ANDEAN CONSERVATION PLAN 2021-2026 FOR THE DUROECOELIA (Aotus lemurinus), IN COLOMBIA

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RESUMEN

Through a cooperation agreement between COLOMBIA WILD CORPORATION, World Wildlife Fund-WWF and the Emberá indigenous community, we draw up conservation strategies for the sustainable and community protection of duroecoelia (Aotus lemurinus), in the Colombian Andes Mountain range. To do this, we review the main threats, habitats, ecological corridors and ecological variables of this species, classified as Vulnerable A2c+3c+4c by the IUCN because it is seriously threatened with extinction due to the anthropic action of 3 threats: illegal trafficking (poaching), habitat loss and climate change.

We propose conservation strategies (creation of a 45Km2 natural protected area in priority habitats); educational strategies (training of 500 young Emberá indigenous people in primate conservation); sustainability strategies (creation of an indigenous environmental office whose corporate purpose is the conservation of the target primate) and communication strategies (informing 15,000 people about program activities and results).

This Conservation and Management Plan also has the purpose of informing the general public of the management and monitoring measures for populations and habitats that guarantee the conservation of the species. It is important to point out that the Conservation Plans propose general measures that must be considered from an adaptive scheme, or progressive adjustment, which in the measure of the results obtained, the knowledge about the species and its habitat, and the improvement in the techniques and methods applied in management, must be updated.

1. BIOECOLOGICAL INFORMATION

1.1. Taxonomy

The taxonomy of night monkeys (Aotus spp.) has been debated and still does not provide a complete picture of the diversity of the genus Aotus. Ruiz-Herrera et al. (2005) reported that cytogenetic studies have characterised 18 different karyotypes with diploid numbers ranging from 46 to 58 chromosomes. The taxonomy of the night monkeys essentially followed the early revision by Hershkovitz (1983), with some modifications for the Colombian and Central American forms. Recent molecular studies have made valuable contributions towards the understanding of night monkeys taxonomy and phylogenetic relations (Plautz et al.2009; Menezes et al. 2010).

Reviewing the entire taxonomy and distributions of the night monkeys, Aotus, Ford (1994) carried out multivariate analyses of craniodental measures and pelage patterns and color, and also took into consideration chromosomal data and blood protein variations. Ford (1994) concluded that there was "good support" for just two species north of the Río Amazonas: A. trivirgatus (Humboldt, 1812) east and north of the Rio Negro, and the polymorphic A. vociferans to the west of the Rio Negro. Aotus vociferans, as such, would include all the forms north of the Río Amazonas/Solimões in Brazil (west of the Rio Negro), Peru, Colombia and Ecuador, and in the Chocó, northern Colombia and Colombian Andes, and Panama: brumbacki, lemurinus, griseimembra, and zonalis.

Hernández-Camacho and Cooper (1976) restricted both lemurinus (Colombian Andes, elevations from 1,000 to 1,500 m up to 3,000–3,200 m) and griseimembra (northern lowlands, Santa Marta mountains, west to Río Sinú, Río San Jorge, lower Río Cauca and lowlands of middle and upper Río Magdalena) to Colombia, while recognizing the form zonalis as the night monkey of north-western Colombia (Chocó) and Panama.

Hershkovitz (1983) recognized lemurinus and griseimembra as distinct, but considered them to be subspecies of a single species; he made no mention of the name zonalis, but as he ascribed Central American night monkeys to A. lemurinus lemurinus, by implication he was regarding it as a synonym of this latter form. Groves (2001) followed Hernández-Camacho and Cooper (1976) in recognizing zonalis as the form in Panama, and listed it as a subspecies of lemurinus along with griseimembra and brumbacki Hershkovitz, 1983. Defler et al. (2001) concluded that the karyotype of Aotus hershkovitzi Ramirez-Cerquera, 1983 (from the upper Río Cusiana, Boyacá, Colombia; 2n = 58) was in fact that of true lemurinus, and that the karyotypes which Hershkovitz (1983) had considered to be those of lemurinus were in fact of zonalis. Defler et al. (2001) and others (Defler 2003, 2004; Defler and Bueno 2003) concluded that Aotus lemurinus of Hershkovitz (1983) is in fact three karyotypically well-defined species, and that the night monkeys of the lowlands of Panama and the Chocó region of Colombia belong to the species A. zonalis, and those of the Magdalena valley to A. griseimembra,

while those above altitudes of 1,500 m should correctly be referred to as A. lemurinus. For a review of the taxonomy of the night monkeys of Panama and northern Colombia see Rylands et al. (2006).

