

A new park in the Bolivian Gran Chaco – an advance in tropical dry forest conservation and community-based management

Andrew Taber, Gonzalo Navarro and Miguel Angel Arribas

The Kaa-Iya del Gran Chaco National Park and Integrated Management Area was established in September 1995. At 3.44 million hectares it is one of South America's largest protected areas. The tropical dry forest of the Chaco, which this reserve protects, is Bolivia's most threatened major lowland habitat type. With the creation of this reserve the protected-area coverage of the Gran Chaco increased to 4.7 per cent. With at least 69 species of mammals (the Chiroptera have not yet been surveyed), it is one of the richest Neotropical sites for this taxonomic group. The Kaa-Iya park is being administered by the Izoceño-Guaraní Indian organization, the Capitanía del Alto y Bajo Izozog, and puts community-based conservation into practice. Threats to the park include encroachment by colonists, ranchers and farmers; the Bolivia–Brazil gas pipeline; and hunting.

Introduction

In September 1995, Bolivia's president signed a decree establishing the 34,411-sq-km Kaa-Iya del Gran Chaco National Park and Integrated Management Area (Figure 1). Its creation increased the protected-area coverage of the entire Gran Chaco from 1.2 to close to 4.7 per cent (c. 22 per cent of the Bolivian Chaco). The establishment of this reserve helps redress the lack of conservation action in the Gran Chaco (see Redford *et al.*, 1990; Taber, 1991), and tropical dry forests in general, although it still leaves large gaps in the protection of the Chaco's different ecological regions. This new protected area is one of the largest in South America and contains extremely high levels of mammal and habitat diversity. Its size alone will help to ensure the preservation of ecological and evolutionary processes as well as viable populations of endangered species.

The proposal to establish this protected area was a joint effort of a technical team contracted by the Bolivian Conservation Directorate (DNCB) of the Ministry of Sustainable Development and the Environment, and the

local Izoceño-Guaraní Indian organization, the Capitanía del Alto y Bajo Izozog (CABI). Unusually, therefore, the protected area was created in response to pressure from local communities in addition to technical concerns. Also, in November 1995 a 10-year agreement was made between the DNCB and CABI assigning the administration of the reserve to the Izoceños. This 'bottom up' (from the local communities) conservation, as opposed to the more traditional 'top down' (from central national park agencies) approach is unusual, but responds to current thinking about making protected-area conservation sustainable (e.g. Kempf, 1993). It further ensures that this park has significant local support, in contrast to some other protected areas in Bolivia (e.g. Amboro National Park), which are fraught with conflict, partly because they were established without adequate consultation with local peoples (A. Taber, personal obs.).

This paper provides background information on conservation in the Gran Chaco, and a review of the community-based protected-area management, biodiversity values and threats to the Kaa-Iya reserve.

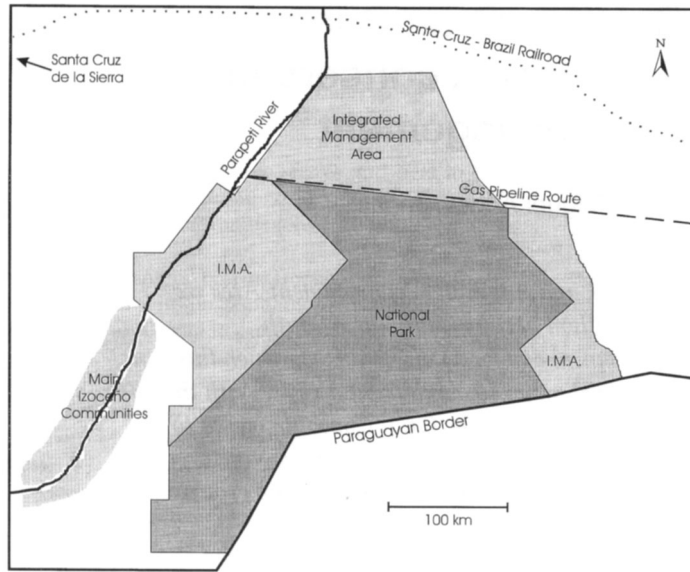


Figure 1. Map of the Kaa-Iya National Park and Integrated Management Area and buffer zone.

