HABITAT PREFERENCE IN THE YELLOW-TAILED WOOLLY MONKEY (*LAGOTHRIX FLAVICAUDA*) AT YAMBRASBAMBA, PERU

by

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A THESIS

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ABSTRACT

We assessed how habitat use and preference in the endemic, and Critically Endangered, yellow-tailed woolly monkey (*Lagothrix flavicauda*) are linked to forest structure and composition. The study took place in the community of Yambrasbamba in Northeastern Peru. Very little is known about the spatial distribution and habitat preference of *L. flavicauda*. Our objective is to identify and highlight the characteristics of habitats most utilized by *L. flavicauda* in order to contribute to its conservation by providing information that will be useful for the selection of priority sites for habitat protection, and to improve habitat quality. The study site was classified into three different use zones, high, medium, and low use, according to the number of presence records collected from May 2013 to February 2014 for one group of *L. flavicauda*. Forest structure and composition were assessed for all use classes using the Gentry vegetation transects methodology. Results show great variation in species composition across the three use zones. Food plants have, predominately, greater density, dominance and ecological importance in high use zones. Use zones presented similar forest structure, a reverse J-shape diameter distribution. None of the structural variables analyzed seem to be related to preference in *L. flavicauda.*

DEDICATION

To the monkeys in the mist.

ACKNOWLEDGMENTS

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INTRODUCTION

The yellow-tailed woolly monkey, *Lagothrix flavicauda,* Sensu [Di Fiore et al., 2014] is endemic to the northeastern Peruvian Andes [Leo Luna, 1980; DeLuycker, 2007; Cornejo et al., 2008; Buckingham & Shanee, 2009; Shanee, 2011; Shanee et al., 2014]. *Lagothrix flavicauda* is classified as a Critically Endangered species by the IUCN [Cornejo et al., 2008]. It was thought to be extinct in the wild until 1974 [Mittermeier et al., 1975], and was listed among the top 25 most endangered primate species in the world from 2000 until 2012 [Mittermeier et al., 2000, 2002, 2006, 2007, 2009, 2012]. The trade of specimens of *L. flavicauda* is prohibited internationally [CITES, 2015] and nationally as it is listed as Critically Endangered by Peruvian law, in Supreme Decree No. 034-2004-AG [Shanee, 2012].

The complex interaction of several factors such as recent increasing human population growth, unregulated land use, increasing environmental temperature, changing rain patterns, deforestation, habitat fragmentation, and poaching threaten the survival of the species throughout its range [Mittermeier et al., 1977; Leo Luna, 1987; Butchart et al., 1995; DeLuycker, 2007; Cornejo et al., 2009; Di Fiore et al., 2014; Shanee et al., 2014]

The main threat faced by *L. flavicauda* is habitat loss [Leo Luna, 1980; DeLuycker, 2007; Shanee, 2011; Shanee & Shanee, 2014]. Buckingham & Shanee [2009] estimated a minimum habitat loss of 56%. It is estimated that population has decreased between 46 and 93% since 1981 [Shanee & Shanee, 2014]. The area occupied by *L. flavicauda* remained well preserved until the 1950s

because of the difficult terrain and access [Buckingham & Shanee, 2009; Shanee & Shanee, 2014]. However, over the last decades the construction of roads and unplanned economic activities such as mining, energy generation, timber extraction, cattle ranching and agriculture [Dourojjeanni et al., 2009] have attracted migration into the area, which has increased deforestation and hunting rates dramatically.

The threats faced by *L. flavicauda* plus its inherent traits that make it susceptible to extinction, such as small and decreasing population size, restricted distribution, slow life history, complex social structure, conspicuous behaviour and large size [Cardillo et al., 2005; Shanee & Shanee, 2014] place *L. flavicauda* at serious risk of extinction. Habitat protection and management programs are needed to ensure the species survival [DeLuycker, 2007].

Understanding habitat preference and use is an important aspect of primate ecology, and is essential for setting conservation strategies [Djègo-Djossou et al., 2015]. The main objective of this study is to characterize habitats utilized by *L. flavicauda* at different intensities (high, medium, low) and to identify the forest characteristics that are unique to the most utilized habitats. We aim to provide information on *L. flavicauda* that can contribute to the identification of priority conservation sites, information useful to improve habitat quality, and information useful to recuperate habitat when necessary.

METHODS

Study Site and Study Species

The study was conducted in the Yambrasbamba district, Bongara province, Amazonas department, northeastern Peru (S 05^0 39’ 46”, W 77^0 54’ 32”, fig 1). The study area, locally known as “El Toro”, is located inside the Tropical Andes Biodiversity Hotspot [Myers et al., 2000]. The area comprises disturbed primary forest and regenerating secondary forest interspersed with pasture established for cattle ranching, all covering an area of 533 ha. The terrain is dominated by high ridges and deep valleys and altitudes at the site vary from 1,800 to 2,400 m.a.s.l. The average precipitation per month is 1,500 mm. The dry season occurs from May to October and wet season from October through April. Average daytime temperature is 14^0C (±5.7) [Shanee & Shanee, 2011].

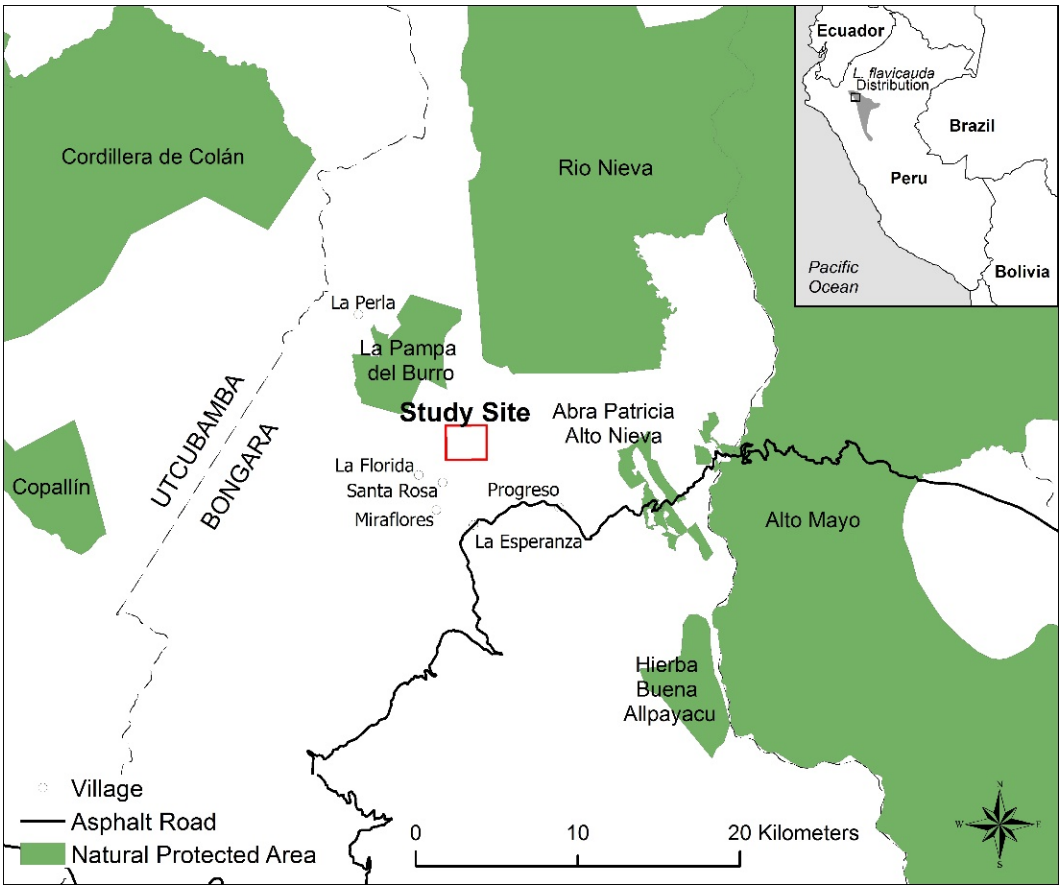

Figure 1. Study site, located in northeast Peru, Amazonas Department, Bongara Province, Yambrasbamba District.

Lagothrix flavicauda is the largest endemic primate to Peru [DeLuycker, 2007]. Individuals are robustly built and average head and body length varies from 51.5 to 53.5 cm [Mittermeier et al., 1977]. They have thick, dense, red-brown colored fur [Leo Luna, 1987]. The most particular characteristics of the species are white colored hair around the mouth area, yellow colored hair on the ventral side of the final third of the tail, and a yellow genital tuft up to 15 cm in length in males, and a smaller tuft in adult females and sub-adult males [Mittermeier et al., 1977; Leo Luna, 1987] (fig. 2). The study group comprised 17 individuals; 7 adults (3 males, 4 females); 6 juveniles and 4 infants.

Figure 2. Juvenil *L. flavicauda* at El Toro forest in Yambrasbamba district, Bongara province, Amazonas department, Peru.

Habitat use classification

Habitat use data were collected from May 2013 to February 2014 by the non-profit organization Neotropical Primate Conservation. Food sources, sleeping locations, and daily movement patterns were recorded and georeferenced using a GPS unit (Fig. 2). Every tree with a DBH (diameter at breast height) greater than 10 cm where *L. flavicauda* was observed eating and/or sleeping was georeferenced. Daily movement patterns were recorded using the track function of the GPS (set to record 1 point every 20 seconds) following a focal subject.

