Articles

THE CONSERVATION STATUS OF *CALLICEBUS CAQUETENSIS* (PITHECIIDAE): A NEW SPECIES IN SOUTHERN CAQUETÁ DEPARTMENT, COLOMBIA

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Abstract

Moynihan (1976) mentioned an undescribed species of *Callicebus* between the ríos Caquetá and Orteguaza, Caquetá Department, Colombia. In August 2008, we confirmed the new species, which is phylogenetically related to *C. ornatus* and *C. discolor* to the north and south of the type locality respectively. We described this species as *Callicebus caquetensis* Defler *et al.*, 2010 establishing its distribution through direct observations and information from local communities. Eighty-two animals were seen, including the holotype and paratype, which were collected. A review of historical archives of aerial photographs and satellite maps was carried out to assess the loss of the original vegetation of the area, and we found the habitat in an advanced state of fragmentation caused by extensive ranching and illegal crop cultivation. Existing coverage is now limited to small fragments of the original primary forest and secondary vegetation. We analyzed a Google Earth image of 75 km^2 of this primate´s habitat and found only 32% of forest and secondary forest vegetation remaining in 2002, the year the image was captured. We propose this Colombian endemic species should be considered as Critically Endangered (CR), (based upon the criteria A3c,d,e, C2 of the IUCN). We suggest that the Colombian and Caquetá governments and private individuals give special attention to this endemic primate, most importantly in the creation of reserves and in environmental education initiatives. This is probably the most endangered of Colombia's primates.

Key words: *Callicebus caquetensis*, endangered primates, endemics, Colombia

Resumen

Martin Moynihan (1976) fue el primero en mencionar la existencia de una nueva especie de *Callicebus* en el Departamento del Caquetá, Colombia. En Agosto del 2008 confirmamos la presencia de esta nueva especie, relacionada filogenéticamente con *Callicebus ornatus* y *Callicebus discolor* al norte y al sur de su localidad tipo (entre los ríos Orteguaza y Caquetá) y describimos la especie como *Callicebus caquetensis* Defler *et al.*, 2010. La distribución de la especie fue establecida a través de entrevistas con la comunidad local y observaciones directas. Un total de 82 animales fueron observados, incluyendo el holotipo y el paratipo que fueron colectados. Una revisión histórica de fotografías aéreas y mapas satelitales fue llevada a cabo para evaluar la disminución de la cobertura vegetal original en el área; encontramos el hábitat en un avanzado estado de fragmentación causado por la ganadería extensiva y cultivos ilícitos. La cobertura existente esta relegada a pequeños bosques primarios y vegetación secundaria. Analizamos imágenes de Google Earth de 100 km^2 del hábitat de este primate y encontramos solo 32% de bosque original y bosque secundario en el 2002, año de captura de la imagen. Proponemos que esta especie debe ser considerada como Críticamente Amenazada (CR), (basados en los criterios A3c,d,e,C2 de la UICN). Sugerimos al gobierno nacional y del Caquetá que presten especial atención a este primate endémico, estabilizando reservas en la zona, estableciendo programas de ganadería sostenible, proyectos REDD y un programa de educación ambiental regional. Esta es probablemente la especie de primate más amenazada de Colombia.

Palabras Claves: *Callicebus caquetensis*, primates amenazados, endémico, Colombia.

Introduction

In 2010, we described a new species of titi monkey, *Callicebus caquetensis* Defler *et al*., 2010, from southern Caquetá Department, Colombia. To date it has been found only in forest patches on agricultural land that has been established in the region over past 50–60 years. This primate was mentioned by Moynihan (1976) from his travels in the piedmont of Colombia in 1969, although Hershkovitz (1990) made no mention of it. In 2008, the first author, a native of Caquetá, agreed to attempt field work where the titi monkey had been first observed by Moynihan (1976). The completely fragmented state of the forest was known to us from satellite images. An analysis of Colombian Amazonian forest cover by Defler (1992) indicated that about 70% of the forest had been lost in southern Caquetá by 1985. A further analysis was carried out with satellite images available to us from 2003. Caquetá is one of the principal colonization fronts in the Colombian Amazon, and in 1985 it was considered to be the Amazonian department that had suffered the most forest loss, with only about 29.4% left, and 79.6% under varying stages of conversion (Defler, 1992). An assessment of the status of this species was evidently a matter of urgency.

