

Annex V: Descriptions of Site Biology

The following narrative provides a brief description of the biological characteristics of the four project sites. There is in general a paucity of empirical data on Paraguay's biodiversity owing to a lack of field research (there is considerable variation in the quality and quantity of information for different taxonomic groups and eco-regions). None of the four sites has been intensively surveyed, and the biological inventory is thus far from complete. But all are known to harbour a number of globally endangered and rare species of flora and fauna, and have zoogeographic and biogeographic characteristics that differentiate them from comparable ecosystems in neighbouring Bolivia, Brazil, and Argentina. The sites capture a broadly representative sample of the country's rich diversity.

General Description

Paraguay is mostly flat and relatively low lying, with a mean altitude of some 160 metres a.m.s.l. (the highest point is a mere 800 metres a.m.s.l. in the Defensores del Chaco NP). The Chaco has a harsh climate, with summer temperatures rising to over 40 °C in the most arid parts. Rainfall in this part of the country varies from less than 44 millimetres per year in the north-west, to 1,200 millimetres in the south-east. The Eastern region receives more rain, with annual precipitation increasing from 1,300 millimetres along the Paraguay River to some 1,700 millimetres along the Brazilian border to the east.

Dinerstein et al. (1995) identify two Main Habitat Types (MHT) in Paraguay, namely Broad-leaved Tropical Rain Forests and Grasslands, Savannahs and Shrublands. The Two Habitat Types are further sub-divided into five eco-regions, namely the Interior Atlantic Forest, Cerrado, Chaco Savannah, Humid Chaco, and Pantanal. These are however, broad categories, and do not fully capture the full variation in ecological conditions. Hueck (cited in Brack. W and Weik, J., 1994) divides the country by vegetation type, with 7 general categories listed. All of these categories are found within the project sites, although 5 types predominate: Deciduous and Mesophytic Subtropical Forests of Eastern and Central Brazil; Campos Limpios (open grasslands); Campos Cerrados (forest/grassland complexes), Chaparrales (shrubland), Central Chacoan Dry Forests, and Gallery Forests. Rio Negro National Park contains small areas of Dry to Semi-humid Forests, and Flooded Grasslands are found in the south-west corner of San Rafael National Park.

Interior Atlantic Forest:

The Interior Atlantic Forest constitutes a sub region of the Atlantic Forest (referred to as Brazilian Interior Atlantic Forest by Dinerstein et al, 1995). According to the convention followed by Hueck, the following general types of vegetation may be identified: Deciduous and Mesophytic Subtropical Forests of Eastern and Central Brazil, and isolated patches of Campos Limpios. The Conservation Data Centre in Paraguay, (CDC-DPNVS/MAG) lists 3 different "eco-regions": Alto Paraná, Selva Central, and Amanbay, providing a more specific level of classification.

The Atlantic Forest zoogeographical region, including the IAF, is a centre of biological endemism. This is true for plants (Mori et al. 1981, Henderson et al. 1995), birds (Haffer 1974, Cracraft 1985, Stotz et al, 1996, Stattersfield et al, 1998), mammals (Mittermeier et al. 1982, Oliver & Santos 1991), reptiles (Müller 1973), and butterflies (Brown 1982). The region as a whole contains 200 endemic species of birds (Stotz et al. 1996) and nearly 60 globally threatened species (Collar et al. 1994). As many as 82 of the region's endemics have been recorded in Paraguay (Brooks et al. 1993, Parker et al. 1996, Hayes 1995), although the species tally is probably higher. Birdlife International has identified 6

Endemic Bird Areas (EBA's) in the zoogeographical region, two of which are found in Paraguay (Stattersfield et al, 1998, ICBP 1992).

The IAF has the highest number of endemic birds of any zoogeographical sub-region in the Neotropics, with 101 endemics (the next in the list is the Central Andes with 70 endemics). 48 of the true IAF endemics have been recorded in Paraguay.

