (CH), traditional hunting (TH), Sport hunting (SPH) and beliefs or rituals

Table 1. Hunting types (HT) and hunted species by locality in the Tamá National Natural Park and its buffer zone, Norte de Santander, Colombia

Locality	Coordinates	HT	Species/ Part used
Asiria	07° 18' 26.6" N 072° 22' 08.4" W	Subsistence	<i>C. taczanowskii</i> (meat), <i>N. nasua</i> (meat, baculum, skin), <i>D. novemcinctus</i> (meat, shell, extremities), <i>N. granatensis</i> (meat and skin)
	07° 17' 43.8" N 072° 22' 22.2" W	Conflict	<i>M. rufina</i> , <i>T. mexicana</i>
	07° 17' 55.5" N 072° 21' 53.4" W	Tradition	<i>P. concolor</i> , <i>Leopardus wiedii</i> , <i>M. rufina</i>
Santa Isabel	07° 16' 07.3" N 072° 20' 06.2" W	Tradition	<i>N. nasua</i> , <i>D. punctata</i> , <i>C. hoffmanni</i> , <i>T. ornatus</i> , <i>M. frenata</i> <i>D. novemcinctus</i> , <i>C. thous</i> , <i>C. semistriatus</i> , <i>T. mexicana</i> (skin)
	07° 15' 54.5" N 072° 19' 28.5" W	Conflict	<i>P. concolor</i>
Quebrada Grande	07° 27' 41.3" N 072° 29' 30.8" W	Subsistence	<i>C. taczanowskii</i> , <i>M. rufina</i> (meat, skin and extremities), <i>C. semistriatus</i> (meat), <i>N. nasua</i> , <i>D. novemcinctus</i> , <i>N. granatensis</i> , <i>D. punctata</i> (meat), <i>T. mexicana</i> (meat)
San Antonio	07° 12' 10.7" N 072° 14' 02.7" W	Subsistence	<i>D. novemcinctus</i> , <i>C. hoffmanni</i> (meat), <i>M. rufina</i> , <i>D. punctata</i> , <i>C. paca</i> , <i>C. semistriatus</i> , <i>T. ornatus</i> (meat and skin), <i>T. mexicana</i>
Mejue	07° 28' 52.2" N 072° 32' 15.0" W	Tradition	<i>T. ornatus</i> , <i>M. rufina</i> , <i>Choloepus hoffmanni</i> , <i>D. novemcinctus</i> <i>Conepatus semistriatus</i> , <i>D. punctata</i>
	07° 28' 54.9" N 072° 32' 49.7" W	Conflict	<i>P. concolor</i>

Table 1. Hunting types (HT) and hunted species by locality in the Tamá National Natural Park and its buffer zone, Norte de Santander, Colombia

Locality	Coordinates	HT	Species/ Part used
Margua	07° 07' 09.3" N 072° 06' 28.2" W	Subsistence	<i>M. rufina</i> , <i>D. punctata</i> , <i>C. paca</i> (meat), <i>N. nasua</i> , <i>C. hoffmanni</i> , <i>T. mexicana</i>
	07° 07' 32.0" N 072° 07' 39.3" W	Conflict	<i>Panthera onca</i>
Páramo del Tamá	07° 23' 14.0" N 072° 20' 59.0" W	Sport	<i>T. ornatus</i> , <i>N. olivacea</i> , <i>M. rufina</i> , <i>P. concolor</i> (skin, extremities and skull)
La Rochela	07° 26' 46.1" N 072° 30' 50.1" W	Subsistence	<i>N. nasua</i> , <i>M. rufina</i> , <i>C. taczanowskii</i> (meat), <i>M. frenata</i> (meat and skin), <i>C. semistriatus</i> , <i>T. mexicana</i>
	07° 25' 06.9" N 072° 30' 58.7" W	Conflict	<i>P. concolor</i>
Alto del Venado	07° 23' 20.4" N 072° 27' 56.5" W	Subsistence	<i>D. novemcinctus</i> , <i>T. ornatus</i> , <i>P. concolor</i> , <i>C. semistriatus</i> , <i>C. taczanowskii</i> , <i>N. nasua</i> , <i>N. olivacea</i> , <i>D. punctata</i> , <i>C. hoffmanni</i> , <i>N. granatensis</i> , <i>M. frenata</i> , <i>C. paca</i> , <i>M. rufina</i> , <i>T. mexicana</i> , <i>D. pernigra</i> (meat and skin)
Páramo de la Cabrera	07° 25' 51.7" N 072° 28' 03.4" W	Sport	<i>M. rufina</i> , <i>N. olivacea</i> , <i>N. nasua</i> , <i>T. ornatus</i> , <i>C. taczanowskii</i>
Belchite	07° 19' 59.2" N 072° 21' 28.8" W	Conflict	<i>P. concolor</i> , <i>T. mexicana</i>
Orocué	07° 25' 06.4" N 072° 26' 49.8" W	Sport	<i>L. wiedii</i> (skull and skin), <i>T. mexicana</i>
Páramo de Santa Isabel		No records	