Defler and Bueno (2007) discussed the karyology of the grey-necked night monkeys and reaffirmed the validity of A. brumbacki, A. griseimembra, A. lemurinus, A. trivirgatus, A. vociferans and A. zonalis.

1.2. IUCN Redlist status

This species is listed as Vulnerable as it is suspected to have undergone a decline exceeding 30% over the past three generations (24 years) and expected to continue to decline at the same rate over the next three generations mainly as a result of habitat loss due to deforestation, expanding illicit crops, coffee and armed conflict. It is likely that the species has lost between 10% to 65% of habitat within its range over the last three generations and that habitat loss will continue at high rates three generations into the future, particularly due to mining and infrastructure development.

Montane Night Monkey is distributed in the Western, Central and Eastern Andes mountains from about 1,000 up to treeline elevations of 3,000 to 3,200 m (Hernández-Camacho and Cooper 1986). Following the range map in Defler (2003, 2004), it extends south as far as region of the headwaters of the rios Caquetá and Orteguaza. Tirira (2007) provisionally regards the montane night monkeys occurring in the subtropical humid forest along the Eastern Andes (elevations 940-1,800 m) as belonging to this species, although he points out (p.160) that its identity has yet to be confirmed. Castaño and Cardona (2005) reported nine different localities with montane night monkeys ranging from 970 to 2050 m. There are few records and all are based on sightings in the wild; the few museum specimens have yet to be studied in this regard. The possibility remains that it may be a variant of A. vociferans occurring otherwise throughout eastern Ecuador and adjacent northern Peru (Aquino and Encarnación 1994a), or even an as yet unrecognized, distinct species.

1.3. Geographic Range

There is only scant information on the elevational distribution of Aotus lemurinus and its distribution limits with Aotus griseimembra.

The species' extent of occurrence (EOO) and area of occupancy (AOO) are declining. In Ecuador, Sierra (2013) estimated the deforestation rate in the montane forests of the eastern slopes of the Andes to be consistently high from 1990 through 2008. In this period, the percentage of deforested area in these ecosystems changed from 19.6% to 32.2% (or a 64.3% decrease in forested area). Most of the deforested area was used for pastures. Although there are no published current estimates of the deforested areas, if this trend persists, the percentage of deforested area by 2020 would be about 40% (i.e. a further 24.2% decrease in forested cover by 2020).

Another study carried out in the south-eastern Andean slopes Torracchi et al. (2013) calculated a mean annual deforestation rate of 1.87% between 1976 and 2002 in the lower montane forest that is part of the species

geographic range. If this deforestation trend persists to date, about 65% of the forest area estimated in 1976 would have been lost by 2002.

In Ecuador, mining is posing an increasing threat to montane ecosystems east and west of the Andes. A large percentage of the forests in the eastern Andean slopes are conceded to mining companies (Vandegrift et al. 2018).

In Colombia, deforestation from 2000 to 2019 in the species' range has ranged from 4.3% in Cundinamarca to 11% in Norte de Santander (Global Forest Watch 2020).

