DIAGNOSIS OF COTAPATA NATIONAL PARK AND INTEGRATED MANAGEMENT NATURAL AREA

PARKS WATCH BOLIVIA

OCTOBER 2005

PARK PROFILE Series

PARKSWATCH
Strengthening Parks to Safeguard Biodiversity

ParksWatch was created in 1999 as a program of Duke University's Center for Tropical Conservation to document the state of protected areas throughout the Tropics, many of which present a dearth of information concerning their biological riches and the problems they face.

Through partnerships with in-country NGOs and individuals, ParksWatch conducts on-the-ground evaluations of protected areas, which analyze threats to their conservation viability, identify strategies for overcoming those threats, and help government agencies, NGOs and community groups succeed at the ultimate goal of strengthening parks in their role as the world's primary instrument for the protection of biodiversity.

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PARKSWATCH BOLIVIA

ParksWatch-Bolivia is member of the ParksWatch network of NGOs, headquartered at Duke University, North Carolina, USA. ParksWatch has other active programs in Mexico, Guatemala, Venezuela, Peru, Brazil, and Argentina, and plans to initiate new programs in other countries and continents.

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SERNAP

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This Park Profile was written by Dimitri de Boissieu, Mario Diego Lilienfeld, and Stéphane Pauquet. Data collection was undertaken by Dimitri de Boissieu (Ecologist) and Charlotte Meunier.

In parallel to our field observations, this report is based primarily on interviews and discussions with the staff and managers of Cotapata National Park and Integrated Management Natural Area and the Bolivian park administration (SERNAP) in La Paz, as well as individuals assisting the park independently or as employees of non-governmental organizations.

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An interactive version of this report is available in two languages (English and Spanish) at the following URL: http://www.parkswatch.org/parkprofile.php?l=eng&country=bol&park=conp

Designed by: Stéphane Pauquet

Photo credits: When not expressly indicated: ParksWatch archive. When initials are used: DDB: Dimitri de Boissieu; SP: Stéphane Pauquet; MSC: Miguel Sevilla Callejo.

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List of Acronyms and Abbreviations

AMBC Amboró-Madidi Biological Corridor

AOP Annual Operational Plan

asl Above Sea Level

BIAP Biodiversidad y Áreas Protegidas

CEPF Critical Ecosystem Partnership Fund

CI Conservation International

CIC Comité Interinstitucional Cotapata

COBEE Compañía Bolviana de Energía Eléctrica

COBIMI Conservación de la Biodiversidad para un Manejo Integrado

D.S. Decreto Supremo

EBT Estación Biológica Tunquini

FAN Fundación Amigos de la Naturaleza

FUNDESNAP Fundación para el Desarrollo de Sistema Nacional de Áreas Protegidas

GEF Global Environment Fund

GTZ Gesellschaft für Technische Zusammenarbeit

ha Hectare or hectares

IADB Interamerican Development Bank

IMNA Integrated Management Natural Area

INE Instituto Nacional de Estadísticas

INRA Instituto Nacional de Reforma Agraria

KFW Kreditanstalt für Wiederaufbau

MEDMIN Medio Ambiente, Minería e Industria

MHNNKM Museo de Historia Natural Noel Kempff Mercado

NGO Non-governmental organization

OMS Organización Mundial de la Salud

PA Protected Area

PPACN Proyecto de Protección Ambiental del Cerro Nogalani

NP National Park

SERNAP Servicio Nacional de Áreas Protegidas

SNAP Sistema Nacional de Áreas Protegidas

SISCO Sistema de Cobro

SNC Servicio Nacional de Caminos

TNC The Nature Conservancy

UMSA Universidad Mayor de San Andrés

USAID United States Agency for International Development

WCS Wildlife Conservation Society

WWF World Wide Fund for Nature

Objectives and Methods

ParksWatch is a non-profit organization headquartered at Duke University's Center for Tropical Conservation in Durham, North Carolina, USA. Its mission is to protect biological diversity by collecting, analyzing, and disseminating up-to-date information on the state of protected areas.

ParksWatch works through partnerships with individuals and local organizations in seven Latin American countries (Mexico, Guatemala, Venezuela, Peru, Brazil, Bolivia and Argentina) to conduct on-the-ground evaluations of protected areas, assessing their levels of implementation and identifying threats. Results of each evaluation are compiled into cross-disciplinary diagnostic reports called "Park Profiles."

Each Park profile prescribes actions to abate or remove the most serious threats and lists recommendations to improve each area's management. These reports are posted on our website (www.parkswatch.org) and printed copies provided to government agencies, conservation organizations, and other stakeholders involved in the park's management. Based on the results of our findings, our partners undertake a variety of activities to support park management and raise awareness among conservation specialists and the general public. Such activities may include the organization of forums, meetings, and workshops or involvement in media campaigns, production of video documentaries and the publication of newspaper articles.

With their journalistic style, widespread distribution, and photographic documentation, our park profiles are also meant to inform citizens of existing threats to their nation's protected areas. Our ultimate goals are to help improve political support, foster adaptive management, promote the adoption of best practices, and instigate the level of implementation needed to guarantee effective biodiversity conservation inside protected areas.

Along with other studies, our reports contribute to the baseline information available for each protected area, against which future evaluations and monitoring activities can be compared in order to measure conservation outcomes. Furthermore, the use of a standardized methodology allows us to draw comparisons between different protected areas within one country or between different countries. Alas, we intend to revisit each park every three or four years to update our database and measure changes in conservation status from a selection of key indicators.

Description of this evaluation

This evaluation began with the compilation of all the available reference material in the libraries of the Bolivian Park Service (*Servicio Nacional de Areas Protegidas*, SERNAP), Conservation International, LIDEMA (*Liga de Defensa del Medio Ambiente*), and Trópico (databases, technical and scientific reports, journal and newspaper articles, etc.).

After this first revision, a series of interviews and field visits to the park's most relevant sites were organized with the park director (Juan Arce Olañeta, now replaced by the former chief ranger, Elias Mamani), after which most of the field work was carried out in company of park rangers, investigators and/or local residents.

The interviews (mostly semi-structured) made to these and other stakeholders were based on ParksWatch's standardized survey form, a Scorecard-based questionnaire that considers a broad range of aspects related to park management and focuses on both direct threats (such as land invasions, deforestation, and oil exploration) and indirect threats (such as budget shortfalls, lack of personnel, political interests, and macroeconomic forces). The data obtained in this way were incorporated to the ParksWatch database (available to interested parties) and were summed to the results of our literature review for the elaboration of the present report.

Below is a brief description of description of the interviews conducted and sites visited, in chronological order:

November 2003

- **La Paz:** Interview with a representative of the Bolivian Bat Conservation Program (Programa para la Conservación de Murciélagos de Bolivia - PCMB), which conducts research at the Tunquini Biological Station. Meeting with Patricia Ergueta, executive director of Trópico, who introduced us to the projects carried out by that organization in the area.

- Samaña Pampa: Interview with the park ranger on duty.

- Samaña Pampa - Pacallo: Visit of the El Choro pre-Hispanic trail. Interviews with community members of Chucura, Challa Pampa, Sandillani, and Chairo community members. In Sandillani, meeting with leaders of Chairo, who intend to settle there. In Chairo, interview with Luis Arteaga, from the Biological Station. In Pacallo, interview with the two park rangers on duty at the station (now transferred to Santa Barbara).

- **Coroico:** Interview with Alejandra Roldan, from the non-governmental organization Biota.

- **La Cumbre Station:** Interview with the three park rangers on duty and assessment of infrastructure.

- **La Paz:** Meeting with the park director to prepare field visits to the Biological Station and the new road.

- **Tunquini Biological Station (currently closed):** Meeting with Eddy Perez and Juan Fernando Guerra, graduate Biology students.

- **Chairo:** Interview with Juan Arce Olañeta and six park rangers.

- **Cotapata - Santa Barbara:** Visit of the new road with the park director.

March-April 2004

- **La Paz:** Series of meetings with Miguel Sevilla Callejo, doctoral Geography student from the Autonomous University of Madrid, who is studying land use dynamics within the park.

2005

- **La Paz:** Various interviews with the new park director (Elías Mamani) to fill information gaps about the park and complete our data.

The National System of Protected Areas of Bolivia

Despite the creation of the first protected area in 1939 (Sajama National Park), Bolivia's National System of Protected Areas (SNAP) is one of the youngest in Latin America. Established in 1992 through the Law of the Environment, its fundamental objectives are the conservation of representative samples of the country's major ecosystems and it is administered by the Servicio Nacional de Áreas Protegidas (SERNAP), under the jurisdiction of the Ministry of Sustainable Development and Planning (MDSP). The SERNAP is responsible for defining and enforcing the laws and regulations pertaining to the management of the country's genetic and biological resources, as well as to administer and implement the Convention of Biological Diversity signed by Bolivia at the Rio Conference (1992) and ratified in 1994.

Although generally supportive of the creation of protected areas, the Bolivian government does not support them financially. As a matter of fact, the management of the SNAP relies almost entirely on international funding (GEF, Dutch government, KfW, IADB, etc.) and on the manpower and additional resources provided by non-governmental organizations (NGOs) (CI, WCS, GTZ, TNC, CARE, WWF, FAN, Trópico, etc).

At present the SNAP is composed of twenty nationally recognized protected areas, covering approximately 16.8 million hectares (15.3% of the national territory) and divided into National Parks, National Reserves, Biosphere Reserves (a category still not recognized by the national legislation), Wildlife Reserves and Integrated Management Natural Areas (equivalent to Multiple-Use Zones). In parallel to the SNAP, there is a growing contingent of protected areas of lesser hierarchy, such as Forest Reserves, Watershed Protection Areas, and Departmental, Regional, and Municipal Parks and Reserves. Another important zoning category is the Reserva Natural de Inmovilización, which corresponds to a temporary ordinance until a final status is defined based on the area's values and characteristics.

Each national or departmental protected area must form a Management Committee inviting spokesmen of the various cultural groups inhabiting its territory or surrounding area to participate in the decision-making process.

Since the creation of the Bolivian SNAP, significant achievements have been made in the following management areas:

(i) planning;

(ii) design and implementation of a monitoring and evaluation system;

(iii) establishment of operational protection corps;

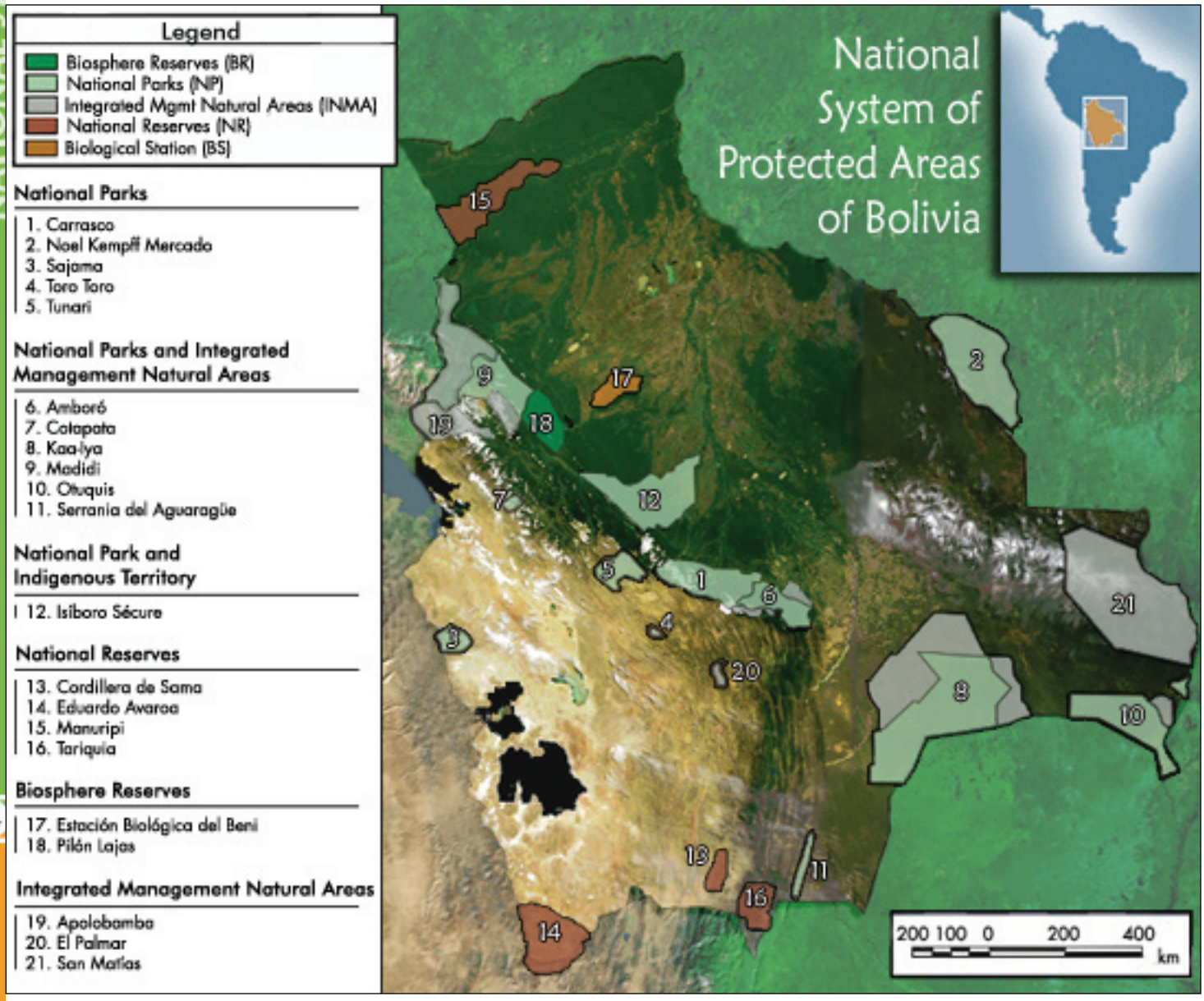
(iv) development of a training program for both park rangers and administrative staff;

(v) adoption of a set of policies for the public use of protected areas, and;

(vi) participation of local stakeholder groups in park decision-making.