The fauna of the Paraguayan IAF includes 403 species of birds, of which 13 threatened and 20 near-threatened forest-dependent species have been reported (9 and 16 of these respectively are Atlantic Forest endemics; of the 48 IAF endemics, 7 are classified as threatened and 9 as near-threatened). Threatened species include the Brazilian Merganser (*Mergus octosetaceus*), Black-fronted Piping-guan (*Pipile jacutinga*), Purple-winged Ground-dove (*Claravis godefrida*), Blue-winged Macaw (*Ara maracana*), Vinaceous Amazon (*Amazona vinacea*), Red-spectacled Amazon (*Amazona pretrei*), Helmeted Woodpecker (*Dryocopus galeatus*), Sao Paulo Tyrannulet, (*Phylloscartes paulistus*), Russet-winged Spadebill, (*Platyrinchus leucoryphus*), Temminck's Seedeater (*Sporophila falcirostris*), and Buffy-fronted Seedeater (*Sporophila frontalis*). Notable near-threatened species include the Solitary Tinamou (*Tinamus solitarius*), Mantled Hawk, (*Leucopternis polionota*), Harpy Eagle, (*Harpia harpyja*) and Crested Eagle (*Morphnus gujanensis*).

Threatened and near-threatened mammals include the Giant Armadillo (*Priodontes maximus*), Bush Dog (*Speothos venaticus*), Azara's Agouti (*Dasyprocta azarae*), Oncilla (*Felis tigrina*), Tapir (*Tapirus terrestris*), Dwarf Red Brocket-deer (*Mazama rufina*), and Short-tailed Opossum (*Monodelphis sorex*— an IAF endemic). Other species include two species of primates, namely the Brown or Tufted Capuchin (*Cebus apella*), Black Howler Monkey (*Alouatta caraya*), Crab Eating Fox (*Cerdocyon thous*), Southern River Otter (*Lutra longicaudis*), several species of opossums, White-lipped Peccary (*Tayassu tajacu*), Nine-banded Long Nosed Armadillo (*Dasypus novemcinctus*), Brazilian Lesser Long-nosed Armadillo (*Dasypus septemcinctus*) and Grey Brocket Deer (*Mazama gouazoubira*).

The Atlantic forests have been severely degraded by anthropogenic pressures, with little more than 13% of the original cover remaining (Brown & Brown 1992), perhaps only 2% in a pristine condition (Wilson 1988). The importance of the Paraguayan IAF is underscored by the fact that much of the Brazilian IAF has already been cleared. But these forests are also severely threatened in Paraguay. Originally covering some 85% of the area of eastern Paraguay, or 93,888 sq. km. (Hueck 1978), more than 87% of the IAF had been cleared by 1994 (DOA 1996), much of the deforestation having occurred during the 1980s. The establishment of Protected Areas in remaining large forest stands is thus a high global conservation priority. Although several Protected Areas have been established, only one, Mbaracayu Natural Reserve (644 square kilometres) is fully operationalised and large enough to safeguard ecological processes over the long-term. Another large area, San Rafael National Park (730 square kilometres), has been legally designated, but site management is lacking.

San Rafael National Park

Located between latitudes 26°25' S. and longitudes 57°40' W, San Rafael was established (under Decree No 13680 of 29-05-92) to conserve the largest extant area of forest within the Paraguayan IAF. According to Lowen, J.C, et al. 1996, the park "presents an excellent opportunity to conserve almost all the fauna and flora occurring in Paraguay's IAF". It is large enough to support populations of most species, including raptors and other widely dispersed species ordinarily found in low-densities. The Park includes an extensive tract of primary forest at its heart, and also contains large bamboo (*Chusquea*) thickets, an important habitat. Despite the limited field work conducted, over 300 species of birds have been recorded (the second highest tally for any site in Paraguay), including 8

threatened and 16 near-threatened species. The final species count is likely higher¹. A number of narrow biological corridors remain to the nearby Caaguzú Protected Area (20 km north of SRNP and with an area of 160 square kilometres). San Rafael is considered by many scientists to be Paraguay's highest conservation priority (Madroño et al, 1997).

Cerrado Forest/ Grasslands Mosaic:

Dinerstein et al (1995) list the Cerrado as a single eco-region, but posit that the category could probably be further be sub-divided, this task being hampered by a dearth of data on patterns of biodiversity. Located mainly in the northern extreme of the Eastern Region, the Cerrado extends south, intermixing with the IAF. Based on Hueck's classification, it is possible to differentiate the following vegetation types: Campos Cerrados, Chaparrales and similar Savannahs. [This type predominates in the province of Concepción, extending to the provinces of Amambay and San Pedro, with small enclaves in Caaguazú and Canindeyú provinces]; and isolated patches of Deciduous and Mesophytic Subtropical Forests from eastern and central Brasil. In the far east of the country, a small area of Campos limpios is found. The Conservation Data Centre within DPNVS/MAG classifies the Cerrado as forming a single eco-region, the Aquidabán.