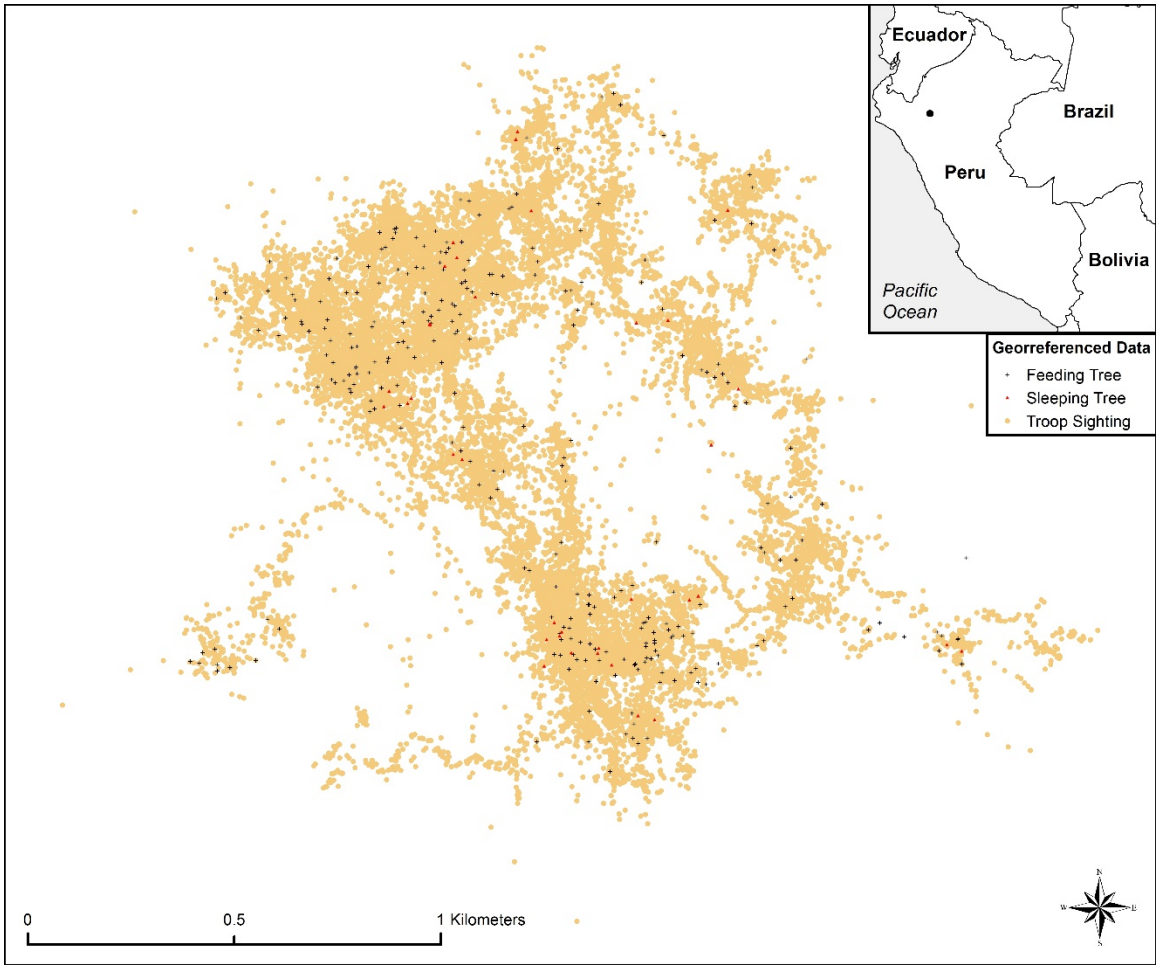

Figure 3. Geographic records of the study troop across El Toro forest in Yambrasbamba District, Bongara Province, Amazonas Department.

A density raster grid was created using the georeferenced data points collected on food sources, sleeping locations, and daily movement patterns. Then, the natural breaks algorithm function of ArcMap v.10.2 was used to classify the area into three use zones (1)high use (2) medium use and (3) low use). Additionally, since areas of pasture are not used by *L. flavicauda,* they were excluded from sampling and classified as “no use zones” (Fig. 3). High use zones covered 3% (17 ha.) of the study site total area. Two separate high use zones were found, one with 10.97 ha. located in the northwest area and the other with 6.02 ha. located in the southeast area. Medium use zones covered 12% of the area divided in five separated areas. The larger of those areas was 50.42 ha.

The low use zones constitute 68% (364.69 ha.) of the study area. No use zones covered 16% of the area (87.16 ha.).

Plant species identified as important food sources for *L. flavicauda* by previous studies [Leo Luna, 1980; Hernandez Jaramillo, 2013; Shanee, 2014a], local knowledge, and observations during vegetation surveys were *Hieronyma asperifolia, Ficus spp., Ocotea sp., Styloceras columnare, Myriocarpa sp., Hedyosmum cuatrecazanum, Heliocarpus americanus, Heteropterys sp.,* and *Cecropia spp.*

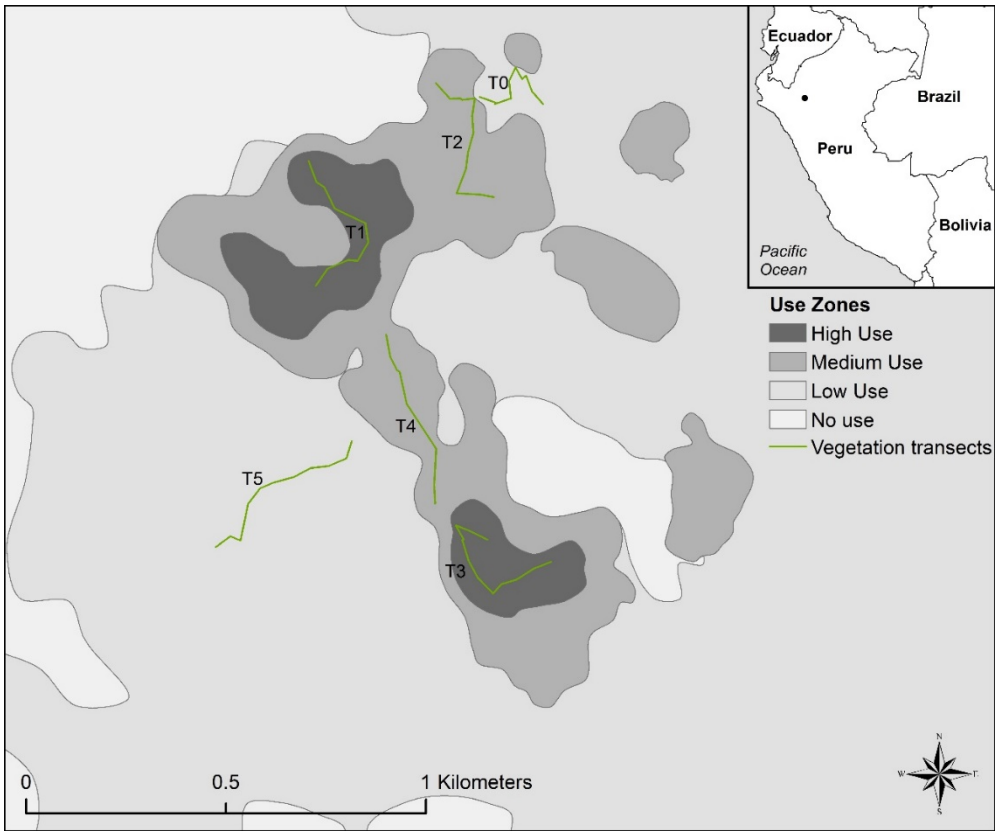

Figure 4. Use zones identified for L. flavicauda, and vegetation transects in Yambrasbamba district, Peru

Data Collection

Forest Composition and Structure

All zones used by *L. flavicauda* (high, medium, low use) were sampled following the Gentry transect method [Gentry, 1982] to assess forest structure and composition during dry season (June – July 2015). Transects provide the most appropriate, complete and representative description for heterogeneous habitats [Ganzhorn, 2011].

Two 0.1 ha transects (2 m x 500 m), composed of ten subplots (2 m x 50 m) were established in each use zone (Table 1, fig. 3). Location of transects was decided systematically to distribute them over the greatest possible area and excluding pastures from sampling. The determining shape of each transect corresponded to the physiographic conditions of the terrain and the total inclusion of each transect in one use zone.

Table 1. Location of vegetation transects and basic structure and composition features.

Transect	Use zone	Geographic Coordinates	Elevation (m.a.s.l)	Slope (%)	Basal area (m^2ha^{-1})	Density (stems ha^{-1})	Canopy cover (%)	Richness (spp $0.1ha^{-1}$)	Diversity (Shannon index*)
1	High	S 5° 39' 27" W 77° 49' 24"	1918-2008	1-48	40	3540	90	64	3.66
3	High	S 5° 39' 55" W 77° 54' 36"	2083-2156	0-51	52.1	3510	91	62	3.47
2	Medium	S 5° 39' 20" W 77° 54' 40"	1948-2529	0-60	65.3	2430	87	66	3.63
4	Medium	S 5° 39' 42" W 77° 54' 42"	2045-2133	2-49	52	3700	92	74	3.73
0	Low	S 5° 39' 17" W 77° 54' 33"	2010-2128	1-60	30.9	2390	94	67	3.49
5	Low	S 5° 39' 49" W 77° 54' 53"	1975-2140	0-39	46	3800	94	78	3.91

*[Shannon & Weaver, 1949]

Species, diameter at breast height (DBH), crown spread, total height, bole height, crown solar exposure, crown position, vine infestation, moss cover, and vascular epiphytes load were recorded

for all trees with a DBH of 2.5 cm or higher when 50% or more of the root system was inside the transect. Geographic coordinates, altitude, slope, aspect, and canopy cover were measured for all subplots (Table 1, table 2). See details on variables measurement in table 1 and appendix 1.

Table 2. Detailed measurement methods for each recorded variable

Variable	Measurement method
Species	Botanic samples analyzed at the herbarium at Universidad Nacional Agraria La Molina, Lima, Peru for taxonomic identification
Diameter at breast height	Measured with a metric fabric diameter tape at 1.3 m height or above buttresses to the nearest milimeter
Crown spread	Arithmetic mean of two perpendicular widths of the crown to the nearest centimeter
Total height	The vertical distance between the stem base and the highest foliage point estimated, after training with a clinometer, to the nearest meter
Bole height	The vertical distance between the stem base and the lowest major branch estimated, after training with a clinometer, to the nearest meter
Crown solar exposure	A crown illumination index was assigned to each crown following the methodology by Dawkins and Field [Dawkins & Field, 1978]
Crown position	A crown position index was assigned to each crown following the classification by Jennings [Jennings et al., 1999]
Vine infestation	A degree of vine infestation was assigned to each individual following the methodology by [Huerta et al., 2006]
Moss cover	A moss cover index was assigned to each individual according to the percentage of the tree that was covered in moss: (0) 0%, (1) 1-25% (2) 26-50%, (3) 51-75%, (4) 76-100%.
Vascular epiphytes load	A vascular epiphytes load was assigned to each individual according to the percentage of the crown that hold epiphytes: (0) 0%, (1) 1-25% (2) 26-50%, (3) 51-75%, (4) 76-100%.
Geographic coordinates	GPS coordinates were recorded at the beginning (0 m.) and end (50 m.) of every subplot using the averaging waypoint function for at least 30 minutes.
Altitude	Altitude was recorded using the GPS along with start and end geographic coordinates for every subplot
Slope	Measured every 25 meters using a Suunto clinometer.
Aspect	Measured every 25 meters using a Suunto compass.
Canopy cover	Measured every 25 meters using a spherical crown convex densiometer

Data Analysis

Forest composition

All species were identified to the lowest possible taxonomic level. Then, density (stems per ha), relative density (contribution to total stems), dominance (m^2 per ha), relative dominance

(contribution to total basal area), and relative importance value index [Curtis & McIntosh, 1951] for all species were calculated for each transect (Table 3).

A detrended correspondence analysis (DCA) was performed to compare floristic composition across transects in the three use zones (Figure 2) using the community ecology package VEGANv.2.3-4 [Oksanen et al., 2016] in Rv.3.2.4. The detrended correspondence analysis (DCA) allows visualization of similarities in species composition across multiple sites [Terborgh & Andresen, 1998; Ter Steege et al., 2000; Pyke et al., 2001; ter Steege et al., 2006; Honorio Coronado et al., 2009]. Additionally, the Shannon index was calculated to measure and compare diversity for each transect. The Shannon index (H'), is based on the proportional abundance of species, useful to compare richness and distribution of plant species' abundance across sites [Magurran, 2005].

Forest structure

One way analysis of variance (ANOVA), Kruskall-Wallis, and Mann-Whitney U tests were performed using IBM SPSS Statistics v.22 to compare means and medians across all six transects for the following variables: total height, bole height, crown position, crown illumination, basal area, quadratic median diameter, load of vascular epiphytes, load of non-vascular epiphytes, moss cover, vine infestation on stems, live stems density, live stems total basal area, dead stems density, dead stems total basal area, density of flowering and/or fruiting stems, and density of vines in transect. A Scheffe, repetitive Kruskall-Wallis, or Dunnett T3 post hoc test was performed when differences were detected ($p < 0.05$).