Protected Areas of Bolivia

Management Category	Number	Area (Ha)
National Park	5	2,592,029
National Park and Integrated Management Natural Area	6	7,133,336
National Park and Indigenous Territory (or Communal Lands)	1	1,236,296
National Reserve	4	1,887,332
Biosphere Reserve	2	535,170
Integrated Management Natural Area	3	3,450,217
TOTAL	**21**	**16,834,380**



SERNAP's policies and strategic agenda are presented in Appendix

Cotapata National Park and Integrated Management Natural Area

Date of last field evaluation	June 2004 (updated in July 2005)
Name	Cotapata
Category	National Park and Integrated Management Natural Area*
Year created	1993
Area	60,000 ha
Main objectives	- Conservation of biological diversity, in particular of the high Andean and Yungas biomes; - Regulation of the use of natural resources by local residents and improvement of their living conditions; - Protection of the local archaeological and cultural heritage and recovery of local inhabitants' traditional knowledge (see Appendix 2)
Location	In the northwest of the La Paz department, in the Nor Yungas and Murillo provinces
Ecoregions	Humid Puna grasslands and Humid montane cloud forests (Yungas)
Habitats	Glaciers, snow-fields, periglacial environments, high Andean grasslands, highland wetlands called "bofedales," Yungas paramos, cloud forest ridges, and humid montane cloud forests

* See definition in Appendix 2.

Summary

Description

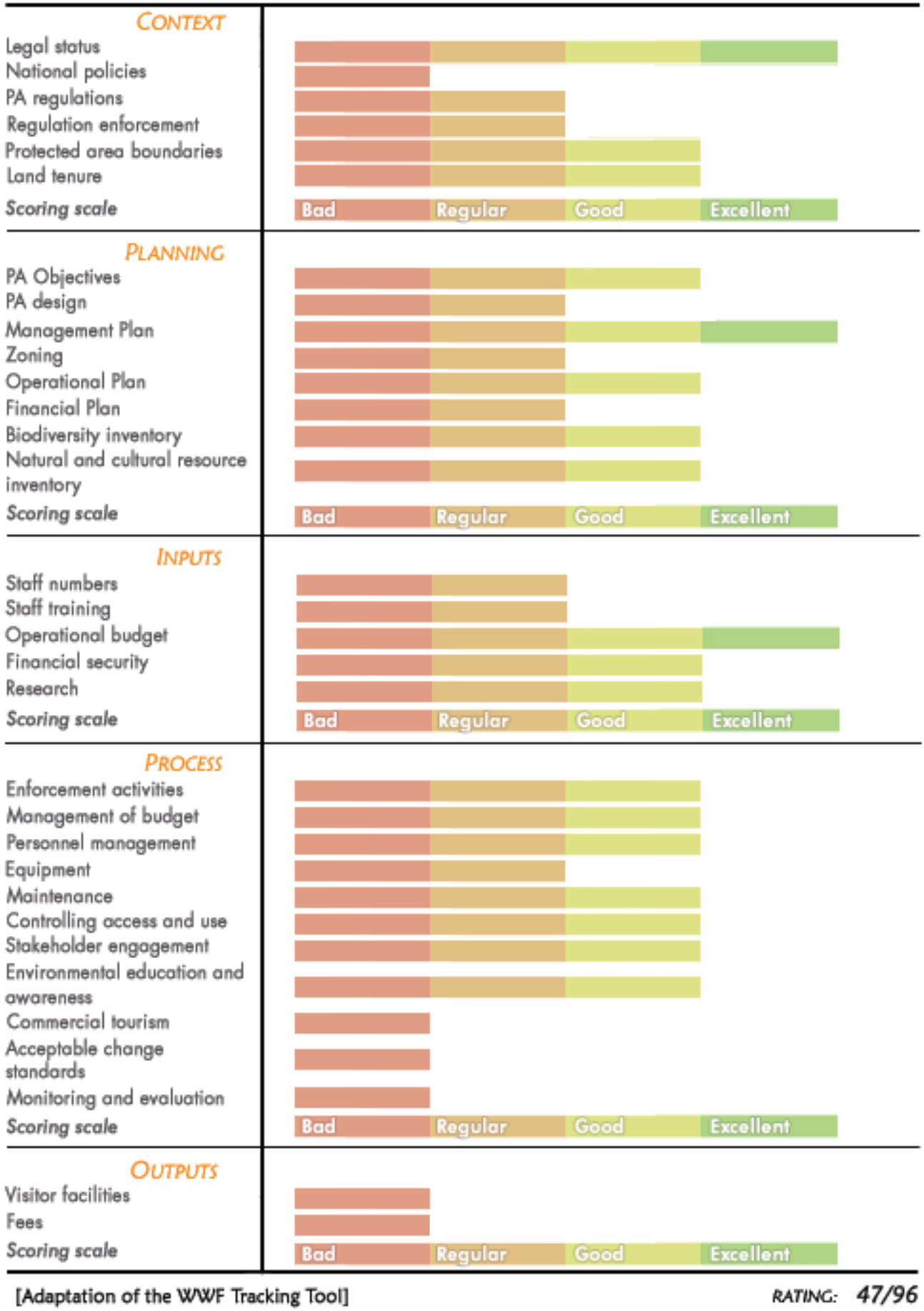
With an elevation range close to 4,500 m, Cotapata National Park and Integrated Management Natural Area (NP-IMNA) protects a representative sample of the Yungas cloud forests of the department of La Paz. Within a relatively small area, this park encompasses five very distinct ecological zones in terms of climate, vegetation, and fauna. These include snow-capped mountain peaks and periglacial environments of the Andean summits, high Andean grasslands, Yungas paramos, cloud forest ridges, and humid montane Yungas forests. The area is also characterized by a rich history and culture, attested to by the presence of numerous archaeological sites.

Biodiversity

This variety of environments hosts a great diversity of organisms and presents a high degree of endemism. Horizontal precipitation created by permanent fog determines a profusion of epiphytic plants, such as orchids and bromeliads. Among the most important tree species in these cloud forests are *Polylepis pepei* and *Podocarpus oleifolius*, both locally threatened. In terms of fauna, there is a great variety of vertebrate species, such as the spectacled bear (*Tremarctos ornatus*) and the Andean cock-of-the-rock or "tunqui" (*Rupicola peruviana*), which are the park's two emblematic species.

Threats

The main threat to Cotapata NP-IMNA is the conflictive situation between the park administration and the communities established in its interior and in throughout its zone of influence. In fact, elaboration of the park's Management Plan was delayed considerably, and many of the management programs had to be postponed because a significant percentage of the local population rejects the protected area. Another threat is the new highway (ironically, the main reason for the creation of the area), being constructed in a highly mountainous and geologically unstable area. According to recent studies, its ecological impacts could affect no less than 10% of the area (in its eastern sector). At the same time, the proximity of La Paz foretells the potential establishment of new human settlements and agricultural zones along the road. Gold mining also generates sediments and heavy metals that pollute some watercourses. The practices of burning grasses and pastures in the area's highlands and clearing land on pronounced slopes in the valleys affect both the soils and biodiversity. Finally, the area's small size and its relative isolation from other protected areas call its biological viability into question. For all of the above reasons, ParksWatch considers the Cotapata PN-ANMI as **vulnerable**.



[Adaptation of the WWF Tracking Tool]

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Description

Geographical location

Cotapata National Park and Integrated Management Natural Area (NP-IMNA) is the closest protected area to the city of La Paz, located only about 50 km away in the Nor Yungas and Murillo provinces and within the jurisdiction of the municipalities of La Paz and Coroico. Its southern limit is defined by the ancient La Paz-Caranavi road, which borders the area from La Cumbre to Central Sacramento. To the southeast, the border follows the Elena river until it joins the Huarinilla river, a tributary of the Beni river and the park's largest water course. To the north and west, the park's limit does not coincide with any natural feature other than the Cielo Jahuira river, the area's second most important river.

Access

The main access to the protected area is from one of the two La Paz-Caranavi roads (the newer one having just recently been completed). The La Cumbre point of entry is only 20 km from the city of La Paz. This is the official beginning of the "El Choro" pre-Hispanic trail, which crosses the entire area until it reaches the little town of Chairo, more than 3,000 m below.

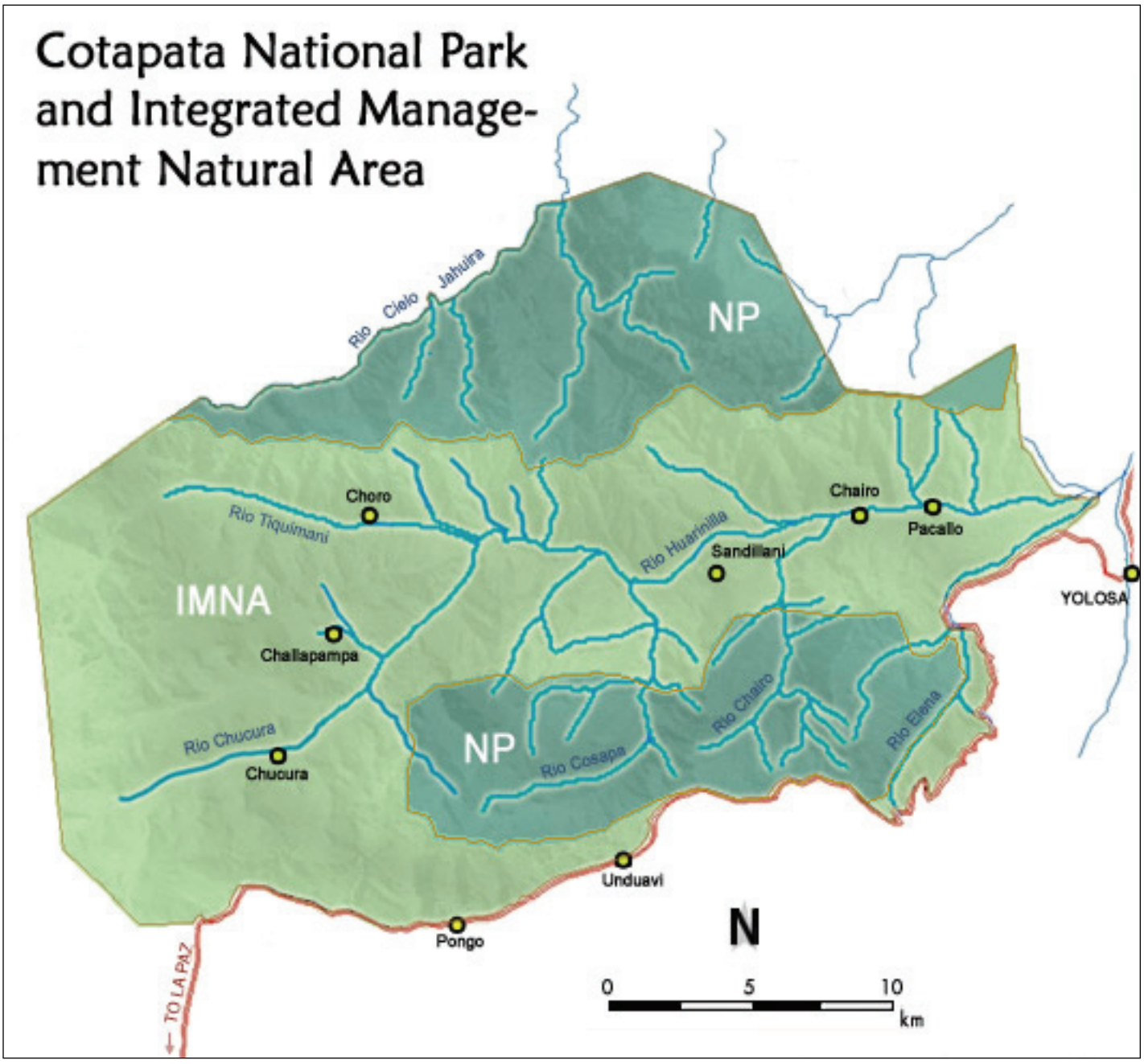
The steep slopes between Chuspipata and the San Juan river impede vehicle access. The park's lower part can be accessed from Coroico (two hours from La Paz using the new Cotapata-Santa Barbara highway), along a road that follows the Huarinilla river. There is an access route from Unduavi to the Chucura area, only half of which can be traveled by car. Also, there is a route accessing the northern part of the area, but the rugged terrain limits vehicular travel.

View of the lower part of the Huarinilla Valley. Photo: SP

Physical description

Despite its small size of approximately 60,000 ha (Sevilla Callejo, 2003), Cotapata encompasses a wide range of ecological zones (also called layers), from the snow-covered peaks of the high Andes (5,519 m asl) to the humid montane cloud forests, known as Yungas (1,035 m asl). Deep valleys and steep slopes characterize most of the area, which is prone to landslides. These natural disturbing factors are one of the most remarkable features of local

geomorphology (Sevilla Callejo, 2003) and determine the concurrence of several successional stages in floristic communities. On such steep terrain, the forest cover plays a very important role in the conservation of the river headwaters (Bruijnzeel and Hamilton, 2001).



Lower part of the Huarinilla river. Photo: MSC

Hydrography

The core of the protected area is formed by the Huarinilla river basin, essentially composed of the Chucura and Tiquimani subwatersheds, which are fed by several glacial lakes. The general direction of flow is oriented eastwards, with pronounced slopes and an overall dendritic configuration. The southern part of the park pertains to the Unduavi watershed and the northern sector to the Cielo Jahuira basin, oriented in southwest-northeast direction.

Climate

The park's ample elevation range determines very heterogeneous climatic conditions across the area. Over a large portion of the park, the trade winds loaded with moist tropical air form an almost permanent cloud cover by meeting the high-Andean barrier, and result in abundant rainfall (Sevilla Callejo, 2003). During the rainy season (from December to March), rainfall levels vary from 1,000 mm in the highlands to more than 3,000 mm in the lowlands. Seasonal change in mid-altitude cloud forests is nearly imperceptible.