Conservation efforts in the neo tropics have tended to overlook the cerrado plains, few Protected Areas having been established in this eco-region. This is a serious gap, given that grassland biomes in the neotropics harbour considerable biodiversity. While at a global level, some 6.3% of threatened bird species inhabit grassland biomes (Collar et al.1994), the percentage for the neotropics is 12% (Wege & Long, 1995). The cerrado has become one of the fastest disappearing habitats in the World (Willis and Oniki, 1988). Less than 5% of the original 2 million square kilometres of Brazilian Cerrado remained in a virgin state by 1988 (Cavalcanti 1988). This degradation has been accompanied by an extirpation of species, several of which face global extinction. Consequently, several conservation biologists maintain that the cerrado ranks amongst the seven most urgent conservation priorities in the neotropics (Kelsey 1991, Wege & Long 1995).

There is a distinct cerrado endemic avifauna, with 41 species being considered as endemic to the region (Stotz et al. 1996). This distinctive avifauna is threatened with extinction: over 75% of the endemic cerrado avifauna are at risk, and over 45% of the species are either threatened or endangered (ibid.). Paraguay's cerrado habitats hold seven threatened, 15 near-threatened, and one data deficient species. Of the threatened species, one is critically endangered, one endangered and five vulnerable (Collar et al. 1994). The threatened/ vulnerable grassland species are the White-winged Nightjar (*Caprimulgus candicans*– critically endangered), Marsh Seedeater (*Sporophila palustris*– endangered), Crowned Eagle (*Harpyhaliaetus coronatus*), Rufous-faced Crake (*Laterallus xenopterus*), Hyacinth Macaw (*Anodorhynchus hyacinthinus*), Rufous-sided Pygmy-tyrant (*Euscarthmus rufimarginatus*), and Black-masked Finch (*Coryphaspiza melanotis*). Near threatened species include the Greater Rhea (*Rhea americana*), Ocellated Crake (*Micropygia schomburgkii*), Sickie-winged Nightjar (*Eleothreptus anomalus*), and Grey-cheeked Grass-

¹ More Atlantic Forest endemic species and Atlantic Forest indicator species (as identified by Parker et al. 1996) have been found in San Rafael National Park than in any other site in Paraguay. In total, 67 of 81 Atlantic Forest endemics have been recorded, and 60 of 72 Atlantic Forest indicator species, an indication of habitat quality. A nesting site of the Russet-winged Spadebill (*Platyrinchus leucoryphus*) has been found in the Park, the only such nest recorded for this globally threatened, Atlantic Forest endemic (Clay and Madroño, 1997). The grasslands in the southwest of San Rafael support one threatened species - Strange-tailed Tyrant, (*Alectrurus risora*)- and survey work in surrounding areas has revealed another three threatened grassland species - Rufous-faced Crake (*Laterallus xenopterus*), Ochre-breasted Pipit (*Anthus nattereri*) and Saffron-cowled Blackbird (*Xanthopsar flavus*)– whose ranges likely extends into the Park. (Rob Clay, Guyra Paraguay, pers comm., 1998).

finch (*Emberizoides piranganus*). Silva (1995a) demonstrated that ca. 70 % of Paraguay's cerrado's have been inadequately studied. Several cerrado-dependent species have ranges that closely approach the Paraguayan border, and it is likely that they occur within the country. These species include the Critically Endangered Blue-eyed Ground-dove (*Columbina cyanopis*), the Endangered Black-and-tawny Seedeater (*Sporophila nigrorufa*) and two Vulnerable tinamous, namely the Lesser Nothura (*Nothura minor*) and Dwarf Tinamou (*Taoniscus nanus*).

One Protected Area has been established and another is in the process of being designated in north-eastern Paraguay to protect cerrados. These are Serranía de San Luis Ecological Reserve (already established, with an area of 126 Sq.Kms), and Paso Bravo National Park (area 1030 square kilometres) which has recently been gazetted. This region receives some 1,400 mms of precipitation annually.