Background on conservation and development in the Gran Chaco

The Gran Chaco of Bolivia, Argentina, Paraguay and Brazil is one of South America's most extensive biogeographical provinces. This vast plain covers about 1 million sq km between latitudes 18 and 33°S and longitudes 57 and 66°W (see Figure 2). The region's vegetation is heterogeneous and includes a variety of ecosystems, from palm *Copernicia alba* savannah and marshes to semiarid thorn forests and open grasslands on sand dunes (Short, 1975; Taber *et al.*, 1994). The largest expanses of surviving tropical dry forests in the Neotropics, a biome that is more threatened than tropical moist forests, are found in the Gran Chaco (e.g. Janzen, 1988; Redford *et al.*, 1990). The Chaco contains high levels of biological diversity for some taxonomic groups, particularly mammals (Redford *et al.*, 1990; Mares, 1992). It has at least 10 endemic mammal species including the Chacoan peccary *Catagonus wagneri*, Azara's night monkey *Aotus azarae*, salt desert cavy *Dolichotis salinicola*, Chacoan naked-tail armadillo *Cabassous chacoensis*, Chacoan fairy armadillo *Chlamyphorus retusus*, rice rat *Oryzomys chacoensis* and four species of the fossorial tuco-tuco rodents

Ctenomys argentinus, *C. bonettoi*, *C. conoveri* and *C. dorsalis*.

Like most tropical dry forest areas, the Chaco has suffered from unsustainable land-use practices, particularly overgrazing by cattle and goats, massive land clearance for intensive agriculture, and overhunting. The Chaco has also been subjected to a number of misguided development projects, which have wasted tens of millions of dollars, produced few economic benefits to the region, and have generally caused ecological degradation (e.g. Chaco Puede in Argentina in the 1960s and Jojoba Reta in Paraguay in the 1980s; R. Ayerza, pers. comm.). Morello and Hört (1985; see also Schofield and Bucher, 1986) suggested that the state of ecological degradation of vast areas of the Argentine Chaco is one of the worst, yet least known, ecological disasters in South America. In Bolivia, the Gran Chaco, where the bulk of the land clearance for intensive mechanized agriculture is occurring, is probably the most threatened major lowland habitat type in the country. In 1995 alone some 1800 sq km of Bolivia's Chaco forest were cut down, increased from an estimated 1000 sq km in 1993 (R. von Oven, IP/CES/KWC, Santa Cruz, Bolivia, pers. comm.). The wildlife of the Gran Chaco has been

particularly hard hit by commercial hunting for the international skin trade (spotted cat, peccary, and broad-snouted and Paraguayan caiman populations have been reduced substantially; Taber, 1991 and unpubl. data; Thorbjarnarson, 1992; Bodmer *et al.*, 1993).

Starting in the 1950s, a number of protected areas were established in the Gran Chaco of Argentina and Paraguay; and by 1995 a total of 12 reserves had been declared, totalling 11,961 sq km and covering about 1.2 per cent of the Gran Chaco's area (Argentina, 0.2 per cent of 500,000 sq km; Paraguay, 3.1 per cent of 350,000 sq km; see Table 1). No protected areas are currently established in the small area of Chaco habitat in Brazil, and none had been established in the Bolivian Chaco (c. 150,000 sq km) until the Kaa-Iya reserve was designated. Concern for Chaco conservation led FAO and UNEP to organize an international workshop in 1985, which found that only four of 13 different ecological



Figure 2. Map of the Gran Chaco.

Table 1. Protected areas in the Grand Chaco

Area	Category	Size (ha)
Argentina		
Potrero 7-B, 1992	Managed Nature Reserve	2,010
Chaco, 1954	National Park	7,100
Río Pilcomayo, 1951	National Park	28,000
La Quebrada, 1987	Natural Water Reserve	4,200
Fuerte Esperanza	Provincial Park	11,619
Pampa del Indio, 1957	Provincial Park	8,633
Chaco, 1954	Strict Nature Reserve	7,900
Río Pilcomayo, 1951	Strict Nature Reserve	19,000
Monte de las Barrancas, 1988	Wildlife Refuge	7,656
Total for Argentina: nine areas		96,118
Paraguay		
Defensores del Chaco, 1975	National Park	780,000
Teniente Enciso, 1980	National Park	40,000
Tinfunque, 1966	National Park	280,000
Total for Paraguay: three areas		1,100,000
Bolivia		
Kaa-Iya del Gran Chaco, 1995	National Park and Integrated Management Area	3,441,000
Total for Gran Chaco		4,637,118
Total size of Gran Chaco		98,851,300
Protected area coverage of Gran Chaco		4.7%

Data from IUCN (1994).

regions were protected to some degree (FAO/PNUMA, 1985); and suggestions were made to greatly expand the protected area system in the region. These recommendations have been largely disregarded, as shown by the limited expansion in the protected area system since 1985 (see Table 1). In fact, the situation is aggravated because most of the existing reserves are small and have too few, undertrained and poorly equipped staff (e.g. the 7800-sq-km Defensores del Chaco National Park in Paraguay had only three park rangers in 1995).