Average annual temperatures vary between 7 and 28 °C (Bach et al., 2003), with a temperature drop of 0.5 to 0.6 °C for every 100 meters of elevation (Kessler and Beck, 2001). Sevilla Callejo (2003) distinguishes five climatic zones in relation to elevation: warm subtropical climate with a drier season in the winter; meso-thermic, hyper-humid, relatively warm climate; meso-thermic, cooler climate with dry winter; meso-thermic cold climate with dry winter; and polar climate at the highest altitudes.

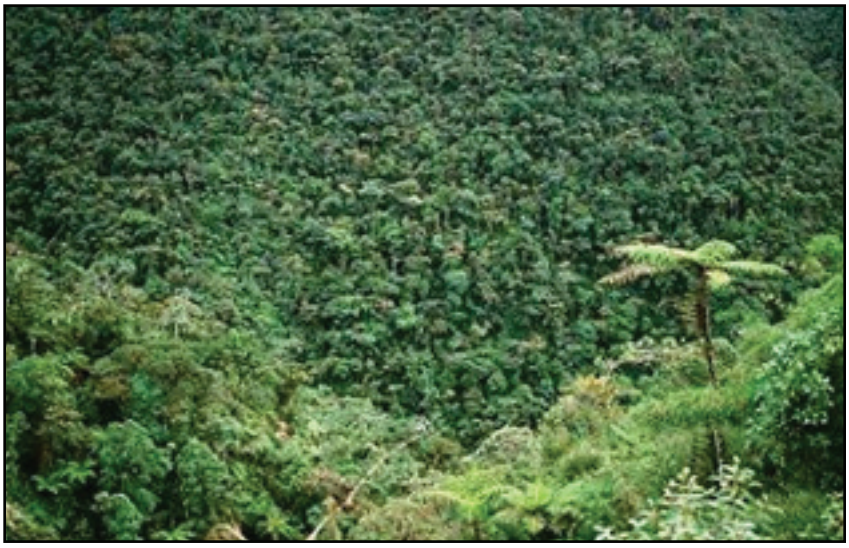
Biodiversity

Cotapata NP-IMNA harbors a wide variety of habitats, which results in an elevated number of species despite a relatively small size. Each ecological zone harbors specific plant and animal communities. The tropical cloud forest, in particular, features the highest species richness and endemism level in the world (CEPF, 2001; Bruijnzeel and Hamilton, 2001). The area is also home to many rare and/or threatened species, as well as species with restricted geographic ranges. Due to these characteristics, the park has been given high priority for conservation within the Amboro-Madidi Biological Corridor and is part of the proposed Cotapata-Cotacajes Sub-Corridor, which encompasses approximately one million hectares (Trópico, in prep.).

3D satelite view of Cotapata NP-IMNA (EarthSat/Google Earth)

a) Flora

735 species of flowering plants have been recorded in the area (Fundeco, 2002 *in* CARE-WCS, 2003), of an estimated total of 1,800 species (SERNAP, 2001). In a transect spanning between 1,600 and 3,400 m (5,250 m asl), Bach et al. (2003) recorded 346 species: 246 ferns, 56 Melastomataceae, 21 Araceae, 17 Bromeliaceae, 2 Cactaceae and 4 Palmeae.



Yungas cloud forest. Photo: MSC

Ecological zone	Elevation range	Description
Snow-capped peaks and periglacial region	Above 4,700 m	Sparse vegetation composed of drought and freeze resistant species. Precipitation occurs almost exclusively in the form of hail and snow, so that the landscape is dominated by rocky outcrops, grasses (*Poa chamaeclinos*), lichens and small shrubs (*Valeriana pynantha* and *Senecio* sp.) (Ribera-Arismendi, 1995a); Sevilla Callejo, 2003).
High-Andean grasslands	4,100 - 4,700 m	Grasses are dominant (*Deyeuxia filosofia*, *Festuca* sp., *Agrostis* sp., *Bromus* sp., *Stipa ichu*, *Calamagrostis* sp., *Bidens andicola* and *Rumex acetocella*) as well as rosette plants (*Hypochoeris* sp., *Lachemilla* sp., *Pycnophyllum* sp., *Azorella* sp.) (SERNAP, 2001). In the bofedal wetlands, the following species are common: *Distichia muscoides*, *Plantago tubulosa* and *Oxycloe andina*.
Yungas paramo	3,500 - 3,200 m	This ecological zone is found in strips and patches of almost constantly humid grasslands and shrublands, with mostly horizontal precipitation (Sevilla Callejo, 2003). It also corresponds to the natural distribution area of lowland *Polylepis pepei* forests, which have been almost completely replaced by grasslands (Ibisch et al., 2003). This genus is endemic to the tropical Andes, where it is often the only arboreal species in areas dominated by herbs and low shrubs (CEPF, 2001). The most common genera of the Yungas paramo are *Stipa*, *Festuca*, *Brachyotum*, *Satureja*, *Mutisia*, *Chuquiraga*, *Baccharis*, *Calceolaria* and *Gnaphalium* (Pacheco et al., 2003). The soils of this ecological zone are generally composed of thick organic material covered by a profusion of mosses, lichens and fungi (Sevilla Callejo, 2003).

Ecological zone	Elevation range	Description
Cloud forest ridges (or cloud forest)	2,400 - 3,500 m*	This forest represents the upper limit of the montane cloud forest, and reaches a maximum of 5-13 meters (Bach et al., 2003). It is characterized by the presence of *Podocarpus oleifolius*, one of the most remarkable and most threatened cloud forest species (Sevilla Callejo, 2003), and bamboos (*Chusquea* sp.). Parts of this ecological zone are dominated by *Weinmannia boliviensis, Weinmannia crassifolia* and the Andean alder (*Alnus acuminata*). Climatic conditions lead to the presence of many epiphytic species, such as orchids, ferns, mosses and lichens, many of which are highly endemic.
Humid montane Yungas forest	1.000 - 2.500 m	This evergreen forest can reach above 25 meters and harbors incredibly high biological diversity. Towards its lower limit, it adopts the structural and floristic features of a tropical piedmont forest. Among others, its dense understory contains a large variety of epiphytic plants (Sevilla Callejo, 2003). Among the most important tree species found here are the Bolivian walnut (*Juglans boliviana*), Lauracea genera (*Nectandra* sp. and *Ocotea* sp.), cedar (*Cedrela lilloi*), quinine (*Cinchona officinalis*) and Podocarpus (*Podocarpus oleifolius*) (Trópico, 2000). This is the most altered ecosystem in the Bolivian Yungas and, within the park, the most threatened by human presence (Sevilla Callejo, 2003).

* Depending on sun exposure and microclimatic conditions.

It should be pointed out that extensive parts of the park are secondary growth or anthropogenic plant communities, particularly in the highlands, along the banks of the Huarinilla river, and on Mount Nogalani.

b) Fauna

The diversity of ecosystems in Cotapata NP-IMNA translates into the presence of many vertebrate species. According to Sarmiento (2002, *in* Colectivo, 2003), 284 vertebrate species have been reported: 66 mammals, 183 birds, 14 amphibians, 11 reptiles and 10 fish. Remsen and Taylor (1985, in Sevilla Callejo, 2003) state that approximately 400 bird species could be nesting in the area or using it as seasonal habitat. Sampling the rivers and streams of Huarinilla, Santa Catalina, Elena, Jucumarini, and Yucupi, Miranda-Chumacero (2004) yielded nine fish species, among which several threatened species. In terms of vertebrate endemisms, the park harbors three confirmed mammal, six bird and two amphibian species endemic to the country (Ergueta & Gómez, 1997).

Andean Condor (Vultur Gryphus).
Photo: Giuliano Gerra

The park's western highlands are home the Andean condor (*Vultur gryphus*), the Peruvian guemal or North Andean deer (*Hippocamelus antisensis*), the Andean fox (*Pseudalopex culpaeus*), the mountain viscacha (*Lagidium viscaccia*), the Andean cat (*Oreailurus jacobita*), the black-and-chestnut eagle (*Oroaetus isidori*) and other bird species. The bofedal wetlands create habitat for ducks such as the speckled teal (*Anas flavirostris*) and pairs of Andean geese (*Chloephaga melanoptera*) (Trópico, 2000).

The home ranges of the spectacled bear (*Tremarctos ornatus*) and puma (*Felis concolor*) span from the high-Andean ecosystems to the montane cloud forest. Among the most outstanding inhabitants of the cloud forest ridges are the ocelot (*Leopardus pardalis*), dwarf brocket deer (*Mazama chunyi*), tayra (*Eira barbara*), coati (*Nasua nasua*), some curassows and toucans, as well as the "tunqui," or Andean cock-of-the-rock (*Rupicola peruviana*) and the black-hooded sunbeam (*Aglaeactis pamela*), which is endemic to Bolivia. Also inhabiting the cloud forest is *Leopardus tigrinus*, a feline recently recorded in Bolivia (Pacheco et al., 2001).

The Yungas Montane forest is home to several mammals such as the spider monkey (*Ateles paniscus*), white-fronted capuchin (*Cebus albifrons*), river otter (*Lutra longicaudis*), agouti (*Dasyprocta punctata* and *Dasyprocta variegata*), agouti (*Agouti paca*), pacarana (*Dinomys branickii*), cats (*Leopardus wiedii, Herpailurus yagouaroundi*, *L. tigrinus*) and peccaries (*Tayassu pecari* and *Pecari tajacu*). There are also many birds such as the Andean guan (*Penelope montagnii*), sickle-winged guan (*Chamaepetes goudotii*), oilbird (*Steatornis caripensis*) and crested oropendola (*Psarocolius decumanus*).

The spectacled bear (Tremarctos ornatus), the tiger cat (Leopardus tigrinus) and the cock-of-the-rock (Rupicola peruviana) are the park's three emblematic species. Photos (from left to right): Stéphane Pauquet, Lira Olivier and André Bärtschi Vaduz

Management

Background

Cotapata NP-IMNA was created on July 9, 1993 (DS N°23,547) in order to mitigate the direct and indirect environmental impacts of the building of the Cotapata-Santa Barbara highway. This mitigation initiative was imposed by the various entities financing the project: Inter-American Development Bank (IADB), KfW (*Kreditanstalt für Wiederaufbau* - German Reconstruction and Development Bank) and CAF (*Corporación Andina de Fomento*).

The highway's area of influence, called "Cerro Nogalani Protection Area" (6,000 ha), is part of the Cotapata NP-IMNA. Between 1995 and 2003, it was under the jurisdiction of the National Roads Service (*Servicio Nacional de Caminos* - SNC) and the Ministry of Sustainable Development and Planning (*Ministerio de Desarrollo Sostenible y Planificación* - MDSP) in the framework of the "Cerro Nogalani Environmental Protection Project", financed by IADB, KfW, and the National Treasury (*Tesoro General de la Nación* - TGN). Its overall objective is to protect and conserve the hydrographic basins and ecosystems affected by the highway's construction (SERNAP, 2003b).

The recently completed and approved Management Plan defines the limits between the park's two management categories: National Park (NP) and Integrated Management Natural Area (IMNA). The National Park, which covers approximately 40% of the total area, is divided in two units: one is located in an inaccessible part corresponding mostly to the Cielo Jahuira river Basin and the Supaypunku Sub-Basin, and the other corresponds to the Elena river valley. The Integrated Management Natural Area is much larger and includes the Huarinilla, Chucura, and Tiquimani river valleys, as well as the zone of influence of the existing La Paz-Caranavi road.

The area's Management Plan, under the responsibility of the COBODES-Trópico-GFA consortium with financing from KfW's Biodiversity and Protected Areas Project (*Biodiversidad y Áreas Protegidas* - BIAP), was finally approved in November 2004 after much delay because of tensions between the park administration and the local communities. Before the Management Plan was approved and implemented, the protected area operated under Annual Operative Plans that were approved in a participative way by the Management Committee and other planning instruments. Characterized by a poor local representation until 2002, the Management Committee was successfully strengthened thanks to the support of the BIAP project, which provided substantial investment funds in support of the park's management. An Interinstitutional Committee was also created to serve as a coordination and planning platform for the different institutions supporting the protected area (SERNAP, 2002).

Administration and personnel

The park's management team was constituted in 1995 and today includes a director, an administrator, a chief ranger, nine park rangers (all from the area), four technical experts (land-titling, environmental education, productive management, and tourism), a driver, and a caretaker. At SERNAP's central office in La Paz, a planning technician and a land-titling are shared with other protected areas.

The 2005 total budget is approximately US$ 225,669, all of which comes from foreign sources: KfW funds through the BIAP project and support from the German Trust Fund. The objectives of the BIAP project are to promote optimal management, administration, and sustainable natural resource use in four Bolivian protected areas. Some notable investments made in Cotapata NP-IMNA as a result of this project include the maintenance of bridges along the El Choro trail and the construction of a hydroelectric plant in the community of Chuchura (in the upper part of the park).

In 2001, the protected area tried to implement an entrance fee system (*Sistema de Cobro* - SISCO) to take advantage of the flow of tourists hiking along the El Choro trail, but this created problems with local communities, who wanted to charge their own fees, and the administration decided to abandon the system after only 6 months.

Infrastructure

The park's infrastructure has been insufficient throughout most of its management history. Up until 2000, there were only two rented stations and a rented office in Coroico. Later, with support from the Canadian Government, a park ranger station was built in the La Cumbre district and signs were installed at the various access points. The launch of the BIAP project in 2001 made several long-needed investments possible, among which the construction of a central park ranger station and the building of a new office in Coroico.

Today the park has two administrative offices - a central office in La Paz and a liaison office in Coroico. Within the protected area there are two SERNAP-owned park ranger stations: Puente Elena (in the lower part of the Huarinilla river, close to the new highway) and La Cumbre (on the park's southwestern side, along the La Paz-Caranavi Highway and at the start of the El Choro Pre-Columbian trail). The administration further plans to set up several temporary refuges along the El Choro trail, and there are talks about installing a control point at the Apacheta pass between the Tiquimani and Zongo valleys to control tourist and resident flows.

This new ranger station by the Elena bridge, now in service, marks the entrance to the low part of the protected area. Photo: DDB

Land ownership

Before the National Revolution of 1953, most of the lands now comprised within Cotapata NP-IMNA were part of large private landholdings. With the Agrarian Reform that ensued, the lands were expropriated and divided among the different communities that developed over time. Although these do not have official property

titles, they have demarcated their respective land claims and have internally defined individual and collective - or communal - property rights for access to natural resources.