Field work in the area was made difficult by the fact that for past 50 years or so, the area where Moynihan (1976) described this primate has been a continual zone of conflict, with the presence of various insurgent groups on both ends of the political spectrum. Data collection in this region demanded careful preparation for all forays into the countryside, involving prior conversations with all possible contacts about the advisability of working in particular zones, and by carefully following the advice given. Despite this, it remained impossible to survey one of the most promising forest fragments for a possible reserve (described below). Field work was facilitated by the fact that the first author was a native of the nearby capital of Caquetá Department, Florencia, and was able to establish some local contacts through his family.

Cattle-raising and illicit cultivars are the main agricultural activities in the region. While cattle-raising has been supported in the past by the Colombian government and by the World Bank (Andrade & Ruiz, 1988), in the last three decades official support for colonization and cattle ranching has been reduced (Myers, 1980; República de Colombia, 1982; Jimeno, 1987; Jaramillo *et al.,* 1989).

Methods

The first author spent 22 days in April, 2008, 21 days in May, 2008 and 39 days in June–July 2010 for a total of 82 days of field work (García, 2008, 2010; García & Defler, 2009). García's field work involved contacting landowners using his family contacts to visit farms where small, forest patches remained. It is necessary to be connected to, and vouched for by, locals to guarantee personal security in this part of Colombia. The local people are very mistrustful of strangers. The study began at the village of Valparaíso, Caquetá, where Moynihan first observed the monkeys in 1969.

In the 2010 survey, García concentrated on the region to the west of the previous observations of 2008 and 2009, as well as the municipalities (*municipios*) of Albania, San José del Fragua and Curillo (see García, 2008; García & Defler, 2009 for details; in Colombia a *municipio* is more comparable to a county and often contains several different towns or cities; the term is not limited to one town as in the United States). Six additional groups were located (Fig. 1).

Google Earth allowed an overall view of the study area; it depicts the region using two different scales or resolutions for southern Caquetá. A baseline resolution of 15 m was used for the majority of the area, but it is not a scale easily analyzed for fragment sizes. A smaller percentage of area is depicted in a finer-grained resolution of 1 m, allowing analysis of forest condition and fragment area. Using a finer resolution, in an area centered around the coordinates 1°06'27.8"N, 75°32'57.6"W, 220 m altitude, we analyzed an image captured on 30 November, 2003 (10.7 km × 7.5 km or 75 km², and the latest image available to us) for the extent of fragmentation. With the results of the field work, and using the Google images, we identified six possible reserves for *C. caquetensis*.

Results and Discussion

During the 82 days of surveys, we detected 82 (including the holotype and paratype) animals with an average of four animals per group. Table 1 shows the breakdown per group for the 13 groups found, and the coordinates of where they were seen. The animals were detected at an altitudinal range of 190–270 m. Figure 1 shows the locations of the sightings made during 2008, 2009, and 2010. The point on the map marked *Callicebus torquatus* identifies a sighting of a *C. torquatus* group, suggesting that originally, when the forest was intact, *C. torquatus* and *C. caquetensis* were sympatric.

All observations were made in forest fragments, some of which were severely degraded. Moynihan (1976) reported seeing a group in a "medium-sized" patch of vegetation mostly less than 7 m in height, and he made a number of observations from "low second growth forest, except for land between a broad river on one side and patches of bamboo and abandoned crop fields on the other" (p.76). We delineated a square of land (Fig. 2) from the most recently available Google World image (30 November, 2003) of 11 km × 7.5 km (75 km²) and calculated the percentage of remaining forest there. Existing *Callicebus* habitat was in the form of fragments and tree-lined streams, and represented about 32% of the total area (about 26.4 km² of the total area) (1°07'45.74"N, 75°34'37.28"W, center of the rectangle) of vegetation that could sustain *Callicebus* at that time.