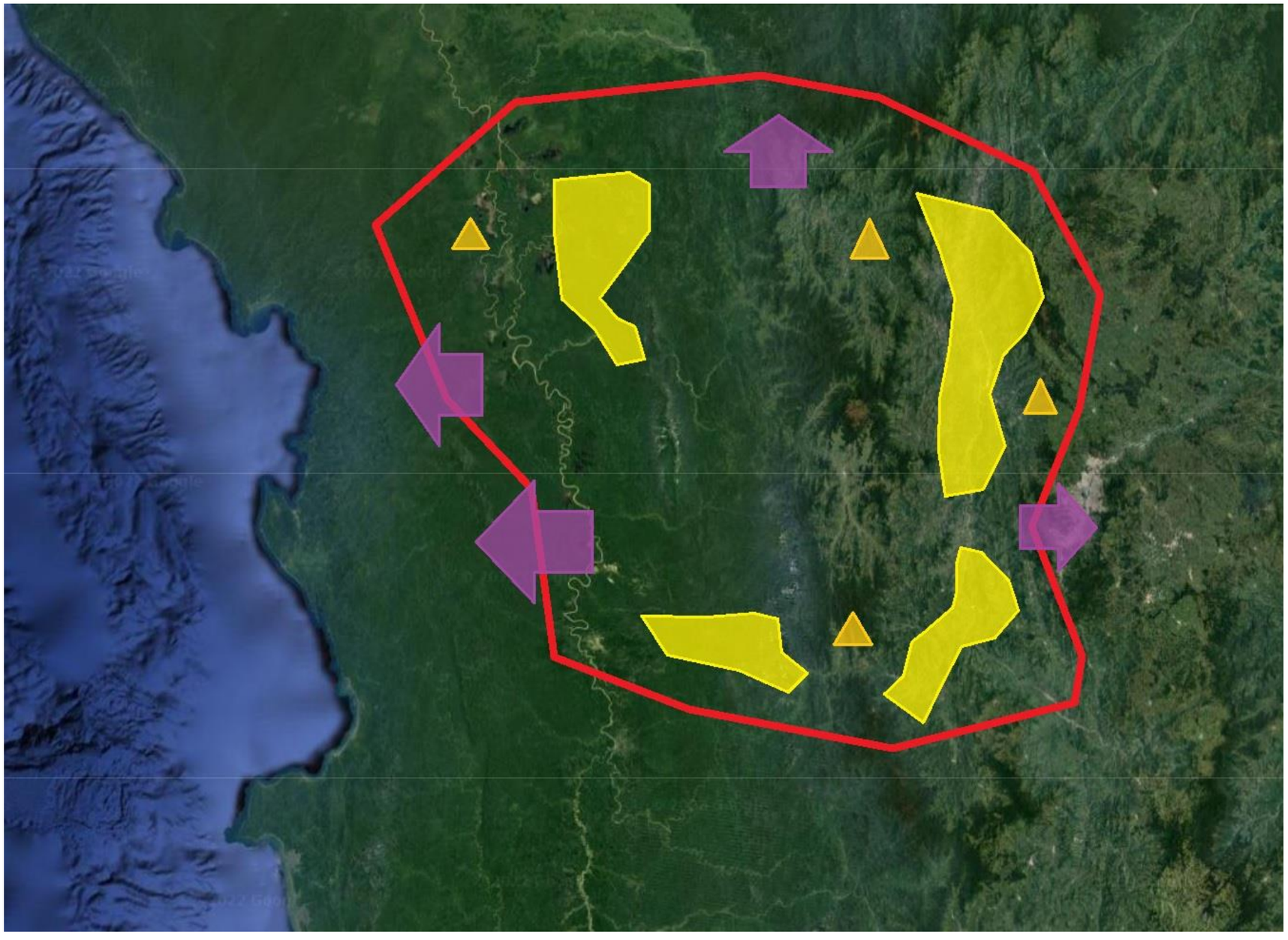
1.4. Populations

No information available. Aquino and Encarnación (1994b) reviewed population structure and densities for the genus. It is suspected that the population has undergone at least a 30% reduction over the last three generations due to habitat loss (due to deforestation, expanding illicit crops, coffee, mining and armed conflict) and degradation. It is suspected that this population decline will continue at the same rate into the future. In Ecuador, Sierra (2013) estimated the deforestation rate in the montane forests of the eastern slopes of the Andes to be high and stable from 1990 through 2008.

In this period, the percentage of deforested area in these ecosystems changed from 19.6% to 32.2%. Most of the deforested area was used for pastures. Although there are no published current estimates of the deforested areas, if this trend persists, the percentage of deforested area by 2020 would be about 40%. In another study carried out in the south-eastern Andean slopes, Torracchi et al. (2013) calculated a mean annual deforestation rate of 1.87% between 1976 and 2002 in the lower montane forest that is part of the species' geographic range.

If this deforestation trend persists to date, about 65% of the forest area estimated in 1976 would have been lost. In Ecuador, mining is posing an increasing threat to montane ecosystems east and west of the Andes. A large percentage of the forests in the eastern Andean slopes are conceded to mining companies (Vandegrift et al. 2018).

MAP 3. GEOGRAPHIC DYNAMICS OF ILLEGAL BIODIVERSITY TRAFFIC IN COLOMBIAN ANDES.