Land ownership and property security were two areas of concern for the communities when the protected area was created, because they feared that the government intended to expropriate their land. This fear, among other reasons, has lead people to take positions against the protected area.

The BIAP project provided the resources necessary for the launch of the land-titling process, which began in 2002 with informative workshops and, in some cases, field appraisals for internal titling (SAN-INT). Nonetheless, this process will probably have to be restricted to the lower part of the protected area because Chucura and other communities refuse to participate. According to the plan, internal titling and informative workshops should be completed by the end of the year and a budget will be calculated for the next titling phase (Elias Mamani, pers. comm.).

Zoning

The limits between the two management categories (NP and IMNA), which had not been clearly defined when the area was declared in 1993, were finally established in the 2004 Management Plan.

a) National Park

The National Park has been divided in two territorial units:

- Northern block:

The Management Plan states, "*it is known that within the protected area's borders, the most isolated and best preserved sector corresponds to the Hornuni, upper Suapi, and Cielo Jahuira watersheds. This block covers approximately 20,000 hectares. In its extreme western edge, a small portion is above 4,200 m in elevation, but most of it lies between 2,000 and 3,000 m, with another small fraction between 1,200 and 2,000 m. As a result, the NP will protect mostly montane cloud forest ridges, followed by montane cloud forests, and to a lesser degree Yungas paramos*". Most importantly, this sector is well protected by its near inaccessibility.

- Southern block:

The other block categorized as National Park corresponds to the upper portions of the Elena, Chairo, and Coscapa rivers, extending approximately 5,000 ha.

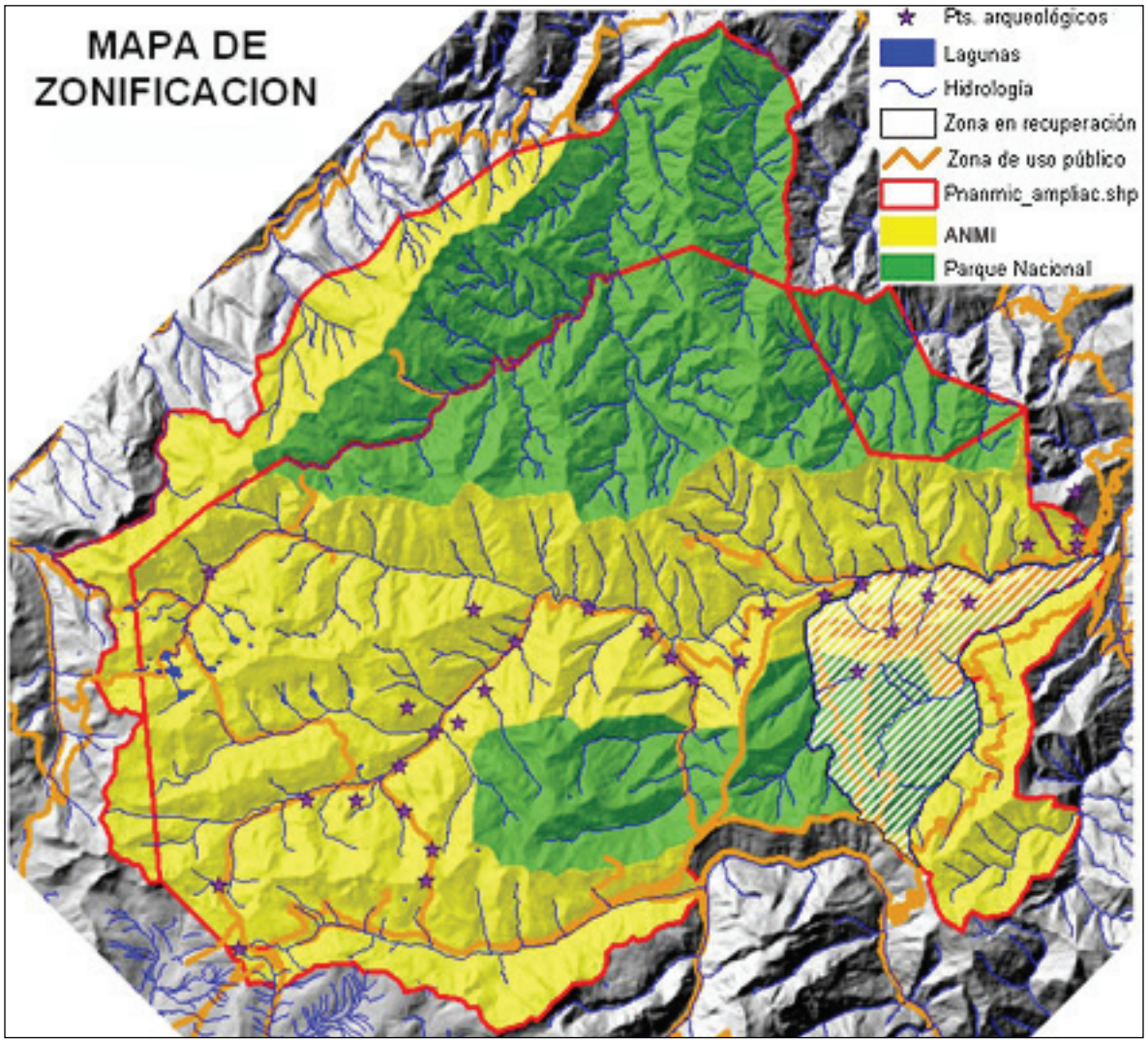
b) Integrated Management Natural Area

The single polygon characterized as IMNA occupies the central part of the protected area, and corresponds to the watersheds of the Unduavi, Chucura, Tiquimani, and Huarinilla rivers. Its surface area is approximately 35,000 ha, or 60% of the total protected area, and it encompasses individual and communal properties of existing communities within the PA (SERNAP, 2004).

With respect to zoning, the park has operated without a proper Zoning Plan since its creation, although various proposals have been elaborated. The first zoning plan, elaborated by a group of graduate students in 1995 was published in a book entitled "*The Trails of Cotapata*" (*Caminos de*

Cotapata in Spanish). Patricia Roncal (B.A.) developed another proposal a few years later for her master's thesis. However, neither proposal was applied because of certain design flaws. A third, preliminary zoning proposal was drafted in 2000 by the park management team. It conformed to legal criteria and respected both traditional use and nature conservation objectives, but was rejected by SERNAP's central administration office for unknown reasons and never applied.

The Management Plan elaborated in 2004 finally established a definitive Zoning Plan, presented below:



Zoning Plan of Cotapata NP-IMNA. Source: SERNAP, 2004.

Management

Even though Cotapata NP-IMNA is a small protected area, a variety of problems and obstacles make it very difficult to manage. Three stages can be distinguished in the park's management since its inception in 1993:

- The first stage began with the implementation of the Cerro Nogalani Protection Program and was characterized by a strict conservation strategy that reflected SERNAP's policies at the time, which was driven by the intention to place local communities' access and use of natural resources under governmental control. This protectionist approach, which came in addition to a total lack of public consultation and information at the time of the park's creation, contributed to a profound resentment among the local population and general rejection of the protected area concept.

- The second stage began in 1999, when a change in the management strategy based on providing more room for dialogue and more flexibility regarding natural resource use for protected area residents resulted in a certain rapprochement between the park administration and the local communities. Nonetheless, scarce financial resources and limited institutional presence in the area (only two institutions were working in the park at that time) limited the park administration's outreach capabilities. Renewing talks with local community leaders was very difficult for several reasons. Beyond the resource limitations and the bad precedents established by the previous administration, certain communities were ridden with internal problems which certain leaders would take advantage of to discredit the park administration and to gain political support.[1] Despite this unfavorable scenario, many communities in the lowlands were willing to cooperate, and they regularly attended the meetings organized by the protection crops. This, in turn, allowed a true participatory planning and outreach process to begin, which involved all of the present institutional stakholders. Unfortunately, this process ended when the director was replaced and a different outreach strategy was applied.

Important milestones of this second management stage include development of planning instruments in the absence of a Management Plan, establishment of minimum infrastructure, and the assessment of investments needs for the upcoming BIAP project.

- The third and current stage is characterized by the substantial financial support provided to the park's administration and communities by the BIAP project. On top of the funds already available for regular operations, this project injected close to one million dollars in investment funds. This allowed significant improvements in the park's equipment, infrastructure, and vehicle fleet, enhancing its public image along with its management. BIAP funds also supported the implementation of different local development and natural resource management projects, as well as the elaboration of

1 During a long time, the park was immersed in a territorial conflict between the municipal governments of La Paz and El Alto (both overlapping the protected area), which resulted in a high level of social instability and a generalized rejection of the protected area, especially among members of the *Central Chucura*.

the Management Plan and the initiation of several of its individual programs. These various factors were obviously instrumental in improving the park's acceptance by the local communities, and the administration now has the means to negotiate with residents and improve local participation and regulation compliance.

The Management Plan was approved at the local level in November 2004 in a very participatory manner, and is now in the process of being approved by government authorities. However, it should be noted that due its predominantly social focus, conservation objectives were relegated to a secondary position. Even with that, and in spite of having largely benefited from BIAP's investments with the construction of a hydroelectrical dam, the Central Chucura continues to maintain antagonistic relationships with the park administration.

To implement this Management Plan, BIAP is providing matching funds through 2005 and part of 2006. Although other financial sources have been promised, it is still uncertain whether or not they will materialize. For 2005, the Management Plan outlines the following five programs:

- Management and administration
- Social and territorial management
- Management of productive activities and socioeconomic development
- Protection, research, and monitoring
- Environmental education and communication

However, the park rangers still carry out mostly enforcement and surveillance activities. In La Cumbre, they register the tourists entering the El Choro trail, and they conduct routine patrols in the area, as well as special patrols according to their protection strategy. They also give talks in the communities, but quite unfrequently.

With support from the BIAP project, the park administration is preparing a variety of activities in accordance with the afore-mentioned management programs (Elias Mamani, pers. comm.):

- Concerning environmental education and communication, there is a program coordinator, a strategy has been elaborated, and materials have been produced. These materials include videos, games, a photographic display, a newsletter ("*El Tunqui*"),[2] radio programs, and a replica of Cotapata in the Kusillo Museum of La Paz. A "green bus" service is also planned, that will offer transport visitors to the protected area.

- With respect to the productive activities and socioeconomic development program, potential projects have been selected through a consultation process with local inhabitants, which yielded several ideas, such as the growing of Peruvian carrot (*Arracacia xanthorrhiza*), horticulture, beekeeping, and the installation of solar panels. However, due to flaws in the projects' design, the BIAP team finally decided to instead select projects based on their marketing potential. A "comparative advantages" study was thus launched in an effort to identify viable and profitable products. In addition, a rotating fund was created with an initial US$ 20,000 donation from FUNDESNAP to be distributed among local producers in the form of small loans (under $ 500 dollars).

2 Available in PDF at the following URL: http://www.uam.es/proyectosinv/cotapata/pnanmic/docs/ptunqui01.pdf

Considering the zone's suitability for coffee cultivation, a feasibility study has been funded with the participation of USAID (through the Mapa Yungas program) and CENCOP, and there is willingness to seek additional funding to continue with the subsequent project phases. An apiculture project has also been designed, but there are not enough funds to execute it.

Three projects have been designed that have to do with the commercialization of live plants and animals, including a butterfly enclosures project, an epiphyte nursery, and the production of ornamental plants. The butterfly rearing project, co-financed by BIAP and the Biocommerce program (*Programa de Biocomercio*), has already completed the investigation stage. However, it had to be suspended with the interruption of the Biocommerce program. Biocomercio program. The epiphyte nursery project relies on studies and available funding, but the market opportunities are still unclear. A joint market study is being planned for both the epiphyte and ornamental plant commercialization projects.

In comparison with other protected areas in Bolivia, Cotapata NP-IMNA is rather privileged when it comes to resource availability. However, most of these resources are being used in the benefit of local communities. And although the present infrastructure, personnel and budget should permit effective management, delayed payments and certain organizational flaws tend to delay the implementation of many activities (SERNAP, 2003b).

Human Landscape

Human occupation

Approximately 300 families (1,600 to 2,000 people) live in Cotapata's IMNA, distributed among approximately twenty communities mostly concentrated along the Huarinilla and Chucura rivers. There are several mining cooperatives with temporary settlements in the southern part of the area (highlands), but no precise demographic data are available. Immediately adjacent to the park, several small communities have developed along the old La Cumbre-Yolosa Road.

Of the park's 17 official communities, 14 are affiliated to the Chucura, 2 de Julio, and Pacallo union groups, and three are independent.

The inhabitants of the highlands, of Aymara origin, have occupied these territories for centuries, while those settled in the Yungas have arrived only recently and are divided between mestizo farmers and Aymara immigrants (Trópico, 2000).

The most important communities are:

Location	Communities
Chucura valley	Chucura, Choro
Huarinilla valley	Charobamba, Yucupi, La Selva, Pacallo, Siñari
La Paz-Caranavi highway	Huayllara, Pongo, Unduavi, Chuspipata

Traditional highland dwelling in San Francisco. Photo: SP

There are also various family settlements scattered throughout the area, such as San Francisco, Bella Vista, and Sandillani.

The population in the highlands is relatively stable, mostly because the cities of Coroico, Caranavi, and La Paz-El Alto constitute a significant draw. However, population in the lowlands is increasing as people return from the cities to occupy lands abandoned by their ancestors (Sevilla Callejo, pers. comm.). But, overall, local population growth is limited by several factors: lack of basic services, incipient transportation and communication infrastructure, and low prices for the area's main agricultural crops, in particular citrus fruits and coffee (Ribera, 1995a).

Economic activities and use of natural resources

a) Agriculture

Most of the park's inhabitants are dedicated to agriculture. Agricultural techniques are basic, with no mechanization, and the only fertilizer used is cattle manure. Pesticide use is still relatively marginal.