Paso Bravo National Park:

PBNP is located at a Latitude: of 22°20' S. and Longitude 57°11' W. The Park constitutes the largest Protected Area – at a global level– in the Cerrado eco-region. [The establishment of this site, already listed in the SINASIP Master Plan, was triggered during Block B implementation.] Paso Bravo contains a savannah / forest complex, with a mosaic of habitats and biological communities including grasslands, shrublands, woodlands and palms. The region is influenced by periodic fires, and the vegetation is naturally fire resistant. The landscape is dominated by low hills with sandy soils, with shrubs, woodlands, and palms dispersed over open grasslands. A recent ornithological survey in the region found most of the threatened and near threatened species of avifauna listed above. Biologists expect the area to harbour a large assemblage of globally rare species, particularly of grasses and shrubs– the biology of which remains largely undocumented.

The fauna includes a number of globally rare and near threatened species, including the Giant Otter (*Pteronura brasiliensis*), Marsh Deer (*Blastocerus dichotomus*), Giant Anteater (*Myrmecophaga tetradactyla*), Jaguar (*Panthera onca*), and Maned Wolf (*Chrysocyon brachyurus*). The reptile fauna includes the Broad-snouted Caiman (*Caiman latirostris*), and species such as the Anaconda (*Eunectes murinus*) and Cuvier's Dwarf Caiman (*Paleosuchus palpebrosus*). The inventory of avifauna includes several threatened macaws, including the Hyacinth Macaw (*Anodorhynchus hyacinthinus*), Red and Green Macaw (*Ara chloroptera*), and Blue-winged Macaw (*Ara maracana*). A recent study of parrots found 16 species, with healthy populations of several rare species (López 1994).

López counted 32 tree species on survey plots, with an average of 2517 trees /hectare. Species inventories for the Cerrados of San Pedro Province (140 kms south-east of Paso Bravo) give a total of 350 plant species (grasses, scrubs and shrubs) (D.Mandelburger, Natural History Museum –DPNVS/MAG. pers. comm.). The Cerrado contains at least 70% of the palm species recorded in Paraguay. Endemic plants found within the PA include species belonging to the Annonaceae, Palmae, Graminae, Bromeliaceae and Compositae families. A preliminary estimate of numbers of plant species gives a total of 600-700. The most abundant trees are Cumbarí (*Coumarouma alata*), Mbocayá (*Acrocomia totai*) and Guatambú (*Balfourodendron riedelianum*). Less common species include Trébol (*Amburana cearensis*), Curuguai (*Copaifera chodatiana*), Pindó (*Syagrus romanzoffiana*, and Avayerú (*Coupeia* sp.).

Chaco Savannah and Chaco/ Pantanal Eco-tone:

Dinerstein et al. (1995) lists the Chaco Savannah and Pantanal as two separate eco-regions. Only a small portion of the Pantanal is located in Paraguay, but the country contains a unique transition between the Pantanal and Chaco savannah. Though the Chaco savannah is listed as a single eco-region, there are considerable variations in vegetation

and faunal communities, correlating with deviations in climatic factors, particularly levels of precipitation (rainfall decreases towards the western Chaco). According to Hueck's classification of vegetation types, the Chaco savannah is dominated by Central Chacoan Dry Forest, a typical Subtropical Dry Forest, with a predominance of trees that reach 25-30 metres in height; also found are Gallery Forests and other vegetation associated with rivers and streams.

Dominant plant species in the Chaco savannah include Quebracho blanco (*Aspidosperma quebracho-blanco*), samuhú (*Chorisia insignis*) and cactaceae such as *Stetsonia coryne* and *Cereus stenogonus*. Common shrubs are guamí piré (*Ruprechtia triflora*), *Capparis* spp., and bougainvillas (*Bougainvillea campanulata*, *B. Infesta*, *B.praecox*). Other species include *Capparis* spp., mistol (*Ziziphus mistol*), palo santo (*Bulnesia sarmientoi*), labón (*Tabebuia nodosa*), *Prosopis* spp. and guayacán (*Caesalpinea paraguariensis*).