ANDEAN CONSERVATION PLAN FOR THE COLOMBIAN NIGHT MONKEY (Aotus lemurinus), IN COLOMBIA

CONVENTIONS

	Project area
	Fragmented populations of Doeroecoeli
	Routes of illegal trafficking of Doeroecoeli
	Emberá indigenous communities

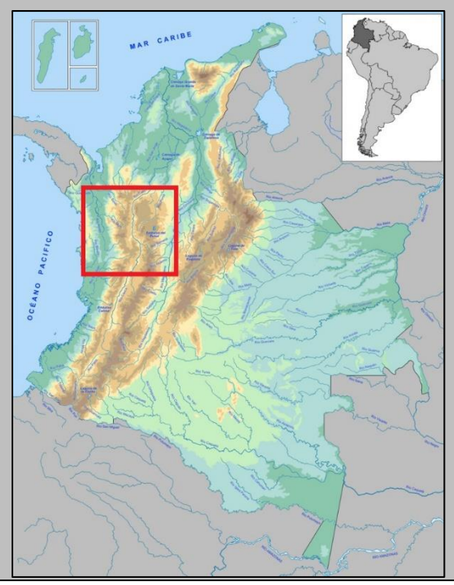
Elevations

	0m – 1,000m
	1,000m – 2,000m
	2,000m – 3,000m
	3,000m – 4,000m

Scale

1cm = 50Km

Source:
-Corpoamazonia, 2020.
- COLOMBIA WILD CORPORATION, 2020.
-Google maps, 2020.



1.5. Habitat and ecology

Night monkeys typically occur in primary and secondary forest (including disturbed forest and selectively logged forest), seasonally flooded and terra firma, lowland forest, submontane and montane (cloud forests) in Colombia and in the Andes to 3,200 m above sea level (the specifically montane forms are Aotus lemurinus and Aotus miconax) (Hernández Camacho and Cooper 1976, Aquino and Encarnación 1994a, Defler 2004). Aquino and Encarnación (1994b) reviewed the habitat and forest preferences of the genus.

Night monkeys are nocturnal: they are most active at dawn and dusk. During the day, they rest in hollows tree trunks and within dense vegetation" (Tirira, 2007). They are frugivorous; their diet includes fruit, nectar and flowers, leaves, and small animals' prey such as insects (Wright 1989; Fernandez-Duque 2007). Aotus azarae and Aotus zonalis has been observed to include a significant portion of leaves in their diet (Hladik and Hladik 1969, Ganzhorn and Wright 1994, Giménez and Fernandez-Duque 2003). The diet of montane night monkeys has been studied by Castaño et al. (2010) in the Western and Central Andes and included 65.8% of fruits, 28.2% of arthropods and complemented its diet with flowers, leaf buds and seeds and Guzman et al. (in review) also reported that montane night monkey fed mostly on fruits and flowers.

They are socially monogamous, living in small groups of an adult pair and offspring of different ages (infant, one or two juveniles and sometimes a subadult. In A. a. azarae, a significant number of adults range alone. They may be subadults that have left their natal groups or older adults which have been evicted from their groups by competitors (Fernandez-Duque and Huntington 2002, Fernandez-Duque 2004). Both sexes disperse. Males care for the infants (carry them) (Rotundo et al. 2002, 2005). Lone adults were observed by Villavicencio Galindo (2003) in northern Colombia. Night monkeys are territorial—groups occupy overlapping territories of 5-18 ha (depending on the species and location) (Wright 1978, 1981; Fernandez-Duque 2007). Wright (1994) and Fernandez-Duque (2007) review the behaviour and ecology of the genus.

Captive male A. lemurinus reach sexual maturity when 2 years old, and captive female A. vociferans and A. nancymaae first breed when 3-4 years old (Dixson 1983, Fernandez-Duque 2007). In the wild, male A. azarae reach adult weight only when about 4 years old, and age at first reproduction is about 5 years of age (Juárez et al. 2003; Fernandez-Duque 2004). A female A. azarae was found to breed for the first time at 58 months of age (Fernandez-Duque et al. 2002). Single offspring are the rule. Wright (1985) recorded births between August and February for A. nigriceps in Peru (Manu National Park), and Aquino et al. (1990) indicated a birth season between December and March) for A. nancymaae in north-eastern Peru. In the Argentinean Chaco, A. azarae shows a peak of births between March and June (Fernandez-Duque 2007).