Normality and homoscedasticity were tested using the Kolmogorov-Smirnov and Shapiro-Wilk tests respectively. When the data did not show a normal distribution the non-parametric Kruskall-Wallis test was performed instead of an ANOVA. When homoscedasticity was not met, the Dunnett T3 post hoc test was used instead of the Scheffe post hoc test. When comparing ordinal variables, such as indexes, medians were compared through the non-parametric Mann-Whitney U test. Additionally, the diametric distribution of stems, defined as the density of stems per 0.1 ha in 5 cm diameter classes, [Nyland, 2002] was calculated for each transect (Figure 2) and separately for plant species identified as food sources for *L. flavicauda* (Figure 3).

RESULTS

Forest Composition

A total of 157 plant species were identified across the six vegetation transects (0.6 ha). A maximum richness of 78 species in transect 5 (high use zone) and a minimum richness of 62 species in transect 3 (high use zone). Plant species diversity varies across use zones and transects. The Shannon diversity index varies from 3.47 to 3.9 (Table 1). Transects 1 and 2 located in high use and low use zones respectively have similar diversity indexes (3.66 and 3.63). Diversity index is 3.49 in transect 0 (low use zone) and 3.73 in transect 4 (medium use zone). Diversity varies across zones and transects. However, this variation does not appear to be related to habitat preference by *L. flavicauda* as the variation in diversity indices does not respond to variation in the intensity of use by *L. flavicauda*.

The DCA showed great variation in species composition across the three use zones apart from the two transects located in high use zones (transects 1 and 3), which share a very similar floristic composition. This is observed in the DCA plot where high similarity in species composition between the two high use zones (transects 1 and 3) is indicated by the proximity of both points (Figure 3).

Transects from medium and low use zones show high dissimilarity in species composition represented by the isolated position of each transect in the plot. Transect 4, from the medium use zone, has the highest similarity in species composition to the high use zones out of the medium and low use zones.

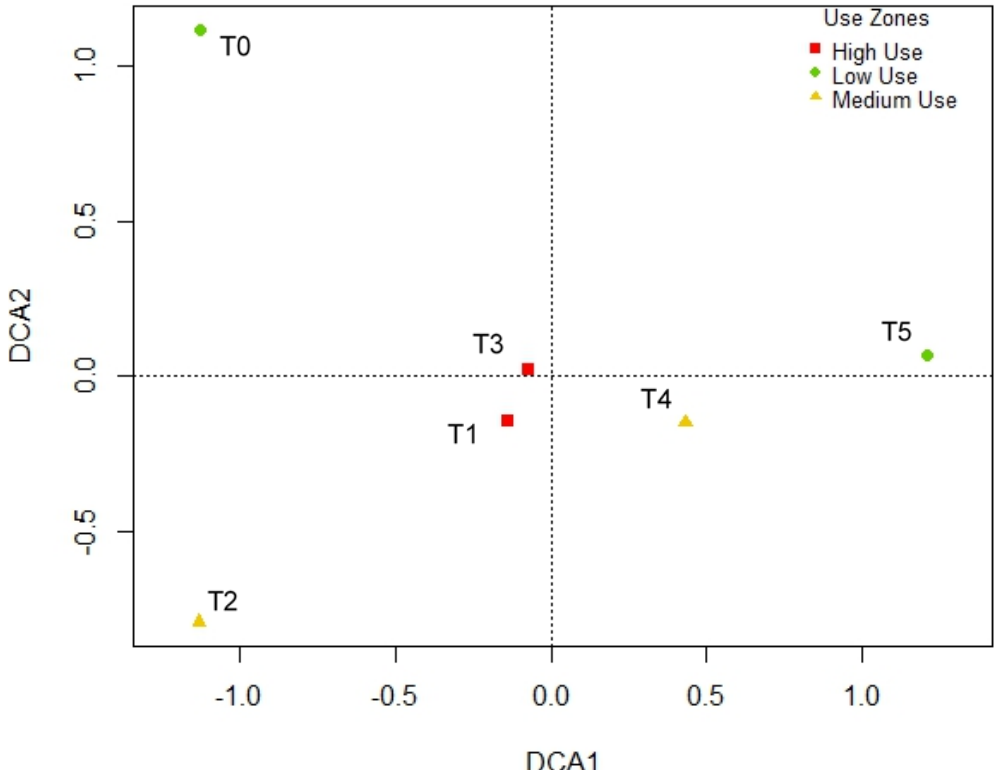

Figure 5. Detrended Correspondence Analysis (DCA) displays the similarity/dissimilarity in plant species composition among transects across the three use zones. High use (T1 &T3), medium use (T2 & T4), low use (T0 & T5).

The habitats used by *L. flavicauda* differ in terms of floristic composition across transects. Species that constitute food sources for *L. flavicauda* had greater density, dominance and ecological importance in both high use transects (Figure 3). In transect 1 (high use zone) the most important species were *Styloceras columnare Müll. Arg*. (9%), *Nectandra membranacea (Sw.) Griseb*. (9%), *Hieronyma asperifolia Pax & K. Hoff*m. (8%), and *Hedyosmum cuatrecazanum Occhioni* (9%). In transect 3 (high use zone) the most important species are *Hedyosmum cuatrecazanum Occhioni*

(9%), *Psychotria aff. tinctoria (Aubl.) Raeusch* (8%), *Pourouma bicolor subsp. bicolor Mart*. (7%), and *Styloceras columnare Müll. Arg*. (6%). All of these species represent important food sources for *L. flavicauda* [Leo Luna, 1980; Hernandez Jaramillo, 2013; Shanee, 2014].

Table 3. Density, relative density, dominance, relative dominance, and relative importance (relative density + relative dominance measures for all live stems ≥ 2.5 cm dbh across the three use zones (six vegetation transects). Relative values are placed in parenthesis next to absolute values.

Species	Density (stems/ha) (relative density (%))						Dominance (m2/ha) (relative dominance (%))						Relative Importance (%)					
	High Use		Medium Use		Low Use		High Use		Medium Use		Low Use		High Use		Medium Use		Low Use	
	T1	T3	T2	T4	T0	T5	T1	T3	T2	T4	T0	T5	T1	T3	T2	T4	T0	T5
Ficus sp.2	0(0)	10(0)	10(0)	0(0)	10(0)	0(0)	0(0)	0(2)	1(13)	0(0)	0(0)	0(0)	0	1.3	6.8	0	0.2	0
Hieronyma asperifolia	120(3)	40(1)	10(0)	40(1)	0(0)	60(2)	5(13)	0(0)	0(0)	0(0)	0(0)	0(0)	8.1	0.7	0.3	0.6	0	1
Ficus sp.1	10(0)	40(1)	20(1)	0(0)	20(1)	10(0)	1(3)	0(6)	1(13)	0(0)	0(3)	0(0)	1.8	3.7	6.7	0	2.1	0.1
Ocotea sp.1	110(3)	170(5)	30(1)	0(0)	0(0)	0(0)	1(3)	0(4)	0(2)	0(0)	0(0)	0(0)	3.1	4.4	1.7	0	0	0
Styloceras columnare	410(12)	300(9)	310(13)	190(5)	470(20)	50(1)	3(7)	0(3)	0(5)	0(3)	0(13)	0(1)	9.2	5.9	8.7	3.9	16.1	1
Myriocarpa sp.1	40(1)	10(0)	10(0)	10(0)	0(0)	10(0)	0(1)	0(0)	0(1)	0(0)	0(0)	0(1)	1.1	0.2	0.5	0.3	0	0.5
Hedyosmum cuatrecazanum	160(5)	140(4)	20(1)	170(5)	10(0)	130(3)	3(7)	10(14)	0(0)	1(11)	0(4)	0(1)	5.7	9	0.5	8	2.1	2.3
Heliocarpus americanus	20(1)	50(1)	20(1)	10(0)	20(1)	20(1)	0(0)	0(3)	0(1)	0(1)	0(2)	0(0)	0.4	2.3	0.8	0.7	1.3	0.4
Heteropterys sp.1	20(1)	60(2)	50(2)	20(1)	10(0)	0(0)	0(0)	0(1)	0(1)	0(1)	0(0)	0(0)	0.3	1.3	1.4	0.7	0.3	0
Cecropia aff. tacuna	0(0)	40(1)	20(1)	30(1)	0(0)	10(0)	0(0)	0(3)	0(4)	0(2)	0(0)	0(3)	0	2.1	2.7	1.6	0	1.8
Cecropia sp.1	0(0)	20(1)	0(0)	50(1)	0(0)	20(1)	0(0)	0(2)	0(0)	0(2)	0(0)	0(1)	0	1.4	0	1.8	0	0.6
Nectandra membranacea	260(7)	180(5)	150(6)	210(6)	60(3)	70(2)	4(10)	0(3)	0(5)	0(3)	0(4)	0(1)	8.5	3.8	5.6	4.6	3.2	1.3
Magnolia aff. rimachii	70(2)	10(0)	10(0)	10(0)	0(0)	10(0)	3(7)	0(1)	0(0)	0(0)	0(0)	0(1)	4.6	0.7	0.4	0.3	0	0.6
Psychotria aff. tinctoria	250(7)	470(13)	20(1)	460(12)	30(1)	50(1)	0(1)	0(3)	0(0)	0(2)	0(0)	0(0)	4.1	8.1	0.5	7.2	0.7	0.7
Eugenia sp.2	20(1)	0(0)	0(0)	0(0)	10(0)	0(0)	2(5)	0(0)	0(0)	0(0)	0(0)	0(0)	3	0	0	0	0.3	0
Elaeagia sp.1	80(2)	0(0)	0(0)	60(2)	0(0)	0(0)	1(4)	0(0)	0(0)	0(0)	0(0)	0(0)	2.9	0	0	0.9	0	0
Cinnanomun triplenerva	110(3)	200(6)	40(2)	140(4)	70(3)	120(3)	1(2)	0(4)	0(4)	0(4)	0(12)	0(4)	2.4	4.8	2.9	4	7.7	3.8
Palicourea aff. buchtienii	110(3)	10(0)	30(1)	130(4)	50(2)	90(2)	1(2)	0(0)	0(1)	0(1)	0(1)	0(1)	2.4	0.2	1.2	2	1.8	1.6
Meriania hexamera	110(3)	170(5)	20(1)	20(1)	210(9)	20(1)	1(1)	0(6)	0(0)	0(0)	0(3)	0(0)	2.2	5.6	0.5	0.3	5.8	0.5
Faramea miconioides	100(3)	60(2)	50(2)	130(4)	30(1)	90(2)	1(2)	0(1)	0(0)	0(1)	0(1)	0(1)	2.2	1.2	1.2	2.2	0.9	1.7
Cyathea sp.2	50(1)	90(3)	10(0)	20(1)	10(0)	20(1)	1(3)	0(2)	0(0)	0(0)	0(0)	0(0)	2	2.2	0.4	0.3	0.3	0.4
Saurauia peruviana	110(3)	60(2)	30(1)	0(0)	0(0)	0(0)	0(1)	0(0)	0(0)	0(0)	0(0)	0(0)	1.9	1	0.6	0	0	0
Palicourea sp.2	70(2)	10(0)	70(3)	80(2)	10(0)	50(1)	1(2)	0(0)	0(1)	0(1)	0(0)	0(2)	1.9	0.1	2	1.5	0.3	1.4
Palicourea sp.1	70(2)	70(2)	20(1)	10(0)	10(0)	100(3)	1(2)	0(2)	0(3)	0(0)	0(0)	0(3)	1.9	2	1.9	0.1	0.2	3
Cedrela odorata	20(1)	20(1)	20(1)	0(0)	10(0)	0(0)	1(3)	0(0)	0(2)	0(0)	0(0)	0(0)	1.7	0.3	1.2	0	0.2	0
Others	1220(34)	1280(36)	1460(60)	1910(52)	1350(56)	2870(76)	9(23)	20(39)	3(43)	3(66)	2(56)	4(79)	28.6	37.7	51.7	58.8	56.3	77
Total	3540 (100)	3510 (100)	2430 (100)	3700 (100)	2390 (100)	3800 (100)	40 (100)	50 (100)	7 (100)	5 (100)	3 (100)	5 (100)	100	100	100	100	100	100

Styloceras columnare, was found to have significant ecological importance in all use zones. In transects 0 through 6 it has an importance of 9%, 5%, 9%, 4%, 16%, and 1% respectively. However, the other plant species that provide a food source are either absent, in low density or dominance in the medium and low use zones (Figure 3, Table 3).