The Pantanal comprises an area of permanently and seasonally flooded savannas, lying at a mean altitude of 120 metres a.m.s.l. This region receives between 1000-1400 millimetres of rain annually, 80% of which drops in summer. Permanently inundated areas support a variety of aquatic plants, including species in the *Eichornia*, *Azola* and *Pistia* genera. The vegetation includes herbs such as *Thalia geniculata*, *Cyperus* spp, *Ipomoea fistulosa*, and *Parathenia postata*, intermixed with shrubs of genera *Cecropia*, *Inga*, *Ficus* and *Astrocaryum*. On higher ground, shrubs such as *Curatella americana*, *Vochysia*, *Piptadenia* and *Qualia* predominate, with patches of low semi-deciduous forest, dominated by genera such as *Tecoma*, *Jacaranda*, *Caryocar* and *Vochisia*. Gallery forests are found along streams and other watercourses, with a dominance of trees of the genus *Tecoma* and the palm Karanda (*Copernicia alba*).

There have been few surveys of the biology of northern Paraguay, which until recently has remained a remote frontier region, isolated from anthropogenic impacts. But threats are accelerating, making conservation efforts a growing priority. There is a unique opportunity to bring significant areas within the Chaco savannah under conservation management, forestalling their degradation. A noteworthy point is that the region contains large numbers of predators, pointing to the good condition of the eco-system at all trophic levels. Numbers of Jaguars, and Pumas are particularly high, when compared to typical population densities in neo tropical forest environments (Redford et al, 1990, Kato and Torres, 1997). 26 species of birds are considered to be endemic to the Chaco (Parker et al. 1996); of these, 22 occur in Paraguay— the majority of which within the two Parks.

Several Protected Areas have been established or are proposed in these eco-regions. Two of these are noteworthy in terms of their global significance, namely the Daniel Cáceres National Park. (5,640 sq.km.) in the driest areas of the Chaco, and Río Negro National Park (3,180 sq.km.), in the Chaco/ Pantanal transition. The project would assist in creating a unique Protected Area complex, which together with the biologically rich Defensores del Chaco NP in North Central Paraguay, would cover the range of Chaco savannah biomes, from the arid north-west to the more humid east. Both Daniel Cáceres and RNNP are in the process of being legally designated, a process that will be completed prior to the commencement of project implementation in 1999.

Daniel Cáceres/ Defensores del Chaco National Parks

Daniel Cáceres is positioned between latitudes 20°30' S. and Longitudes 62°00' W, and Defensores del Chaco between 19°45' S. and 61°10' W. The two sites, which form a single Protected Area complex, are located in the extreme north-western region of Paraguay, and contain a variety of dry ecosystems. The north-western area within Daniel Cáceres is particularly dry, receiving 400 millimetres of rain on average per annum, and facing occasional extended periods of drought. Rainfall increases to wards the East.

The north-western section of Daniel Cáceres has an unusual landscape, containing sizeable dune formations, stabilised by herbs (such as *Elionorus muticus*) and shrubs. This region has a unique vegetation not captured in existing protected areas, including Defensores del Chaco. Immediately east of the dunes, also within Daniel Cáceres is a dry savannah, characterised by an open landscape with trees such as Jacarandá (*Jacaranda cuspidifolia*), quebracho colorado (*Schinopsis balansae*), guatambú (*Aspidosperma pyrifolium*), tipa colorada (*Pterogyne nitens*), aroma negro (*Acacia aroma*), algarrobillo (*Prosopis affinis*), yaguareté nambi (*Maytenus vitis-idaea*) and palo papel (*Cochlospermum salbrucknerii*). Further to the east, there is a transition to a more complex dry forest (with taller trees, reaching a height of 25-30 mts). Dominant species include Quebracho blanco (*Aspidosperma quebracho-blanco*), and samuhú (*Chorisia insignis*), with an abundance of cactaceae (*Stetsonia coryne* and *Cereus stenogonus*). Other trees include palosanto (*Bulnesia sarmientoi*) and labón (*Tabebuia nodosa*). Defensores del Chaco NP includes a mix of Red Quebracho Thornscrub, Palosantal-Labonal Forest, Gallery Forests, Saline Bushes and Humid savannah.

