The camera trap as a powerful tool for mammal sightings to improve the knowledge of species distribution and diversity records in Colombia

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The continued rise in the world's human population, currently estimated at over seven billon (United Nations, 2014. http://esa.un.org/unpd/), has led to urban agglomeration, and the creation and expansion of rural areas. Subsequently, the increase of mega-projects – hydroelectric, mining and petrol stations, agricultural and highway projects – have led to deforestation, and forest fragmentation and degradation. These human activities negatively impact natural ecosystems causing a rise in the number of vulnerable species (UNEP, 2008), a reduction in species diversity and an increase in species density due to restrictions on their distribution. Ultimately, each species is forced to adapt to different and often less heterogeneous environments through evolutionary processes or face becoming extinct.

The first population census conducted in Colombia in 1918 recorded a total of 5,472,604 inhabitants. Since then, the last census in 2005 (http://www.dane.gov.co/index.php/poblacion-y-registros-vitales/censos/censo-2005) revealed a seven-fold recorded population increase to 41,468,384. This population increase has reduced overall forest coverage where only reserves and national parks survive as places protecting wildlife from hunting, and urban and industrial mega-projects (Convention of Biological Biodiversity, submitted through National Law 165 of 1994). Colombia has a continental area of over one million squared kilometres, of which only 12% is part of its National System of Protected Areas (SINAP).

The first species "inventories" conducted in Colombia showed great biodiversity and wildlife richness. Begun in 1783 by Jose Celestino Mutis, the Botanic Expedition was a thirty-year study that described approximately 20,000 plant and 7,000 animal species. Post-dating Mutis' expedition there have been few published biodiversity studies on Colombia's mammals. Noteworthy are: Eisenberg (1989), Emmons (1990), Rodríguez-Mahecha *et al*. (1995), Cuervo *et al*. (1986), Alberico *et al*. (2000) and Alberico and Rojas-Diaz (2002). Most recently, Solari *et al*. (2013) recorded 492 mammal species in Colombia, of which 91 are considered endangered species.

Mammal studies in Colombia over the last 20 years have been conducted as environmental studies required, amongst others, for hydroelectric, mining, petrol, agricultural and interstate highway development permission. These studies led by biologists, veterinarians and forest engineers, frequently use three types of observational methods: direct, using amongst others Sherman and Tomahawk traps, and mistnets; indirect, by tracking animal footprints and dung; and camera traps (CT). Use of CT are cost and time efficient and are ideal for surveying medium and large mammals in forest areas where direct and indirect methods are not practical. In surveys small traps are the most commonly used which likely bias species counts towards smaller mammals. Therefore, the question arises if in Colombia we have an accurate understanding of the number, distribution and ecology of medium and large mammal species.

The World Wildlife Fund (WWF, https://worldwildlife.org/initiatives/camera-traps) promotes the use of CT for biodiversity and ecology studies, as they have the capability to provide sightings of rare or hard to see mammals. For example, the use of CT technology by El Sistema de Parques Nacionales Naturales de Colombia (http://www.parquesnacionales.gov.co/portal/fototrampeo/) have recorded *Tremarctos ornatus* and *Odocoileus virginianus*, and Aburra Natural have recorded *Cuniculus taczanowskii* and *Eira barbara* in peri-urban areas of Medellín (http://www.aburranatural.org/) (Delgado *et al*., 2011); species that are difficult to observe with traditional methods.

In this study we set CT (Bushnell, Trophy Cam, HD, 119537C) in two locations near El Valle de Aburra, Department of Antioquia, Colombia, an area of 1,157 km^2 and approximately 3.5 million inhabitants. Location 1. Municipality of Sabaneta, village La Romera. Location 2. Municipality of Fredonia, coffee plantations in village Jonas. In addition we also set CT in the Municipality of Trinidad, Department of Casanare, Colombia. In all locations three CT were set for 30 days attached to tree trunks at 50 cm above land level. Trap locations were chosen inside fragmented forest patches that interconnect human dwellings or farms, which showed evidence of animal tracks. After 30 days the CT were disassembled and the data records analysed in the laboratory. It is worth noting that none of the study sites in this research are considered protected areas by SINAP.