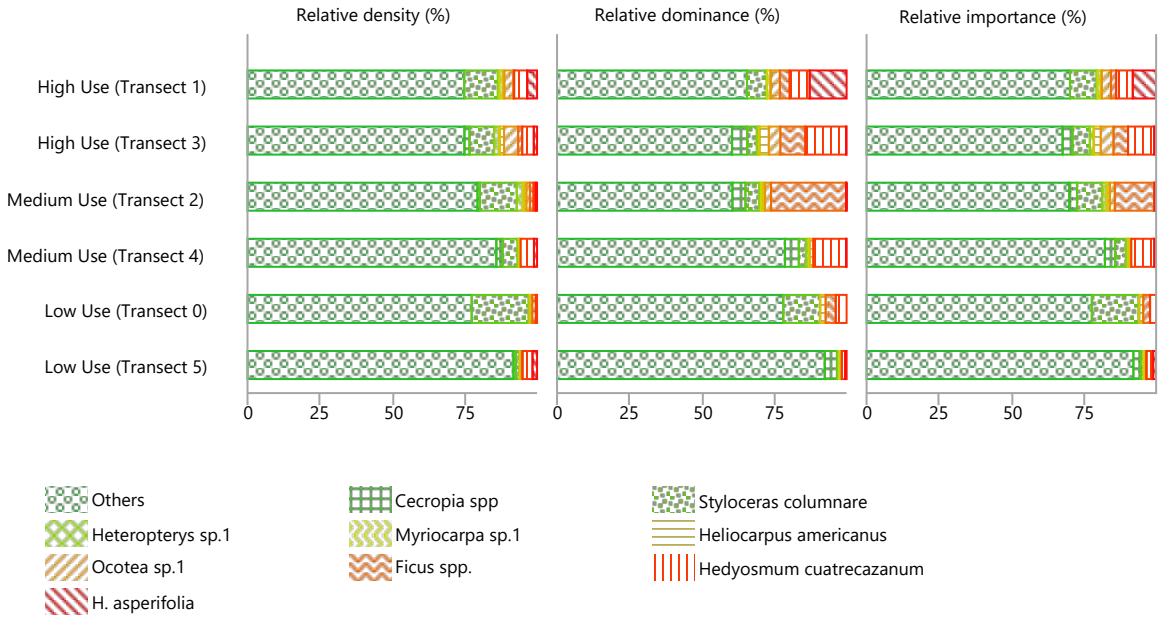

Figure 6. Relative density, dominance and importance of feeding plants for *Lagothrix flavicauda* across use zones in Yambrasbamba, Amazonas, Peru.

Hyeronima. asperifolia and Hedyosmum. cuatrecazanum are the most important sources of fruits and flowers for *L. flavicauda* [Hernandez Jaramillo, 2013]. *H. asperifolia* has a relative dominance of 13% in transect 1 (high use zone). On the other hand, its relative dominance is below 0.5% in all other transects. Higher dominance is related to greater diameters, meaning that individuals of *H. asperifolia* found in transect 1 have greater diameters than those present in medium and low use zones. DBH is an accurate indicator of tree size, which is positively correlated to fruit yield [Chapman et al., 1992; Miller & Dietz, 2004]. Similarly, in transects 3 (high use zone), 4 (medium use zone), and 1 (high use zone); *H. cuatrecazanum* has a relative dominance of 14%, 11% and

7% respectively. While it accounts for 4%, 0.1% and 1% in transects 0, 5 (low use) and 2 (medium use) respectively.

Nectandra. membranacea and *Magnolia aff. rimachii* also show particularly high relative dominance in transect 1 compared to medium and low use zones. *M. aff rimachii* has a relative dominance of 7% in transect 1 while its relative dominance is lower than 1% in the medium and low use zones. *Nectandra membranacea* has a relative dominance of 10% in transect 1 while it only accounts for 5% or less of the total basal area in medium and low zones.

Forest Structure

Forest structure analysis revealed significant differences ($p < 0.05$) across transects regarding stems density, density of flowering / fruiting stems, vine density, total height, crown spread, moss cover, crown illumination, and vine infestation (Table 2). However, the post hoc tests indicate that they do not determine habitat preference by *L. flavicauda.*

Table 4. Structural parameters significantly different across transects. Values with different letters (a, b, c) indicate post hoc results at $p < 0.05$.

	High Use		**Medium Use**		**Low Use**	
Parameter	T1	T3	T2	T4	T0	T5
Density (stems 0.01 ha $^{-1}$)	35.4 ± 2.16 ab	35.1 ± 2.81 ab	24.3 ± 2.10 a	37 ± 2.40 b	23.9 ± 1.69 a	38 ± 3.3 b
Density (stems ha $^{-1}$)	3540	3510	2430	3700	2390	3800
Density of flowering/fruiting trees (stems 0.01 ha^{-1})	3.20 ± 0.69 ab	3.6 ± 0.86 ab	1.6 ± 0.43 ab	4.4 ± 0.91 a	1.1 ± 0.55 b	1.6 ± 0.54 ab
Density of flowering/fruiting trees (stems 1 ha $^{-1}$)	320	360	160	440	110	160
Vine density in transect	0.9 ± 0.38 ab	0.5 ± 0.22 a	1.7 ± 0.56 ab	0.9 ± 0.38 ab	3.3 ± 0.8 b	1 ± 0.49 ab
Total height (m)	6.62 ± 0.39 a	7.44 ± 0.31 ab	8.89 ± 0.7 b	7.05 ± 0.28 ab	7.48 ± 0.52 ab	7.28 ± 0.33 ab
Crown spread (cm)	2.07 ± 0.1 a	2.8 ± 0.13 b	3.18 ± 0.277 b	2.57 ± 0.13 ab	2.74 ± 0.19 ab	2.75 ± 0.25 ab
Moss cover *	1.88 a	2.16 a	2.41 ab	2.49 ab	2.64 b	1.84 a
Crown illumination index *	1.88	2.16	2..47	2.49	2.64	1.84
Vine infestation index *	0.82 ab	1.81 a	1.29 ab	1.42 ab	1.35 ab	1 b

The results of the post hoc tests showed that transects located in low and high use zones have similar characteristics. For example, moss cover was found to be significantly similar (table 4) in transects 1, 3 (high use zone) and 5 (low use zone). Similarly, we did not find a relationship between high use zones and vine density, total height crown spread, crown illumination, and vine infestation (Table 2).

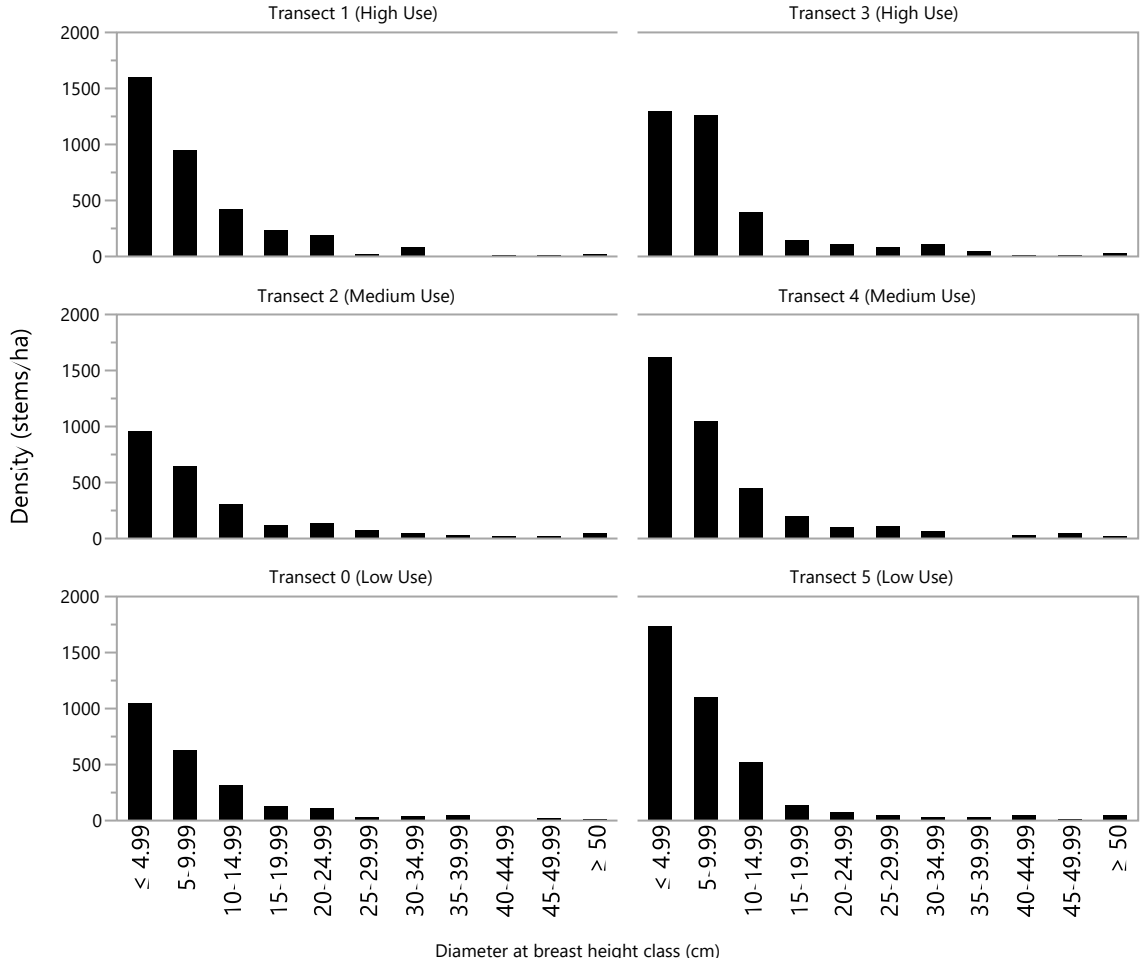

Figure 7. Diameter Distribution. Density of stems per 0.1 ha in 5 cm diameter classes across the three use classes (two transects per class).

