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Northernmost distribution of the Andean bear (*Tremarctos ornatus*) in South America, and fragmentation of its associated Andean forest and Paramo ecosystems

DANIEL RODRÍGUEZ¹, ADRIANA REYES¹, NICOLÁS REYES-AMAYA^{1,2*}, SILVANA GALLEGOS-SÁNCHEZ³, JORGE GUTIERREZ^{1,4}, RAÚL SUÁREZ⁴ AND FERNANDO PRIETO⁵

¹ Fundación para la Investigación, Conservación y Protección del Oso Andino (Fundación Wui). Calle 161 25C-30, Bogotá 110911. Colombia. Email: danielosito85@hotmail.com (DR), shisdre@hotmail.com (AR), jegumo@gmail.com (JG).

² Consejo Nacional de Investigaciones Científicas y Técnicas - Unidad Ejecutora Lillo (CONICET-UDEL). Miguel Lillo 251, San Miguel de Tucumán 4000. Argentina. Email: nreyesa@unal.edu.co (NRA).

³ Carrera de Biología, Facultad de Ciencias Biológicas, Universidad Central de Ecuador, Quito, Ecuador (UCE). Calle Iquique 14-121, Quito 170136. Ecuador. Email: yantana.sags@gmail.com (SGS).

⁴ Corporación Autónoma Regional del Cesar (CORPOCESAR). Carrera 9A 9-88, Valledupar 200001. Colombia. Email: raulsuarez@corpocesar.gov.co (RS).

⁵ Corporación Autónoma Regional de la Guajira (CORPOGUAJIRA). Carrera 9A 9-88, Valledupar 200001. Colombia. Email: f.prieto2@gmail.com (FP).

*Corresponding author

Current northernmost distribution of the Andean bear (*Tremarctos ornatus*) is not defined precisely; mentioned to be located “at the Serranía del Perijá” without accurate/confirmed distribution records, and placed by the IUCN at the Serranía de Portuguesa (Venezuela). There is an information gap on the fragmentation of the Andean bear associated ecosystems (Andean forest and Paramo) throughout its distribution in Colombia and Venezuela. The aim of this study is to provide precise knowledge on the current northernmost distribution of the Andean bear in South America at the Serranía del Perijá, besides quantifying spatial trends of the fragmentation of its associated ecosystems at the eastern and western slopes. Confirmed distribution records were obtained from field surveys (2009 to 2016), literature, scientific collections and biodiversity databases. The fragmentation degree of Andean bear associated ecosystems was characterized using FRAGSTATS (V 4.2) software with satellite images from 2008. A current population block with at least three sectors of incidence is present along both slopes of the Serranía del Perijá. Although the Colombian slope comprises greater raw area of Andean bear associated ecosystems, it is highly fragmented and isolated. Core area analysis (extracting a disturbance buffer of 1,000 m into the border of each patch) exhibits a Venezuelan slope maintaining greater amount of Andean bear associated ecosystems at few, large and less fragmented patches. This study extends the distribution of the species 180 km until the north of the Serranía del Perijá (regarding the current distribution recognized by the IUCN) and provides the northernmost confirmed distribution records for South America: Barrancas (Colombia) and Mara (Venezuela) municipalities. This study provides the first fine-scale information on Andean bear associated ecosystems fragmentation for Colombia and Venezuela, with traceable landscape measurements permitting future long-term comparative analyses. A high fragmentation degree of the Andean bear associated ecosystems is present at the Colombian slope of the Serranía del Perijá due to extensive legal and illegal agricultural activities and wood extraction. The lack of information about the Andean bear distribution and its associated ecosystems fragmentation could be putting the survival of local populations at risk, while a clear knowledge on these issues could generate planned conservation actions by the governmental environmental authorities.

La distribución más septentrional actual del oso andino (*Tremarctos ornatus*) no está definida con precisión; generalmente se le localiza “en la Serranía del Perijá” sin registros precisos/confirmados, y la UICN la ubica en la Serranía de Portuguesa (Venezuela). Existe un vacío de información de la fragmentación de los ecosistemas asociados al oso andino (bosque Andino y Páramo) en Colombia y Venezuela. El objetivo de este estudio es brindar conocimiento preciso sobre la distribución más septentrional del oso andino en Suramérica en la Serranía del Perijá, además de cuantificar las tendencias espaciales de la fragmentación de sus ecosistemas asociados en las vertientes occidental y oriental. Los registros de distribución confirmados se obtuvieron de exploraciones de campo (2009 to 2016), literatura, colecciones científicas y bases de datos de biodiversidad. El grado de fragmentación de los ecosistemas asociados al oso andino se caracterizó utilizando el software FRAGSTATS (V 4.2) con imágenes satelitales del 2008. Un bloque poblacional actual con al menos tres sectores de incidencia está presente en ambas laderas de la Serranía del Perijá. Si bien la vertiente colombiana presenta una mayor área en bruto de los ecosistemas asociados del oso andino, está altamente fragmentada y aislada. Análisis de área de núcleo (extrayendo un área de influencia de perturbación de 1,000 m desde el borde de cada parche) exhiben que la vertiente venezolana contiene una mayor cantidad de ecosistemas asociados al oso en pocos parches, grandes, y menos fragmentados. Este estudio extiende la distribución de la especie 180 km hasta el norte de la Serranía del Perijá (en relación con la distribución actual reconocida por la UICN) y proporciona los registros de distribución más septentrionales confirmado para Sudamérica: municipio de Barrancas (Colombia) y Mara (Venezuela). Este estudio proporciona la primera información a escala fina sobre la fragmentación de los ecosistemas asociados al oso andino para Colombia y Venezuela, con mediciones espaciales del paisaje monitoreables, permitiendo análisis comparativos a largo plazo. Un alto grado de fragmentación de los ecosistemas asociados al oso andino está presente en la vertiente colombiana de la Serranía del Perijá debido a actividades agrícolas legales e ilegales y extracción de madera. La falta de información sobre la distribución del oso andino y la fragmentación de sus ecosistemas asociados podría poner en riesgo la supervivencia de las poblaciones locales, mientras que un conocimiento claro sobre estos temas podría generar acciones de conservación planificadas por parte de las autoridades ambientales gubernamentales.

Key words: Colombia; ecosystems fragmentation; northernmost distribution; *Tremarctos ornatus*; Venezuela.

Introduction

The Andean bear (*Tremarctos ornatus*) is the only extant Ursid in South America (Peyton 1999), and categorized as Vulnerable (VU) to extinction by the International Union for the Conservation of Nature (IUCN) due to increasing threats such as habitat loss (deforestation and extension of agricultural activities), and illegal hunting of specimens as retaliation because human-bear conflicts (Velez-Liendo and García-Rangel 2017). The distribution of the Andean bear is strongly associated to the Andean mountain range, in discontinuous population blocks (Kattan *et al.* 2004) located from the Republic of Colombia and the Bolivarian Republic of Venezuela (Rodríguez *et al.* 2003; García-Rangel 2012) at the north, to the Plurinational State of Bolivia and the Republic of Argentina (Del Moral and Lameda 2011; Teta *et al.* 2018) at the south.