The Gran Chaco of Santa Cruz Department, Bolivia

The Gran Chaco of Santa Cruz in Bolivia is the northernmost area of this biogeographical province. To the west the lowland Chaco ends at the foot of the Andes where moist cloud forest begins, although Chaco-like vegetation extends up to about 2000 m in montane dry valleys (2800 m in the adjoining Cochabamba Department). To the east, and on to the Brazilian Shield to the north, the vegetation grades into the tropical subhumid forest and savannah of the *cerrado*. Geomorphologically, the most striking aspect of the lowland Chaco in this region is the presence of isolated mesas and small ranges of hills rising 200–300 m above the surrounding plain (e.g. Cerro San Miguel). These outcrops occur elsewhere in the Chaco only in the Cerro Leon formation of Paraguay.

Most of the Chaco of Santa Cruz was virtually intact only 10 years ago, with the main transport corridors, and hence settlements and cattle ranches, being located on its northern and western border. However, some of the best soils in Bolivia are found in this region and it is now the focus of considerable development pressure with a major agricultural land boom under way. It is probable that 1–2 million ha of Chaco forest in Santa Cruz will have been cleared within the next 5 years (R. von Oven, pers. comm.). Most of the land is being converted to plant soya beans with a large proportion of farm owners being

Mennonites, and Brazilian and other foreigners.

Two main ethnic groups, the Izoceños and the Ayoreos, historically occupied the Chaco in Santa Cruz Department. The Chiquitano Indians to the north also periodically make forays into the Chaco to hunt for subsistence. The highly organized Izoceños (population c. 7500) inhabit the banks of the Parapetí River (see Figure 1), making their living from irrigated agriculture, cattle and goat ranching, fishing, hunting and migratory labour in the cane harvest elsewhere in Santa Cruz (Guzmán, 1992). The Ayoreos, a nomadic group that traditionally used most of the new reserve, have almost all been brought out into various missions and settlements. The reserve's only permanent inhabitants at present are some small Izoceño communities on the reserve's edge, a small group of Ayoreos (<100) still avoiding contact in the heart of the national park, soldiers (<40) at two tiny military posts and a couple of small cattle ranches in the integrated management areas. There are also a number of undeveloped inholdings of dubious legality, totalling perhaps 500 sq km.

Management of the Kaa-lyá protected area

For management purposes the area is divided into four sectors: a national park core area of about 20,000 sq km, and three integrated management areas (Figure 1). In Bolivian national parks, biodiversity conservation is the pre-eminent management objective and extractive use of natural resources is usually prohibited, while integrated management areas permit sustainable resource extraction as long as a significant loss of biodiversity does not result. The eastern (c. 2800 sq km), northern (c. 4200 sq km), and western (c. 7500 sq km) integrated management areas are set aside for the use of the Ayoreo, Chiquitano and Izoceño Indians.

The protected area will be jointly administered by CABI and the DNCB. The former will take the lead in the area's management, with the latter playing a primarily supervisory role. The park director (chosen on purely technical

grounds) is not an Indian, but the park rangers have been chosen among the most qualified Izoceño, Ayoreo and Chiquitano Indians. To date 21 park guards have been contracted and are in various levels of training, and plans have been developed to construct at least eight guard posts at strategic points around the reserve over the next 3 years with financial support to the Bolivian Government from the Global Environment Fund. The Wildlife Conservation Society is working closely with CABI to train an additional cadre of indigenous parabiologists in natural resource management; and 25 Izoceños, Ayoreos and Chiquitanos have attended courses and participated in field surveys. A Management Committee, which acts as a board of directors, has been established as a means of giving different interest groups a voice in the reserve's management. Its 10 members are: the park director, a representative from the DNCB, five representatives from various Indian organizations, one representative from each of two neighbouring towns, and a representative from a conservation NGO (currently the Wildlife Conservation Society).