However, transects 4, 1, and 3 (from the high and medium use zones) do show a higher density of fruiting/flowering trees compared to the low use zone and transect 2 from the medium zone. No statistical differences ($p < 0.05$) were found in basal area, dead stems density, dead stems basal area, bole height, crown position, vascular epiphytes load, non-vascular epiphytes load, and canopy cover across transects.

Collectively, stems from all species formed a reverse-J-shape diameter distribution across all transects (Figure 6). This trend indicates continuous regeneration and recruitment into larger diameter classes throughout the study area. However, when looking at the diameter distribution of the eight most important food plants for *L. flavicauda*, separately, we found different diameter distributions across transects and across species (Figure 7).

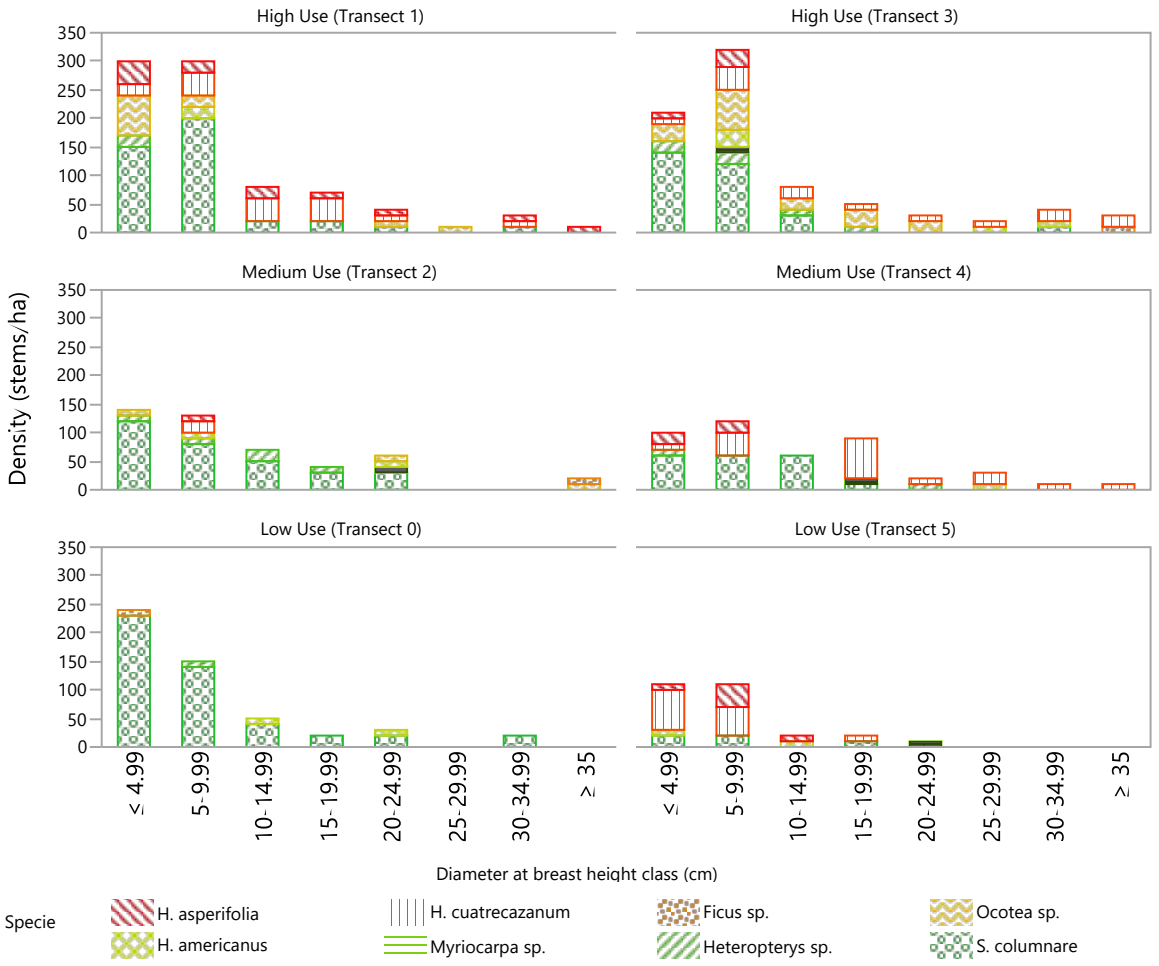

Figure 8. Density of stems per 0.1 ha in 5 cm diameter classes across the three use classes of most important food species for *Lagothrix flavicauda*. Yambrasbamba, Amazonas, Peru.

Both transects located in the high use zones (transect 1 and 3) have an overall higher presence of preferred food plants across diameter classes than transects in the medium and low use zones. Transects 1 and 3 have a total of 880 and 780 stems of preferred feeding species/ha respectively. While densities in low and medium use transects fluctuate between 520 and 270 stems of preferred feeding species/ha.

Natural regeneration (DBH <10 cm.) of preferred feeding plants occurs at higher densities in both high use transects. In transect 1, all alimentation species, but *Ficus spp.*, are present in diameter classes lower than 10 cm. and add to a total of 630 stems per hectare. In transect 3, there are 530 stems (DBH <10cm) per hectare, including all eight alimentation species. In all other transects, natural regeneration occurs at lower densities and diversity. For example, transect 0 has a total regeneration of 390 individuals and 94% (370) of them are *Styloceras columnare*. Transects 2, 4, and 5 have a feeding plants natural regeneration of 270, 220, and 220 individuals per ha. respectively. However, 54% (120 stems/ha) of the natural regeneration in transect 5 corresponds to *Hedyosmum cuatrecazanum* while in all other transects density of *H. cuatrecazanum* in regeneration classes (DBH<10cm) is lower than 60 stems/ha.

Similarly, in DBH classes greater than 20cm, transects in the high use zone (T1 and T3) present the highest density of feeding plants. With 100 stems/ha in transect 1 and 120 in transect 3. Transects 2 and 4 (medium use zone) had 80 and 70 stems of preferred feeding species/ha. Low use transects (0 and 5) presented the lowest density of alimentation plants stems, with 60 and 10 stems/ha for transects 0 and 5 respectively.

DISCUSSION

Habitat Preference

Foraging and food consumption occupies a great part of the time budget of all primate species. *L. flavicauda* spends on average 30% of their time feeding and 13 – 18% foraging [Shanee & Shanee, 2011; Hernandez Jaramillo, 2013]. The spatial distribution, and density of food sources can influence the intensity with which habitat is utilized through time [Terborgh, 1983; Chapman, 1988]. Accordingly, our results show that differences in forest composition and especially the dominance of preferred mature food trees appear to be important factors for habitat preference in *L. flavicauda*. At least nine of the plants consumed in *L. flavicauda* have high ecological importance (density + dominance) in high use zones (Figure 3) and present continuous regeneration and recruitment into larger diameter classes (Figure 5). On the contrary, food plants in medium and low use zones have less ecological importance or are absent.

Conversley, structural differences do not appear to be related to habitat preference in *L. flavicauda*. None of the structural characteristics measured (vine density, total height, bole height, crown spread, crown position index, crown illumination index, moss cover, vine infestation index, fallen trees density, vine density in transect, vascular epiphytes load, and total basal area), was significantly different in high use zones compared to medium and low use zones.

We found that density of flowering / fruiting trees was generally higher in high use zones compared to medium and low use zones. However, transect 4 (medium use zone) showed the highest density of flowering and fruiting trees.

Tree height has been reported to play a role in habitat preference where some primate species prefer taller trees as an anti-predation strategy [Enstam & Isbell, 2004] and other species prefer lower forest strata [Pyritz et al., 2010]. *L flavicauda* has been reported to predominantly use higher forest strata, using the mid canopy for traveling and the upper canopy for resting and feeding [Shanee, 2014b]. We did not find the high use zones to have higher average tree height. However, visual estimates of height are subject to error. This apparent non-preference for higher trees could be a specific trait of the study group dictated by conditions specific to the study site such as low density of major predators or strata dominance of *L. flavicauda* over other primate species, or differences in habitat structure.

Epiphytes are known as sources of arthropods as they serve them as food, shelter, and breeding sites [Kitching, 2000; Wester et al., 2010]. Studies on woolly monkeys have reported arthropods as an important part of their diet [Fiore & Rodman, 2001; Stevenson & Quiñones, 2004; Pickett et al., 2012; Rothman et al., 2014; Vargas et al., 2014]. Therefore, the availability of epiphytes and arthropod food sources are considered important factors when designing conservation plans[Vargas et al., 2014]. Epiphyte load and moss cover were not significantly different across use zones by *L. flavicauda* in our study site. However, this is most likely a characteristic specific to the this site, where the study troop of *L. flavicauda* has been observed feeding mainly on fruits

and leaves [Hernandez Jaramillo, 2013]. A more detailed assessment of abundance and diversity of epiphyte will provide a better insight into the relationship of epiphytes and woolly monkeys.

Habitat preference by yellow tailed woolly monkeys can be better understood by incorporating seasonal movement of the troop, feeding behavior and plant phenology into the analysis. However, this initial results will be useful to be used in designing conservation strategies while further studies are developed and more information become available.

Ecological and Conservation Implications

Forest demography and structure are profoundly influenced by seed dispersal [Schupp & Fuentes, 1995; Nathan & Muller-landau, 2000; Wang & Smith, 2002]. In our study, the importance of the ecological role of *L. flavicauda* as a seed disperser is evidenced when taking into account the spatial distribution of the use zones and the spatial distribution of plant species and regeneration. The two high use zones are separated by a distance of 0.6 km. However, the DCA analysis revealed that high use zones have the highest similarity in floristic composition. This interaction between feeding plants and seed dispersals, such as *L. flavicauda*, represents a positive feedback loop, where the home range and spatial distribution of the troop is influenced by the spatial distribution of trees, and the spatial distribution of seeds is influenced by the troop seed dispersal.

Spatial distribution of seeds dispersed by woolly monkeys within its home range is highly correlated to habitat use [Stevenson, 2004]. In our study, besides the 2 high use zones, important regeneration of *Hieronyma asperifolia, Styloceras columnare, Hedyosmum cuatrecazanum,* and *Heteropterys sp.* was observed in transect 4 (medium use zone, located between the 2 high use

zones) and transect 5 (low use zone). Accordingly, regeneration of feeding plant species is observed in transects 2 and 0 to a lesser extent.

Hieronyma asperifolia, Styloceras columnare, Hedyosmum cuatrecazanum, Ficus spp., and probably most feeding plants have fleshy colorful fruits, and like most fleshy fruited species from the tropics, their seeds are dispersed by endozoochory [Chapman, 1995]. Primates are the main consumers of fruits in tropical forest [Terborgh, 1983], therefore the main seed dispersers of, at least, the species they feed on.

The natural regeneration represents potential for future habitat improvement. Sites where regeneration is occurring naturally are of particular importance because conservation efforts in these areas can be more effective and less costly if we allow the seed dispersers to do their job and aid them by avoiding deforestation. Additionally, our results of forest we recommend targeting reforestation with key food species, where natural regeneration is not possible. Furthermore, identification and protection of sites with similar floristic composition to the high use zones will ensure habitat availability for *L. flavicauda*.