The northern distribution of the Andean bear in South America has been reported to extend until the Serranía de Portuguesa at Sierra de Mérida along the north-eastern Venezuelan territory (Yerena *et al.* 2007), and the Serranía del Perijá along the northern Colombian and Venezuelan geographic limits (Rodríguez and Lozada 1989; Peyton 1999; Rodríguez *et al.* 2003; Corredor-Carrillo and Muñoz-Saba 2007; Yerena *et al.* 2007; Solari *et al.* 2013). However, the current northernmost distribution of the Andean bear in South America has not been defined precisely; most authors have suggested this northernmost distribution as being located “at the Serranía del Perijá”, without accurate and confirmed distribution records along this mountain range (Rodríguez and Lozada 1989; Peyton 1999; Rodríguez *et al.* 2003; Corredor-Carrillo and Muñoz-Saba 2007; Yerena *et al.* 2007; Solari *et al.* 2013). The IUCN reports the current northernmost distribution of this species at the Venezuelan Serranía de Portuguesa (north-eastern portion of the Sierra de Mérida; Velez-Liendo and García-Rangel 2017). Although Mondolfi (1989) and Vilorio *et al.* (1995) provided some confirmed distribution records of the Andean bear for the eastern slope of the Serranía del Perijá at Venezuela, these records corresponds to the 50’s, 70’s and 90’s decades.

The lack of information about the Andean bear distribution could be putting the survival of local populations at risk (García-Rangel 2012). Additionally, there is a knowledge gap about the fragmentation of Andean bear associated ecosystems (Andean forest and Paramo) along its Colombian and Venezuelan distribution. In this sense, the aim of this study is to provide precise knowledge on the current northernmost distribution of the Andean bear in South America at the Colombian and Venezuelan Serranía del Perijá, and quantify spatial trends of fragmentation processes of the Andean bear associated ecosystems at the western (Colombia) and eastern (Venezuela) slopes of this mountain range. This constitute a contribution to the knowledge of the species and its associated ecosystems, for the elaboration of future habitat monitoring initiatives and accurately planned conservation actions headed by the environmental authorities (governmental institutions) at their respective local jurisdictions.

Methods

During the years 2009–2016, 15 field surveys were carried out in the Colombian municipalities of Becerril, Chimichagua, Codazzi, Curumaní, La Jagua de Ibirico, La Paz, Manaure, San Alberto (department of Cesar), Barrancas, El Molino, La Jagua del Pilar, Urumita, and Villanueva (department of La Guajira; Figure 1). Additionally, involuntary incursions to the Bolivarian Republic of Venezuela was made during field surveys searching Andean bear traces (see Appendix 1).

In order to obtain accurate and confirmed distribution records of the Andean bear in northern Colombia along the Serranía del Perijá, the zones with recent information of possible presence of the Andean bear (based on the information from the local communities) were visited at each sampled municipality. The presence of the species was verified through the search of bear traces during field surveys in Andean forest and Paramo ecosystems (*e. g.*, foot prints, tracks, bark of trees marked with scratches, feeding traces, feces, direct observations), and occasionally installing camera traps (just for the municipalities of Manaure and La Paz, department of Cesar). Additionally, we performed a revision of online information about presence records of the species (*e. g.*, voucher specimens, camera trap images, direct observations and indirect traces of presence) from scientific literature, scientific collections (Alberto Cadena García Mammal Collection of the Instituto de Ciencias Natu-

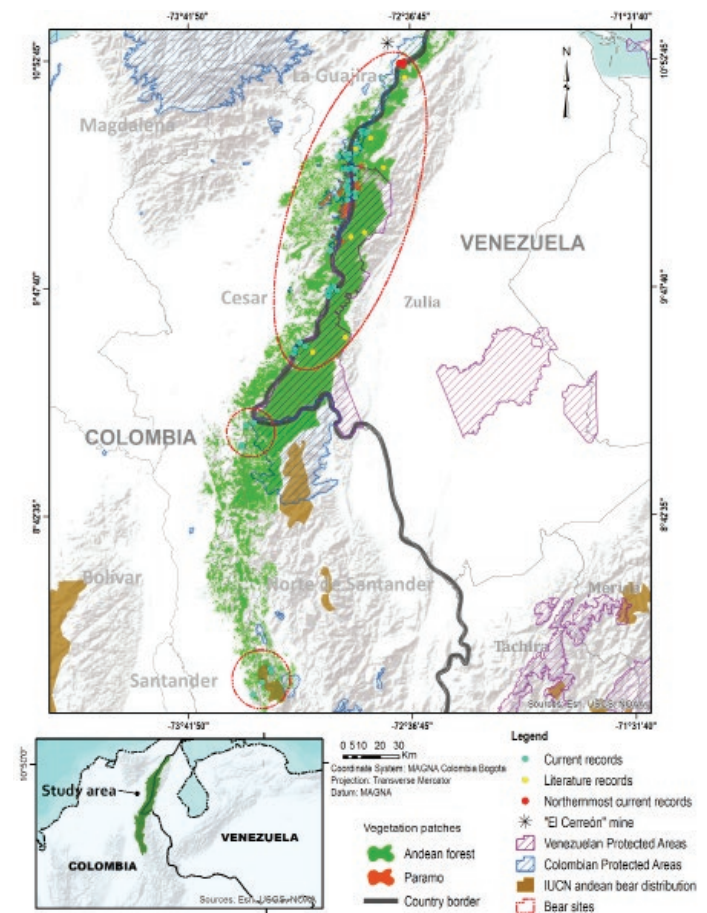


Figure 1. Confirmed presence records of the Andean bear (*Tremarctos ornatus*) obtained during the field surveys made for this study, and within the revised literature, including the northernmost distribution records for the species at South America.

rales, ICN; Mammal Collection of the Instituto Alexander von Humboldt, IAvH) and Biodiversity databases (Global Biodiversity Information Facility, GBIF; Mammal Networked Information System, MaNIS; System of Information on Biodiversity of Colombia, SIB). The distribution records obtained through the different sampling methods were organized at Appendix 1, including information on locality, geographical coordinates and type of record (Appendix 1), also being displayed on a map (Figure 1).