hunting (HBR) (Palacios-Mosquera *et al.* 2010, Rojas *et al.* 2013). Furthermore, we characterize the different hunting techniques employed and the type of species hunted as follows: The use of dogs, guns, lances, trappers, wooden slingshots (“caucheras” in Spanish), or by hand. To evaluate this information and their relationships a statistical analysis using the Bray-Curtis dissimilarity metrics and a heatmap were implemented using the Vegan 2.0. package (Oksanen *et al.* 2013) on R. 3.0.2 software (R Core Team 2013). At the same time, mammals remain donated by farmers and hunters were used as evidence of the hunting processes carried out in the area, which were used also for the species taxonomic identification (Tlapaya and Gallina 2010, Cáceres-Martínez *et al.* 2016, Figura 3).

Results

A total of 39 interviews were conducted, 37 (95%) were adults, of which 19 (48%) were hunters. The main hunting patterns were SH (67.5%) and TH (17.5%), which registered the greatest number of species hunted, with 15 and 13 mammalian species respectively (Table 1, Figure 2). These patterns were followed by the SPH (10%) and CH (5%), with seven and three species respectively. In terms of the hunting techniques, the use of firearms are the most used methods (54% of the recorded events), followed by the use of dogs (39% of the events) and other elements such as spears and “caucheras” (16%).

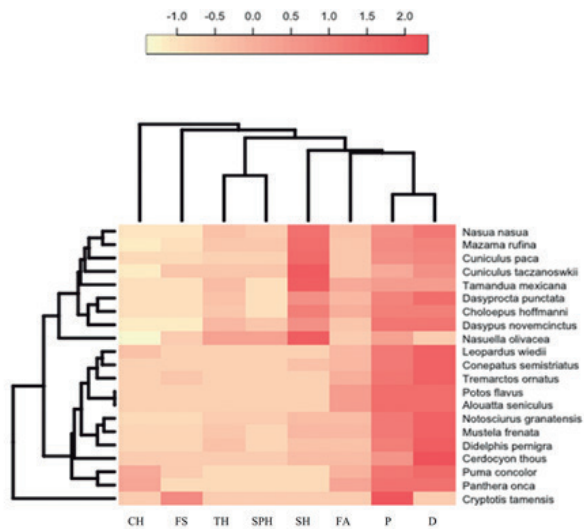


Figure 2. Relationships between hunting types and species within the protected area. Subsistence hunting (SH), conflict hunting (CH), traditional hunting (TH) and Sport hunting (SPH). Feral Species (FS), Fires and arsons (FA), Hunting (H), Contamination (P), livestock (L) and Deforestation.

species, and arsons are the most frequent. Deforestation and pollution are the most predominant, covering the 76 (10 localities), 76 and 69% (9 localities) of the area followed by livestock (61% of localities). While arsons and the presence of feral species were less represented but not less important, with 23% and 8% of the localities respectively.

Discussion

In the Tamá NNP have been reported near 21 species of medium an large terrestrial mammal's (Cáceres-Martínez *et al.* 2016, Cáceres-Martínez *et al.* 2017), of which 18 (86%) species are under some kind of hunting as we observe herein (Table 1, Figure 2). These species are under constant hunting pressure in all these communities, mainly as food resource and due to conflict, which could be having important effects leading to population declines and possibly leading to local extinctions (Kays *et al.* 2017)

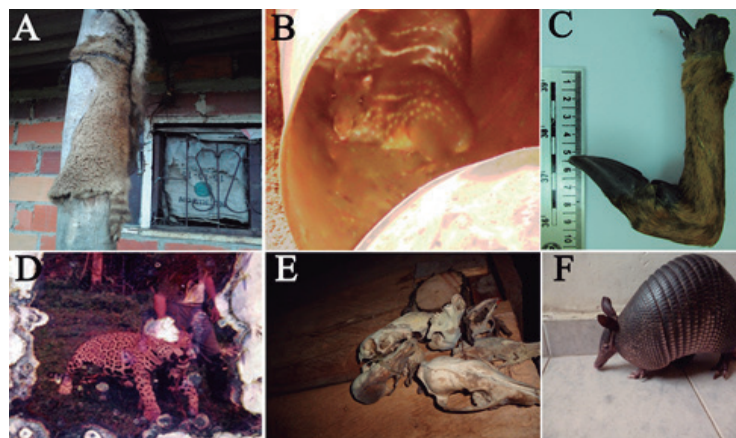


Figure 3. Some of the species hunted in the Tamá NNP and their buffer zone. A. *Nasua nasua* fur skin used as adornment. B. *Cuniculus paca* kept in captivity for consumption. C. *Mazama rufina* limb used as a trophy. D. Historical record of a *Panthera onca* hunted in the Margua sector. E. *Nasua nasua* and *Cerdocyon thous* skulls used as trophies. F. *Dasypus novemcinctus* kept in captivity for consumption.