The wildlife list for the area is impressive, and includes Guanaco (*Lama guanacoe*), Puma (*Felis concolor*), Geoffrey's Cat (*Felis geoffroyi*), Ocelot (*Felis pardalis*), Jaguarundi (*Felis jagouarundi*), Jaguar (*Panthera onca*), Hog-nosed Skunk (*Conepatus chinga*), Brazilian Tapir (*Tapirus terrestris*), Tamandúa (*Tamandua tetradactyla*), Capybara (*Hydrochoerus hydrochaeris*), White-lipped Peccary (*Tayassu pecari*), Collared Peccary (*Tayassu tajacu*), Chacoan Peccary (*Catagonus wagneri* – a species that until 1975 was believed to be extinct), Nine Banded Long-nosed and Yellow Armadillos (*Dasypus novemcinctus* and *Euphractus sexcinctus*), Giant Armadillo (*Priodontes maximus*), and Night Monkey (*Aotus azarae*). The density of large mammals is particularly high in the dry forest areas (Kato and Torres, 1997), recent surveys pointing to abundant evidence (scats, sightings and tracks) of Jaguars, Pumas and various species of ungulates.

The birdlist includes the King Vulture (*Sarcoramphus papa*), Greater Rhea (*Rhea americana*), Turquoise-fronted Amazon (*Amazona aestiva*), Jabirú (*Jabiru micteria*), Charata or Chaco Chachalaca (*Ortallia canicollis*). Although very limited bird inventory work has been done in the Park, available evidence points towards an area with a unique assemblage of species (Rob Clay, Guyra Paraguay, pers comm.). Reptiles include Cascabel (*Crotalus durissus*), Broad-snouted Caiman (*Caiman latirostris*), Tejú Guazú (*Tupinambis teguixin*) and turtles such as *Carbonaria chacoensis*.

Río Negro National Park

This park, (Latitude: 19°55' S. Longitude: 58°35' W), which is in the process of being legally established, is one of the most outstanding in Paraguay – containing as it does transitional ecosystems between the Chaco Savannah and Pantanal. Forest cover includes types associated with the Chaco savannahs with species such as Quebracho blanco (*Aspidosperma quebracho-blanco*), samuhú (*Chorisia insignis*), and cactaceae. Common shrubs are duraznillo (*Ruprechtia triflora*), at least four species of *Capparis* spp. and bouganvilla. Also found are mistol (*Ziziphus mistol*), palo santo (*Bulnesia sarmientoi*), labón (*Tabebuia nodosa*), algarrobillos (*Prosopis* spp) and guayacán (*Caesalpineia* sp). The transitional zone is dominated by species such as quebracho colorado (*Schinopsis balansae*), ivirá itá (*Astronium fraxinifolium*), palo blanco (*Callycophyllum multiflorum*), and labón (*Tabebuia nodosa*) giving way, to the east, to large extensions of Palm forest with Karanda (*Copernicia alba*), and various species of algarrobos or algarrobillos (*Prosopis* sp., *Prosopis nigra* and *Prosopis affinis*). In the extreme east, these palm forests are intermixed with seasonally flooded grasslands.

The Pantanal area forms part of an important flyway/ stopover site for some 32 species of migratory birds. The bird list includes species such as Jabiru Stork, (*Jabiru mycteria*),

Taguató (*Rosthramus sociabilis*), Hyacinth Macaw (*Anodorhynchus hyacinthinus*), Osprey (*Pandion haliaetus*), and hummingbirds like *Eupetomena macroura*. The area supports large populations of Spectacled Caiman, (*Caiman crocodilus*), Broad-snouted Caiman (*Caiman latirostris*), Capybaras (*Hydrochoerus hydrochaeris*), and Southern Otter (*Lutra longicaudis*). The threatened Maned Wolf (*Chrysocyon brachyurus*) and Marsh Deer (*Blastocerus dichotomus*) inhabit grasslands along the riverbanks. Other mammals include the White Marmoset (*Callithrix argentata*), Duski Titi monkey (*Callicebus moloch*), Night Monkey (*Aotus trivirgatus*), Giant Anteater (*Myrmecophaga tridactyla*), Armadillo (*Dasypus novemcinctus*), Agouti (*Dasyprocta punctata*), Pampas Fox (*Dusycion gymnocercus*), Hog-nosed Skunk (*Conepatus chinga*), Tayra (*Eira barbara*), Jaguar (*Panthera onca*), Brazilian Tapir (*Tapirus terrestris*), Puma (*Felis concolor*), and Gray Brocket Deer (*Mazama gouazoubira*).