A characterization of the fragmentation degree of Andean bear associated ecosystems (Andean forest and Paramo) at the Colombian (western) and Venezuelan (eastern) slopes of the Serranía del Perijá was performed through the analysis of satellite images from 2008 (TERRA ASTER satellite: 3A1-70, 3A1-71, 3A1-72, 3A1-73, 3A1-74; SPOT satellite: 645-330, 646-329, 56463290503141521431A, 2A/203045101). The satellite images were interpreted using ArcMap software (v10.1; ESRI, Redlands, CA, USA), taking into account land coverages over 500 m of elevation to generate a landscape coverage map (scale 1:100,000). Three landscape coverage classes were established: Andean forest (comprising natural Andean forest coverages, considered as natural habitat of the Andean bear), Paramo (comprising natural highland shrubs and grass coverages, considered as natural habitat of the Andean bear), and transformed coverages (comprising anthropogenic or anthropogenic-natural mixed landscape coverages such as pasturelands, croplands and urban areas, not considered as natural habitat of the Andean bear). A raster image (250 m resolution) was extracted from the landscape coverage map and analyzed with FRAGSTATS software (v4.2; [McGarigal et al. 2012](#)). Twelve metrics at landscape (overall landscape configuration), class (specific landscape coverages configuration) and patch (individual patch configuration, including a core area analysis extracting a disturbance buffer of 1,000 m into the border/edge of each patch) levels were calculated (for detailed descriptions of metrics see Table 1), quantifying the fragmentation spatial trends for the Andean bear associated ecosystems at the western (Colombia) and eastern (Venezuela) slopes of the Serranía del Perijá (Table 1). Taking into account the current knowledge of home ranges for female (1,477 ha) and male (5,908 ha) Andean bears ([Castellanos 2011](#)), individual patches were also categorized per area interval as small (1 ha < patch ≤ 1,500 ha), medium (1,500 ha < patch ≤ 6,000 ha) and large (patch > 6,000 ha) patches. The Andean bear associated ecosystems fragments (patches) were displayed on a map (Figure 1). Although Andean bears do not recognize political geographic limits at its natural movements across associated ecosystems, we focused the fragmentation analysis at a bi-national (Colombia and Venezuela) scale, as a contribution to future management efforts headed by environmental authorities (governmental institutions) of both countries at their respective local jurisdictions.

Results

From the field surveys, 97 confirmed presence records of the Andean bear was found along the Serranía del Perijá at the municipalities of Becerril, Chimichagua, Codazzi, Curumaní, La Jagua de Ibirico, La Paz, Manauare, San Alberto (department of Cesar), Barrancas, El Molino, La Jagua del Pilar, Urumita and Villanueva (department of La Guajira) for the western slope of the Serranía del Perijá at Colombia, and at the municipalities of Mara, Jesús Enrique Lozada, Rosario de Perijá and Machiques de Perijá (state of Zulia) for the eastern slope of the Serranía del Perijá at Venezuela (involuntary incursions to the Bolivarian Republic of Venezuela during field surveys while searching Andean bear traces). Literature review provided eight presence records of the Andean bear at the municipalities of Mara, Jesús Enrique Lozada, Machiques del Perijá and Rosario del Perijá (state of Zulia) for the eastern slope of the Serranía del Perijá at Venezuelan ([Mondolfi 1989](#); [Viloria et al. 1995](#); Appendix 1), and did not yield results for the western slope of the Serranía del Perijá at Colombia. The revision of online records coming from scientific collections and biodiversity databases did not yield results for presence records of the Andean bear at the north of Colombia and Venezuela along the Serranía del Perijá.

We report the current northernmost distribution records of the Andean bear in South America for the locality Monte Fresco at the western slope of northern Serranía del Perijá in Colombia (municipality of Barrancas, department of La Guajira), and the adjacent eastern slope of northern Serranía del Perijá in Venezuela (municipality of Mara, state of Zulia; Figure 1; Appendix 1). These northernmost records corresponded to recent scratches on trees of Nigüito (*Miconia* sp.), Aguacatillo (*Persea* sp.), Pringamoza (*Urera bac-cifera*), Guamo (*Inga* sp.) and feces on natural bear trails into the Andean forest, as well as direct observations of an individual feeding on corn and plantain crops (Appendix 1).

The results of the characterization of the spatial trends of fragmentation degree of the Andean bear associated ecosystems (Andean forest and Paramo) along the Serranía del Perijá are summarized in Table 1. The Colombian slope possess a much greater fragmentation degree regarding the Venezuelan one, represented by greater patches diversity index values (SHDI: 0.78 Colombia vs 0.48 Venezuela; SIDI: 0.52 vs 0.25) at the landscape level analyses (Table 1), a greater number of patches (NP: 336 vs 19; class level analysis), smaller size of patches (AREA_MN: 628.46 ha vs 7,119.18 ha) and bigger isolation between patches (ENN_MN: 650.86 m vs 520.75 m) for the Andean forest (the dominant landscape coverage for both slopes in terms of surface and patch occurrence, Table 1), as well as greater edge amount for the Andean forest (ED: 13.48 m/ha vs 3.13 m/ha) and Paramo (ED: 0.63 m/ha vs 0.45 m/ha), and a greater irregular shape of patches for the Andean forest (SHAPE_MN: 1.63 vs 1.59) and Paramo (SHAPE_MN: 2.24 vs 1.91), at the class level analyses (Table 1).

Table 1. Metrics quantifying spatial trends of Andean bear associated ecosystems fragmentation degree for the year 2008 at the Colombian (western) and Venezuelan (eastern) slopes of the Serranía del Perijá.