Figure 3 shows a group of interconnected fragments on the William Cuartas farm (1°8'17.9"N, 75°34'28.5"W) totaling about 2.5 km² of forest. Only one group of *C. caquetensis* was found there, even though this large fragment could evidently harbor more, since groups of the closely related *C. ornatus* have been observed in territories of 3.29 ha, 4.18 ha, and 3.5 ha in gallery forests in Meta and 14.2 ha in closed canopy forest (Defler, 2004; Mason, 1965, 1966). Robinson (1977) estimated densities for *C. ornatus* at about 5 individuals/km², which would suggest that this fragment could hold at least 12.5 animals (3–4 groups) of *C. caquetensis.*

Although there are no large blocks of forest in the area confirmed as the range of *C. caquetensis*, there are still possibilities for small reserves for this species and we suggest several here. An advantage of declaring several small reserves is the insurance against any large disaster in any one of them, since other small reserves will continue to protect the species. Presuming that *C. caquetensis* groups defend territory similar in size to those defended by *C. ornatus*, we believe that a fair population could be preserved in some of the larger available fragments between the Rios Orteguaza and Caquetá. Part of our future work will involve the development of proposals for the establishment of biological corridors to connect some of these reserves. Below are some suggestions for small reserves to protect *Callicebus caquetensis*.

1. El Dorado (*municipio* of Albania) contains *Mauritia flexuosa* palm forests combined with gallery forest close to a school (Institución Educativa Rural El Dorado) in El Dorado where environmental work could be carried out with the added advantage of security. The forest has easy access for the development of basic ecology or behavior projects. These forests might provide connections to forests along the Río Pescado, although they are