- Highlands

Inhabitants of the highlands raise llamas, sheep, horses, and sometimes cattle. This small-scale activity does not appear to directly threaten the quality of the pastures, although at times, the fires set annually to renew the grasses can affect large areas due to a lack of control. The main crops include potato, oats, broad beans, and wood sorrel (*Oxalis tuberosa*), among others. The ridge cloud forest is an important source of firewood, (Trópico, 1999), but llama manure is also used as fuel. At the highest elevations, ice is extracted from the glaciers and sold to refrigerate chicken.

Llama raising is one of the key economic activities of the park's highland areas. Photo: Menuka Scetbon-Didi

- Lowlands

Maize field in Siñari. Photo: MSC

Most of the agricultural activities taking place in the lowlands use the slash-and-burn technique and rely on such staple crops as yucca roots, Peruvian carrots, chili (*Capsicum pubescens*), peanuts, maize, coca leaves, and plantains (Trópico, 1999). Each community member cultivates his own plot, with a per capita annual cultivated surface of approximately 0.25 ha (Sevilla Callejo et al., 2003). These parcels were distributed to local inhabitants after the Agrarian Reform in 1953, but there are still a few large private landholdings in the area. Shade coffee and citrus fruits are the only commercial crops in this zone, and it seems that the agricultural frontier is relatively stable (Arce-Olañeta, pers. comm.).

This part of the park is also the scene of non-timber forest product (NTFP) collection, including incense (*Clusia* sp.), copal (*Protium* sp.), medicinal plants, and some fast growing trees that are used to produce tool handles (for domestic use or to sell in the markets of La Paz and El Alto) such as Andean alder (*Alnus acuminata*) and Bolivian walnut (*Juglans boliviana*). Tree ferns (*Cyathea* sp.) and several palms (in particular *Geonoma megalospatha* and G. *lindeniana*) are used in home construction (Cuba, pers. comm.). Although logging is very limited in the Park, it has been the root cause of one of the greatest conflicts between the SERNAP and local residents (Trópico, 1999).

b) Hunting and fishing

The intensity of subsistence hunting in the area is relatively low. Hunted mammals include the Southern viscacha (*Lagidium viscacia*), Andean deer (*Hippocamelus antisensis*), agouti (*Agouti paca*), brown agouti (*Dasyprocta variegata*), spectacled bear (*Tremarctos ornatus*) and peccaries (*Tayassu pecari* and *Tayassu tajacu*). Among the birds, the most affected species include Andean geese (*Chloephaga melanoptera*), Andean guan (*Penelope montagnii*), and two other species (locally known as viloco and panama) (Trópico, 1999).

Animals are also used for medicinal uses, wool, leather, and feathers, but the most hunted animals are those considered harmful to livestock and crops. In the highlands, around Chucura, there are some problems related to the presence of puma and spectacled bear, which are indiscriminately slaughtered when found roaming near the fields and settlements. In the lowlands, crop damage is mostly caused by agoutis, parrots, some monkeys, and peccaries. Peccaries deserve special mention, because they can destroy entire fields when they invade in large herds, and villagers hunt them with particular persistence (Sevilla Callejo, 2003).

Some sport hunting is also practiced in the area, especially in the high-Andean zone, next to the highway between La Cumbre and Pongo. Most hunters come from La Paz to hunt viscachas, Andean

deer, Andean geese, rabbits (introduced from Europe), foxes or Andean cats. Despite this, the area's protection corps seems to have poaching under control, which has diminished notably in the lowland part.

The residents of Pongo make a living selling goods to the users of the La Paz-Caranavi highway. Foto: S. Mayer

Fishing is very limited and mostly affects rainbow trout (*Oncorhynchus mykiss*), an exotic species introduced in 1970 (De Morales, 1995). Dynamite use, which used to be frequent in the past, is now entirely prohibited and regulated by the communities themselves.

c) Other

In the towns of Pongo and Unduavi, there are stores selling goods and food to highway users. All along the El Choro Trail, some families make their living from tourism by offering food and lodging. In the zone of Pacallo, many community members were hired to work on the new highway construction project. In 2001 (date of the last census), approximately one-third of the lowland population (315 people) were involved in this activity (INE, 2002, in Sevilla Callejo, 2003). The National Roads Service (*Servicio Nacional de Caminos* - SNC) employed 800 people in total (Robison et al., 2000), lodged in a large camp along the Huarinilla river. Another activity is gold mining. The largest gold mining cooperatives are Jesús del Gran Poder, Unión Ideal, San Luis and Cotapata Ltda, and most miners originate from outside of the area.

Tourism

Three factors combine to make Cotapata NP-IMNA a potentially important tourist destination:

- presence of many valuable archeological ruins, including a pre-Columbian trail;
- an outstanding scenic beauty and high diversity of natural environments;
- proximity to the city of La Paz (only two hours on the new highway).

The park owes its outstanding scenic beauty in large part to its Yungas forests and their permanent springtime feel. Photo: SP

Approximately 5,000 people hiked the El Choro trail in 2002, which amounts to nearly 95% of all park visitors during that year (Vargas Rios, 2000). Data from 1999 indicate that 59% of the visitors are nationals and 41% are foreigners (SERNAP, 2000b). During the Easter holiday (*Semana Santa*), up to 1,000 people use this road for their religious pilgrimage. The busy tourism season is between June and October, which corresponds to the dry season. Around 30 tourism agencies offer tours to Cotapata, but most are located in La Paz and only make periodic incursions.

View of a small strech of the El-Choro pre-Colombian trail. Photo: DDB

The El Choro pre-Columbian trail is part of an ancient network of Inca roads, and used to be the major access route to the lowlands of the northern part of the La Paz department, where a lot of the staple crops consumed by La Paz and altiplano residents are produced. El Choro is also the only Inca trail to have been fully restored inside the park, and its 64 km can be explored on foot in three to four days. During this vertiginous 3km descent into the lower Yungas valley region, hikers can enjoy archeological riches (rock platforms, canals, ridges, bridges, retention walls, etc.) and experience an impressive succession of ecosystems, from the Puna grasslands to the Yungas rainforests.

Most communities along the trail (Lama Khuchu, Samaña Pampa, Chucura, Challapampa, Choro, San Francisco, Bella Vista, Sandillani and Chairo) provide camping areas and sell basic goods. In Chairo, there are often minibuses taking tourists to the nearby town of Coroico. Many agencies offer guides, porters, and cooks. In Chucura, villagers formed Multiactive Guide and Porters Association (*Asociación Multiactiva de Guías y Porteadores de Chucura*), charging visitors a fee to supposedly

ensure trail maintenance, although without the legal right to do so. This, along with the desire of the El Alto Municipal government to also charge park visitors entering from La Cumbre was one of the reasons which led the park administration to abandon the implementation in 2001 of an official entrance fee system (*Sistema de Cobro* - SISCO) after only six months.

The NGO Trópico published a guide and a brochure on the El Choro Trail, which can be obtained at the La Cumbre ranger station. Park rangers at this and at the Puente Elena Station ensure visitor control and provide information to all of the tourists that hike the trail.

In addition to El Choro, there are three other pre-Columbian trails: Sillu Tinkara, Huancané, and one starting in Challapampa. These trails are currently closed by vegetation, but several restoration projects are being projected. The Río Selva Resort, a five-star hotel located along the Huarinilla river in the community of Pacallo, caters to wealthy tourists. Recently, a nautical center began offering canoeing, kayaking, and rafting activities downriver. La Cumbre (at 16,000 feet) is an important recreation destination for La Paz residents, who ride mountain bikes, motorcycles and four-wheelers, take short hikes, picnic, and may practice sport hunting, as mentioned above (SERNAP, 2000a).

Each year, a growing number of tourists come to test their courage on the "Death Road". Photo: SP

Even though motor vehicles still use the old highway to Coroico, christened the "Death Road" because of the number of vehicles that fall off its vertical cliffs every year, today it has become a highly popular mountain biking route, already attracting near to a thousand adventurers every year. These pay La Paz agencies between $40 and $60 for the 3-hour descent, but only rarely visit the park due to a lack of access, promotion, and services. Instead, they stay in Coroico, which has become a popular tourist destination in recent years and offers a wide range of amenities, including lodging, restaurants, and outdoor activities.

Although the number of tourists does not exceed the area's carrying capacity, it still generates certain problems and some conflicts with local communities. Major impacts are related to inappropriate waste disposal, especially in La Cumbre and along the El Choro trail. Another source of solid waste pollution is the Río Selva Hotel, which has been reported to throw its garbage into the Huarinilla river. This hotel also purportedly promotes prohibited activities, such as the collection of butterflies. Uncontrolled tourism during certain times of the year (such as Easter and Christmas) and in certain localized areas (La Cumbre, El Choro trail, and some areas along the highway and along the Huarinilla river), also results in a gradual deterioration of the area's archeological heritage, mainly due to vandalism.

In 2000, Trópico drafted the "Preliminary Strategy for Tourism Development" (*Estrategia Preliminar*

de Desarrollo Turístico, Vargas Rios, 2000), which was never implemented. Nonetheless, it was used as an input during the elaboration in 2001 of a Minimum Tourism Ordinance Plan (*Plan Mínimo de Ordenamiento Turístico*), which was designed according to SERNAP's conceptual framework and based on a series of participative workshops. Although the results have yet to be published, the park administration already relies on this document to regulate tourist activities.

Despite excellent prospects and high expectations, the area's tourism potential has not yet been harnessed by local residents, resulting in some tensions among communities, which consider that the park administration is not fulfilling its engagements. The situation is completely different in the park's eastern zone of influence: with 3,200 inhabitants (Pref. de La Paz, 2001), Coroico is rapidly becoming a tourism hub for La Paz residents and a growing number of foreign visitors, who can now travel the 96 km along the new highway in just two hours.

As the region's main tourism hub, Coroico, located in the park's direct area of influence, is undergoing rapid growth. Photo: MSC

Lately, the investments made by the BIAP project have generated renewed expectations concerning tourism development. Various projects have been launched with distinct communities (except Chucura), including:

- Construction of tourist cabins in Sandillani;
- Restoration of the Coscapa and Sillutinkara Pre-Hispanic Routes;
- Building of four bridges and posting of signs on the El Choro trail;
- Design of biking and interpretive trails in Pongo and Hayllara;
- Training of local guides with support from Conservation International and Trópico;

- Construction of an information center in La Cumbre;
- Construction of a museum in Charobamba;
- Establishment of a butterfly farm;
- Various projects in the Huarinilla valley.

Solid waste accumulation and the gradual deterioration of the area's archaeological heritage are the consequences of an insufficient control of tourism and recreation activities. Photos: DDB

Conservation and Research Programs

The park administration does not currently have enough resources to carry out its own research activities. Instead, most research to date has been carried out by the Ecology Institute of the *Universidad Mayor de San Andrés* (UMSA, La Paz), which started working in the area in 1995. That same year, Ribera conducted a socio-ecological assessment and in the "*Caminos de Cotapata*" book (De Morales, 1995), Aguirre et al. elaborated a preliminary management plan which included the park's first zoning proposal. Using a participative diagnosis approach, between 1998 and 1999 Trópico carried out a thorough study of the area's cultural heritage and natural resource use and management, practices.

Since 1997, the Ecology Institute has operated the Tunquini Biological Station (*Estación Biológica Tunquini* - EBT) with funding from the MacArthur Foundation. It is located in a humid montane forest (approximately 1,500 asl), a few kilometers from the locality of Chairo. And, until its closing in August 2005, the station was one of the few study centers for tropical montane forests, which are much less known and understood than other tropical ecosystems (Bruijnzeel and Hamilton, 2001).

Until its closure in August 2005, the Tunquini Biological Station provided unique opportunities for the study of humid montane forests. Photos: Left: DDB; Right: Elmer Cuba

During its operation, the EBT concurrently implemented five conservation programs: fauna management (control of crop-ravaging vertebrate species and generation of economic alternatives for commercial butterfly and ornamental fish management), forestry management (targeting species used to make tool handles), agroecology (analysis of the agricultural potential of the area's lowland soils), development planning (carried out by local communities), and environmental quality monitoring (using various biological indicators). All of these medium-term projects attempted to generate economic alternatives for the station's neighboring community, Chairo. Work was also conducted on epiphyte and dung beetle management (Pacheco, pers. comm.).

The EBT also hosted other organizations, such as the Bolivian Bat Conservation Program (*Programa para la Conservación de Murciélagos de Bolivia* - PCMB), whose scientists studied bat diversity

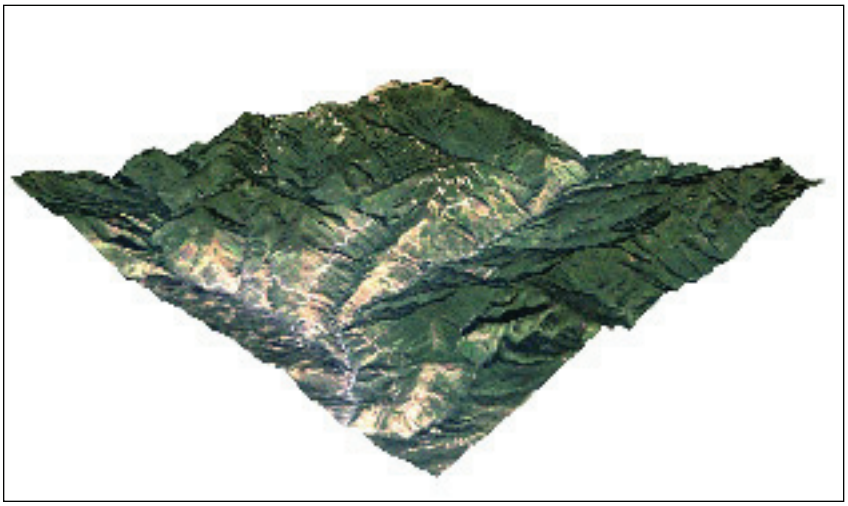
and their role in seed dispersal in secondary forests and croplands between the community of Chairo and the biological station (Rios-Aramayo et al., 2000). A joint collaboration between the University of Göttingen (Germany) and UMSA investigated altitudinal variations in the Yungas forests' climate, soil, and flora (Bach et al., 2003).