Our results show a diverse group of mammalian species inhabiting areas near El Valle de Aburra (Antioquia), Fredonia (Antioquia) and Trinidad (Casanare) (Table 1). A total of 23 species were sighted, including large mammals that cannot be caught in small Sherman or Tomahawk traps. Amongst the mammals observed were five of the six species of Felidae reported in Colombia: *Puma concolor, P. yagouaroundi*, *Leopardus pardalis, L. wiedii and L. tigrinus.* These mammals were sighted in areas of small fragmented forest around human populations, environments atypical of these species' natural habitats. We therefore suggest that these mammals are adapting to new environments due to human incursion into their natural habitats and/or are using forest fragments as corridors for movement. Further studies are necessary to understand the ecology of the species observed in our research.

In the tropics, mammals have an important role as hosts of different diseases such as arbovirus, leishmaniasis, rabies and Chagas (Travi *et al*., 1994). The black-eared common opossum (*Didelphis marsupialis*) is one of the main reservoirs of leishmaniasis and Chagas (Travi *et al*., 1994). However, may be their frequent incrimination as reservoirs is a consequence of these species being easy to capture with Tomahawk traps, the trap most frequently used in surveys. Our results show a higher than expected number of wildlife living near to houses in villages and towns that could also have a role in the transmission of zoonoses (Bengis *et al*., 2004). These mammalian "reservoirs" may continue to go unnoticed if CT technologies/methodologies are not adopted. It should be noted that other mammals such as bats and small rodents are also important reservoirs of diseases, which in addition to those species that are important in maintaining tropical forest ecosystems such as, insectivores, pollinators and seed dispersers, are difficult to sight with CT. Therefore, we suggest a combination of traditional methods observation (direct and indirect) complemented with CT to know the complete diversity of species in a specific area.

This study demonstrates that not only the areas protected by SINAP, but also small forest fragments on the periphery of the cities and coffee plantations for example, need to be conserved and studied due to the underestimation and lack of studies of the mammal species present.

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LITERATURE CITED

Alberico, M.A., A. Cadena, J. I. Hernández-Camacho & Y. Muñoz-Saba. 2000. Mamíferos (Synapsida: Theria) de Colombia. Biota Colombiana 1: 43-75.

Alberico, M. & V. Rojas-Diaz. 2002. Mamiferos de Colombia. In G. Ceballos y J.A. Simonetti. Eds. Diversidad y conservación de los mamíferos neotropicales, Conabio-UNAM, Mexico, D. F. Pp 185-226.

Bengis, R.G., F.A. Leighton, J.R. Fischer, M. Artois, T. Morner & C.M. Tate. 2004. The role of wildlife in emerging and re-emerging zoonoses. Revue Scientifique et Technique. 23: 497-511.

Cuervo, D. A., J. Hernandez & A. Cadena. 1986. Lista actualizada de los mamíferos de Colombia, anotaciones sobre su distribución. Caldasia. XV: 71-75.

Delgado, C.A., Alzate-Arias, A., Botero, S & Sanchez-Londoño, J.D. 2011. Registro de *Cuniculus taczanowskii* (Rodentia: Cuniculidae) y *Eira barbara* (Carnivora: Mustelidae) en una zona periurbana de Medellín, Colombia. Brenesia. 75-76: 124-126.

Eisenberg, J.F. 1989. Mammals of the Neotropics, The Northern Neotropics, Volume 1. The University of Chicago Press. Chicago. 449 pp.

Emmons, L. 1990. Neotropical Rainforest Mammals: A Field Guide. The University of Chicago Press. Chicago. 281 pp.

Rodríguez-Mahecha, J.V., J.I. Hernández-Camacho, T.R. Defler, M. Alberico, R.B. Mast, R.A. Mittermeier & A. Cadena. 1995. Mamíferos colombianos: sus nombres comunes e indígenas. Conservation International, Santafé de Bogotá, 56 pp.