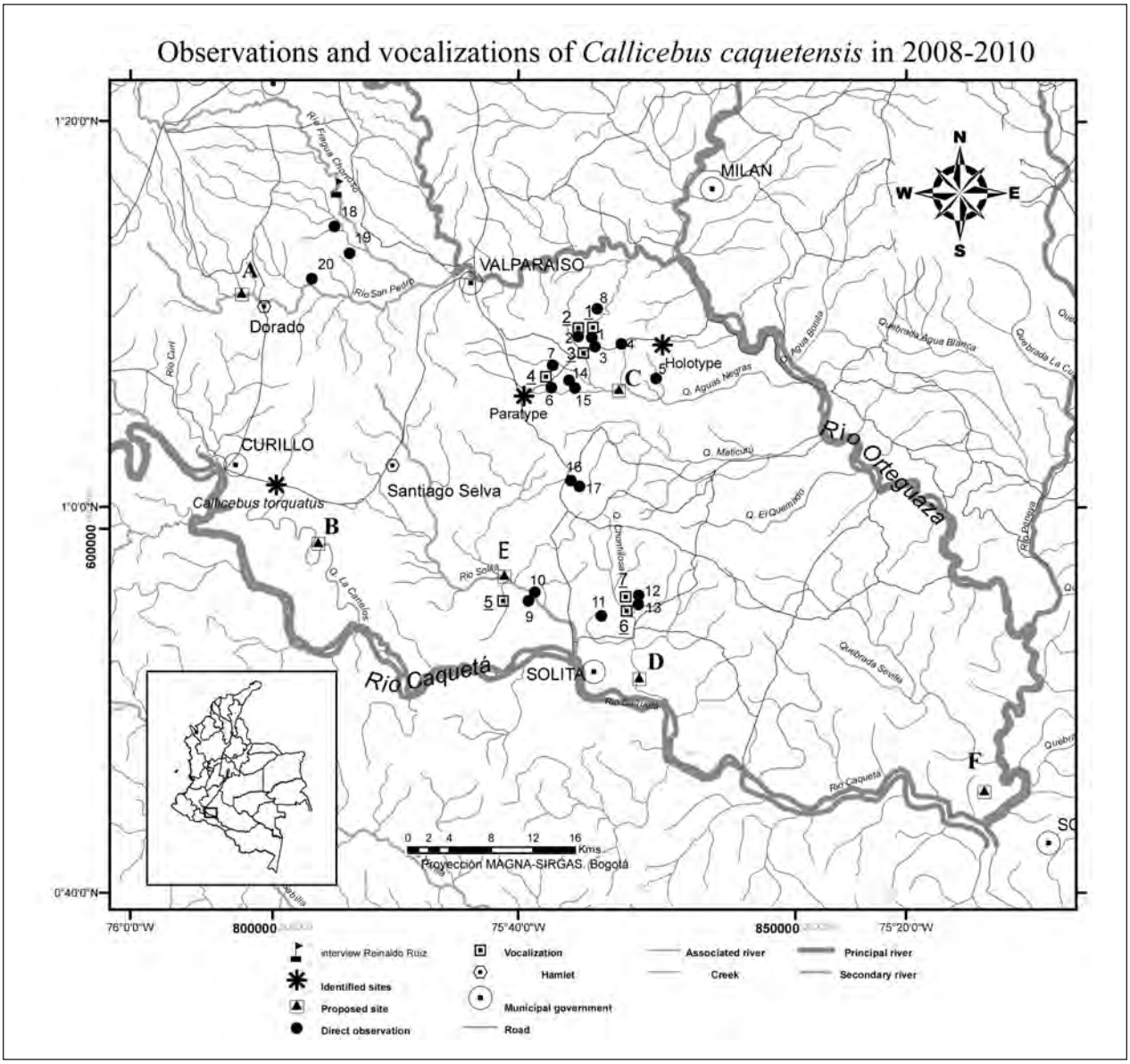

Figure 1. Map of observations of *Callicebus caquetensis* 2008–2010.

Table 1. Size, composition and location of *Callicebus caquetensis* and *Callicebus torquatus* groups observed in 2008–2009.

	M	F	Subad.	Juv.	Inf.	Total	Place	Coordinates
1	1	1	1	1	0	4	Nilson Barragán farm	01°08'38.3"N 75°36'00.4"W
2	1	1	0	2	1	5	Nilson Barragán farm	01°08'40.8"N 75°36'43.0"W
3	1	1	0	1	0	3	Alirio Santanilla farm	01° 08'09.4"N 75°35'51.4"W
4	1	1	0	1	1	4	Hacienda William Cuartas	01°08'17.90"N 75°34'28.5"W
5	1	1	1	0	1	4	Resbalón Creek	01°06'30.4"N 75°32'42.8"W
6	1	1	2	0	1	5	Hacienda Moisés Cruz	01°06' 54.4"N 75°37'27.3"W
7	1	1	0	1	1	4	Fidelino Peña farm	01° 07'11.0"N 75°38'01.1"W
8	1	1	2	1	1	6	Vereda la Florida*	01°10'07.92"N 75°35'43.86"W
9	1	1	1	0	1	4	La Solita Creek	0°54'57.42"N 75°39'15.76"W
10	1	1	1	0	0	3	La Solita Creek	0°55'05.2"N 75°39'00.6"W
11	1	1	0	0	1	3	Yaneth Soto farm	0°54'12.6"N 75°35'31.22"W
12	1	1	0	0	1	3	Doña Amparo farm	0°55'15.4"N 75°33'34.9"W
13	1	1	1	2	1	6	Edilberto Suárez farm	0° 54'47.8"N 75°33'36.3"W
14	1	1	1	1	1	5	Libardo Rojas farm	01°06'24.35"N 75°37'10.82"W
15	1	1		1	1	4	Libardo Rojas farm	01°06'12.27"N 75°36'58.80"W
16	1	1				2	Bello Diamante farm	01°01'13.09"N 75°37'5.26"W
17	1	1	1	2			**LOCATION**	01°01'06.87"N 75°37'1.02"W
18	1	1		1		3	Road along a creek, 4 km from Albania to Valparaiso	01°14'23.55"N 75°49'16.16"W
19	1	1	1		1	4	Forest road to Valparaiso	01°13'00.43"N 75°48'29.97"W
20	1	1		1		3	Hacienda Don Félix	01°11'39.84"N 75°50'27.34"W
Total observed						80	**Altitudes**	190–270 m
Average group size						4		
Holotype captured by locals							LOCATION	01°08'24.61"N 75°32'34.04"W
Paratype captured by locals							LOCATION	01°06'23.10"N 75°38'32.5"W
***Callicebus torquatus* group**							LOCATION	01°01'11.49"N 75°52'28.71"W