Metrics level	Metric	Description	Category	Value	
				Colombia	Venezuela
Landscape level	Shannon's Diversity Index (SHDI)	Increases as the number of different patch classes increases (patch richness). Equals "0" when the landscape contains only 1 patch of a particular class of landscape coverage (no diversity).	Landscape	0.78	0.48
	Simpson's diversity index (SIDI)	Increases (approaching 1) as the number of different patch types (patch richness) increases. Equals "0" when the landscape contains only 1 patch of a particular class of landscape coverage (no diversity).	Landscape	0.52	0.25
Class level	Total class area (CA)	It is the total area of a particular class of landscape coverage. Approaches "0" when a class of landscape coverage becomes rare in the landscape. Measured as hectares (ha).	Forest Paramo	42,6094 ha 15,931 ha	313,244 ha 7,394 ha
	Percentage of landscape (PLAND)	It is the percentage of the total area of the entire landscape comprised by a particular class of landscape coverage. Approaches "0" when a class of landscape coverage becomes rare in the landscape. Measured as percentage (%).	Forest Paramo	47.56 % 1.78 %	85.37 % 2.01 %
	Total core area (TCA)	It is the total core area of a particular class of landscape coverage. Approaches "0" when a class of landscape coverage becomes rare in the landscape. Measured as hectares (ha).	Forest Paramo	71,462 ha 1,131 ha	219,350 ha 56 ha
	Core percentage of landscape (CPLAND)	It is the percentage of the total area of the entire landscape comprised by a particular class of landscape coverage. Approaches "0" when a class of landscape coverage becomes rare in the landscape. Measured as percentage (%).	Forest Paramo	7.98 % 0.13 %	59.78 % 0.02 %
	Number of patches (NP)	It is the number of patches of a particular class of landscape coverage. Equals "1" when a class of landscape coverage contains only 1 patch.	Forest Paramo	336 18	19 15
	Mean patch size (AREA_MN)	It is the mean size of patches of a class of landscape coverage. Approaches "0" when a class of landscape coverage becomes rare in the landscape. Measured as hectares (ha).	Forest Paramo	628 ha 1,225 ha	7,119 ha 528 ha
	Edge density (ED)	Increases as the number of patches of a class of landscape coverage increases, increasing more when patches are smaller (greater contact edge per patch). Equals "0" when a class of landscape coverage contains only 1 patch. Measured as meters per hectare (m/ha).	Forest Paramo	13.48 m/ha 0.63 m/ha	3.13 m/ha 0.45 m/ha
	Mean shape index (SHAPE_MN)	Increases as mean patch shape of a class of landscape coverage becomes more irregular. Equals "1" (minimum value) when patch shape is circular or squared (not irregular shape).	Forest Paramo	1.63 2.24	1.59 1.91
	Mean euclidean nearest neighbor distance (ENN_MN)	It is the mean distance between nearest patches of a class of landscape coverage. Approaches "0" when the distance between nearest neighbor patches decreases. Measured as meters (m).	Forest Paramo	650.86 m 888.37 m	520.75 m 1,174.04 m
	Patch level	Absolute number of patches (and its area, ha) per area interval	It is the number of patches of andean bear associated ecosystems (and the area comprised by them) within a particular area interval	Small (1 < patch ≤ 1,500 ha)	667 (57,562 ha)
Medium (1,500 ha < patch ≤ 6,000 ha)				13 (35,693 ha)	3 (7,631 ha)
Large (patch > 6,000 ha)				11 (348,768 ha)	2 (305,750 ha)
Absolute number of patches (and its area, ha) per core area interval		It is the number of patches of andean bear associated ecosystems (and the core area comprised by them) within a particular core area interval	Small (1 < patch ≤ 1,500 ha)	17 (4,512.5 ha)	4 (200 ha)
			Medium (1,500 ha < patch ≤ 6,000 ha)	2 (5,493 ha)	0 (0 ha)
			Large (patch > 6,000 ha)	1 (62,587 ha)	2 (219,206 ha)

In terms of patch level analyses, when core area analyses were performed (extracting a disturbance buffer of 1,000 m into the border/edge of each patch, Table 1), for the Colombian slope of the Serranía del Perijá, the total area comprised by small (1 ha < patch ≤ 1,500 ha), medium (1,500 ha < patch ≤ 6,000 ha) and large (patch > 6,000 ha) patches of Andean bear associated ecosystems is reduced from 57,562.5 ha to 4,512.5 ha (small patches), 35,693.75 ha to 5,493.75 ha (medium), and 348,768.75 ha to 62,587.5 ha (large patches; Table 1). On the other hand, for the Venezuelan slope of the Serranía del Perijá, those reductions were from 7,256.25 ha to 200 ha (small patches), 7,631.25 ha to "0" (medium), and 305,750.01 ha to 219,206.25 ha (large patches; Table 1).

Discussion and conclusions

The presence records of the Andean bear obtained during the field surveys made for this study and from the revised literature, reveals at least three distinguishable sectors with bears presence along the eastern (Venezuela) and western (Colombia) slopes of the Serranía del Perijá (Figure 1; Appendix 1). The first sector corresponds to the southernmost portion of the Serranía del Perijá at the municipality of San Alberto (department of Cesar) at Colombia, coinciding with the only Andean bear distribution currently recognized by the IUCN for the Serranía del Perijá (Velez-Liendo and García-Rangel 2017; Figure 1). The second sector corresponds to the center of the Serranía del Perijá, and includes the municipalities of Chimichagua and Curumaní (department

of Cesar) at Colombia, which is most probably connected with the Andean bear distribution block recognized by the IUCN for the Colombian National Natural Park Catatumbo Barí in the department of Norte de Santander (adjacent, but not belonging to the Serranía del Perijá; [Velez-Liendo and García-Rangel 2017](#); Figure 1). The third sector correspond to the north of the Serranía del Perijá and includes the municipalities of La Jagua de Ibirico, Becerril, Codazzi, La Paz, Manauare (department of Cesar), La Jagua del Pilar, Urumita, Villanueva, El Molino and Barrancas (department of La Guajira) at Colombia, and the municipalities of Mara, Jesús Enrique Lozada, Rosario de Perijá and Machiques de Perijá (state of Zulia) at Venezuela (Figure 1). Although there is abundant information from local communities on the presence of the species at other municipalities from the western slope of the Serranía del Perijá at Colombia, that could complement the distribution information for the species at the south (Municipalities of Abrego, San Martín and Cachira at the department of Norte de Santander), middle (El Carmen Municipality at the department of Norte de Santander, and the municipalities of Chiriguaná, La Gloria, Pelaya and Pailitas at the department of Cesar) and north (municipalities of San Juan del Cesar and Fonseca at the department of La Guajira) of the Colombian Serranía del Perijá ([Torres 2008](#); [Rodríguez and Reyes 2009](#); [Rodríguez et al. 2010](#); [Rodríguez et al. 2011](#)), those areas were not sampled for this study.

These results exhibit a current Andean bear population block located along the eastern (Venezuela) and western (Colombia) slopes of the Serranía del Perijá (Appendix 1; Figure 1), previously suggested as the “Perijá population nucleus” by [Rodríguez and Lozada \(1989\)](#). The current geographical distribution recognized by the IUCN for the Andean bear in South America states that its northernmost limit is reached at the Venezuelan Serranía de Portuguesa (Sierra de Mérida, north-eastern Venezuela; [Velez-Liendo and García-Rangel 2017](#); Figure 1), including just the southernmost portion of the Serranía del Perijá in the distribution range of this species, and dismissing previous distributions mentioned by [Mondolfi \(1989\)](#), [Rodríguez and Lozada \(1989\)](#), [Viloria et al. \(1995\)](#), [Peyton \(1999\)](#), [Rodríguez et al. \(2003\)](#), [Corredor-Carrillo and Muñoz-Saba \(2007\)](#), [Yerena et al. \(2007\)](#), and [Solari et al. \(2013\)](#), that suggested the northern presence of the Andean bear as reaching at least the middle portion of the Serranía del Perijá. Thus, the presence records provided at this study extend the distribution of the species 180 km at the north of Colombia and Venezuela until the north of the Serranía del Perijá regarding the current distribution recognized by the IUCN ([Velez-Liendo and García-Rangel 2017](#); Figure 1), provide confirmed records that supports previously suggested distributions of the Andean bear along the Serranía del Perijá ([Rodríguez and Lozada 1989](#); [Peyton 1999](#); [Rodríguez et al. 2003](#); [Corredor-Carrillo and Muñoz-Saba 2007](#); [Yerena et al. 2007](#); [Solari et al. 2013](#)), update previous records reported for the Venezuelan (eastern) slope of the Serranía del Perijá ([Mon-](#)

[dolfi 1989](#); [Viloria et al. 1995](#)), and elucidate a more accurate northernmost distribution limit for this species in South America at Colombia and Venezuela. These findings locate the northernmost distribution range limit of the Andean bear at the municipality of Barrancas (locality Monte Fresco, department of La Guajira) in Colombia, and the municipality of Mara (state of Zulia) in Venezuela (Figure 1; Appendix 1). These northernmost records also confirm that feeding traces on plantain bushes include not just fruit consumption, but also buds consumption, in agreement with popular information previously collected ([Rodríguez and Reyes 2009](#), [Rodríguez et al. 2010](#)).