Size: Adult male weight average 0.920±0.075 kg (n=7, range 0.608-1.15 kg), adult female weight 0.859±0.088 kg (n=6, range 0.578-1.05 kg) (Hernández-Camacho and Defler 1985). NB: This could refer to griseimembra, considered by Hernández-Camacho and Defler (1985) to be a subspecies of A. lemurinus.

1.6. Threats

Most of the geographical distribution of montane night monkey (montane forests in the northern Andes)

overlaps with areas of high human population densities and strong anthropogenic disturbance (Etter and Wyngaarden 2000). The major drivers of habitat transformation and forest fragmentation are associated to deforestation for agricultural and cattle ranching activities and more recently expanding illicit crops. A significant amount of the species' habitat has been lost (Global Forest Watch 2020).

Many Aotus in Colombia have been released from captivity outside their range and could be hybridizing; however, very little is known of the effects of this practice. A potential big impact for the population of this species in Ecuador is the mining, as it is one of the main activities of development the in the Andes foothills, along the distribution range of the species (Tirira et al. 2011, Vandegrift et al. 2018). It is listed on Appendix II of CITES.

Most urgent is the protection of any forests that provide habitat for populations in northern Colombia. Censuses of populations and habitat are needed to better assess the population status of this species, including the protected areas where the species inhabits as a way of evaluating the effectiveness of their protection. Finally, there is a need to confirm if A. lemurinus is the species that occurs in the eastern Andean slopes in Ecuador.

2. ANDEAN CONSERVATION PLAN 2021-2026 FOR THE DUROECOELIA (Aotus lemurinus), IN COLOMBIA

Overall objective: CONSERVE VIABLE AND ECOLOGICALLY FUNCTIONAL POPULATIONS OF THE DUROECOELIA (AOTUS LEMURINUS) IN SIRAP-EC.

Specific objective 1: Increase the quantity and quality of Duroecoelia habitat in SIRAP-EC.

Line of action: Research and monitoring

ACTIVITIES

- Determine the presence of Duroecoelia populations in potential sites within their geographic distribution in the SIRAP-EC region.

Time: Short term (1-3 years).

Results: Populations found.

Indicators: Number of localities evaluated and number of localities with confirmed presence of populations.

Place: East of the department of Caldas and north of the department of Tolima, extending the search to the municipality of Armero-Guayabal (including small forest remnants and gallery forests, on private and public properties).

- Estimate population densities of Duroecoelia in SIRAP-EC.

Time: Short term (1-3 years).

Results: Density Estimates population.

Indicators: Number of populations studied.

Place: Influenza area of the Amaní-Isagen reservoir, Charca de Guarinocito Integrated Management District, Laguna de San Diego Integrated Management District, Selva de Florencia National Natural Park, Bella Vista Reserve, Río Manso Civil Society Nature Reserve, Venecia in Caldas, Mariquita Municipal Forest and Jabiru Civil Society Nature Reserve in Tolima, and other locations where the species is recorded.

- Evaluate the state of the habitat of the populations in the SIRAP-EC.

Time: Short term (1-3 years).

Results: Diagnosis of the state of the habitats.

Indicators: Number of localities evaluated.

Place: Influenza area of the Amaní-Isagen reservoir, Charca de Guarinocito Integrated Management District, Laguna de San Diego Integrated Management District, Selva de Florencia National Natural Park, Bella Vista Reserve, Río Manso Civil Society Nature Reserve, Venecia in Caldas , Mariquita Municipal Forest and Jabiru Civil Society Nature Reserve in Tolima, and other localities where the species is recorded**.**

- Design and implement a population and habitat monitoring program in SIRAP-EC.

Time: Short, medium and long term (1-10 years).

Results: Monitoring program established and localities evaluated under the protocols.

Indicators: Number of populations and habitats monitored.

Place: Influenza area of the Amaní-Isagen reservoir, Charca de Guarinocito Integrated Management District, Laguna de San Diego Integrated Management District, Selva de Florencia National Natural Park, Bella Vista Reserve, Río Manso Civil Society Nature Reserve, Venice in Caldas, Mariquita Municipal Forest and Civil Society Nature Reserve Jabiru in Tolima, and other locations where the species is recorded.

- Evaluate the genetic diversity and determine the levels of gene flow between populations of Duroecoelia in SIRAP-EC.

Time: Short term (1-3 years).

Results: Estimates of genetic variability and gene flow among the evaluated populations.