M: Adult male
F: Adult female

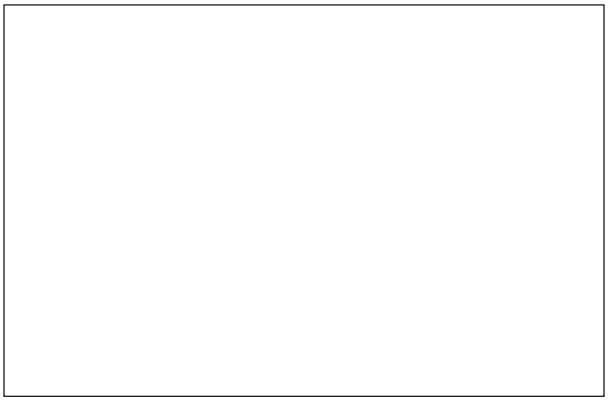

Figure 2. 75-km^2 quadrate analyzed for fragmentation and percent of forest cover (Image Google Earth, 2003).

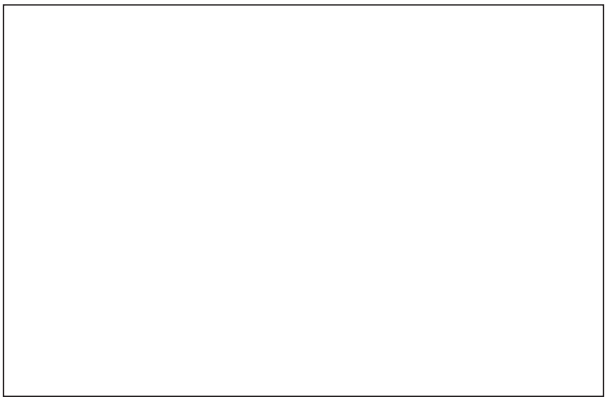

Figure 3. Area around the Hacienda William Quartas (4 km × 2.75 km) showing ongoing fragmentation. (Image Google Earth, 2003).

extremely fragmented. Local people confirm that *C. caquetensis* eats *Mauritia flexuosa* fruits, just as has been observed for *Callicebus torquatus lugens* by Palacios *et al*. (1997) and *Callicebus t. lucifer* by TRD (unpubl. data).

2. Both *C. torquatus* and *C. caquetensis* occur in the forests of Canelo Creek. From the north it is easy to enter the area, although there are some security issues at this time. Canelo Creek flows into the Río Caquetá and would be important as a protective zone for that part of the river.

3. Aguas Negras Creek (*municipios* of Milán and Valparaiso) is a corridor that has sizeable forests along most of its length and may serve as habitat for *C. caquetensis*. South of it is a small forest of 90 ha, but it is being logged and will soon be ruined, although secondary vegetation probably would be attractive for this primate. Access to this forest is via the Río Orteguaza and Valparaíso.