Although there is some general information about Andean bear distribution range fragmentation and habitat availability for the northern Andes (Venezuela, Colombia and Ecuador; [Kattan et al. 2004](#)), this information focuses at a large scale analysis of potential distribution discontinuity for the species, with landscape coverage information from 1994 for some sectors and from 2000 for others. Although the characterization of the spatial trends of fragmentation degree of the Andean bear associated ecosystems (Andean forest and Paramo) along the Serranía del Perijá made for this study used satellite images from 2008 (and fragmentation trends could have slightly changed), this study provides the first fine-scale information on Andean bear associated ecosystems fragmentation for Colombia and Venezuela, with traceable landscape measurements permitting long-term comparative analyses in the future (Table 1). These analyses exhibit that the Colombian (western) and Venezuelan (eastern) slopes differ in patch number, size, shape, edge and isolation between patches, so that the Colombian slope possess a much greater fragmentation degree regarding the Venezuelan one (Table 1).

Although the Colombian slope of the Serranía del Perijá comprise a bigger raw area of Andean bear associated ecosystems (442,025 ha vs 320,638 ha), the Venezuelan slope comprise much less fragmented ones (Table 1), so that the Andean bear associated ecosystems resulting from core area analyses exhibit much more extension (area) for the Venezuelan slope (219,406.25 ha) than the Colombian one (72,593.75 ha; Table 1). This phenomenon is related to the high quantity of small and irregularly shaped patches present at the Colombian slope of the Serranía del Perijá (that disappear at the core area analyses) (Figure 1); smaller patches with greater shape complexity have less internal area, which constitutes less habitat availability and greater edge effect ([McGarigal et al. 2012](#)). In the case of the Colombian slope of the Serranía del Perijá, the loss of natural landscape coverage is a result of extensive agricultural activities for legal (food production for self-maintenance or trade) and illegal (crops to produce illegal drugs) purposes, as well as wood extraction to generate grazing pastures (livestock) or build houses ([Torres 2008](#); [Rodríguez and Reyes 2009](#); [Rodríguez et al. 2010](#); [Rodríguez et al. 2011](#)). In this sense, [Kattan et al. \(2004\)](#) previously mentioned that large habitat blocks encompassing a continuous elevational gradient

remain in the Venezuelan (eastern) slope of the Serranía de Perijá.

The Andean bear associated ecosystem Paramo is scarcely represented along the Serranía del Perijá, constituting 1.78 % of the landscape in the Colombian slope, and 2.01 % in the Venezuelan slope of this mountain range (PLAN; Table 1). Due to its natural distribution at Andean mountain peaks separated between them by large distances (Cuatrecasas 1958), this ecosystem is intrinsically fragmented (Jiménez-Rivillas *et al.* 2018). When Paramo is present, Andean bear uses it, but it does not constitute its main habitat (Rodríguez 1991; Ríos-Uzeda *et al.* 2006), a fact supported by the small amount of Paramo ecosystem comprised by the distribution of the persistent Andean bear population block of Perijá (Mondolfi 1989; Vilorio *et al.* 1995; Appendix 1). In this sense, many authors have previously indicated the preference of the Andean bears to use the Andean forest rather than the Paramo ecosystem (Walker 1964; Borrero 1967; Knight 1967; Mondolfi 1971; Peyton 1980; Yerena 1987; Rodríguez 1991; Ríos-Uzeda *et al.* 2006).

The elongated shape of Andean bear distribution range and patterns of anthropic land use in the northern Andes make the distribution range of this species particularly prone to fragmentation (Kattan *et al.* 2004). Taking into account the high degree of fragmentation for the Andean bear associated ecosystems at the Colombian slope of the Serranía del Perijá (Table 1), presumably when bears belonging to the Perijá population block transit between the two slopes of the Serranía del Perijá, they pass from the Venezuelan (eastern) slope with mature and relative continuous forests, to the Colombian (western) slope where the continuity of the forest is broken due to intensive and extended human activities and the ecological integrity is very compromised (Figure 1; Table 1). Those intensive and extended human activities at the Colombian slope increases the risk of human-bear conflicts and hunting retaliations from settler communities, as well as subsistence hunting activities by indigenous communities.

The Andean bear is categorized as vulnerable to extinction (VU) at a general scale by the IUCN (Velez-Liendo and García-Rangel 2017), and at Colombia by the Ministerio de Ambiente, Vivienda y Desarrollo Territorial (MADS 2017), also categorized as endangered (EN) by Rodríguez *et al.* (2015) at Venezuela. There is no information on the population dynamics and conservation threats of the northernmost portion of the Andean bear population block of Perijá at the municipalities of Barrancas (locality Monte Fresco, department of La Guajira) in Colombia and Mara (state of Zulia) in Venezuela (Figure 1; Appendix 1), a concerning matter since this sector of the Serranía del Perijá is subjected to intense wood extraction and hunting activities (Rodríguez *et al.* 2010), and located just 12 kilometers southeast from the largest open-pit coal mine in Colombia (El Cerrejón; Figure 1).

There are generalized and not confirmed assumptions about the northern distribution of the Andean bear in South America, as the case of the lacking-evidence distribution reported for the species at the Colombian Sierra Nevada de Santa Marta at the departments of Cesar, Magdalena and La Guajira (north-western Colombia; Solari *et al.* 2013), refuted by Reyes-Amaya (2015), and the wrong assumption of not presence of the species at the Colombian and Venezuelan Serranía del Perijá (Velez-Liendo and García-Rangel 2017; Figure 1) refuted in this study (Figure 1; Appendix 1). Likewise, the absence of fine-scale information on Andean bear associated ecosystems fragmentation for Colombia and Venezuela could represent a major challenge for the conservation of this Ursid. The lack of information about the Andean bear distribution (García-Rangel 2012) and its associated ecosystems fragmentation could be putting the survival of local populations at risk, while a clear knowledge on these issues could generate planned conservation actions for this species by the governmental environmental authorities at their respective local jurisdictions. The absence of information on the conservation state of the northernmost population block of this species at South America (at the Serranía del Perijá) makes it necessary to carry out biological research on its conservation and threats.