The park's biological diversity

Flora and habitats

The vegetation of the protected area is primarily low scrubby thorn forest with some areas of marsh, and palm and dry savannah. However, it has considerable habitat heterogeneity, with 15 interdigitated and ecologically distinct environmental units depending on soil texture, drainage and rainfall (annual precipitation in different parts of the reserve varies from 350 to 800 mm). The principal environmental units include (i) low semiarid and scrubby thorn forest on sandy (often mixed with savannah), well-drained, moderately drained or badly drained soils; (ii) tall dry forest to the northern and eastern limits of the reserve; and (iii) seasonally flooded habitats including palm savannah, palm forest and riverine forest. Seven of these environmental units are restricted to the Santa Cruz region,

are under severe threats from development and are protected only in this reserve. Three other habitats are extensive elsewhere in the Chaco, but are now so badly degraded that their best hope of conservation is also in the park. Of the other five units, two are extensive elsewhere in the Chaco but in Bolivia are well protected only in this reserve, and three have only token representation in the reserve but are extensive elsewhere.

The reserve contains at least eight plant species endemic to the Chaco, including: the cacti *Monvillea ebenacantha*, *Echinopsis klingeriana*, *Frailea laevis*, *Gymnocalycium izozogii*; the endemic orchids *Oncidium bolivianense* and *O. morenoi*; *Arrabidaea truncata* (Bignoniaceae) and the newly described genus and species *Izozogia nelii* (Zygophyllaceae; Navarro, 1997). As more surveys are carried out it is probable that more new and endemic species will be found. It also contains one of the last large unexploited populations of the threatened 'palo santo' tree *Bulnesia sarmientoi*. There are at least four endangered and 15 threatened species in the reserve (R. Lara, pers. comm.; Taber *et al.*, 1994). While plant diversity does not approach that of tropical moist forest, the reserve is important from an ethnobotanical perspective because the Izoceños have a sophisticated traditional pharmacopoeia and regularly use at least 48 species for various medicinal purposes, as well as 45 plant species for food, fibres and other purposes.

Mammals

The Kaa-Iya del Gran Chaco Protected Area has at least 69 species of mammals, not including bats, of which five are endemic to the Chaco: Chacoan fairy armadillo, Azara's night monkey, Chacoan peccary, salt desert cavy and *Ctenomys conoveri*. At least three of the species in the reserve are Endangered and 10 are Vulnerable (see Table 2). Small mammals have yet to be sampled systematically and the bats of the reserve are virtually unstudied, so the mammalian species list is preliminary and bound to increase. This high level of diversity is striking compared with other areas in the Neotropics, and ranks third compared with

Table 2. Threatened species present in the Kaa-Iya Reserve

Species	Threat category*
Mammals	
<i>Alouatta caraya</i>	VU
<i>Callithrix argentata?</i>	DD
<i>Myrmecophaga tridactyla</i>	VU
<i>Euphractus sexcinctus</i>	DD
<i>Priodontes maximus</i>	VU
<i>Chaetophractus vellerosus</i>	DD
<i>Chaetophractus villosus</i>	DD
<i>Tolypeutes matacus</i>	DD
<i>Chlamyphorus retusus</i>	DD
<i>Lutra longicaudis?</i>	VU
<i>Oncifelis colocolo?</i>	DD
<i>Felis concolor</i>	DD
<i>Felis geoffroyi</i>	DD
<i>Felis pardalis</i>	VU
<i>Leopardus wiedii</i>	DD
<i>Felis yagouaroundi</i>	DD
<i>Panthera onca</i>	VU
<i>Tapirus terrestris</i>	VU
<i>Tayassu pecari</i>	VU
<i>Tayassu tajacu</i>	VU
<i>Catagonus wagneri</i>	EN
<i>Lama guanicoe</i> (Chaco population)	EN
<i>Ozotoceros bezoarticus?</i>	VU
<i>Mazama americana</i>	DD
<i>Mazama gouazoubira</i>	DD
Birds	
<i>Rhea americana</i>	VU
<i>Cairina moschata</i>	VU
<i>Sarkidiornis melanotus</i>	VU
<i>Harpyhaliaetus coronatus</i>	VU
<i>Morphnus guianensis</i>	VU
<i>Harpia harpyja</i>	VU
<i>Ara macao</i>	VU
Reptiles	
<i>Geochelone carbonaria</i>	VU
<i>Geochelone chilensis</i>	DD
<i>Tupinambis rufescens</i>	LR
<i>Tupinambis teguixin</i>	LR
<i>Boa constrictor</i>	LR
<i>Caiman latirostris?</i>	CR
<i>Caiman yacare</i>	LR

* Based on the Bolivian Red List (Ergueta and Morales, 1996).