4. One of the largest fragments that probably protects *C. caquetensis* is immediately east of the town of La Solita. Because of local security concerns it has not yet been possible to survey the fragment to determine if the species is there, although it has been confirmed nearby to the north. This fragment, about 17 km in length and 1–4 km wide, lies alongside the Río Caquetá. The species complex *C. ornatus*, *C. caquetensis*, *C. discolor*, and *C. cupreus* is particularly attracted to low-lying land alongside rivers, so the forest could be prime habitat for this small monkey (Defler, 2010). We have detected *Pithecia monachus*, *Lagothrix lagothricha lugens*, *Saimiri sciureus*, *Saguinus nigricollis hernandezi*, and *Cebus apella* in other, nearby fragments, and this large fragment might well protect small populations of *C. caquetensis* as well (García, 2008; García & Defler, 2009). The forest is probably scrubby, since lumbering in the region has long ago harvested the largest trees. *Callicebus* from this species group are also known to do well in scrubby and secondary vegetation, so we can surmise that this would be adequate habitat for *C. caquetensis* (Moynihan, 1976; Defler, 1994; Van Roosmalen *et al*., 2002). This fragment is a prime choice for further evaluation in the future when the security situation improves.

5. Another possible reserve for this species could be established along La Solita Creek to the west of La Solita. *Callicebus caquetensis* has been registered there and, although the forest is not as extensive as to the east of La Solita, there is adequate vegetation along this creek for at least 6 km, and at its mouth the vegetation (probably seasonally flooded and attractive to this titi monkey) extends to a width of 5 km. To the north *C. ornatus* is very common in riparian (gallery) forests or forests along creeks and this preference is probably shared with *C. caquetensis*. The advantage of reserves being established in these two patches of large fragments is that they could be administered in part from the village of La Solita, situated between the two.

6. Other large fragments of forest still persist to the east, towards the mouth of the Río Orteguaza, where it flows into the Río Caquetá. The largest fragment (6 km × 4 km) is across the river from "Tres Esquinas", the Colombian air force base "Ernesto Esguerra" and village, where security might be stronger due to the military presence and where a reserve might be more easily protected. However, presently it is conjecture whether it contains *C. caquetensis*, since this part of the interfluvium of the Orteguaza and Caquetá has not been surveyed.

The species might be present in some other large fragments in this part of the interfluvium, but the fragments have not been surveyed, and they are isolated in terms of transportation and security. Forests along the right bank of the Río Orteguaza seem promising, since these are wide fragments and the forest following the right bank is continuous from just below Valparaíso. If this forest has not been cut

because it is low-lying and seasonally flooded, it is a good possibility for establishing reserves for *C. caquetensis*.

Reynaldo Ruíz (a colonist of the area) mentioned the historic presence of *C. caquetensis* in the floodplain of the Río Fragua (see Fig. 1), but it seems to be locally extinct there due to intense agricultural activities. This would be the westernmost point of its distribution and the point closest to the Cordillera de los Andes. Field work in 2010 confirmed the absence of the species west of the Río Pescado (*veredas* [= a subdivision of a *municipio* in Colombia], La Esperalda and Rochela, in the *municipio* of Morelia). We suppose that the western range extension of the species might prove to be more extensive than we have been able to demonstrate to date and this has important implications. Unfortunately the Agencia Nacional de Hidrocarburos of Colombia is planning extensive oil exploration in this western part of Colombia, but it is unclear whether such development will include safeguards for the conservation of the flora and fauna (<http://www.anh.gov.co/es/index.php?id=1>).