According to the species used, it was observed that the parts of the hunted animals were used mainly as ornaments and for housework. Carcass of *Dasyus novemcinctus* are used to make dishes, while skins of *Tamandua Mexicana*, *Mazama rufina* and *Tremarctos ornatus*, *Notosciurus granatensis*, *Nasua nasua*, *Nasuella olivacea*, *D. novemcinctus*, *Cerdocyon. Thous* and *Potos flavus* are used for making rugs

or ornaments. Likewise, fur skins and the baculum of *Nasua nasua* and *Nasuella olicacea* are used for production of rustic bags and aphrodisiac powder. On the contrary, fur skins and claw of *T. ornatus* and *Puma concolor* are used as a hunting trophy (Figure 3, Table 1).

Among the other threats found in the area, pollution, deforestation, livestock, the presence of feral

both inside the park and in its buffer area. Other species present in the park such as *Cryptotis tamensis*, *Potos flavus* and *Alouatta seniculus* apparently do not face any hunting pressure possibly because the communities do not see any immediate use, or have conflict with them or possible they do not see these species as a food resource as seen in other areas at least with the last two species (Bodmer *et al.* 1997, De Souza-Mazurek *et al.* 2000, Peres 2000). However, it is important to note that the hunting effects could be differential throughout the park according to the preferences of each community, that would probably would probably put some species at greater risk than others, for example medium and large mammals are among the most harvested species followed by bird and reptile (De Souza-Mazurek *et al.* 2000, Peres 2000).

According to hunting types, the preference for the use of shotguns and dogs is similar to what is found in other studies (Escobedo *et al.* 2006, Palacios-Mosquera *et al.* 2008, Racero-Casarrubia and González-Maya 2014). However, in some localities as Margua, hunters construct permanent firetraps-weapons within the forest, call “tramperos”, mainly used for species such as *Cuniculus paca*, *Mazama rufina* and *Dasyprocta punctata*. This is one of the most dangerous practices that have been carried out in the park and other areas in Colombia (e.g. Middle Magdalena Valley, Arias-Alzate pers. obs.), since it does not discriminate species, sex or reproductive status, what becomes a great threat to the species conservation in the area. Also, this practice has been seen to have important consequences for the species population and its continued use is not sustainable in the long term (Pacheco *et al.* 2004, Chacón and González-Maya 2013, Martínez-Polanco and Montenegro 2015). Thus monitoring and control of the possession of weapons, and hunting dogs inside and outside of the park can be considered an important measure to prevent hunting within the area.

On the other hand, the presence of traditional hunting and sport hunting occurs on specific areas of the park, although in a lesser extent also contributes to the reduction of vulnerable species such as the Andean bear (*T. ornatus*, at least 5 individuals have been hunted in the last two years), the puma (*P. concolor*) and the jaguar (*Panther onca*). Curiously other hunting patterns such as rituals, trade or medicinal

propose were not documented in the area as has been documented in other regions of the country (Castaño and Corrales 2010, Palacios-Mosquera *et al.* 2010), perhaps people were afraid to supply this type of information. Nevertheless, we find on a small scale, that some species of snakes mixed with herbs are used as medicinal elements (is believed to cure arthritis).

The Tamá NNP presents other several threats to the conservation of medium and large mammals and other species. Activities such as habitat deforestation for cattle ranching, infrastructure expansion, introduction of feral species and agriculture are added to the effects generated by hunting and thus exacerbating the effects and pressure on wildlife populations, which could lead to changes on the structure of vertebrate communities and could generate local extinctions at the medium or long term (De Souza-Mazurek *et al.* 2000, Peres 2000). Therefore, is imperative the inclusion of these thematic in the management and planning of protected areas such Tamá NNP in order to ensure the protection of biodiversity and its regional natural resources (Minambiente 2008, Ruiz *et al.* 2012). In this sense, we consider that rural communities have an important role and can become a key factor in the conservation of biodiversity (Naughton-Treves *et al.* 2003, López-Arévalo *et al.* 2011), since they could look after the preservation of biological communities and ecosystems in this protected area regardless of its conservation figure, in exchange for better living conditions.

We hope that the information obtained herein help to improve our knowledge of these threats and allow to generate concrete management actions in the region. We highlight the possible control of feral species within the area. The success of the strategies for the prevention, management and control of these threats will depend on the communities' inclusion and participation in order to promote knowledge and the effective management and conservation of one of the most biodiverse regions of northern Colombia.

Conclusions

- The main hunting patterns that takes place in the Tamá NNP and its buffer zone are subsistence hunting (11 localities; 14 species) and retaliation conflict hunting (4 localities; 3 species). The use of “tramperos” is one of the most dangerous prac-

tices since it does not discriminate species, sex or reproductive status, what becomes a great threat to the species conservation in the area.

- It is important to document the biomass and the number of individuals extracted in order to elucidate the potential effects that this may be having on the ecosystems in these areas. A first step is to incorporate this information into the park management actions plans.
- If we want to change the perception that communities have about biodiversity and the environment for a more sustainable conservation, it is important to include them in these management and conservation processes. Rural communities have an important role and can become a key factor in the conservation of biodiversity in the region.

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