Indicators: Number of populations or subpopulations evaluated and number of individuals and family groups sampled.

Place: Influenza area of the Amaní-Isagen reservoir, Charca de Guarinocito Integrated Management District, Laguna de San Diego Integrated Management District, Selva de Florencia National Natural Park, Bella Vista Reserve, Río Manso Civil Society Nature Reserve, Venice in Caldas, Mariquita Municipal Forest and Jabiru Civil Society Nature Reserve in Tolima, and other localities where the species is recorded.

- Assess the health status of the populations of Duroecoelia.

Time: Short term (1-3 years).

Results: Health status of the populations. Indicators: Number of studies carried out and populations evaluated.

Place: Influenza area of the Amaní-Isagen reservoir, Charca de Guarinocito Integrated Management District, Laguna de San Diego Integrated Management District, Selva de Florencia National Natural Park, Bella Vista Reserve, Río Manso Civil Society Nature Reserve, Venice in Caldas, Mariquita Municipal Forest and Jabiru Civil Society Nature Reserve in Tolima, and other localities where the species is recorded.

- Evaluate the impact of introduced species on populations of Duroecoelia in SIRAP-EC. Time: Short and medium term (1-6 years).

Results: Evaluated impact.

Indicators: Number of studies developed and locations evaluated.

Place: Influenza area of the Amaní-Isagen reservoir, Charca de Guarinocito Integrated Management District, Laguna de San Diego Integrated Management District, Selva de Florencia National Natural Park, Bella Vista Reserve, Río Manso Civil Society Nature Reserve,

Venice in Caldas, Mariquita Municipal Forest and Jabiru Civil Society Nature Reserve in Tolima, and other localities where the species is recorded.

- Conduct ecology studies (e.g. diet, habitat use, population density, size) among populations found in fragmented and continuous habitats.

Time: Short term (1-3 years).

Results: Information on ecology.

Indicators: Number of studies developed.

Place: Influenza area of the Amaní-Isagen reservoir, Charca de Guarinocito Integrated Management District, Laguna de San Diego Integrated Management District, Selva de Florencia National Natural Park, Bella Vista Reserve, Río Manso Civil Society Nature Reserve, Venice in Caldas, Mariquita Municipal Forest and Jabiru Civil Society Nature Reserve in Tolima, and other localities where the species is recorded.

- Diagnose the need, feasibility and implications of carrying out re-introduction programs for Duroecoelia in SIRAP-EC.

Time: Long term (1-10 years).

Results: Identification and evaluation of localities where the species was extirpated and It has possibilities of natural recovery due to geographic isolation. At least two studies. Establishment of the extremes of variation of population parameters in the wild (e.g. recruitment rates, age at first reproduction, proportion of reproductive individuals).

Analysis of the need and feasibility of reintroducing the species.

Diagnosis on the positive and negative implications of the reintroduction of the species in different locations.

Indicators: Number of evaluations carried out.

Location: Charca de Guarinocito Integrated Management District and those with similar characteristics in the fluvial valley of the Magdalena River.

- Establish the distribution of threats (e.g. habitat loss, fragmentation, selective extraction of timber species, hunting) and their impact on Duroecoelia populations in SIRAP-EC.

Time: Short term (1-3 years).

Results: Information on ecology.

Indicators: Number of studies developed.

Place: Influenza area of the Amaní-Isagen reservoir, Charca de Guarinocito Integrated Management District, Laguna de San Diego Integrated Management District, Selva de Florencia National Natural Park, Bella Vista Reserve, Río Manso Civil Society Nature Reserve, Venice in Caldas, Mariquita Municipal Forest and Jabiru Civil Society Nature Reserve in Tolima, and other localities where the species is recorded.

Line of action: Landscape conservation and management

Activities

- Enrich degraded habitats where populations of Duroecoelia exist.

Time: Medium and long term (3-10 years).

Results: Habitat recovered or enriched with species of importance to the Duroecoelia (e.g. Moraceae, Fabaceae).

Indicators: Areas restored or enriched with the habitat requirements of Duroecoelia. Place: Influenza area of the Amaní-Isagen reservoir, Charca de Guarinocito Integrated Management District, Laguna de San Diego Integrated Management District, Selva de Florencia National Natural Park, Bella Vista Reserve, Río Manso Civil Society Nature Reserve, Venice in Caldas, Mariquita Municipal Forest and Jabiru Civil Society Nature Reserve in Tolima, and other localities where the species is recorded.