In 2005, the relations between the EBT and the community of Chairo seriously deteriorated when the latter made a series of requests that did not and should not pertain to EBT's attributions, and which the former refused to attend. In response, the community threatened the station's staff and forced them to abandon the property. The Ecology Institute tried to mediate the conflict and to obtain certain guarantees concerning the security of staff, infrastructure, and equipment, without which they would have to abandon the site, but negotiations failed. Other communities in the protected area have offered their support and suggested the possibility of transferring the station to their communal properties.

The BIAP project has hired staff to develop a monitoring program for Cotapata, which will follow the guidelines of SERNAP's Conservation Monitoring System (Monjeau et al, 2003).

Since 2000, the Theoretical and Applied Biological Study Center (*Centro de Estudios en Biología Teórica and Aplicada* - BIOTA), with help from the protection corps, conducted a forestry inventory in order to understand the harvest patterns and recovery dynamics of the area's forestry species (cedar, nogal, five varieties of laurel, incense and copal) (SERNAP, 2003b). Since 2003, this organization has operated an environmental education radio program in the municipality of Coroico, also working with local schools in the framework of its "*Schoolyard Ecology Teaching*" program (*Enseñanza de Ecología en el Patio de la Escuela* - EEPE) (Roldán, pers. comm.).

Active in three protected areas in the country (Cotapata NP-IMNA, Apolobamba IMNA, and Amboró NP-IMNA), COBIMI is a cooperative program between the Conservation and Biodiversity Center of the American Museum of Natural History (CBC-AMNH), the Bolivian Fauna Collection (*Colección Boliviana de Fauna*), the National Museum of Natural History (MNHN) and the Noel Kempff Mercado Natural History Museum in Santa Cruz (MHNNKM). Along with its principal activity - the support of small community conservation projects, between 1999 and 2003 the program conducted investigations on the altitudinal distribution of Cotapata's animal diversity and organized workshops on research in protected areas and community participation in conservation.



3D rendering of Mount Nogalani, where the impacts of the new road can be clearly identified. Author: MSC

In 2003, a student from the Geography Department of the *Universidad Autonóma* of Madrid (UAM) carried out a detailed land use analysis of Mount Nogalani and of the lower parts of the Huarinilla valley, focusing on the state of conservation efforts and environmental impacts from the Cotapata-Santa Barbara

highway (Sevilla Callejo, 2003 and Sevilla Callejo et al., 2003). This led to the drafting of a zoning and management proposal, which the same student is now applying to the entire protected area in the framework of a doctoral thesis.

In the direct vicinity of the park, another student is involved in the monitoring of the deforestation process of the Uchumachi mountain range (Municipalities of Coroico and Coripata) using remote sensing techniques and GIS (Cuba-Orozco, in preparation).

Since 1997, the NGO Ayuda en Acción has provided assistance to rural development projects in the park's zone of influence (in the surroundings of Coroico).

Alas, Cotapata NP-IMNA is part of the Amboró-Madidi Biological Corridor (AMBC), the Bolivian portion of the binational Vilcabamba-Amboró Corridor (CEPF, 2001), whose regional conservation focus has captured donor interest and thus catalyzed a large number of national and regional conservation and research projects. CI-Bolivia, FAN (*Fundación Amigos de la Naturaleza*), MHNNKM, and Trópico have published or are about to publish various documents related to this corridor (Ibisch and Araujo, unpublished; Trópico, in press; Navarro et al., 2004; Ibisch and Araujo, 2003; Young and Leon, 2003; Araujo and Ibisch, 2000).

Pressures and Threats

The Yungas forests are one of the most threatened biomes in the country, especially affected by colonist populations from the highlands using inappropriate and harmful agricultural techniques (Hanagarth and Arce, 1986; Ribera, 1995a). In its ecological assessment of the Amboró-Madidi Corridor, FAN determined that the Yungas forests of the La Paz department are in critical conservation state (Araujo and Ibisch, 2000), corroborating WWF's observation that the Tropical Andes Moist Forest ecoregion is severely threatened (Olson et al., 2000).

The old road to the lowlands, nicknamed "Death Road" for the number of accidents that occur every year. Photo: C. Leroy

From the city of La Paz, the principal access route to the northern and northeastern lowlands of the country (departments of La Paz, Beni, and Pando) is the Coroico-Caranavi-Yucumo highway. Its construction in the 1930s, and its consolidation in the 1970s, generated large migration waves and the establishment of numerous settlements in the fragile Yungas ecosystems. This phenomen undoubtedly significantly increased human pressure in Cotapata's main valley (Huarinilla). The construction and recent opening of a new stretch of highway between Cotapata and Santa Barbara is directly impacting 10% of the area (specifically, Mount Nogalani and the lower part of the Huarinilla river) with an increased risk of cave-ins and landslides (Saucedo and Lavayen, 2003).

In spite of this population and development surge, a relatively low human density, the lack of transport routes and an abrupt topography have allowed a large portion of the park to remain in its natural state (Ribera, 1995a).

In its strategic protection plan (SERNAP, 2003), the park administration assigned numeric values to the various tangible pressures identified in the area. According to this document, the principal threats to Cotapata NP-IMNA are: construction of the new highway, uncontrolled fires, human settlements, and mining activities.

The present evaluation came to relatively similar conclusions, yielding the following list of major pressures and threats:

Pressures

- High level of social conflict
- Construction of the Cotapata-Santa Barbara highway
- Gold mining
- Slash-and-burn land clearing and wildfires

Threats

- Population extinctions due to reduced size and isolation
- Human colonization
- Tourism
- Dam construction
- Coca cultivation

Other minor issues exist, but which cannot yet be considered as tangible threats, such as NTFP collection, tourism, and deficiencies in the area's management. Most of these have been addressed in previous sections, and will therefore not be discussed again.

Pressures

High level of social conflict

The mistrust of local peoples towards the park administration stems from the initial use of a prohibitive and rather non-participatory management policy and the failure of past alternative development projects such as, for example, the Agroyungas project (Robison et al., 2000; Sevilla Callejo, 2003).

The negative attitude towards the protected area started as a result of the lack of consensus building during its creation process (Robison et al., 2000), eventually fueled by the first park

administration's highly conservationist approach to management, which was opposed to most traditional uses and practices (hunting, logging, burning, etc.). In addition, the park's first management team had poor relations with the director of the Cerro Nogalani Protection Program (under the jurisdiction of the National Roads Service) and there were tensions between the communities, the miners, and the company in charge of building the Cotapata-Santa Barbara highway.

Several years of tension culminated in a general rejection of the protected area, which persists today and which some leaders deliberately maintain in spite of profound changes in the protection corps' attitude. This is due to several factors, such as corruption, political and economic interests, misinformation, lack of community organization, short-term vision, and a general intolerance of government intervention.

In order to mitigate conflicts and improve relationships with the local population, in 1999 the park administration began organizing participatory workshops to identify the residents' needs and expectations. However, many of those demands could not considered because they did not correspond to either the park's objectives or the management team's capacities, and those that did receive attention were mostly abandoned when the park director was changed.

Until the launch of the BIAP project, one inherent problem in the park's management was an insufficient budget, which did not allow for a satisfying outreach strategy, often based on the provision of services or "gifts" to the communities. This severely impeded dialogue and information exchange between community members and the protection corps. Another consequence was the lack of adequate infrastructure for the organization of training workshops and informative meetings concerning that park's role and objectives. In the few meetings that took place, most issues addressed and demands formulated were simply beyond the scope of the support institutions' competencies.

These poor relations determined the failure of the implementation of an entrance fee system (SISCO) in 2001, the cancellation of the COBIMI program, and the near-abandonment of Trópico's activities in the area. The BIAP project, which was at the time involved in the maintenance of bridges on the El Choro trail and the construction of a small hydroelectric plant in the community of Chucura, also ran into many difficulties in carrying out its activities. Elaboration of the management plan was delayed for several years, as was the process to title lands as planned by the National Agrarian Reform Institute (*Instituto Nacional de Reforma Agraria* - INRA).

However, ever since the implementation of the BIAP project began, there has been a notable change in local communities' attitudes. They have started to become interested in the protected area's management and promise more participation, attracted by the arrival of community development funds.[1] Because of this change of position and more open attitude, the Management Plan has been elaborated and the conditions are much improved to implement its suggested projects. While relations have improved a great deal over the last few years, a significant amount of conflict

1 Development projects that aim to improve relations with local people and improve their living conditions are not directly related with the area's conservation objectives or with the SERNAP's ethical obligations.

still exists between certain communities and the area's administration. This remaining conflict not only represents a long-standing threat to the area, it is an obstacle to effective management in the future.

Construction of the Cotapata-Santa Barbara highway

The relationship between this new road - which partly replaces the old access route to the Yungas - and the park is ambiguous. Although it can be considered one of the protected area's largest threats, but on the other hand, it should not be ignored that the protected area was created as a "compensation" measure for the highway's environmental impacts (see the '*Management*' section).

Until recently, the La Paz-Yolosa-Caranavi highway was the only access route to the Yungas and to the Department of Beni from the Altiplano. It is part of the country's West-North Communication Corridor (*Corredor de Comunicación Oeste-Norte*) that connects La Paz with the Beni and Pando departments, and from there with Peru and Brazil. Construction of the 48.8 km stretch between Cotapata and Santa Barbara began in 1995 to replace a narrow and very unstable stretch of the ancient road, infamous internationally as "the most dangerous road in the world" because of the number of accidents occurring every year.

Old road to the lowlands. The geological instability of the slopes where it was built result in a countless number of landslides. The same fate probably awaits the new road. Photos: Left: SP; Right: MSC

The building of the San Rafael tunnel determined a considerable increase in the construction costs. Photo: MSC

The fact that the new road is also located in a highly geologically unstable zone, on the slopes of Mount Nogalani, resulted in significant construction delays and to the astronomical cost of 180 million dollars, or US$ 3.7 million per kilometer, making this road project, under contract to the Andrade-Gutiérrez-Copesa-Minerva Consortium, one of the largest civil engineering works in the country's history (Saucedo and Lavayen, 2003; Sevilla Callejo, 2003).

The new highway affects Cotapata's southeastern area, between Mounts San Rafael and Nogalani, as well as the lower part of the Huarinilla valley and the southern parts of the Chairo, Azucarani, and Elena river watersheds. This amounts to an area of approximately 6,000 hectares, with significant impacts on cloud forests (Sevilla Callejo, 2003; Sevilla Callejo et al., 2003). It should however be noted that these forests were not pristine when the work began due to logging of pines, walnut, and alder trees in the past (with the presence of an on-site sawmill). As to the northern slope of the Huarinilla valley, degradation of the forest cover probably took place several centuries (Ribera, 1995a).

Road building in such fragile areas generally results in severe plant cover loss and soil erosion. Photo: SP

Highway construction is considered a priority by the Bolivian government in an effort to foster the country's development. It is also a very powerful political argument, and on many occasions has launched such projects without properly considering all the technical, economic, social, and environmental aspects (CEPF, 2001). By all accounts, the environmental and social impacts caused by the Cotapata-Santa Barbara highway are significant, and the future of this road is far from secured. Due in part because the project's very incomplete environmental impact assessment was carried out in 1990 (PCA-CEEDI, 1991) - i.e., before the promulgation of the 1992 Law on Environment (N°1,333) - decision was made to clear extensive areas of their vegetation and to excavate large quantities of soil material in an area subject to abundant rainfall and prone to massive landslides. Excavation and leveling operations lead to the dumping of 10 million cubic meters of earth in at least 73 sites (Saucedo and

Lavayen, 2003). Even though landslides, as previously mentioned, are part of the area's natural geomorphological dynamics, it is predicted that these dump sites will have a notable impact on the physical and chemical properties of the Elena, Azucarani, Chairo, and Huarinilla rivers. In addition, the highway's drainage system is precarious, incomplete, and has already generated serious erosion problems and accelerated water run-off (Sevilla Callejo, 2003; Sevilla Callejo et al., 2003).

While there are no quantitative data available regarding impacts on the aquatic fauna, existing information suggests that certain species have disappeared, such as the river otter (*Lutra longicaudis*) and some fish species. Many birds abandoned the site because of the noise generated by machinery and the dynamite use. In addition to habitat loss for many vertebrate species, linear constructions such as highways create a barrier effect for certain mammal species, impeding their movements and restricting their distribution. A large portion of the Elena valley's montane forest is thus "closed in" between the old and new highways.

The highway's construction also generated considerable problems for local residents. It destroyed farming areas where vegetables, plantains, maize, citrus fruits, and coffee were grown (although there is a compensation program in place) and increased the risk of floodings in the Huarinilla valley, especially near the community of Pacallo. Loss of productive soils due to erosion and the accumulation of solid waste (cement, diesel, and garbage) in the work camps - many of which were abandoned without any clean-up efforts - are two other direct consequences of this project.

With respect to indirect impacts, over the medium term the major negative effect expected from this new highway is human encroachment. Rural farmers without any landholdings are anticipated to try to invade the area and establish new settlements. Delays in the regional land-titling process and failure of the informative workshops organized by INRA to implement it have created a delicate situation for the park administration, which in the absence of clear land tenure does not have the authority to evict invaders. In addition, improved access to Coroico from La Paz is likely to lead to population growth and tourism development. Without any planning and control, these two trends will most definitely increase pressure on the protected area, particularly in relation to real estate transactions, land speculations, and development in its direct surroundings and the growing number of visitors.


ECOLOGÍA

El cerro por el que atraviesa la nueva ruta a los Yungas esconde mucha vida. Dos geólogos hallaron una rica veta para sus investigaciones. Lo que descubrieron va más allá de lo que le interesa a la Geología.

Miguel Vargas
Fotos: Miguel Sevilla C.

COTAPATA

La carretera cambió al Nogalani

Article published in 2004 in a Bolivian weekly magazine (Escape). Source: MSC

Finally, all persons interviewed, including workers of the National Roads Service, admit that the construction of the Cotapata-Santa Barbara highway resulted in a particularly high environmental impact, probably higher than that of any other road in the country. The Cerro Nogalani Environmental Protection Project,

whose goal was to monitor the project's environmental record, was inefficient and poorly coordinated with the SERNAP and park administration. Almost none of the mitigation measures, such as the reforestation of denuded slopes, were completed because of the lack of follow-up and enforcement.

