

Monitoring Biodiversity in Alto Chagres

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Case Study

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The FOUNDATION FOR THE CONSERVATION OF NATURAL RESOURCES, NATURA, is a non-profit organization legally incorporated on March 21, 1991, with broad experience in the administration of national and international funds geared for environmental programs, plans, and projects that develop civil society as well as governmental organizations, either independently or in coordination with other entities. Natura has equally worked on strengthening these organizations and institutions, both from the point of view of institutional development and for technical aspects of execution, and currently runs the Panama's Ecological Trust Fund (FIDECO), the Chagres National Park Conservation Fund (Chagres Fund), and the Darien National Park Conservation Fund (Darien Fund).

The Chagres National Park Conservation Fund (Chagres Fund) is a national environmental fund created by virtue of the Park Conservation Agreement, subscribed in 2003 between the National Government of the Panama Republic, The Nature Conservancy (TNC), and the NATURA Foundation.

Chagres Fund resources come from the first Debt-for-Nature Swap formalized by the country on July 10, 2003, in a 10 million dollar amount for which the equivalent Panamanian foreign debt was bought off by the Government of the United States, with input from the TNC, in the framework of the Tropical Forest Conservation Act, established in the US on July 29, 1998, with Congress approved amendment N. 105-214.

The Chagres Fund contributes to the conservation, maintenance, and restoration of forest in Chagres National Park (PNCh) and its buffer zone, extending 5 kilometers into the Park's adjacent areas, by means of funding the National Park's management programs and environmental initiatives carried out by non-profit organizations in accordance with the Park's Management Plan.

For the Fund's Biodiversity Monitoring component, the eight (8) conservation objects defined in two (2) previous planning processes — the Alto Chagres Conservation Plan¹ and the Chagres National Park Management Plan² — were reviewed, and it was also based on the technical experience generated during the *Parque en Peligro* Project's conservation actions. Five (5) conservation objects were selected, and ecological attributes were defined under size, condition and landscape categories.

The objects of conservation include the jaguar, the harpy eagle, the semi-deciduous forest, the lotic ecosystem, and the cloud forest; and to assess the status of each object of conservation a total of eleven (11) biological indicators were identified.

The process of prioritizing indicators was based on the outcome of feasibility analyses, situational threats, and strategies where cost-benefit analyses were made. The monitoring period started in 2006 and is done for some indicators in the dry season and in the rainy season, and, for others, in one of the seasons, for instance, aquatic insects from the benthos show up in the early rainy season.

The biological indicators being monitored are the abundance of jaguar and harpy eagle prey, the number of hunted down jaguars, the density of jaguars, the number of amphibian species, the number of bat species, the number of aquatic insect families, the forest coverage, and the number of orchid bee species, as started in 2009.

Among the findings this far, the following ought to be mentioned:

- **Cloud Forest:**

These forests comprise the high biodiversity sectors of Cerro Brewster, Cerro Bruja, Cerro Jefe, and Cerro Azul, particularly with endemic species and as a protection area for headwaters, among others, and the *Number of Amphibian Species in Canyons* indicator is used to measure the condition of a cloud forest by means of the composition of amphibian species.

According to the 2006-2010 censuses, by means of approximately 200 x 1 m transects along selected canyons in the cloud forests at heights ≥ 600 masl, the trend points at an increasing wealth of amphibian species in the monitored region.

The Ecologic Feasibility Analysis for the *Number of Amphibian Species in Canyons* indicator complies with the following considerations:

Indicator	Pondering the Indicator according to the Number of Species				Indicator current status	Desired qualification
	Poor	Regular	Good	Very Good		
Number of Amphibian Species in Canyons if	≤ 17 spp	18-22 spp	23-26 spp	≥ 27 spp	Good	Very Good

During the three monitoring periods (2006-2008, 2009 and 2010), results of the Ecologic Feasibility Analysis qualified the conservation status of Cerro Brewster site as Very Good-Good. The Cerro Jefe and Cerro Azul sites presented two the lowest values concerning their conservation status, whereas Cerro Jefe was qualified as Regular-Poor, and Cerro Azul was rated as the only site that presented Poor values throughout the monitoring periods.

¹ Candanedo, et al. 2003

² ANAM, 2005

- **Relative density of the jaguar population (individuals per 100km²)**

Jaguar density represents the number of jaguars occupying a certain area and, in Alto Chagres, that has been estimated by employing the camera-trap method. The information thus obtained is then analyzed by a population size estimating program (CAPTURE).

The cameras enable an assessment of the minimum activity area for some individuals that have been photographed and the estimated density is obtained by **dividing the number of jaguars (abundance) within the effective sampling area** (Wilson y Anderson 1985).