-Promote programs to protect habitats and associated plant cover for the Duroecoelia in SIRAP-EC.

Time: Medium and long term (4-10 years). Results: Habitat protection programs promoted.

Indicators: Number of protection programs and strategies established and number of localities where they are implemented.

Place: Influenza area of the Amaní-Isagen reservoir, Charca de Guarinocito Integrated Management District, Laguna de San Diego Integrated Management District, Selva de Florencia National Natural Park, Bella Vista Reserve, Río Manso Civil Society Nature Reserve, Venecia in Caldas, Mariquita Municipal Forest and Jabiru Civil Society Nature Reserve in Tolima, and other localities where the species is recorded.

- Promote the use of landscape management options with local communities that increase connectivity and generate low impact on habitats.

Time: Medium and long term (3-10 years).

Results: Establishment of connectivity programs.

Indicators: Number of alternatively managed areas.

Place: Basins of the Manso River, the Miel River, the Samaná, Guarinó river and the fluvial valley of the river

Magdalena and others who identify themselves.

- Establish or increase connectivity between populations through natural forest corridors.

Time: Long term (6-10 years).

Results: Connected natural forest fragments.

Indicators: Number of connected natural forest fragments.

Place: Influenza area of the Amaní-Isagen reservoir, Charca de Guarinocito Integrated Management District, Laguna de San Diego Integrated Management District, Selva de Florencia National Natural Park, Bella Vista Reserve, Río Manso Civil Society Nature Reserve, Venice in Caldas, Mariquita Municipal Forest and Jabiru Civil Society Nature Reserve in Tolima, and other localities where the species is recorded.

- Articulate the conservation and management plan for Duroecoelia for SIRAP-EC with management plans for the protected areas in the region where populations of this species are found, and in consultation with local communities.

Time: Short term (1-3 years).

Results: Management plans in action.

Indicators: Number of articulated plans.

Place: Influenza area of the Amaní-Isagen reservoir, Charca de Guarinocito, Laguna de San Diego Integrated Management District, Selva de Florencia National Natural Park, Bella Vista Reserve, Río Manso Civil Society Nature Reserve, Venecia in Caldas, Mariquita Municipal Forest and Jabiru Civil Society Nature Reserve in Tolima, and other localities where the species is recorded.

- Generate impact mitigation options for the populations of the Duroecoelia that are affected by development projects (e.g. infrastructure works, changes in land use, among others.).

Time: Short term (1-3 years).

Results: Proposed mitigation options. Indicators: Number of proposed mitigation options.

Location: Surroundings of the village of Berlín, the middle basin of the Guarinó River and the Bella Vista Reserve in Caldas.

- Establish protected areas where populations of Duroecoelia are found in SIRAP-EC.

Time: Long term (6-10 years).

Results: New protected areas with populations of Duroecoelia.

Indicators: Number of new protected areas.

Place: In those localities that are not under any form of protection and where there are records of the species.

Line of action: Policies and management instruments.

Activities

- Provide mechanisms (e.g. training, technical and legal assistance) that encourage the conservation of Duroecoelia aimed at owners of properties where there are populations.

Time: Medium and long term (4-10 years).

Results: Increase in the number of properties with areas dedicated to the conservation of the Duroecoelia. Indicators: Number of properties or amount of area favored with the incentives.

Location: Throughout the region, as priorities have been identified in previous activities.

Line of action: Education and communication

Activities

- Develop educational campaigns focused on the conservation of Duroecoelia aimed at property owners, communities, rural schools and visitors to parks and protected areas.

Time: Short term (1-3 years).

Results: Educational campaigns developed.

Indicators: Number of people participating in the campaigns.

Place: Influenza area of the Amaní-Isagen reservoir, Charca de Guarinocito Integrated Management District, Laguna de San Diego Integrated Management District, Selva de Florencia National Natural Park, Bella Vista Reserve, Río Manso Civil Society Nature Reserve, Venice in Caldas, Mariquita Municipal Forest and Jabiru Civil Society Nature Reserve in Tolima, and other localities where the species is recorded.

- Develop educational campaigns for the general public through mass media.

Time: Short term (1-3 years).

Results: Material produced (guides, brochures, posters, advertisements).

Indicators: Educational material produced and distributed.