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Appendix 1

Presence records of the Andean bear obtained from the literature, and during field surveys made for the present study along the Colombian (western) and Venezuelan (eastern) slopes of the Serranía del Perijá. Some presence records are supported with evidence, providing repository files access. Voucher samples are in inclusion process at the mammal collection Alberto Cadena García (ICN, Instituto de Ciencias Naturales, Universidad Nacional de Colombia), collector number is specified in parentheses.

Country	Department	Municipality	Locality	Date	Source	North	West	Altitude	Kind of evidence
Colombia	Cesar	Becerril	Indigenous settlement La Misión	14/03/2009	This study	9° 46' 56.40"	73° 0' 54.4"	1,800	Tree bark marked with scratches
Colombia	Cesar	Becerril	Indigenous settlement Sokorpa	12/03/2009	This study	9° 46' 52.30"	73° 0' 19.3"	1,923	Feeding evidence on epiphyte Bromeliaceae
Colombia	Cesar	Becerril	Indigenous settlement Sokorpa	12/03/2009	This study	9° 48' 15.80"	72° 59' 33.8"	1,715	Tree bark marked with scratches
Colombia	Cesar	Becerril	Indigenous settlement La Misión	3/14/2009	This study	9° 45' 53.00"	73° 0' 55"	1,842	Tree bark marked with scratches, footprint over trail
Colombia	Cesar	Becerril	Indigenous settlement Sokorpa	3/14/2009	This study	9° 45' 28.50"	73° 0' 49.9"	1,974	Feeding evidence on epiphyte Bromeliaceae
Colombia	Cesar	Becerril	Indigenous settlement Sokorpa	3/11/2009	This study	9° 46' 3.67"	73° 0' 49.1"	1,635	Tree bark marked with scratches
Colombia	Cesar	Becerril	Indigenous settlement Sokorpa	3/11/2009	This study	9° 46' 53.60"	73° 0' 50.4"	1,610	Tree bark marked with scratches
Colombia	Cesar	Becerril	Indigenous settlement Sokorpa	3/12/2009	This study	9° 46' 57.50"	73° 0' 40.1"	1,740	Tree bark marked with scratches
Colombia	Cesar	Becerril	Indigenous settlement Sokorpa	3/11/2009	This study	9° 46' 57.70"	73° 0' 41.60"	1,715	Tree bark marked with scratches
Colombia	Cesar	Becerril	Indigenous settlement Sokorpa	3/13/2009	This study	9° 47' 40.99"	72° 59' 47.74"	1,827	Feeding evidence on Palm buds (Arecaceae)
Colombia	Cesar	Becerril	Indigenous settlement Sokorpa	3/12/2009	This study	9° 48' 16.90"	72° 59' 14.5"	1,798	Tree bark marked with scratches
Colombia	Cesar	Chimichagua	-	19/03/2012	This study	9° 2' 21.33"	73° 26' 14.11"	1,700	Tree bark marked with scratches
Colombia	Cesar	Chimichagua	-	19/03/2012	This study	9° 3' 3.57"	73° 26' 11.97"	1,500	Footprints over trail
Colombia	Cesar	Codazzi	-	10/07/2008	This study	10° 14' 36.79"	72° 54' 54.74"	3,070	Hairs and feeding evidence on Bromeliaceae (Puya sp)
Colombia	Cesar	Codazzi	-	07-2010	This study	10° 13' 3.09"	72° 55' 8.52"	3,076	Feces
Colombia	Cesar	Codazzi	Indigenous settlement Shikeimo	09/07/2013	This study	9° 58' 22.90"	73° 0' 15.2"	2,221	Tree bark marked with scratches
Colombia	Cesar	Curumani	-	22/09/2011	This study	9° 8' 34.46"	73° 24' 56.8"	1,850	Tree bark marked with scratches
Colombia	Cesar	Curumani	-	21/09/2011	This study	9° 9' 26.98"	73° 22' 36.38"	1,730	Tree bark marked with scratches
Colombia	Cesar	La Jagua de Ibirico	-	09/01/2011	This study	9° 32' 2.19"	73° 9' 21.1"	1,450	Feeding evidence on Palm buds (Arecaceae)
Colombia	Cesar	La Jagua de Ibirico	-	09/01/2011	This study	9° 32' 13.17"	73° 9' 20.47"	1,340	Footprints over trail
Colombia	Cesar	La Jagua de Ibirico	-	09/01/2011	This study	9° 32' 16.13"	73° 9' 8.12"	1,544	Footprints over trail