CR, Critically Endangered; EN, Endangered; VU, Vulnerable; DD, Inadequate data but probably threatened; LR, Low Risk; ?, not yet documented but that reports of indigenous peoples and range maps suggest species is probably present.

seven other areas for which we have data in tropical South America (see Table 3). The Kaa-Iya falls behind only the relatively heavily studied Manu National Park (70 species) and the Cuzco Amazónico Reserve of Peru (80 species). The former includes areas of lowland tropical forest as well as montane cloud forest, and thus embraces at least two biogeographical provinces, while the latter is transitional between humid and dry tropical forest.

Birds

Two-hundred-and-eighty-five species of birds belonging to 54 families have been registered in the Kaa-Iya protected area (Taber *et al.*, 1994). Among them are permanent residents of the dry forest, such as *Rhinocrypta lanceolata*, *Saltatricula multicolor*, *Ortalis canicollis*, *Pseudoseisura lophotes* and *Upucerthia certhioides*. In the humid areas of the Chaco *Crax fasciolata*, *Herpilochmus atricapillus*, *Celeus lugubris* and *Basileuterus culicivorus* are found. The eastern portion of the protected area borders the Cerrado Geographical Province, where various bird species characteristic of that region are present, such as: *Rhynchotus rufescens*, *Saltator atricollis*, *Falco femoralis*, *Buteo leucorhous* and *Phacellodomus sibilatrix*. The Chaco is also important for many migratory birds including *Tyrannus tyrannus*, *Bartramia longicauda*, *Knipolegus hudsoni* and *Elaenia albiceps*. Seven of the species found in the reserve are Vulnerable (Table 2).

Reptiles and amphibians

The reptile and amphibian fauna of the Bolivian Chaco has been little studied. Species from at least four families of amphibians and 10 families of reptiles have been documented in the area. Recently, the land tortoise *Geochelone chilensis* was discovered to be present in great abundance in the region. Another vulnerable tortoise *Geochelone carbonaria* is also found in the reserve (Table 2). In the Bañados del Izozog the Paraguayan caiman *Caiman yacare* is found in permanent pools, as is at least one endemic river turtle *Kinosternon scorpioides seriei*, and possibly *Platemys pallidipectoris*

and the endemic toad *Chacophrys pierottii*. The critically endangered broad-snouted caiman *Caiman latirostris* may also be present in the marshes (Izoceño hunter reports).

Threats to the Kaa-Iya protected area

Encroachment

The principal threats to the protected area come from the north-west where the agricultural frontier is expanding at an extraordinary rate and hundreds of thousands of hectares of Chaco forest are being converted to mono-crop agriculture (principally for soya beans) and grazing land each year. This unsustainable development has unleashed a flood of land speculators, some of which are attempting to grab land within the integrated management areas under often fraudulent titles. As much as 500 sq km (the actual amounts are not clear) of forest along the Parapetí River on the north-western edge of the protected area are contested. This is particularly problematic for biodiversity conservation because this portion of the reserve has the highest levels of precipitation and is where the tallest and most diverse forests and small areas of wetlands are

found. Unless the protected area is rapidly consolidated, important land could be lost in this most diverse and ecologically fragile part of the reserve. There are a number of other in-holdings elsewhere in the protected area, probably representing less than 5 per cent of the total area, but these tend to be in habitats that are well represented in the reserve and the resolution of these conflicts is less urgent.

The Santa Cruz–São Paulo gas pipeline

Construction will be starting in 1997 on the Santa Cruz, Bolivia to São Paulo, Brazil gas pipeline. This is one of South America's largest ongoing construction projects and is being undertaken by a consortium including YPFB (the partially privatized Bolivian state oil company), Petrobras (the Brazilian state oil company), and the US-based companies ENRON and TENNICO. The Inter-American Development Bank and the World Bank will be providing part of the financing for the project. The pipeline route will cross the northern third of the reserve (see Figure 1), an area that has been almost completely inaccessible, and could represent a considerable threat to the area's integrity and biodiversity.