Gold mining

According to oral history, the Spanish exported gold from the area during colonial times (Quiroga Veizaga, 1996), but gold mining in modern times reappeared just 15 to 20 years ago. Although it is a rather small-scale activity, the problems arise due to the high number of concessions.

Tin and wolfram mining in the area ended when prices abruptly dropped during the 1980s, leaving only those miners searching for gold. The actual number of active miners in the area is unknown, but a sizeable growth in mining activity over the last decade has been documented (Trópico, 1999). Most miners live in La Paz or El Alto and come to the area temporarily, usually for a few weeks at a time. In the highland, gold is extracted from primary rock inside mines established on gold veins, while in the lowlands, gold panners called "*barranquilleros*" extract the precious metal from riverbeds. In 1996, the National Directorate for Biodiversity Conservation (*Dirección Nacional de Conservación de la Biodiversidad* - DNCB) identified 60 operations throughout the area (Fundación MEDMIN, 1996, in Trópico, 1999), of which between 20 and 30 are still active today (Quispe-Mendoza, pers. comm.). As a matter of fact, this activity is characterized by the continuous opening and closing of mines.

The landslides and other soil loss processes generated by mining activities are having tangible effects on the area's hydrology. Photo: SP

In the highlands, mining activity is concentrated near Coscapa, a montane forest ridge environment (at 3,000 m asl) located in the headwaters of the Chairo river (Jesús del Gran Poder, Unión Ideal and Cotapata Ltda cooperatives) and of the Coscapa river (San Luis cooperative, close to Pongo). These two rivers flow into the Huarinilla river, where the Virgen de Rosario cooperative is located (in Santa Rosa). The Tres Hermanos cooperative operates between these two areas, along the Chairo river, close to its confluence with the Huarinilla river. Another mining zone within the area is located in the Cielo Jahuira river basin, in the park's extreme northern sector.

Mining is permitted in Bolivia as long as the companies have secured official environmental licenses with the Ministry of Sustainable Development and Planning, which grants them according to a technical report issued from the Vice-ministry of Mining and Metallurgy. The license establishes the conditions, specific environmental control measures and actions required from any mining operation in the country (Fundación MEDMIN, 2001). However, there is no

legal measure regarding the presence of mines inside protected areas. The three cooperatives with official activity in Cotapata have their environmental licenses, but the park administration does not have the capacity to monitor their activities and park rangers' actions are usually limited to instructions concerning solid waste management and latrine construction.

In mining operations, environmental damages caused by mineral extraction are minor when compared to the impacts associated with the gravimetric concentration phase - when mud and tailings are dumped into the rivers - and the amalgamation and melting stage, when mercury is used and subsequently emitted into the atmosphere and water (Fundación MEDMIN, 2001). Mercury is especially problematic because it persists in the environment and accumulates in body tissues. In aquatic ecosystems, microbial activity converts mercury into methyl-mercury, a persistent, lasting form that accumulates in food chains. Atmospheric mercury is dissolved and falls with precipitation, thereby contaminating terrestrial ecosystems as well. According to estimates, at least 330 tons of waste mercury have been introduced into the country's environment since 1952 (Maurice-Bourgoin et al., 2000).

An analysis of mercury concentration in the Chairo and Huarinilla rivers conducted in 1996 indicated that concentrations reach more than 400 times World Health Organization (WHO) safety standards (Quiroga Veizaga, 1996). In addition, inhalation of mercury vapors directly affects miners' health by causing pneumonitis, cough, fever, and other pulmonary symptoms, while the fish from these rivers are unfit for human consumption. Despite Fundación MEDMIN's efforts at the end of the 1990s (*Programa de Manejo Integrado del Medio Ambiente en la Pequeña Minería* - MEDMIN), which provided technical assistance to some cooperatives for the acquisition of low-pollution technologies, many mining operations continue dumping mercury directly into the rivers.

In addition to mercury contamination, the mining activity is responsible for landslides, trail creation, and solid waste accumulation because miners do not clean up their camps. Wildfires have even been reported to be set by inadvertent miners.

Clearings and wildfires

Although the overall area currently used by agricultural activities is relatively small, associated practices and potential unplanned expansions could jeopardize the area's biological integrity.

One of these detrimental practices is pasture burning in the highlands. Burning grasslands is a long-standing tradition among highland communities, which serves specific objectives like renewing pastures for livestock raising (mainly of llamas and alpacas) or killing snakes and other pests, but in many cases, fires are set irrationally and without any basis (Aramayo, 1998). Ribera (1995a) also explains that burns are driven solely by custom and are only rarely controlled. It should be noted that a certain number of the wildfires in the area, particularly during the driest season (between June and July), have been traced to children playing with firecrackers.

These seasonal fires negatively impact the fauna by destroying its habitats and producing smoke and high temperatures. This problem also occurs in the Yungas paramo, where gradual vegetation changes have occurred as a response to the water regime alterations caused by the fires (Ribera, 1995b).

The use of slash-and-burn agricultural practices on steep slopes results in severe erosional processes. Photo: SP (taken in the park's area of influence)

In studies of altitudinal variability in the Yungas during July 2004, Beck reaffirmed that these burns have ancestral origins and that today's Andean puna landscape is directly related to this practice.

In the lowlands, as has been previously mentioned, agrarian systems, slash-and-burn agriculture, permanent citrus fruit and coffee cultivation, and coca cultivation, are all on the rise because of the improved access conditions provided by the new highway. Furthermore, crops are often planted on steep slopes. The result is a loss of plant cover, periodic fires, and destabilization of slopes. Although the agricultural frontier appeared to have stopped expanding in the last few decades - Sevilla Callejo (2003) demonstrated that agriculture occupied more extensive areas on Mount Nogalani and the lower part of Huarinilla valley three decades ago than today - as long as alternative activities are not promoted the area will be faced with serious agricultural expansion pressure as abandoned lands are returned to production and relatively conserved zones are converted by new settlers (such as the tens of road workers that decided to stay in the area after the road construction ended).

Threats

Population extinctions due to reduced size and isolation

The fact that Cotapata NP-IMNA is the smallest and most isolated of the AMBC' seven protected areas undermines its viability for biological conservation (Araujo and Ibisch, 2000). Based on criteria employed by WCS in the framework of its Living Landscapes project (Coppolillo et al., 2004; Gómez, 2003), Cotapata NP-IMNA is not large enough to guarantee survival of the spectacled bear (*Tremarctos ornatus*), one of the area's flag species.[1] However, it should be noted that north of the park,

1 Approximately 3,100 km² of montane forest are needed to maintain a viable population of spectacled bears (Gómez, 2003), yet inside Cotapata NP-IMNA these forests only cover 600 km².

there is an extensive territory of nearly pristine habitat suited for this species, still without formal protection.

Highly disturbed landscape directly outside of the park's eastern border. Photo: SP

Several conservation gaps in the Corridor have been identified by different groups/researchers: FAN and Trópico consider the Yungas of La Paz and Cochabamba a priority area, which is directly connected with Cotapata NP-IMNA. Ibisch (2000), identified an area northeast of Cotapata NP-IMNA as the most urgent conservation gap, while Trópico views an extending over 10,000 km² southeast of the park as the most important conservation gap (with the so-called "Cotapata-Cotacajes Sub-Corridor"). Despite these contradictions, essentially due to the use of different criteria by the mentioned institutions, these gap analyses clearly indicate that Cotapata NP-IMNA is a high priority for conservation.

Human colonization

One of the most important threats to the park is the encroachment that would result from population growth in its area of influence, which is directly related to the improved accessibility conditions provided by the new highway. This threat is also closely related to the lack of clear land ownership in the area and consequent arrival of colonists and land speculators. The opening of the highway already generated a notable increase in the price of land for vacation homes in the environs of Coroico (Trópico, 1999), and legally questionable real estate transactions are already taking place.

Land invasion processes have already started along the new highway, such as on this picture taken near Siñari. Photo: SP

With regard to unclear land ownership, Mount Nogalani is the scene of a variety of problems related to overlaps between private properties and communities. Also, a group of 15 families plans to settle lands claimed as private property (Sagrado Corazón), and three families

intend to settle in the area where the old Sacramento Bajo sawmill was located. Members of the Siñari community and the owners of Sagrado Corazón are in dispute over 20 hectares of land close to the new highway that present gentle slopes and are still covered with primary forest. But overall, the new highway provides quick and secure access to Mount Nogalani, and as a result this area is rapidly being invaded by farmers practicing slash-and-burn agriculture (Sevilla Callejo, 2003; Sevilla Callejo et al., 2003).

Further inside the area, a group of ten people from the city of La Paz, who are descendants of Sandillani inhabitants (along the El Choro trail), project to settle in this hamlet to live off of agriculture and tourism. The community of San Francisco faces the same situation, and in Siñari the return of former residents has already started (Sevilla Callejo, 2003). In short, in spite of the park administration's success - with support from local residents - in stopping the establishment of new settlements to date, it is feared that once the new highway is completely opened, colonization pressure will seriously increase. Considering the level of complexity that the 1953 Agrarian Reform introduced in the area's land ownership pattern (Robison et al., 2000), land titling is an urgent need.

Finally, the Landless Peasants' Movement (*Movimiento Sin Tierra* - MST) has apparently manifested its willingness to take land near the new highway, to which existing communities are strongly opposed (Elías Mamani, pers. comm.).

Tourism

Tourism development in Cotapata's area of influence, and especially along the pre-Columbian trail that crosses the park, is inevitable because, among other favorable factors, it is close to La Paz. While tourism could generate substantial funds for the park and local communities, without proper management, it is likely to generate both social and environmental problems. This issue has been more amply discussed in the '*Tourism*' section.

Dam construction

The region of Cotapata also has hydroelectric potential. In 1998, La Paz's first electrical company, Electropaz, carried out a feasibility study for the construction of dams on the Chucura and Tiquimani rivers. Even though the project (called "*Proyecto Hidroeléctrico Coroico*") was abandoned for economic reasons, Electropaz and COBEE still possess large concessions within the protected area and maintain a water diversion system from the headwaters of the Tiquimani river to the Zongo valley, the country's hydropower-generation center. As energy demands in La Paz and El Alto increase, these projects may become viable and would mean altering water courses and installing high-tension power lines, which would considerably diminish the area's scenic values.

Coca cultivation

Over the last few years, the amount of land dedicated to coca cultivation in the Yungas of La Paz has increased considerably. Increased demand and decreased supply (production has slackened in other regions, such as in the Chapare province due military eradication campaigns), are leading many local farmers to favor this age-old crop over other less productive ones or whose markets prices have considerably dropped (e.g., coffee).

Coca plantations in the lower part of the Huarinilla valley (near the park's border). If it keeps intensifying, coca cultivation could rapidly become a new threat to the protected area. Photo: SP

Recommended Solutions

High level of social conflict

As was previously mentioned, the relationship between the communities and the park administration has registered some improvements lately, and as a result the Management Plan was approved and its implementation has begun. Considering that almost 60% of the protected area is categorized as IMNA, future protected area planning should try to focus on conservation programs that are compatible with the legitimate aspiration of local residents to improve their living conditions. In order to do so, the SERNAP and the park administration should coordinate closely with the members of the Management Committee and strengthen community participation.

The remaining resources from the BIAP project provide an excellent opportunity to start the implementation of some management programs and projects, and further improve relationships between park administration and communities. Nonetheless, this relationship should not be based on short-term interests, because funding may eventually diminish in the coming years. Instead, long-term agreements should be reached with the communities, based on a sense of shared responsibility for the success or failure of participatory and concerted planning.

ParksWatch recommends placing special emphasis on finding matching funds for planned or existing projects and seeking to promote the participation of a wider range of support and development institutions. However, as a condition for project execution, it is absolutely necessary that beneficiaries make a commitment to nature conservation.

Some of the principal factors in the conflict between the park administration and communities have been a lack of information and the misinformation spread by some leaders. To avoid this situation repeating in the future, people must be kept well and constantly informed about the management processes, which can be achieved through both the Management Committee (asking the members to inform their constituencies) and proactive information and communication campaigns.

Contruction of the Cotapata-Santa Barbara highway

With the final completion of the highway, a variety of environmental liabilities remain that should be assumed by an entity that will take responsibility for restoration actions, which were neglected by the consortium in charge of the construction works, such as: replanting sites where excavated material was dumped, completing and maintaining the drainage system, and restoring watersheds.

The road project's Environmental Manifesto, which was completed in July 2004, describes some of the mitigation actions needed and also provides some guidelines about resolving the land-titling problem and dealing with the increased colonization pressure in the road's area of influence. Even though this document is not perfect, remains very general in focus, and neglects some important aspects, the park administration should still seek the implementation of its proposed remediation efforts.

The main risk associated with this road being the probability of new human settlements, the park administration should take advantage of the BIAP funds and the local opposition against the arrival of colonists to resume and complete the land-titling process in the highway's area of influence.

The USAID-Bolivia Program for 2004-2009, which is considering an environmental impact study of the highway in order to formulate effective mitigation measures (ARD, 2002), should focus on colonization risks, restoration of degraded habitats, and tourism development in the area.

Finally, ParksWatch supports the compensation, by the relevant entity, of those people whose houses, belongings or property were damaged during road construction.

Gold mining

A serious effort must be put forth to monitor mining activities inside the protected area. Park rangers should organize regular visits to the mines in order to keep track of the number of mining operations, number of workers involved, extractive and gold amalgamation techniques used, solid

waste management methods implemented, the state of the latrines, etc. Guards should make follow-up visits accordingly. Complementing this monitoring initiative with training workshops and environmental education programs could gradually help reduce the impacts from this activity. As an example, the Santiago mine in the Apolobamba IMNA has successfully reduced its impacts with help from the MEDMIN Foundation (Pauquet, 2005). In future management planning, we recommend dedicating part of the park's budget to this effort.

In the medium term, it is important to provide technical assistance to miners until every cooperative or other operation has its environmental license and improved its gold extraction and amalgamation processes. For mines already equipped with clean systems, we recommend monitoring the operation and evolution of these systems over time.