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Colombia	Cesar	La Jagua de Ibirico	Guarumera	09/04/2011	This study	9° 29' 8.67"	73° 10' 53.55"	2,121	Feeding evidence on epiphyte Bromeliaceae	
Colombia	Cesar	La Jagua de Ibirico	Guarumera	09/04/2011	This study	9° 29' 10.68"	73° 10' 39.84"	2,334	Tree bark marked with scratches	
Colombia	Cesar	La Jagua de Ibirico	Guarumera	09/04/2011	This study	9° 29' 18.38"	73° 10' 42.67"	2,301	Tree bark marked with scratches	
Colombia	Cesar	La Jagua de Ibirico	Guarumera	09/04/2011	This study	9° 29' 14.68"	73° 10' 54.02"	2,200	Feeding evidence on Palm buds (Arecaceae)	
Colombia	Cesar	La Jagua de Ibirico	La esperanza	12/04/2011	This study	9° 30' 18.61"	73° 10' 30.27"	2,600	Feeding evidence on Palm buds (Arecaceae)	
Colombia	Cesar	La Jagua de Ibirico	La esperanza	09/07/2011	This study	9° 30' 22.44"	73° 10' 35.66"	2,445	Feeding evidence on epiphyte Bromeliaceae	
Colombia	Cesar	La Jagua de Ibirico	La esperanza	09/07/2011	This study	9° 30' 24.45"	73° 10' 42.64"	2,227	Feeding evidence on epiphyte Bromeliaceae	
Colombia	Cesar	La Jagua de Ibirico	La esperanza	10/09/2011	This study	9° 30' 16.70"	73° 10' 37.29"	2,414	Feeding evidence on Palm buds (Arecaceae)	
Colombia	Cesar	La Paz	-	7/10/2008	This study	10° 15' 15.60"	72° 54' 58.33"	3,029	Hairs and feeding evidence on Bromeliaceae (Puya sp)	
Colombia	Cesar	La Paz	Agua Lindas	10-2012	This study	10° 16' 35.30"	72° 55' 33.6"	3,019	Feces in cave, near predated cattle	
Colombia	Cesar	La Paz	Rancho Quem	30/12/2015	This study	10° 16' 40.60"	72° 54' 58.4"	2,888	Camera trap image*	file 5
Colombia	Cesar	La Paz	Rancho Quem	15/12/2015	This study	10° 16' 38.00"	72° 55' 19.0"	2,957	Camera trap image*	file 6
Colombia	Cesar	La Paz	Los Sauces	11-2013	This study	10° 13' 38.10"	72° 58' 12.8"	2,886	Feces	
Colombia	Cesar	La Paz	Brisas del Chiraiamo	29/02/16	This study	10° 16' 51.31"	72° 55' 25.74"	2,968	Camera trap image*	file 7
Colombia	Cesar	La Paz	Brisas del Chiraiamo	24/11/13	This study	10° 16' 47.85"	72° 55' 44.91"	2,961	Feeding evidence on Palm buds (Arecaceae)	
Colombia	Cesar	La Paz	Brisas del Chiraiamo	21/03/16	This study	10° 16' 49.50"	72° 55' 20.4"	2,801	Camera trap image*	file 8
Colombia	Cesar	La Paz	Brisas del Chiraiamo	24/11/13	This study	10° 16' 56.70"	72° 55' 17.7"	2,756	Feces	
Colombia	Cesar	La paz	Brisas del Chiraiamo	24/11/2013	This study	10° 16' 46.90"	72° 55' 2.8"	2,819	Palm with climbing evidence	
Colombia	Cesar	La paz	Brisas del Chiraiamo	24/11/2013	This study	10° 17' 6.43"	72° 55' 35.19"	2,748	Tree bark marked with scratches	
Colombia	Cesar	La Paz	Cerro de Medialuna	17/04/2014	This study	10° 15' 52.62"	72° 55' 5.16"	3,237	Skull and Skin of a Hunted bear. (DR 305, 306)*	file 1
Colombia	Cesar	Manaure	Sabana Rubia	2/8/2009	This study	10° 22' 12.00"	72° 54' 8.2"	3,055	Tree bark marked with scratches	
Colombia	Cesar	Manaure	Sabana Rubia	2/5/2016	This study	10° 22' 15.40"	72° 54' 0.4"	3,044	Camera trap image*	file 9
Colombia	Cesar	Manaure	Sabana Rubia	07/02/2009	This study	10° 22' 1.55"	72° 53' 56.4"	3,089	Tree bark marked with scratches	
Colombia	Cesar	Manaure	Sabana Rubia	13/03/2016	This study	10° 21' 48.80"	72° 56' 22.6"	2,900	Camera trap image*	file 10
Colombia	Cesar	Manaure	Sabana Rubia	17/08/2010	This study	10° 21' 28.70"	72° 55' 2.2"	3,023	Paw of a Hunted bear. (DR 287)*	file 2
Colombia	Cesar	Manaure	Sabana Rubia	21/08/2010	This study	10° 22' 5.49"	72° 55' 42.26"	3,010	Paw of a Hunted bear. (DR 288)*	file 3
Colombia	Cesar	Manaure	Sabana Rubia	19/04/2016	This study	10° 21' 34.60"	72° 55' 7.7"	3,096	Camera trap image*	file 11
Colombia	Cesar	Manaure	Sabana Rubia	20/08/2013	This study	10° 21' 51.60"	72° 55' 15.7"	3,087	Direct observation*	file 4
Colombia	Cesar	Manaure	Sabana Rubia	01/03/2016	This study	10° 18' 25.14"	72° 55' 1.24"	2,591	Camera trap image*	file 12
Colombia	Cesar	Manaure	Sabana Rubia	06/03/2016	This study	10° 21' 55.30"	72° 55' 42.1"	2,997	Camera trap image*	file 13
Colombia	Cesar	San Alberto	-	29/03/2011	This study	7° 58' 53.23"	73° 18' 8.56"	2,760	Tree bark marked with scratches	
Colombia	Cesar	San Alberto	-	31/03/2011	This study	7° 58' 7.80"	73° 17' 49.6"	2,678	Tree bark marked with scratches	
Colombia	Cesar	San Alberto	San Jose de Belen	21/04/2011	This study	7° 55' 7.00"	73° 20' 20.1"	1,203	Feces	
Colombia	Cesar	San Alberto	-	30/06/2011	This study	7° 51' 28.91"	73° 23' 7.62"	1,082	Footprints over trail	
Colombia	La Guajira	El Molino	-	7/24/2008	This study	10° 32' 32.95"	72° 50' 40.69"	2,176	Feces	
Colombia	La Guajira	El Molino	-	7/24/2008	This study	10° 32' 37.00"	72° 50' 50.70"	2,123	Hairs and feeding evidence on Bromeliaceae (Puya sp)	
Colombia	La Guajira	El Molino	-	7/24/2008	This study	10° 32' 41.77"	72° 50' 40.86"	2,216	Footprints over trail	
Colombia	La Guajira	La Jagua del Pilar	-	8/6/2008	This study	10° 25' 25.57"	72° 57' 46.09"	2,341	Hairs and feeding evidence on Bromeliaceae (Puya sp)	
Colombia	La Guajira	Urumita	-	17/06/2008	This study	10° 28' 24.37"	72° 52' 22.04"	2,441	Tree bark marked with scratches	
Colombia	La Guajira	Urumita	-	06/08/2008	This study	10° 24' 52.13"	72° 54' 54.27"	2,679	Direct observation	
Colombia	La Guajira	Urumita	-	6/18/2008	This study	10° 28' 18.26"	72° 52' 1.91"	2,526	Feces	
Colombia	La Guajira	Urumita	-	6/18/2008	This study	10° 28' 23.44"	72° 52' 16.51"	2,449	Hairs and feeding evidence on Bromeliaceae (Puya sp)	
Colombia	La Guajira	Urumita	-	6/18/2008	This study	10° 28' 32.22"	72° 52' 24.41"	2,228	Tree bark marked with scratches	
Colombia	La Guajira	Urumita	-	6/18/2008	This study	10° 28' 36.44"	72° 52' 23.63"	2,078	Feeding evidence on epiphyte Bromeliaceae	
Colombia	La Guajira	Urumita	-	6/18/2008	This study	10° 28' 54.91"	72° 52' 26.31"	1,836	Feeding evidence on epiphyte Bromeliaceae	
Colombia	La Guajira	Urumita	-	18/06/2008	This study	10° 28' 12.95"	72° 51' 55.73"	2,491	Feces with Bromeliaceae remains	