Cattle ranching is an important economic activity in the department of Caquetá, even though the soils are not appropriate (oxisols, poor in nutrients); one hectare of land can sustain an average of only 0.58 cattle (Ruiz *et al*., 2007). A study by the Colombian government concluded that Amazonian departments were not apt for this use due to the poor soils and environmental factors that favor persistent diseases which tend to decrease natality (PRORADAM, 1979). Paradoxically such use has been encouraged by the government. Lately the capacity of the land to sustain cattle production has begun to decrease and this forces land owners to convert what land is left into pasture (SINCHI, 2007). Conversion to cattle pastures involves clear cutting and burning, supplying a pulse of nutrients that can be assimilated by introduced grasses. But once the soils are leached and eroded, the maintenance of a healthy pasture becomes untenable, and further forest is cut. Forest recovery is seriously jeopardized and slow. Such is the process that gradually lays waste to enormous tracts of land, unproductive for crops or as cattle pasture. To illustrate the trend, one forest section where groups of *C. caquetensis* were observed in 2008 was found to be completely clear cut in 2010 (Fig. 4). Unfortunately the margins of rivers that maintain gallery forest so appealing to *Callicebus*, provide the most productive soils, and these forest are the first to be converted to grassland, even though this is prohibited by law (Article 4, Decree 2278, 1953). The fragmentation isolates these primates, and impedes dispersal. The environmental impacts of cattle ranching are numerous: negative influences of erosion and soil compaction, genetic uniformity from the grass monoculture, elimination of secondary vegetation using herbicides or uprooting, drying out of wetlands, construction of more roads, an increased demand for posts for fencing, corrals, contamination of water and soil using synthetic fertilizers and insecticides, as well as gas emissions produced by forest burning and the flatulence of the cattle.

In 2001, more than 50% of the territory of nine municipalities of Caquetá had been converted to grassland. Our calculation based on satellite images (2003) of 75 km² of land near Valparaiso yielded a conversion of 68%.

Figure 4. Pasture cut from former study forest. (Photo by Javier García).

Eighty-nine percent of La Solita had been converted by 2001; 98% of the municipality of Albania. Like other species of *Callicebus*, from this complex, *C. caquetensis* seems tolerant of human activities, and habituated animals readily move and probably disperse using very scarce vegetation or none at all. We saw a number of groups that seemed unconcerned by our presence. One animal was seen to pass over barbed wire from one patch of vegetation to another (Fig. 5). Another animal ate unconcernedly while being photographed (Fig. 6). Since primates are mostly ignored in this part of Colombia, the major pressure is forest conversion, although "poor", "broken-up", "isolated patches", "bamboo thickets", "dense vegetation, crowded and relatively low forests, thickets, and tangles" and secondary vegetation is sometimes used by this primate and by closely related species (Mason, 1965, 1966; Moynihan, 1976; Kinzey, 1981; Defler, 2004).

We believe that alternatives need to be supported that allow for a change in the mentality in this part of Colombia so heavily given to cattle ranching. But even though the low prices of milk and meat do not support successful cattle production, the frontier mentality in rural Colombia places a high premium on this activity, just as it does in so many other nations. Part of the solution in the area between the Ríos Orteguaza and Caquetá must be inclusion into national strategies such as the Project Sustainable Colombian Cattle-ranching supported by the Federación Colombiana de Ganaderos (FEDEGAN), see <http://portal.fedegan.org.co/TDR/100929%20TORs%20Contador%20para%20publicar.pdf>), international agreements such as the United Nations' Programa de REDD (Reducing Emissions from Deforestation and Forest Degradation, see <http://www.unredd.org/NewsCentre/87_million_approved_for_Global_Activities/tabid/1413/language/en-US/Default.aspx>) and financial support for communities that practice sustainable development in the region, as well as support for conservation priorities such as the *Workshop–90: Biological Priorities for Conservation in Amazonia* that identified conservation priorities, such as an endemic fish fauna in the Río Orteguaza (Rylands *et al.* 1991; Kress *et al.*, 1998). We would hope that organizations such as Parques Nacionales Naturales, Corpoamazonía, the Instituto de Investigaciones Amazónicas (SINCHI), the government of Caquetá and mayors of the different *municipios* would agree to consolidate the area as a biological corridor between the Colombian Amazon and the Andes, just as we soon hope to propose.