Clearings and wildfires

A study of the traditional practice of burning highland grasslands would be very valuable to evaluate the impact on local fauna and the water regime of affected grasslands and wetlands (*bofedales*). Workshops should be organized with the communities to alter this practice according to findings.

The frequent uncontrolled burnings during the dry season can transform into large wildfires, such as this one in a gold mining area. Photo: MSC

The use of slash-and-burn techniques for land clearing in the lowlands also needs to be reasoned. Once published, results from the research conducted at the Tunquini Biological Station should provide important information about soil capacity in the Huarinilla valley. These studies should then be used as inputs for developing environmental education workshops with communities in the area, associated with technical assistance programs. We also recommend providing support to communities in the adoption of agroforestry systems.

Finally, the protection corps needs equipment and training to combat wildfires, which would ideally also involve community members.

Population extinctions due to reduced size and isolation

In order to be biologically viable, Cotapata NP-IMNA's extension must be increased or the protected area must be complemented by another adjoining conservation unit. Ribera (2002) suggests extending Cotapata's limits to the Uchumachi Range, but this area is highly disturbed and densely populated. Another area under consideration for expansion is the Zongo valley, towards the north,

which maintains high ecological value in spite of its hydropower development and is currently placed under a watershed protection designation (Ribera, 1995a).

The other possible areas envisioned for potential incorporation to the park are listed in the Management Plan: the snow-capped peaks of the Huayna Potosí (to the northwest), the valley located between the Pekekara and Sacramento mountains (to the southeast) and the area upstream of the Incachaca dam near La Cumbre (to the southwest).

Adopting an ecoregional conservation focus (Ibisch et al., 2003), SERNAP and other conservation organizations with active projects in the region should join forces to create other conservation units in order to increase the proportion of Yungas forests placed under legal protection. ParksWatch recommends providing support to the conservation measures promoted by Trópico with the communities adjacent to the protected areas of the "Cotapata-Cotacajes Sub-Corridor" As well as the creation of a departmental protected area in the Altamachi mountain range (Cochabamba department).

A joint management with municipalities, which would involve the declaration of municipal protected areas or conservation districts, could help avoid the park's increased isolation over time even though it would do little to increase the park's size.

Human colonization

The success or failure of the pending land-titling process in the highway's area of influence will in great part determine the level of future colonization pressure. It is therefore extremely important that the park administration closely coordinate with the delegates of INRA and local authorities in the organization of informative workshops for the communities of Mount Nogalani and the Huarinilla valley. Information disseminating and communication is essential in order to correct widespread misperceptions and counter misinformation efforts, which have caused a general rejection of the titling process.

The park administration should also establish definitive regulations concerning the establishment of new settlements in the area.

Tourism and environmental education

Cotapata NP-IMNA is one of Bolivia's best suited protected areas for tourism. With the projected increase in visitor affluence, potential for achieving financial sustainability is great, as are the prospects for the residents who will know how to take advantage of this activity. The park's Minimum Tourism Ordinance Plan was drafted in 2000 (SERNAP, 2000a), but it was not implemented or approved by SERNAP authorities despite the fact that it proposed several interesting initiatives for improving the protected area's tourist services. Now that the Management Plan has been approved, the tourism program should be implemented as a priority.

However, an actual tourism development plan remains to be elaborated, which should be based on the results of the participative assessment conducted by Trópico in 1999 and on the "Cotapata

NP-IMNA Preliminary Tourism Development Strategy" (Vargas Rios, 2000), as well as on the aforementioned ordinance plan. A new public consultation is probably needed to take account of the social changes that might have occurred in the past five years. Among other aspects, this plan should consider the following:

1) improve tourist services offered by local residents along the El Choro trail;

2) implement a waste management program (by installing dumps, latrines and signs in each community);

3) train tourist guides;

4) fine violators of PA regulations, like those regularly perpetrated by some tourism agencies. The area's administration has to work with tourism operators to regulate their activities and strengthen Chucura's Multiactive Guide and Porters Association.

There is also great potential to develop environmental education and interpretation activities along the El Choro trail for schoolchildren from La Paz and El Alto and to generate economic resources for the area. To do so, however, the park administration must ensure continued maintenance of the trail and its bridges, in coordination with the local communities. Another important recommendation is to improve the quantity and quality of information available on the protected area, and to install informative signs along the trail. Given the number of nationals visiting every year, Cotapata NP-IMNA is the perfect place for a nature interpretation center and/or trail. Such centers/trails are found in an increasing number of protected areas across the country. We also recommend organizing the transportation service between Chairo and Coroico and lodging along the Inca Trail. Only once these conditions are satisfied will it be appropriate to reconsider the implementation of an entrance fee system. However, in order to avoid another failure, this system will need to be planned and implemented in tight coordination with the communities.

Projects aimed at developing new tourist circuits, recreation activities, and services should be developed in the Huarinilla valley, considering its proximity to the town of Coroico, which has by far the region's largest lodging capacity. The park administration needs to closely coordinate with the tourism agencies in La Paz and Coroico to regulate existing and future biking, trekking, and kayaking activities.

Park ranger presence along the Inca trail is necessary (for example, in Choro) to ensure a rapid response in case of problems (for example, accidents, robberies, vandalism, and other infractions) and to attend to visitors' and community members' needs.

Scientific research

In their work on cloud forests, Bruijnzell and Hamilton (2001) observed that tropical cloud forests have received very little scientific attention compared to almost all other important ecosystems. The situation with the long-term monitoring of these forests is even worse, perhaps because of their poor accessibility or their generally inhospitable environments. While EBT's research projects are aimed to improve this situation, very few results actually reach the area's administration.

It is therefore important and urgent that the results of research projects and studies conducted in

the area be disseminated, especially to the park administration and in some cases to local residents (i.e. in the form of posters and flyers or through the establishment of a documentation center in a convenient location). With respect to historical and cultural values, Cotapata lacks an archeological research program altogether. The lack of historical, social, economical, and archeological data calls for the design of multidisciplinary research programs.

Within the framework of its Management Plan and future monitoring efforts, the park administration should urgently identify its priority information and research needs. In this way, support from other institutions could be oriented at filling these information gaps and strategic alliances could be sought with the relevant academic institutions. The universities of La Paz have the potential to provide a continuous flow of students to carry out the necessary research.

Another crucial aspect is the control and coordination of the existing research projects in the area, which is currently very weak. A new agreement must be reviewed and drafted with the Ecology Institute in light of the recent events with the TBS. SERNAP, as the competent authority directly related to the station's functioning, should intervene to protect its integrity and ensure its permanence in the protected area. SERNAP's non-intervention would set a negative precedent and weaken its image as a conservation organization

Conclusions

Despite its small size and its relative isolation when compared to other protected areas, Cotapata NP-IMNA's high biodiversity and watershed protection function determine both a great conservation importance and high ecosystem service value to resident and adjacent communities. If rugged terrain impedes access to a large portion of the protected area, the lowlands are under important human pressure, which in the present socioeconomic context can only be alleviated through participatory training workshops and the promotion of alternative productive and non-productive activities such as ecotourism.

Currently, partial funding is available to carry out a series of projects in the area, which has helped to ease social tensions and provided space for dialogue and participation. This situation should be taken advantage of by consolidating the Management Committee and improving its level of representation and searching for complementary funds to pursue implementation of current and planned projects. As a matter of fact, the area's consolidation still hinges upon a potential future funding gap once the BIAP project finishes (end of 2006). In the wake of this "return to normality", relations between the park administration and communities need to be intensified and local residents' environmental awareness raised via information campaigns and education activities.

Finally, in order to reduce the dangers associated with the opening of the Cotapata-Santa Barbara highway, the land-titling process must be executed as soon as possible and development planning in the area needs to be take place rapidly, involving all the local stakeholders. In order for the park to benefit from its high tourism potential conferred by its proximity to La Paz, the informal and disorganized tourism development process the prevails throughout the region must be harnessed and channeled.

Panoramic view of a hamlet located on the higher portion of the El Choro pre-Colombian trail. Photo: SP

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APPENDIX 1

Institutional Framework of the SERNAP

1/ Policies

The following outlines SERNAP's political framework, which forms the basis for establishing its objectives and selecting and implementing actions directed at meeting those objectives:

- o Consolidate the SERNAP as an institution.
- o Achieve financial sustainability for protected area management.
- o Conserve biological and cultural diversity in the protected areas.
- o Strengthen public participation in protected area management.
- o Promote protected area management integration in national economic and social policies.
- o Contribute to improving the living conditions of local residents.
- o Guide personal and collective values, attitudes and practices towards protected area conservation.
- o Promote protected area integration at the international level.

2/ Strategic agenda

The 2003-2004 Activity Report lists the following advancements in relation to the actions outlined in the 2004-2007 strategic agenda:

- o Strengthening of public participation via co-administration agreements with associations of municipalities (*mancomunidades*) and farmer organizations.
- o Joint establishment, among all SNAP stakeholders, of an effective, efficient, and transparent management model focusing on "Parks with People".
- o Promotion and implementation of tourism strategies, policies, and activities in protected areas, with tangible benefits for local people and communities.
- o Development of a conflict management and resolution system for preventive action against emerging conflicts within the SNAP.
- o Launching of a national gap analysis to guarantee representation of the country's ecosystems within the SNAP and as a principal input for the design of its Master Plan.

o Laying the foundations for the achievement of financial sustainability and adoption of financial management policies for donor funds or internal revenues.

o Strengthening SERNAP's interinstitutional and intersectorial relations through establishment of crosscutting principles, policies, and strategic management plan.

o Implementing productive uses (sustainable use of natural resources, tourism, etc.) and land titling in protected areas.

Future work includes:

o Continue the prevention, management, and resolution of social conflicts related to protected areas.

o Implement the agenda of the Constitution of the National Consultative Council as a starting point for a social pact with grassroots organizations.

o Ensure the continuity of technical and financial support provided by such organizations as MAPZA-GTZ, GEF-World Bank, BIAP-KfW and other technical/financial aid agencies, in accordance with the SERNAP policies and strategic agenda and based on the harmonization and complementation of processes.

o Propose and approve a Supreme Decree for the institutional reorganization of the SERNAP in accordance with the reality and conditions determining the institution's current restructuring.

o Start the elaboration of a Master Plan for the SNAP.

o Conclude, adjust and initiate the elaboration of Management Plans in at least eight protected areas.

o Adjust and improve public and institutional participation mechanisms in protected area management.

APPENDIX 2

Main Objectives of Cotapata National Park and Integrated Management Natural Area

Legal basis:

D.S. N°23,547 of July 9, 1993

Article° 3.- The main objectives of COTAPATA National Park and Integrated Management Natural Area are:

1.- To regulate natural resource use by traditional area residents, in an effort to improve their quality of life and access to benefits derived from the area's conservation and management.

2.- To permanently protect pristine, representative ecosystems and high-Andean and Yungas biomes harboring exceptional representative biodiversity, genetic resources, and species of conservation importance, such as the Yungas cloud forest ridge, characterized by the presence of very important plant species, such as the mountain pine (*Podocarpus* sp.), Peruvian walnut (*Juglans neotropica*), huaicha (*Weinmannia microphylla*), Andean alder (*Alnus acuminata*), cedar (*Cedrela* sp.) and keñoa (*Polylepis* sp.).

3.- Protect rare, threatened, or endangered species like the spectacled bear (*Tremarctos ornatus*), Andean cat (*Felis jacobita*), Andean deer (*Hippocamelus antisensis*), white-tailed deer (*Odocoileus virginianus*), puma (*Felis concolor*), pacarana (*Dinomys branickii*), brocket deer (*Mazama americana*), monkeys like the spider monkey (*Ateles paniscus*), white-faced capuchin (*Cebus albifrons*), and birds such as the torrent duck (*Merganetta armata*), Andean guan (*Penelope montagnii*), black-and-chestnut eagle (*Oroaetus isidori*), Andean condor (*Vultur gryphus*), the extremely rare oilbird (*Steatornis caripensis*), and the Andean cock-of-the-rock (*Rupicola peruviana*).

To date, three endemic mammals are known: *Thomasomys ladeyi, Oxymycterus hucucha* (rodents) and *Marmosa acetamarcae* (marsupial). There are also six endemic species of the Order Passeriformes (perching birds): *Grallaria erythrotis, Schizoeaca harterti, Aglaeactis pamela, Myrmotherula grisea, Hemitriccus spodiops,* and *Odontorchilus branickii*. There are also six known endemic amphibians: *Phrynopus laplacai, Centrolenella bejaranoi, Epipedobates bolivianus, Eleutherodactylus fraudator, E. Mercedase* and a species of the *Telmatobius* genus. The total of 15 endemic vertebrate species reported for the area confers the park an extraordinary biological value.

4.- Help safeguard archeological and cultural heritage and rescue traditional knowledge of local residents. The park's main archeological resource is the El Choro pre-Columbian trail, more commonly known as the Inca trail.

5.- Protect geomorphological formations and unique landscapes of the mountain range, paramos, and Yungas, of hydrographic basins and sources of water.

6.- Provide opportunities for nature recreation, scientific research, monitoring of ecological processes, and environmental education.

What is a National Park and Integrated Management Natural Area?

D.S. N° 24,781, 07.31.1997

Art° 20.- The National Park (NP) category is aimed at the strict and permanent protection of representative samples of ecosystems or biogeographic provinces and the plant and animal species, as well as the geomorphological, scenic or landscape values that they harbor. A national park is a relatively large area which ensures the continuity of ecological and evolutionary processes of its ecosystems.

Art° 23.- Extractive or consumptive use of renewable or non-renewable natural resources is strictly forbidden, just as the construction of infrastructure - to the exception of scientific research, ecotourism, and environmental education purposes as well as the susbistence activities of native people, once expressly defined and authorized, so as to provide the population with tourism, recreational, environmental monitoring, nature interpretation, environmental education, and ecological awareness opportunities, in accordance with the park's zoning, management plan, and regulations.

Art° 25.- The Integrated Management Natural Area (IMNA) category is meant to harmonize the conservation of biological diversity with the sustainable development of the local population. It constitutes a mosaic of land uses, including representative samples of ecoregions, biogeographic provinces, natural communities or plant and animal species of special importance, traditional land use systems, multiple-use zones, and strict protection zones (Art. 25).