Table 3. Comparison of the non-volant mammal fauna of the Kaa-Iya Reserve with other regions of South America

Locality	No. non-volant mammals	No. medium and large non-volant mammals (> 1 kg)
Masaguaral Ranch, Venezuela*	29	21
Guatopo National Park, Venezuela*	40	23
Acurizal Ranch, Pantanal, Brazil†	43	31
Ríos Blanco y Negro Wildlife Reserve, Bolivia‡	64	40
Belém Region, Brazil§	66	43
Kaa-Iya del Gran Chaco Protected Area, Bolivia¶	69	47
Manú National Park, Peru**	70	40
Cuzco Amazónico Region, Peru ††	80	45

* Eisenberg *et al.*, 1979.

† Schaller, 1983.

‡ Rumiz and Taber, 1994; A. Taber, unpubl. data.

§ see Medellín, 1994.

¶ A. Taber, unpubl. data.

** MacQuarrie, 1992.

†† Woodman *et al.*, 1991.

As currently planned, other than the pipeline and associated access road, no major permanent infrastructure construction (e.g. pumping stations) will be undertaken within the reserve. The principal threats from the pipeline are therefore: (i) disturbance during the construction phase; (ii) sport and commercial hunting during and after construction along the pipeline access road; and (iii) colonization by *campesinos* (peasant farmers) or large-scale ranchers or farmers facilitated by the access road. All these threats could be minimized at relatively low cost for such a huge project by careful planning, sound construction practices and rigorous prohibition of hunting and colonization during and after construction. Capitanía del Alto y Bajo Izozog has been lobbying for part of the revenues from the gas pipeline to be used to cover the recurrent operating expenses of the protected area, as well as for park staff to oversee the construction and environmental monitoring within the reserve when the pipeline starts operating. It is, however, unclear whether the Bolivian Government has the political will to minimize the threats to biodiversity represented by the pipeline, and to date (September 1996) there has been a minimum of consultation between the construction consortium and CABI, the Kaa-Iya park director, and the DNCB (J. Aguirre, Director Kaa-Iya del Gran Chaco National Park, pers. comm.; M. O. Ribera, DNCB, pers. comm.).

Commercial and sport hunting

The north-western sector of the Kaa-Iya reserve is one of the best and most accessible hunting areas for sport hunters from the city of Santa Cruz de la Sierra, although in Bolivia only subsistence hunting is currently legal. The region has also historically been a key area for commercial skin hunters, who trapped and hunted extensively in the Gran Chaco of Santa Cruz from the 1960s, when the area was offered up for petroleum explorations, to the early 1990s, particularly for the hides of large and small spotted cat, fox and peccary. As late as 1994 Brazilian meat and skin hunters took at least 300 white-lipped

peccaries (B. Barrientos, Capitán Grande CABI, pers. comm.); and in 1996 a group of foreign jaguar sport hunters was found in the park. The Chaco's fauna has not yet recovered from this onslaught and populations of species such as ocelot and the Chacoan peccary are still very low (A. Taber, unpubl. data; Taber, 1991). How much of a threat commercial and sport hunting represent to the reserve's biodiversity today is unclear.

Degradation of the upper Parapeti River watershed

The Parapeti River is a critical part of the region's ecology: it maintains the wetlands, and tall and diverse forest along the reserve's western boundary, and it provides the Izocoño Indians with fish, and water for irrigation to maintain their traditional agricultural system. The headwaters of this river are located high in Andean valleys hundreds of kilometres to the west. Some of these steep valleys are currently being colonized, which is resulting in severe erosion in some areas, thus representing a considerable threat to the integrity of the Izozog region. It is therefore of critical importance that action is taken to protect the Parapeti River's upper watershed.

In the lower river basin, both upstream and downstream of the protected area, there is considerable agro-industrial activity, including the establishment of irrigated rice plantations along the river. These activities represent a threat to the integrity of the system from (i) the use of pesticides, herbicides and fertilizers, which may contaminate the river, and (ii) through reducing the seasonal water flow and thus putting at risk the integrity of the Izozog wetlands (Baños del Izozog) as more and more water is used for irrigation.

Conclusions

The Kaa-Iya del Gran Chaco National Park and Integrated Management Area is the world's largest tropical dry forest reserve (see IUCN, 1994), and is one of the largest protected areas in South America. Biodiversity

surveys in the area have been very limited, yet data collected to date show that it has among the highest diversities of non-volant mammals of any protected area in South America. Further, it conserves a wide range of species from other taxonomic groups as well as hitherto unprotected and highly threatened dry and semiarid habitats. Its huge size should make it one of the few reserves in South America where ecological and evolutionary processes can go on almost unaffected by outside human activities.