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NORTHERNMOST ANDEAN BEARS

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Colombia	La Guajira	Urumita	-	24/07/2008	This study	10° 32' 43.60"	72° 51' 8.00"	2,154	Feces with remain of seeds of Lauraceae
Colombia	La Guajira	Urumita	-	7/3/2010	This study	10° 25' 56.20"	72° 55' 41.4"	2,838	Tree bark marked with scratches, hairs
Colombia	La Guajira	Urumita	-	7/4/2010	This study	10° 26' 2.30"	72° 54' 33.9"	3,202	Feces
Colombia	La Guajira	Urumita	-	7/4/2010	This study	10° 26' 7.10"	72° 54' 39.01"	2,840	Hairs and feeding evidence on Bromeliaceae (Puya sp)
Colombia	La Guajira	Villanueva	-	7/25/2008	This study	10° 32' 13.30"	72° 50' 49.1"	2,126	Tree bark marked with scratches
Venezuela	Zulia	Jesús Enrique Lozada	-	6/17/2008	This study	10° 27' 21.35"	72° 51' 48.83"	2,758	Feeding evidence on epiphyte Bromeliaceae
Venezuela	Zulia	Jesús Enrique Lozada	-	6/18/2008	This study	10° 27' 38.37"	72° 51' 32.95"	2,672	Tree bark marked with scratches
Venezuela	Zulia	Jesús Enrique Lozada	-	6/18/2008	This study	10° 27' 25.23"	72° 51' 38.85"	2,672	Feeding evidence on epiphyte Bromeliaceae
Venezuela	Zulia	Jesús Enrique Lozada	-	6/18/2008	This study	10° 27' 35.61"	72° 51' 41.64"	2,672	Tree bark marked with scratches, hairs
Venezuela	Zulia	Jesús Enrique Lozada	-	6/18/2008	This study	10° 27' 43.42"	72° 51' 30.20"	2,672	Tree bark marked with scratches
Venezuela	Zulia	Jesús Enrique Lozada	-	6/18/2008	This study	10° 27' 45.80"	72° 51' 28.55"	2,672	Tree bark marked with scratches
Venezuela	Zulia	Jesús Enrique Lozada	-	6/18/2008	This study	10° 27' 54.17"	72° 51' 32.83"	2,462	Tree bark marked with scratches, hairs
Venezuela	Zulia	Jesús Enrique Lozada	-	6/18/2008	This study	10° 28' 5.47"	72° 51' 45.22"	2,498	Feces
Venezuela	Zulia	Jesús Enrique Lozada	-	6/18/2008	This study	10° 28' 8.25"	72° 51' 48.25"	2,484	Tree bark marked with scratches, hairs
Venezuela	Zulia	Jesús Enrique Lozada	-	7/24/2008	This study	10° 31' 56.80"	72° 49' 32.35"	2,061	Marca en árbol
Venezuela	Zulia	Jesús Enrique Lozada	-	25/07/2008	This study	10° 32' 27.37"	72° 49' 4.54"	2,285	Tree bark marked with scratches
Venezuela	Zulia	Jesús Enrique Lozada	-	07/10/2010	This study	10° 26' 18.19"	72° 52' 37.16"	3,116	Hairs and feeding evidence on Bromeliaceae (Puya sp)
Venezuela	Zulia	Jesús Enrique Lozada	-	08/10/2010	This study	10° 26' 41.09"	72° 52' 29.79"	3,158	Feeding evidence on epiphyte Bromeliaceae
Venezuela	Zulia	Machiques de Perijá	-	10/07/2008	This study	10° 13' 49.73"	72° 52' 53.28"	3,157	Hairs and feeding evidence on Bromeliaceae (Puya sp)
Venezuela	Zulia	Machiques de Perijá	-	7/10/2008	This study	10° 15' 8.53"	72° 52' 57.63"	3,084	Hairs and feeding evidence on Bromeliaceae (Puya sp)
Venezuela	Zulia	Machiques de Perijá	-	10/02/2009	This study	10° 21' 18.58"	72° 52' 52.67"	3,304	Feces
Venezuela	Zulia	Machiques de Perijá	-	14/03/2009	This study	9° 47' 4.76"	72° 58' 7.17"	1,793	Feeding evidence on epiphyte Bromeliaceae
Venezuela	Zulia	Machiques de Perijá	-	09/01/2011	This study	9° 31' 15.23"	73° 7' 34.27"	1,695	Footprints over trail
Venezuela	Zulia	Machiques de Perijá	-	10-2013	This study	10° 19' 0.71"	72° 52' 46.83"	3,238	Feces
Venezuela	Zulia	Rosario de Perijá	-	04/02/2015	This study	10° 21' 43"	72° 52' 53.13"	3,379	Tree bark marked with scratches

Northernmost Distribution Records of the Andean Bear for South America at the Serranía del Perijá (Colombia and Venezuela) provided at this study

Colombia	La Guajira	Barrancas	-	10/8/2010	This study	10° 51' 59.22"	72° 39' 24.31"	1,425	Direct observations, feeding on corn and plantain crops
Colombia	La Guajira	Barrancas	-	10/8/2010	This study	10° 51' 58.60"	72° 39' 44.7"	1,182	Tree barks of Pringamosa and file 14 Aguacatillo marked*
Venezuela	Zulia	Mara	-	07/10/2010	This study	10° 51' 59.40"	72° 38' 29.25"	1,656	Tree bark of Guamo (Inga sp.) marked file 15 with scratches*
Venezuela	Zulia	Mara	-	07/10/2010	This study	10° 52' 25.96"	72° 38' 27.72"	1,600	Feces on natural bear trails into the file 16 andean forest*
Venezuela	Zulia	Mara	-	09/10/2010	This study	10° 51' 25.31"	72° 38' 43.42"	1,311	Tree bark of Nigüito (Miconia sp.) file 17 marked with scratches*

Distribution Records coming from scientific literature

Venezuela	Zulia	Mara	Rio Palmar	-	Mondolfi 1989	10° 48' 4.80"	72° 38' 17.24"	-	Two skulls of hunted bears (not in a scientific collection)
Venezuela	Zulia	Jesús Enrique Lozada	Rio Guasare	-	Mondolfi 1989	10° 30' 41.28"	72° 48' 20.51"	-	Skin of a hunted bear (MCC 873)
Venezuela	Zulia	Machiques de Perijá	Rio Negro	-	Mondolfi 1989	10° 21' 29.53"	72° 54' 9.99"	-	Skull of a hunted bear (USNM 282620)
Venezuela	Zulia	Machiques de Perijá	Rio Tocuco	-	Mondolfi 1989	9° 29' 30.55"	73° 5' 27.17"	-	Skin and skull of a hunted bear (EBRG 2839)
Venezuela	Zulia	Jesús Enrique Lozada	Cerro Pintado	-	Viloria <i>et al.</i> 1995	10° 27' 30.00"	72° 52' 33"	3,050	Skeleton of a dead bear (not in a scientific collection)
Venezuela	Zulia	Rosario de Perijá	Mesa Turik	-	Viloria <i>et al.</i> 1995	10° 22' 10.00"	72° 44' 30"	1,600	Direct observation
Venezuela	Zulia	Machiques de Perijá	Rio Barakai	-	Viloria <i>et al.</i> 1995	9° 33' 47.00"	72° 55' 57"	1,600	Skull of a hunted bear (MBLUZ-M 0191)
Venezuela	Zulia	Machiques de Perijá	Rio Negro	-	Viloria <i>et al.</i> 1995	10° 3' 40.00"	72° 50' 13"	650	Tree bark marked with scratches

* doi:10.5061/dryad.9b2n1f3

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