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APPENDIX 1. FIELD DATA COLLECTION FORMAT AND GUIDELINES

Caracterización del Hábitat del mono choro cola amarilla
Yellow-Tailed Woolly Monkey Habitat Characterization

Formato de recolección de datos
Data Collection Formats

Sup parcelas – Sub plots

Fecha:
Hora inicio SP:
Hora final SP:

Investigadores:
Coordenadas inicio: e.g. T1-SP0-I
Coordenadas final: e.g. T1-SP0-F

Topografía 1(0m):
Topografía 2 (25m):
Cuerpo de agua:

T	S	I	Familia	Género	Nombre Común	DAP	At	Af	CRa	CRb	Ci	PS	LB	E	F	Ex
1	1	1			machimango	37	18	21	1	2	1	1	0	1	F,H	S
1	1	2			machimango	38	17	21	1	1	1	2	4	2	Fr,F,H	S
1	1	-			claro (gap)	10.5	-	-	4	2	-	-	-	-	caído	-

Cobertura (cada 25 metros) – Canopy cover (every 25 meters)

Meters (Metros)	Arriba (Up)	Derecha (Left)	Abajo (Down)	Derecha (Right)
25				

Definición de variables
Variables definition

- T: Número de transecto
  Number of the assigned transect
- S: Número de subparcela. Cada transecto tiene 10 subparcelas de 2x50
  Number of sub plot inside transect. Each transect has 10 sub plots of 2x50m
- I: Número correlativo de individuo dentro de la subparcela
  Correlative number of sampled plant inside each subparcela
- Familia: Familia taxonómica del individuo
  Taxonomic Family of the sampled tree/vine
- Género: Genero al que pertenece el individuo
  Taxonomic Genus of the tree/vine
- Nombre común: Common name
- DAP: Diámetro a la altura del pecho en cm
  Diameter (or circumference) at breast height in cm
- At: Altura total
  Total Height in meters
- Af: Altura fuste
  Bole height
- CRa: Radio mayor de la copa
  Biggest Crown radius
- CRb: Radio menor de la copa
  Perpendicular to largest Crown radius
- Ci: iluminación de copa
  Crown illumination, light regarding the position of the crown.

COD	Definición	Definition
1	Suprimido (Ninguna iluminación directa)	No direct light (crown not lit directly
2	Intermedio (Iluminación lateral)	Lateral light (<10% of the vertical projection of the crown exposed to vertical light, crown lit laterally)
3	Codominante (Alguna iluminación superior)	Some overhead light (10-90% of the vertical projection of the crown exposed to vertical illumination)
4	Dominante (Plena iluminación superior)	Full overhead light (≥90% of the vertical projection of the crown exposed to vertical light, lateral light blocked within some or all of the 90º inverted cone encompassing the crown)
5	Emergente (Plena iluminación superior y lateral)	Crown fully exposed to vertical and lateral illumination within the 90º inverted cone encompassing the crown

- PS: Posición sociológica
  Strata position

COD	Definición	Definition
1	Suprimido, más bajo que el nivel general del dosel y no recibe luz	Shorter than the canopy level and receiving no illumination
2	Intermedio, más bajo que el nivel general del dosel pero aun recibe algo de luz	Shorter than the general canopy level, but still illuminated from above
3	Codominante, la copa está dentro del nivel general del dosel	Crown within the general level of the canopy
4	Dominante la copa está por encima del nivel general del dosel	Crown above the general level of the canopy

- LB: Cantidad de lianas y bejucos en el fuste y copa del árbol
  Amount of vines present in the tree bole and crown

COD	Definición	Definition
0	Libre de Lianas y bejucos	No vines
1	Lianas/bejucos en el fuste	Presence of vines in bole
2	Lianas/bejucos en la copa	Presence of vines in crown
3	Baja presencia de lianas y bejucos en el fuste y la copa	Low presence in bole and crown
4	Alta presencia de lianas y bejucos en el fuste y la copa	High presence in bole and crown

- E: Cantidad de epifitas vasculares en el árbol (bromelias, orquídeas, araceas, helechos)
  Amount of vascular epiphytes (bromeliads, orchids, aroids, ferns)

COD	Definición	Definition
0	No hay epifitas en la copa	No epiphytes on the tree
1	25% de la copa está cubierto por epifitas	25% of the crown is occupied by epiphytes
2	50% de la copa está cubierta por epifitas	50% of the crown is occupied by epiphytes
3	75% de la copa está cubierta por epifitas	75% of the crown is occupied by epiphytes
4	100% de la copa está cubierta por epifitas	100% of the crown is occupied by epiphytes

- F: Fenología del árbol
  Phenological state of the individual.

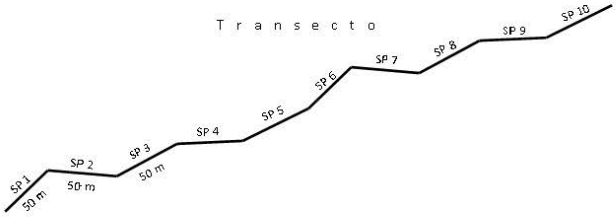
COD	Definición	Definition
Fr	Hay frutos en el árbol	There are fruits on the tree
F	Hay flores en el árbol	There are flowers on the tree
H	Hay hojas en el árbol	There are leafs on the tree

- Ex: El tipo de exudado
  The kind of exudate

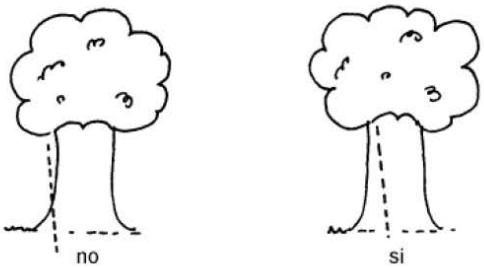
COD	Definición	Definition
S	Savia	Sap
G	Goma	Gum
L	Látex	Latex
R	Resina	Resin

Instrucciones para la toma de datos
Guidelines for data collection

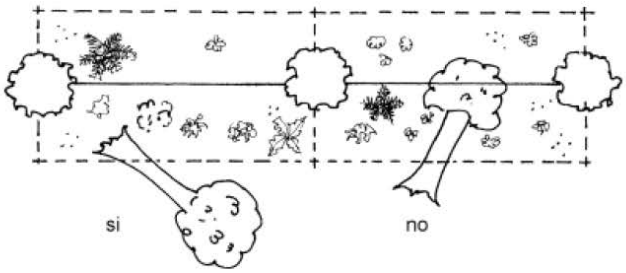
- T y SP: Transecto y subparcela – Transect y subplot



- I: Individuo – Plant:
  Se registraran y tomaran 3 muestras botánicas de todas las plantas dentro de la subparcela con:
  We will register and take 3 botanic samples from all plants inside the subplot if:
  - DAP mayor o igual a 2.5cm
    DBH is equal or greater than 2.5cm
  - Por lo menos el 50% de la raíz está dentro de la subparcela
    At least 50% of the root system falls within the subplot



  - Si hay un árbol vivo caído, cuya raíz se encuentra dentro del transecto, pero su tallo y follaje están fuera del mismo, entonces debe incluirse. Por el contrario, si su tallo y follaje están dentro del transecto, pero no su raíz, entonces no debe incluirse.

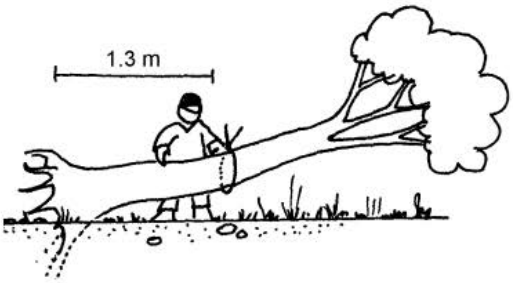


  - Cuando se encuentra un individuo caído (vivo o muerto) dentro de un transecto, su DAP o CAP debe ser medido sobre el tronco a una distancia 1.3 m desde donde sale la raíz.

Las colecciones botánicas se ponen en una bolsa marcada con cinta o una etiqueta con el número del transecto, el número de la subparcela y el número del individuo: por ejemplo T1-SP1-1A (esto quiere decir individuo 1 de la subparcela 1 del transecto 1).

Árboles caídos
Fallen trees

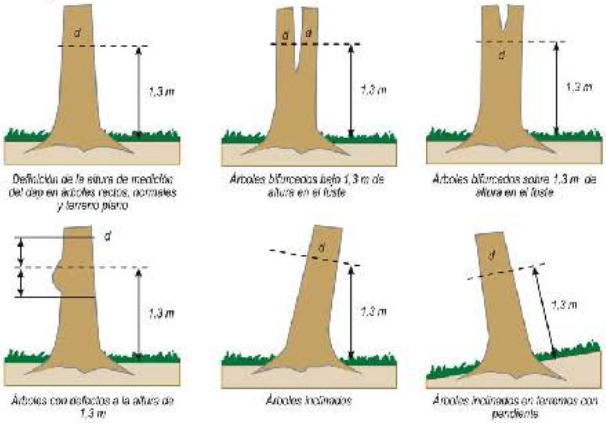
- Anotar el DAP y los radios menor y mayor del claro
- Register DBH and the biggest and radius of the gap perpendicular to largest radius

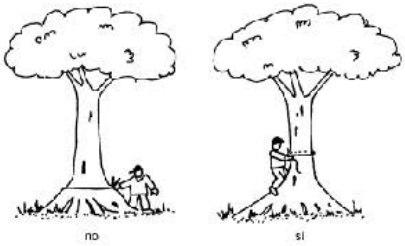


Árboles muertos en pie
Standing dead tree

- Cuando se encuentra un árbol caído se toma el **DAP** y los radios menor y mayor del claro

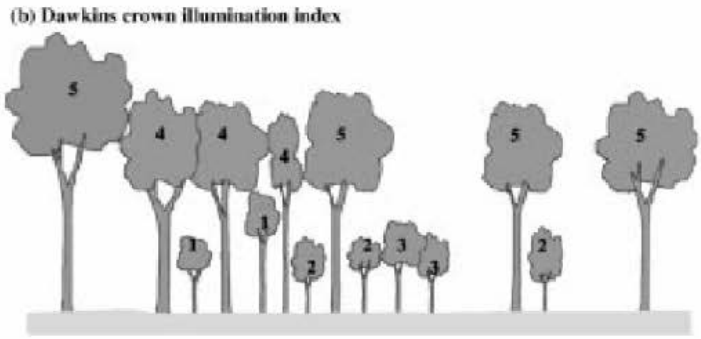
- **DAP:** Diámetro a la altura del pecho – **Diameter at breast height**