A proposal is currently being discussed in Paraguay on extending the Defensores del Chaco National Park out to the Bolivian border to adjoin the Kaa-Iya reserve. If the political will can be found to accept this proposal, the combined area of both country's protected areas would total c. 48,000 sq km. This would represent an outstanding conservation opportunity and would ensure the protection of the Gran Chaco's remaining core area of dry forest. This, however, would still leave major holes in the protected-area coverage of the Chaco, particularly in the moister ecological regions, and a major effort must be made to fill these gaps, especially in Argentina and Paraguay.

With the assignment of the management of this protected area to CABI an experiment is under way in local community-based conservation. Can a local indigenous organization, with limited experience in protected-area management, and whose principal focus must be on ensuring the well-being of its constituents, adequately manage a protected area? This is a topic of current concern among Neotropical conservationists (e.g. see papers in Redford and Mansour, 1996). In Bolivia, the management of national parks and reserves from the main cities of La Paz and Santa Cruz has often proven deficient (A. Taber, pers. obs.), and this local group, with a vested interest in conserving the biodiversity of the region where they live, and where their culture evolved, will provide, we hope, a model for park management in Bolivia. The portions of the protected area zoned as national park will require strict preservation; but in the integrated management areas, some of which con-

tain extremely fragile habitats of great importance for biodiversity, sustainable resource use is permitted as long as a loss in biodiversity does not result. The key to the preservation of biodiversity in this region is likely to be the reconciliation of the developmental aspirations of the indigenous groups living in and around the reserve with biodiversity conservation needs, while staving off threats from other social and economic groups from the outside. At present a USAID-funded project, run by CABI and the Wildlife Conservation Society, is starting to work with the Izocoños on institution building, protected-area management, natural resource use, and environmental and cultural education.

The Izocoño people led the fight to establish this reserve in the face of considerable external economic interests. They did this as a means of consolidating their territorial control over the region and, especially, to hold off the predatory development pressures from outside, which would in all likelihood have reduced, in the long run, much of this part of the Chaco to ecologically degraded ranch and farmland of low productivity (particularly given the low rainfall). They also recognize the importance of protecting the Chaco as part of their cultural patrimony, and helped establish the park as a means of conserving a place for their Kaa-Iya, the spirit guardians of the forest (see Riester, 1983).

Acknowledgements

This paper is dedicated to the memory of Lic. Antonio Rojas R. Antonio fought eloquently and long for Indian rights in lowland Bolivia. At the time of his premature death he was working to form an alliance between Indian groups and conservationists, of which the Kaa-Iya park was his first victory (albeit posthumously). He is irreplaceable and we miss him.

The research to establish the park was funded by GEF funds channelled through the DNCB. Additional surveys were funded by the Wildlife Conservation Society. A. Taber was supported in part, during the writing of this paper, by funds from the Bolivia Office of the United States Agency for International Development (USAID), and the opinions expressed in this paper do not necessarily reflect the views of USAID. We thank Alejandra

Sánchez de Lozada, Mario Baudoin, Gonzalo Merida and Marco Octavio Ribera of the DNCB. Srs. Helio Montenegro, Ciro Justiniano and Marcelino Morales assisted in the field surveys. We also acknowledge the help of Mike Yates of USAID/Bolivia and Gary Hunnisett of the World Bank. Of the many Izoceños who have helped, we especially thank Capitán Grande Bonifacio Barrientos and Evelio Arambiza. Lastly we thank the Bolivian President Gonzalo Sánchez de Lozada for his active steps in establishing the park.