- **Rio Piedras:** In 2009, a pilot sampling of this southeast sector of Alto Chagres reflected five photo-identified jaguars, and in 2010, they were down to four. The number of jaguars per 100 km², or jaguar density, was estimated in 2010 at 6.02 jaguars/100km². This number falls within the Regular range, according to the conservation status indicator, whereby the upper limit of that category is near the Good condition.
- **La Llana:** The survey was conducted in 2006 and 2008. In the pilot study conducted during the first year (2006-2007), two jaguars were photo-identified, and the same result was achieved in 2007 and 2008. The number of jaguars/100km² (density) was estimated at 3 for 2007 and 2008, considering the conservation status of the jaguar determined for both years as Poor. In this sector, jaguar condition is that of a severely threatened species.



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- **Relative abundance of jaguar prey**

This is a jaguar conservation status indicator that informs on food availability for this cat and, indirectly, on poaching effects upon ecosystem ecological integrity as well as on deforestation effects upon jaguar. The availability of forest mammals is established by their abundance. The reduction or disappearance of these prey species, such as the white-lipped peccary (*Tayassu pecari*), collared peccary (*Pecari tajacu*), red brocket (*Mazama americana*), mountain paca (*Cuniculus paca*), and Central American agouti (*Dasyprocta punctata*), among others, is potentially the main reason of jaguar displacement to cattle raising areas in search for food.

- La Llana: the main jaguar prey species have been identified as collared peccary (*Pecari tajacu*), red brocket (*Mazama americana*), mountain paca (*Cuniculus paca*), and Central American agouti (*Dasyprocta punctata*), among other earthbound and tree-dwelling frugivores. The relative abundance index (indic/km) of these prey in this sector is obtained in 2006, 2007, and 2008, except for the Central American agouti (*Dasyprocta punctata*).
 - From 2006 to 2008, the collared peccary shows a reduced relative abundance index (0.78-0.35) whereas it increased for the mountain paca (0.13-0.27).
 - The red brocket showed an increased relative abundance index in 2006-2007 and a reduced index in 2008.
- Río Piedra: jaguar prey indicator starts to be measured in this sector in 2009, whereby the Central American agouti (*Dasyprocta punctata*), the red brocket (*Mazama americana*), and the mountain paca (*Cuniculus paca*) present a Regular condition. The latter two fall within the lower range, close to Poor, whereas the Central American agouti is in the upper range, closer to Good.

The availability of jaguar prey species may be affected in the survey area, first because of the local deletion of important prey (*Tayassu pecari*) a couple of decades ago; then, because of poaching pressure on the prey species, which still persist in the area, and because of changes to their habitat. Importantly enough, the prey under analysis here are also available to other carnivores (*Puma concolor* and *Leopardus pardalis*).

- **Relative abundance of harpy eagle prey:**

This is an indicator of threat to and of status of the object of conservation, represented by the relative abundance parameter of primates such as the mantled howler monkey (*Alouatta palliata*) and the brown-throated two- and three-toed sloths (*Choloepus hoffmanni* and *Bradypus variegatus*, respectively), which stand among harpy eagle's main prey in Panama and in other sites of the Neotropic. This indicator reflects tree-dwelling prey availability for the harpy eagle, and the loss of forest coverage because of cattle raising or other activities would affect the prey because of their tree-borne nature.

These three harpy eagle preferred prey species were recorded in Alto Chagres (La Llana – Santo Domingo, Rio Piedra) in the 2006-2010 studies.

In la Llana (2007), it was established that the primate group is in Regular to Good condition, and, as a group, they offer good availability as prey species to the harpy eagle. Within the group, the bigger size species, such as the mantled howler monkey, the black-handed spider monkey (*A. geoffroyi*), the Panamanian night monkey (*Aotus zonalis*), the white-throated capuchin (*Cebus capucinus*), and the Geoffroy's marmoset (*Saguinus geoffroyi*) do not appear to be submitted to strong poaching pressure, and this is why their availability as prey is likely to remain in the mid run.

Other tree-dwelling species that have been observed are the squirrels (*Sciurus* and *Microsciurus*), the sloths (*Choloepus*), and anteaters (*tamandua*), which could eventually be incorporated in the eagle's diet, thereby increasing the availability of different types of prey.

In general, the primates appear to be in Regular-Good condition in the survey area, possibly due to the good status of the La Llana forest coverage and the low poaching pressure.

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- **Number and abundance of bat species in the Cerro Azul and Cerro Jefe cloud forest, Chagres National Park:**

This area is located towards the south of the Park and is a higher altitude zone within this protected area (1.077 masl). The area shown in Cerro Azul is composed of secondary forest located in the vicinities of natural El Patriarca and Romeo & Julieta trails. The purpose of this 2010 study is to learn the diversity status of bats, and also to determine the functionality of the ecosystem and the threats to biodiversity.

References

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