Place: Influenza area of the Amaní-Isagen reservoir, Charca de Guarinocito Integrated Management District, Laguna de San Diego Integrated Management District,

Selva de Florencia National Natural Park, Bella Vista Reserve, Río Manso Civil Society Nature Reserve, Venice in Caldas, Mariquita Municipal Forest and Jabiru Civil Society Nature Reserve in Tolima, and other localities where the species is recorded.

Line of action: Conservation and management of specimens and ex situ populations

Activities

- Strengthen the program of the wildlife rehabilitation center in eastern Caldas, in the municipality of Victoria, as a refuge for confiscated fauna and an education center.

Time: Short term (1-3 years).

Results: Captive population management protocols designed and implemented.

Indicators: Program in operation and financing.

Place: Wildlife Rehabilitation Center of Eastern Caldas.

SPECIFIC OBJECTIVE 2: Eliminate the extraction of individuals from natural populations.

Line of action: Research and monitoring

Activities

- Define routes and rates of extraction of the Duroecoelia populations and use as pets.

Time: Short term (1-3 years).

Results: Estimates of extraction of individuals.

Indicators: Number of studies carried out.

Location: Medellín-Bogotá highway, Dorada-Norcasia-Florencia highway, Dorada-Victoria-Samaná highway, including populated centers and others that have been identified.

- Monitor the effectiveness of activities to control Duroecoelia extraction rates.

Time: Short, medium and long term (1-10 years).

Results: Decreased rates of extraction.

Indicators: Studies carried out.

Location: Medellín-Bogotá highway, Dorada-Norcasia-Florencia highway, Dorada-Victoria-Samaná highway, including populated centers and others that have been identified.

Line of action: Education and communication.

Activities

- Train officials from institutions responsible for control and surveillance (environmental police, army, highway police) on aspects of trafficking in wild fauna and flora.

Time: Short term (1-3 years).

Results: Officials of institutions trained.

Indicators: Number of institutions and personnel capable.

- Develop information campaigns and raising awareness about the impacts and effects of threats on populations of Duroecoelia in SIRAP-EC.

Time: Short term (1-3 years).

Results: The communities know and welcome the legislation that prohibits hunting. Indicators: Numbers of sensitized people and reduction of hunting and extraction of Duroecoelia.

Location: As many locations with hunting threat as possible in eastern Caldas and northwestern Tolima.

Line of action: Policies and management instruments.

Activities

- Strengthen the link between different actors of the SIRAP-EC in the activities of control and surveillance of fauna and flora trafficking.

Time: Short and medium term (1-6 years).

Results: Actors involved in control and surveillance activities.

Indicators: Decrease in reports of hunting.

Place: Departments of Caldas and Tolima.

METHODOLOGY FOR THE CONSTRUCTION OF BIOLOGICAL LANDSCAPE MODELS FOR THE DUROECOELIA (AOTUS LEMURINUS)

The Biological Landscapes are maps of the distribution of the landscape species, in this case it refers to the species that are the object of conservation for the SIRAP-EC. They are generally habitat quality maps that indicate the capacity that certain areas may have to maintain viable populations of species in the long term. These habitat quality maps are designed to reflect the abundance of animals on the ground (high quality areas will have higher abundance than low quality areas). However, even maps considered to be very accurate may not reflect the true abundance of the species. These impressions may be due to ecological factors such as the source sink effect. These maps are made using spatial modeling tools (Didier & The Living Landscape Program 2006).

Spatial Modeling

Models are a representation of reality that help us understand, describe or predict some phenomenon or event. A spatial model is a series of spatial processes that convert input data into an output map using specific operations on graphical and/or alpha-numeric databases (Gao et al. 2004).

There are two basic types of spatial models:

Empirical Models (statistical models): They are created from field observations, preferably collected following procedures that are suitable for statistical rigor. Models based on fundamental principles (expert models): They are obtained from more general information such as (1) Literature review, (2) Qualitative descriptions of habitat use, (3) Experience and opinion of researchers and (4) Principles and knowledge of ecology (Clevenger et al. 2004).

This spatial modeling exercise was based on fundamental principles, using a Raster data structure, where each cell or pixel represents a location and an average value of the landscape. This type of data has advantages over Vector data, since it represents continuous surfaces and thus facilitates statistical and spatial analysis, as well as having the ability to overlay complex data.

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