References

- Bodmer, R.E., Sows, L.K. and Taber, A.B. 1993. Economic importance and human utilization of peccaries. In *Status Survey and Conservation Action Plan: Pigs, Peccaries and Hippos* (ed. W. L. R. Oliver), pp. 29–36. IUCN, Gland, Switzerland.
- Eisenberg, J.F., O'Connell, M.A. and August, P.V. 1979. Density, productivity and distribution of mammals in two Venezuelan habitats. In *Vertebrate Ecology in the Northern Neotropics* (ed. J. F. Eisenberg), pp. 187–207. Smithsonian Institution Press, Washington, DC.
- Ergueta, P. and de Morales, C. 1996. *Libro Rojo de los Vertebrados de Bolivia*. Centro de Datos para la Conservación, La Paz, Bolivia.
- FAO/PNUMA. 1985. *Un Sistema de Areas Silvestres Protegidas para el Gran Chaco*. Proyecto FAO/PNUMA FP 6105-85-01, Documento Técnico 1, Santiago, Chile.
- Guzmán, M. 1992. *Karuai: Diagnostico Alimentario-nutricional de las Comunidades Izoceño-Guaranies del Gran Chaco Boliviano*. Apoyo Para el Campesino Indígena del Oriente Boliviano, Santa Cruz, Bolivia.
- IUCN, 1994. 1993 United Nations List of National Parks and Protected Areas. Prepared by WCMC and CNPPA. IUCN, Gland, Switzerland and Cambridge, UK.
- Janzen, D.H. 1988. Tropical dry forests: the most endangered major tropical ecosystem. In *Biodiversity* (ed. E. O. Wilson), pp. 130–137. National Academy Press, Washington, DC.
- Kempf, E. (ed.) 1993. *The Law of the Mother: Protecting Indigenous Peoples in Protected Areas*. Sierra Club Books, San Francisco, California.
- MacQuarrie, K. 1992. *Peru's Amazonian Eden: Manu National Park and Biosphere Reserve*. F. O. Pathey and Sons, Barcelona, Spain.
- Mares, M.A. 1992. Neotropical mammals and the myth of Amazonian biodiversity. *Science*, **255**, 976–979.
- Medellín, R.A. 1994. Mammal diversity and conservation in the Selva Lacandona, Chiapas, Mexico. *Conservation Biology*, **8** (3), 780–799.
- Morello, J. and Horrt, G. 1985. Changes in the areal extent of arable farming, stock raising and forestry in the South American Chaco. *Applied Geography and Development* (Tubingen), **25**, 109–127.
- Navarro, G. 1997. *Izozogia nellii* (Fam: Zygothylacae). *Novon*, **7** (1), 1–5.
- Redford, K.H. and Mansour, J.A. (eds). 1996. *Traditional Peoples and Biodiversity Conservation in Large Tropical Landscapes*. America Verde Publications. The Nature Conservancy, Arlington, Virginia.
- Redford, K.H., Taber, A. and Simonetti, J.A. 1990. There is more to biodiversity than the tropical rain forests. *Conservation Biology*, **4** (3), 328–330.
- Riester, J. 1983. *Textos Sagrados de los Guaranies en Bolivia*. Los Amigos del Libro, La Paz, Bolivia.
- Rumiz, D. and Taber, A. 1994. *A Mammal and Large Bird Survey of the Ríos Blanco y Negro Wildlife Reserve: Status and Recommendations*. Wildlife Conservation Society, Working Paper 3.
- Schaller, G.B. 1983. Mammals and their biomass on a Brazilian ranch. *Arquivos de Zoologia, Sao Paulo*, **31** (1), 1–36.
- Schofield, C.J. and Bucher, E.H. 1986. Industrial contributions to desertification in South America. *Tree*, **1** (3), 78–80.
- Short, L. 1975. A zoogeographic analysis of the South American Chaco avifauna. *Bulletin of the American Museum of Natural History*, **154**, 165–352.
- Taber, A. 1991. The status and conservation of the Chacoan peccary in Paraguay. *Oryx*, **25** (3), 147–155.
- Taber, A., Rosales, A.R., Navarro, G. and Arribas, M.A. 1994. *Parque Nacional y Area Natural de Manejo Integrado Kaa-Iya del Gran Chaco: Propuesta Técnica y Etnica*. Report to the Biodiversity Conservation Directorate, Ministry of Sustainable Development and the Environment, Government of Bolivia.
- Thorbjarnarson, J. 1992. *Crocodiles: An Action Plan for their Conservation*. IUCN, Gland, Switzerland.
- Woodman, N., Timm, R.M., Arana, C., R. Pacheco, V., Schmidt, C.A., Hooper, E.D. and Pacheco, A.C. 1991. Annotated checklist of the mammals of Cuzco Amazonico, Peru. *Occasional Papers of the Museum of Natural History, University of Kansas*, **145**, 1–12.
- Andrew Taber, Wildlife Conservation Society, Bronx Zoo, Bronx, New York 10460, USA.
Gonzalo Navarro S., Universidad Complutense, Facultad de Farmacia, Departamento de Botánica, Ciudad Universitaria, Madrid 28040, Spain.
Miguel Angel Arribas, PO Box 2873, Santa Cruz, Bolivia.