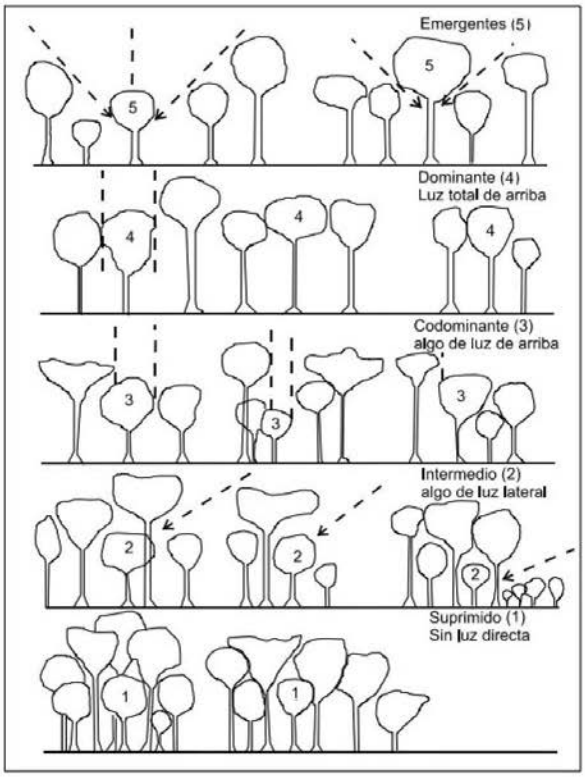




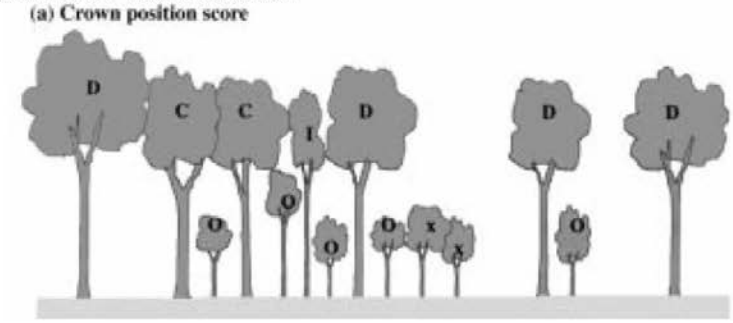
Árboles con raíces tablares deben medirse arriba de éstas, es decir, donde comienza el fuste recto del tallo, así esté por encima de la altura del pecho.

- Ci: Crown Illumination – Iluminación de la copa



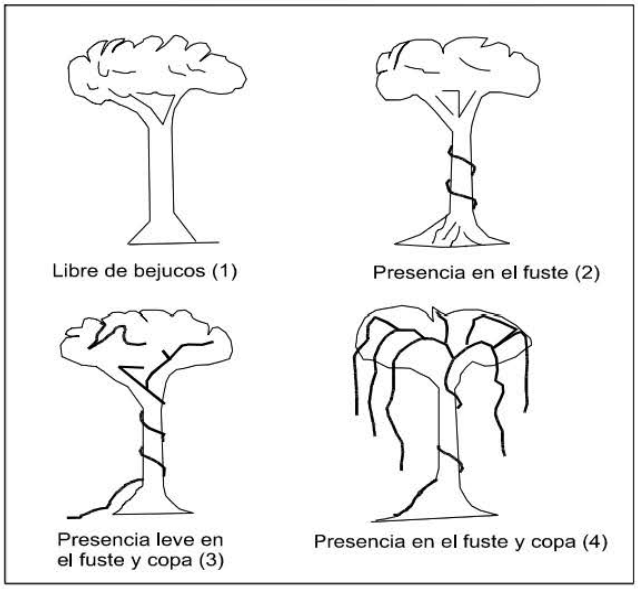


- PS:Sociological Position – Posición sociológica

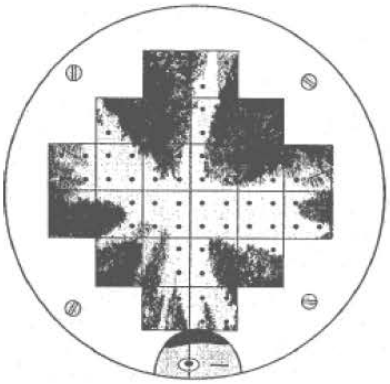


D=1, C=2, I=3, O=4,

- LB: amount of vines – Cantidad de lianas



- Canopy cover- Cobertura



Vista del densiometro mostrando los 96 puntos imaginarios.

View of densiometer mirror showing placement of operator's head and with the 96 imaginary dots represented.

APPENDIX 2. RESEARCH AUTHORIZATION FROM THE PERUVIAN GOVERNMENT

REPÚBLICA DEL PERÚ

RESOLUCIÓN DE DIRECCION GENERAL
N° 225 -2015-SERFOR-DGGSPFFS

Lima, 27 AGO 2015

VISTA:

La solicitud de autorización para realizar investigación científica con colecta de fauna y flora silvestre, presentada por la Ing. Forestal Sandra Lucía Almeyda Zambrano;

CONSIDERANDO:

Que, la Constitución Política del Perú de 1993, en el artículo 66° establece que los recursos naturales, renovables y no renovables, son patrimonio de la Nación. El Estado es soberano en su aprovechamiento. Por ley orgánica se fijan las condiciones de su utilización y de su otorgamiento a particulares. La concesión otorga a su titular un derecho real, sujeto a dicha norma legal;

Que, la Ley N° 26821, Ley Orgánica para el aprovechamiento sostenible de los Recursos Naturales, establece en el artículo 9° que el Estado promueve la investigación científica y tecnológica sobre la diversidad, calidad, composición, potencialidad y gestión de los recursos naturales. Promueve, asimismo, la información y el conocimiento de los recursos naturales. Para estos efectos, podrán otorgarse permisos para investigación en materia de recursos naturales incluso sobre recursos materia de aprovechamiento, siempre que no perturben el ejercicio de los derechos concedidos por los títulos anteriores;

Que, el artículo 13° de la Ley N° 29763, crea el Servicio Nacional Forestal y de Fauna Silvestre-SERFOR, como organismo público técnico especializado, con personería jurídica de derecho público interno, como pliego presupuestal adscrito al Ministerio de Agricultura y Riego. Asimismo, se señala que el SERFOR es la autoridad nacional forestal y de fauna silvestre, ente rector del Sistema Nacional de Gestión Forestal y de Fauna Silvestre (SINAFOR), y se constituye en su autoridad técnico normativa a nivel nacional, encargada de dictar las normas y establecer los procedimientos relacionados a su ámbito;

Que, mediante Decreto Supremo N° 007-2013-MINAGRI, modificado por Decreto Supremo N° 016-2014-MINAGRI, se aprobó el Reglamento de Organización y Funciones - ROF del SERFOR, el mismo que en su literal g) del artículo 53, señala como una de las funciones de la Dirección General de Gestión Sostenible del Patrimonio Forestal y de Fauna Silvestre, la de otorgar permisos de investigación o de difusión cultural con o sin colecta de flora y fauna silvestre;

Que, mediante Resolución Ministerial 424-2014-MINAGRI, se da por concluido el proceso de transferencia de la Dirección General Forestal y de Fauna Silvestre al Servicio Nacional Forestal y de Fauna Silvestre – SERFOR, así como el proceso de fusión por absorción, entre otros;

Que, el artículo 328° del Reglamento de la Ley Forestal y de Fauna Silvestre, aprobado mediante Decreto Supremo N° 014-2001-AG, establece que la investigación científica o estudio que implique colección de especímenes o elementos de la flora y fauna

silvestre no vedados y la obtención de datos e información de campo, requiere autorización del INRENA;

Que, el Decreto Supremo N° 004-2014-MINAGRI y D.S. Nº 043-2006-AG, se aprueba la actualización de la lista de clasificación y categorización de las especies amenazadas de fauna y flora silvestre respectivamente legalmente protegidas;

Que, la Tercera Disposición Final del Reglamento de Acceso a los Recursos Genéticos, aprobado por Resolución Ministerial N° 087-2008-MINAM, señala que la obtención de permisos, autorizaciones y demás documentos que otorguen entidades públicas, tales como el Ministerio de Agricultura y que amparen la investigación, obtención, provisión, transferencia u otro de recursos biológicos, con fines distintos a su utilización como fuente de recursos genéticos, no faculta a sus titulares a utilizar dichos recursos como medio para acceder a los recursos genéticos, ni determinan ni presumen autorización de acceso;

Que, el Decreto Supremo N° 003-2009-MINAM que eleva a rango de Decreto Supremo la Resolución Ministerial N° 087-2008-MINAM, y ratifica la aprobación del Reglamento de Acceso a Recursos Genéticos efectuadas por la referida Resolución;

Que, mediante Resolución Ministerial N° 212-2011-AG, se aprueba la modificación al Texto Único de Procedimientos Administrativos (TUPA) del Ministerio de Agricultura y Riego, el mismo que establece en su procedimiento 21, los requisitos de la autorización para realizar actividades de investigación científica y filmaciones con fines comerciales de flora y fauna fuera de Áreas Naturales Protegidas, el mismo que resulta aplicable para el presente procedimiento, en virtud de lo dispuesto en el artículo 6° de la Resolución Ministerial N° 0424-2014-MINAGRI;

Que, mediante Resolución de Dirección Ejecutiva N° 031-2014-SERFOR-DE del 01 de octubre del 2014, emitida por el Servicio Nacional Forestal y de Fauna Silvestre – SERFOR, se designó al Blgo. Mirbel Alberto Epiquién Rivera, las funciones de Director General de Gestión Sostenible del Patrimonio Forestal y de Fauna Silvestre del Servicio Nacional Forestal y de Fauna Silvestre – SERFOR;

Que, en fecha 17 de junio de 2015, la Ing. Forestal Sandra Lucía Almeyda Zambrano, representante del proyecto, solicita autorización para realizar investigación científica con colecta de fauna y flora silvestre, en el marco del Proyecto denominado "La Esperanza: Corredor Biológico para la Conservación del Mono Choro Cola Amarilla, una investigación participativa – séptima etapa"; por el período comprendido entre el 01 de junio del 2015 hasta el 01 de junio del 2020;

Que, el Informe Técnico N° 0027-2015-SERFOR-DGGSPFFS-DGSPFS-MEBS del 11 de agosto de 2015, emitido por la Dirección de Gestión Sostenible del Patrimonio de Fauna Silvestre, indica que la responsable del Proyecto, ha cumplido con presentar los requisitos establecidos en el procedimiento Nº 21 del TUPA del MINAGRI y concluye que el desarrollo y ejecución del proyecto, es importante, debido a que es la continuación de una investigación que se viene realizando desde hace ya varios años, de dos especie de primates, *Oreonax flavicauda (Lagothrix flavicauda)* categorizada como En Peligro Crítico (CR) tanto a nivel nacional como internacional, así como de la especie *Aotus miconax*, categorizada como Vulnerable (VU) a nivel nacional e internacional. Las investigaciones realizadas en los últimos años, han contribuido a incrementar el conocimiento de su

población, de su ecología, de su comportamiento, así como del impacto que produce la actividad antrópica que ocasiona la fragmentación de su hábitat; Los resultados que se obtienen están siendo utilizados para realizar proyectos de conservación tan necesarios para las especies de los bosques montanos de la Amazonía del Perú;

Que, finalmente el informe recomienda que el responsable del Proyecto debe garantizar que se adoptarán las medidas necesarias a fin de reducir los impactos y aplicar todas las medidas de seguridad y eliminación de impactos que se puedan producir por las actividades propias de las fases de campo, como toma de datos, tratamiento y transporte de muestras, transporte de equipos, personal, etc.;

En uso de las atribuciones conferidas por el artículo 53º del Reglamento de Organización y Funciones del Servicio Nacional Forestal y de Fauna Silvestre - SERFOR, aprobado por Decreto Supremo Nº 007-2013-MINAGRI, el mismo que en su literal k) precisa como función de la Dirección General de Gestión Sostenible del Patrimonio Forestal y de Fauna Silvestre, el otorgar permisos de investigación o de difusión cultural con o sin colecta de flora y fauna, en el marco de las normas nacionales e internacionales vinculadas a la materia y estando a lo informado y con la visación correspondiente de la Dirección de Gestión Sostenible del Patrimonio de Fauna Silvestre.