Solari, S., Y. Muñoz-Sabana, J.V. Rodríguez-Mahecha, T.R. Defler, H.E. Ramírez-Chávez & F. Trujillo. 2013. Riqueza, endemismo y conservación de los mamíferos de Colombia. Mastozoologia Neotropical. 20: 301-365.

Travi, B.L., C. Jaramillo, J. Montoya, I. Segura, A. Zea, A. Goncalves & I.D. Velez. 1994. *Didelphis marsupialis*, an important reservoir of *Trypanosoma* (*Schizotrypanum*) *cruzi* and *Leishmania* (*Leishmania*) *chagasia* in Colombia. American Journal of Tropical Medicine and Hygiene. 50: 557-65.

UNEP – The United Nations Enviroment Programme. Vital Forest Graphics. 2008. FAO, UNFF. Produced by UNEP/GRID-Arendal. Job No. DEW/1032/NA. Pp 1-67.

Table 1. Recordings and counts of mammal species sighted with camera traps in three localities of Colombia: **Ca:** Casanare, N = 8, Video: http://www.yo utube.com/watch?v=CbdLqNRVg7Q&feature=share. **Sa:** Sabaneta**,** Antioquia, N = 9, Video: https://www.youtube.com/watch?v=jpbe_maA1_Q. **Fre**: Fredonia, Antioquia, N = 8, Video: https://www.youtu be.com/watch?v=l-ZiAL1HI0I&feature=share.

Family / Species	Common name	Localities		
		Ca	**Sa**	**Fre**
Didelphidae				
Didelphis marsupialis Linnaeus, 1758	Chucha	**x**	**x**	**-**
Marmosa sp. Gray, 1821.	Marmosa	**-**	**-**	**x**
Dasypodidae				
Dasypus sp Linnaeus, 1758	Armadillo	**x**	**-**	**x**
Cabassous centralis (Miller, 1899)	Armadillo	**-**	**-**	**x**
Myrmecophagidae				
Tamandua tetradactyla Linnaeus, 1758	Oso hormiguero	**x**	**-**	**-**

Table 1, continues

Family / Species	Common name	Localities		
Canidae				
Cerdocyon thous (Linnaeus, 1766)	Perro zorro	-	-	x
Procyonidae				
Nasua nasua (Linnaeus, 1766)	Coati	-	x	-
Procyon cancrivorus (G.[Baron] Cuvier, 1798)	Mapache	-	-	x
Nasuella olivacea (Gray, 1865)	Coati de montaña	-	x	-
Mustelidae				
Mustela frenata Lichtenstein, 1831	Mustela	-	x	-
Eira barbara (Linnaeus, 1758)	Tayra	-	x	x
Felidae				
Puma concolor Linneo, 1771	Puma, león americano	x	x	-
Leopardus pardalis (Linnaeus, 1758)	Ocelote	-	x	-
Leopardus wiedii (Schinz, 1821)	Margay	-	-	-
Leopardus tigrinus (Schreber, 1775)	Oncilla	-	-	-
Puma yagouaroundi (É. Geoffroy Saint-Hilaire, 1803)	Jaguaroundi	-	-	x
Suidae				
Sus scrofa Linnaeus, 1758	Cerdo común (cerdo feral)	x	-	-
Sciuridae				
Sciurus granatensis Humboldt, 1811	Ardilla roja	-	x	x
Microsciurus sp. J. A. Allen, 1895.	Ardita	-	x	-
Dasyproctidae				
Dasyprocta fuliginosa Wagler, 1832	Agutí negro	x	-	-
Cuniculidae				
Cuniculus paca (Linnaeus, 1766)	Guagua	x	-	-
Cuniculus taczanowskii (Stolzmann, 1865)	Guagua de montaña	-	-	-
Caviidae				
Hydrochoerus hydrochaeris (Linnaeus, 1766)	Chigüiro	x	-	-