Illegal crops such as marijuana, poppy and coca have traditionally been a problem in this part of Colombia, although in the last decade coca plants have become dominant and continued to increase in Currillo, Milan, Solita and Valparaiso during the period 2008–2009 (SIMCI II, 2010; see <http://www.unodc.org/colombia/es/simci/simci.html>]). The opening of a coca plot usually takes place in the center of a patch of forest to avoid detection, thus, although promoting the permanence of some forest, contributes to its degradation and fragmentation (Fig. 7).

Herbicide is known to affect aquatic habitats and to cause malformation of tadpoles (Giesy, 2000; Chivian & Bernstein, 2008). Continuing fumigation of illegal crops with glyphosate causes environmental pollution and has never

Figure 5. *Callicebus caquetensis* negotiating barbed wire fence between two fragments. (Photo by Javier García).

Figure 6. *Callicebus caquetensis* eating a guava fruit. (Photo by Javier García).

Figure 7. Coca plantation in a forest fragment. (Photo by Javier García).

been evaluated in terms of its damage to arboreal fauna such as titi monkeys. Genotoxic, hormonal, and enzymatic effects of glyphosate in mammals have been reported, nevertheless (Lioi *et al.*, 1998; Peluso *et al.*, 1998; Daruich *et al.*, 2001). In rats, glyphosate has been found to decrease the activity of some detoxifying enzymes, cytochrome P-450, and monooxygenase activities and the intestinal activity of aryl hydrocarbon hydroxylase when injected into the abdomen (Hietanen *et al.*, 1983). The fact that this primate depends on vegetation that may often be sprayed with glyphosate around coca fields means that the animals are subjected to yet another environmental assault, which has never been evaluated—die-back of a part of their habitat due to spraying, the ingestion of affected fruits, or even being directly coated by the herbicide.

General poverty in southern Caquetá means that any conservation effort needs to be seen to provide economic advantages to the local communities. Socioeconomic conditions in southern Caquetá are difficult, and the rural population suffers from the lack of basic necessities (for example, inadequate housing with overcrowding, poor sanitation, poor structural integrity, and poor school attendance). The last national census of the Departamento Administrativo Nacional de Estadística (DANE) (2005: <http://www.dane.gov.co), showed this to be true for 54.59% of the rural population from the *municipios* of Milan, Valparaiso, Solita, Currillo, and Albania where we have found *C. caquetensis*. These conditions threaten the species in as much as many people use the forest fragments to satisfy basic needs, notably hunting for food. These problems urgently need to be addressed in order to guarantee a future for this endemic and endangered primate.

For the reasons above, we recommend that this species be classified as Critically Endangered (CR) on the *IUCN Red List of Threatened Species* applying a number of criteria. We believe that there has been a population reduction of more 80% in the last 10 years or three generations due to a reduction of the area of occupation, and the causes of the reduction have certainly not stopped, and they are affected by introduced taxa and contaminants A3(c,e). Population size is estimated to number fewer than 250 mature individuals, there is an estimated continuing decline of at least 25% within three years, and no subpopulation is estimated to contain more than 50 mature individuals — C1, 2a(i).

Conservation of *Callicebus caquetensis*

Our studies suggest that a variety of actions urgently need to be taken to ensure a future for this and other wildlife in the region.

1. Continued study is needed to clarify the conservation status of the species. The first author plans to do his master´s degree research on the region and on the species' conservation status.

2. One or two reserves need to be established immediately. We suggest six possible reserves in this paper.

3. The local people need to be convinced of the importance of preserving their local fauna. This small monkey evidently does not represent an important food source to local people, but this point must be researched in the future.

4. Political leaders and environmental agencies need to be brought into the conservation process to provide for socio-economic improvements with an understanding that the well-being of these local communities lies in the maintenance of healthy ecosystems for the provision of the natural resources they need.

5. Colombians need to hear about their newest and most endangered species of primate, and allies need to be identified to protect this animal and its habitat.

6. Before the possibilities are lost, a biological corridor must be established that connects the last relict forests of southern Caquetá with the east slopes of the eastern cordillera of the Andes, thus helping to protect a modicum of the region's wealth of biodiversity.

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