SE RESUELVE:

Artículo 1º.- Autorizar a la representante del proyecto y a los siguientes investigadores; la realización de la investigación científica fuera de Áreas Naturales Protegidas, con colecta de fauna silvestre, en el marco del Proyecto denominado "La Esperanza: Corredor Biológico para la Conservación del Mono Choro Cola Amarilla, una investigación participativa – séptima etapa", ubicado en el distrito de Yambrasbamba, provincia de Bongará, departamento de Amazonas; por el período comprendido de cinco (05) años, contados a partir de la fecha de emisión de la presente Resolución:

NOMBRES Y APELLIDOS	CARGO	PASAPORTE/DNI
Sandra Lucía Almeyda Zambrano	(Representante del Proyecto)	DNI N° 43735083
Néstor Francisco Allgas Marchena	(Investigador)	DNI N° 40325593
Sam Shanee	(Colaborador)	C.E.N° 001082271
Noga Shanee	(Colaborador)	C.E.N° 000976418

Relación de especies biológicas a colectar: Teniendo en cuenta los objetivos y metodologías presentadas por la responsable del Proyecto y considerando la importancia de la investigación, se recomienda autorizar la colecta de material fecal de primates endémicos y la colecta de un número reducido de muestras de especies botánicas que no puedan ser identificadas en campo. Debiéndose indicar que no se colectaran especies de fauna silvestre categorizadas en el D.S. Nº 004-2014-MINAGRI y que además no menos del 50% de las muestras colectadas serán depositadas en el Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos y el Herbario de la facultad de Ciencias Forestales de la Universidad Nacional Agraria La Molina; según compromisos;

Artículo 2º.- El titular de la autorización y los investigadores que intervengan en su implementación, se comprometen a:

a. Respetar estrictamente el artículo 27° de la Ley 26839, Ley sobre la conservación y aprovechamiento sostenible de la Diversidad Biológica, la que establece que los derechos otorgados sobre recursos biológicos no otorgan derechos sobre los recursos genéticos contenidos en los mismos.
b. Colectar únicamente los especímenes autorizados.
c. No colectar especies categorizadas como amenazadas según el Decreto Supremo N° 004-2014-MINAGRI.
d. No ceder el material colectado a terceros.
e. Entregar el 50% del material colectado por tipo de muestra a una institución científica nacional debidamente reconocida. Los ejemplares únicos de los grupos taxonómicos colectados y holotipos, sólo podrán ser exportados en calidad de préstamo.
f. El material debe ser depositado debidamente preparado e identificado, o de lo contrario, los investigadores que realicen el depósito deberán sufragar los gastos que demanden la preparación del material para su ingreso a la colección correspondiente.
g. No contactar, ni ingresar a los territorios comunales sin contar con la autorización de las autoridades comunales correspondientes.
h. Entregar a la Dirección General Forestal y de Fauna Silvestre dos (02) copias del informe final en idioma español, como resultado de la autorización otorgada, copias del material fotográfico y/o slides que puedan ser utilizadas para difusión, en un plazo no mayor de seis (06) meses de finalizada la investigación. Asimismo, entregar tres (03) copias de las publicaciones, producto de la investigación realizada en formato impreso y digital, que incluya la lista taxonómica de las especies de fauna y flora objeto de la presente autorización de colecta con las respectivas coordenadas (en formato excel).
i. Indicar el número de la Resolución en las publicaciones generadas a partir de la autorización concedida.
j. No ingresar a las Áreas Naturales Protegidas sin contar con la autorización respectiva.
k. Debido al tiempo que va a durar la investigación; se recomienda que la representante del proyecto, entregue un reporte anual de los avances que realice.

Artículo 3º.- Los derechos otorgados sobre los recursos biológicos no otorgan derechos sobre los recursos genéticos contenidos en ellos, ni autoriza el estudio a nivel genético, de acuerdo con la tercera disposición final del Reglamento de Acceso a los Recursos Genéticos, aprobado por Resolución Ministerial Nº 087-2008-MINAM, el mismo que fue elevado al rango de Decreto Supremo por el artículo 1º del Decreto Supremo Nº 003-2009-MINAM, el que también ratifica la aprobación del Reglamento de Acceso a Recursos Genéticos;

Artículo 4º.- El Servicio Nacional Forestal y de Fauna Silvestre, no se responsabiliza por accidentes o daños sufridos por la Ing. Forestal Sandra Lucía Almeyda Zambrano, y por el equipo de investigadores, durante la ejecución del proyecto; asimismo, se reserva el derecho de demandar del proyecto de investigación los cambios a que hubiese lugar en los casos en que se dicten nuevas disposiciones legales o se formulen ajustes sobre la presente autorización;

Artículo 5º.- El incumplimiento de los compromisos adquiridos podrá ser causal para denegar futuras autorizaciones a nivel institucional; sin perjuicio de ejercer las acciones civiles y penales que correspondan;

REPÚBLICA DEL PERÚ

Artículo 6º.- Notificar la presente resolución a la Ing. Forestal Sandra Lucía Almeyda Zambrano, representante del proyecto, transcribirla a la Dirección General de Información y Ordenamiento Forestal y de Fauna Silvestre del SERFOR, a la Dirección General de Gestión del Conocimiento Forestal y de Fauna Silvestre, y a la Dirección Ejecutiva de Gestión de Bosques y de Fauna Silvestre del Gobierno Regional de Amazonas.

Regístrese y comuníquese

[redacted]

Ing. Sara Ruth Yalle Paredes
Directora General (e)
Dirección General de Gestión Sostenible del Patrimonio Forestal y de Fauna Silvestre
Servicio Forestal y de Fauna Silvestre - SERFOR

APPENDIX 3. HERBARIUM CERTIFICATES

UNIVERSIDAD NACIONAL AGRARIA LA MOLINA

FACULTAD DE CIENCIAS FORESTALES: FAX: 349-2041, TEF: 349-5647 / 349-5669, Anexo .203 / 244, APDO. 12 –056 LA MOLINA LIMA PERU

CONSTANCIA

076-2016-HF-UNALM

EL DIRECTOR DEL HERBARIO FORESTAL DE LA FACULTAD DE CIENCIAS FORESTALES-UNALM

Da Constancia:

Que esta Institución ha recibido 25 muestras botánicas herborizadas, las cuales se nos ha informado son provenientes del distrito de Yambrasbamba, provincia de Bongará, departamento de Amazonas; producto del trabajo de investigación **"La Esperanza: Corredor Biológico para la Conservación del Mono Choro de Cola Amarilla, una investigación participativa – Séptima etapa"**; a cargo de la investigadora Sandra Lucía Almeyda Zambrano.

La interesada señala que la colecta mencionada corresponde a la autorización **RD N° 225-2015-SERFOR-DGGSPFFS.**

Se expide el presente documento a solicitud de la interesada para los fines que hubiere lugar.

Lima, 21 de Marzo del 2016

[redacted]

Carlos Reynel Rodríguez Ph. D.
Profesor Principal, Dpto. Manejo Forestal
Director del Laboratorio de Dendrología
y Herbario FCF - UNALM (MOL)

UNIVERSIDAD NACIONAL AGRARIA LA MOLINA

FACULTAD DE CIENCIAS FORESTALES: FAX: 349-2041, TEF: 349-5647 / 349-5669, Anexo .203 /244, APDO. 12 – 056 LA MOLINA LIMA PERU

CONSTANCIA DE DETERMINACIÓN BOTÁNICA

A solicitud de la Ing. **Sandra Lucía Almeyda Zambrano**; se proporciona la identidad de los especímenes indicados, los cuales se hallan depositados en el Herbario Forestal . La infprmaciòn alcanzada por la depositante sobre la procedencia de las muestras es :

Zona de Colección : Bosque "El Toro" de la comunidad campesina de Yambrasbamba
Distrito : Yambrasbamba
Provincia : Bongará
Región : Amazonas
Colector : Sandra Lucía Almeyda Zambrano

N° COL	NOMBRE CIENTÍFICO	FAMILIA
SA-04	***Faramea miconioides*** Standl.	RUBIACEAE
SA -05	***Graffenrieda emarginata*** (Ruiz & Pav.) Triana	MELASTOMATACEAE
SA -06	***Miconia radula*** Cogn.	MELASTOMATACEAE
SA -07	***Psychotria aff. tinctoria*** (Aubl.) Raeusch.	RUBIACEAE
SA -08	***Hieronyma asperifolia*** Pax & K. Hoffm.	PHYLLANTHACEAE
SA -09	***Inga*** sp.	FABACEAE
SA -10	***Piper calvescentinerve*** Trel.	PIPERACEAE
SA -11	***Hedyosmum goudotianum*** var. ***goudotianum*** Solms	CHLORANTHACEAE
SA -12	***Clusia pallida*** Engl.	CLUSIACEAE
SA -13	***Guatteria glauca*** Ruiz & Pav.	ANNONACEAE
SA -14	***Miconia aff. livida*** Triana	MELASTOMATACEAE
SA -15	***Miconia*** aff. ***aggregata*** Gleason	MELASTOMATACEAE
SA -16	***Ocotea*** sp.	LAURACEAE
SA -17	***Vismia glabra*** Ruiz & Pav.	HYPERICACEAE
SA -18	***Meriania tetragona*** (Cogn.) Wurdack	MELASTOMATACEAE
SA -19	***Miconia punctata*** (Desr.) D. Don ex DC.	MELASTOMATACEAE
SA -20	***Miconia*** aff. ***livida*** Triana	MELASTOMATACEAE
SA -21	***Blakea*** sp.	MELASTOMATACEAE
SA -22	***Miconia*** aff. ***thaminantha*** Wurdack	MELASTOMATACEAE
SA -23	***Clusia*** sp.	CLUSIACEAE

UNIVERSIDAD NACIONAL AGRARIA LA MOLINA

FACULTAD DE CIENCIAS FORESTALES: FAX: 349-2041, TEF: 349-5647 / 349-5669, Anexo .203 /244, APDO. 12 – 056 LA MOLINA LIMA PERU

SA -24	***Miconia saltuensis*** Wurdack	MELASTOMATACEAE
SA -25	***Croton rimbachii*** Croizat	EUPHORBIACEAE
SA -01	***Styloceras columnare*** Müll. Arg.	BUXACEAE
SA -02	***Ossaea*** sp.	MELASTOMATACEAE
SA -03	***Nectandra membranácea*** (Sw.) Griseb.	LAURACEAE

[redacted]

Determinador: **Carlos Reynel Rodríguez Ph.D.**
Profesor Principal Dpto. Manejo Forestal
Director del Laboratorio de Dendrología
Y Herbario Forestal UNALM (MOL)

La Molina, 21 de marzo 2016

* ROGAMOS A LOS USUARIOS DE LOS SERVICIOS DE HERBARIO FORESTAL (MOL) TENER ESPECIAL CUIDADO EN TRANSCRIBIR CORRECTAMENTE LOS NOMBRES PROPORCIONADOS.