Final Comments

Dinerstein lists the Chaco Savannah, Cerrado, Pantanal and IAF as being of the highest conservation priority. A fifth eco-region, that of the humid Chaco is listed as being important for conservation at a national scale, and is consequently not included within the scope of this project. [The humid Chaco covers a large area in the central and south portion of the Occidental region, and the south-west section of the Paraguayan Orient.

Annex VI: Root Causes Annex

1. Interior Atlantic Forest: San Rafael National Park:

1.1 Located mainly in Itapúa Province (total area 16,525 square kilometres), with the northern extremity lying in Caazapá Province, this park comprises the largest remaining block of Interior Atlantic Forest in Paraguay. This eco-region is the most threatened in Paraguay, facing a motley of pressures ranging from agricultural production, logging, extraction of minor forest products, including medicinal plants, and hunting. The population of Itapúa Province presently stands at 376,000 (9.1 % of the total for Paraguay), giving a density per square kilometre of 22.7. Some 25,000 people live in the area immediately surrounding the Park. Farms include a mix of smallholder plots and large and medium-sized landholdings. Soya production predominates, with some grains and food crops also being cultivated. The eco-region faces a large in migration of Brazilian farmers, cultivating mainly medium-sized plots. Land prices are relatively high, but the soil and climatic conditions are ideal for agriculture, fuelling the process of land cover conversion.

1.2 Some 85% of the Paraguayan Interior Atlantic Forest has already been cleared, leaving small pockets of forest in mainly hilly areas. This situation accentuates the conservation value of San Rafael Park. But it faces pressures from encroachment. Subsistence hunting is a growing problem, particularly of small mammals and birds, commercial hunting for the trade in wildlife (particularly of Parrots) is widespread, and the harvest of rare flora, including orchids, medicinal and ornamental plants is also damaging. Illegal logging is also a problem, and needs to be urgently curtailed. Some 480 Mbya Amerindians live in the environs of the Park. This community hunts within the Park for subsistence and harvests forest products, including medicinal plants and firewood. By themselves, pressures from the community are minimal, but they contribute to the conjunction effect of threats. A final problem is that there is an almost total lack of integration of conservation into agricultural activities in areas buffering the Park. A corridor between the Park and Caaguazú PA in the north-west needs to be maintained to foreclose genetic insularisation.

1.3 In common with the other project sites, management at San Rafael National Park is limited. A holistic set of interventions – as would be effected through this project– are urgently required to stem pressures. Opportunities exist to stem the process of colonisation with prompt action and the engagement of communities, particularly Amerindian groups in the planning and execution of conservation measures. The lack of field staff at the site means that policing is perfunctory; the placement of staff, construction of infrastructure, and provision of equipment constitute urgent needs.

2. Cerrado: Paso Bravo National Park:

2.1 There has been very limited attention paid in Paraguay and neighbouring Brazil, to the conservation of the Cerrado ecosystems (see Collar et al. 1992). The natural cerrados of Southern Brazil, Paraguay and Northern Argentina rank amongst the 7 most critical conservation priorities in the neotropics (Kelsey, 1991). Whilst the Cerrado eco-region in the area surrounding Paso Bravo NP remains relatively intact, in neighbouring Brazil, less than 5% of the biome remained intact by 1988 (Cavalcanti, 1988). A large number of species endemic to this region have been extirpated in large parts of their former ranges (Collar et al. 1992). Much of the disturbance has occurred within the past thirty years,

with land being converted to cattle ranches and permanent agriculture (mainly soya cultivation). Few Protected Areas exist in the region (less than 1.5% of the Brazilian Cerrado has been accorded protection.) Unfortunately, data on the extent of Cerrado destruction are not available for Paraguay, but the ecosystem, particularly in its southern reaches, faces similar threats to those prevailing in Brazil. The Paso Bravo area comprises one of the largest intact samples of Cerrado globally, underscoring its global significance.

2.2 At an eco-regional level, the establishment of large ranches has increased competition between wildlife and cattle. It has also tended to result in the introduction of exotic grasses as improved fodder, at the expense of native species. In addition, charcoal production in Brazil poses a direct threat to ecosystem integrity, resulting in the clearance of large swathes of land (this situation may come to prevail in Paraguay). There is a general paucity of information on the biodiversity of the region, and the impacts of anthropogenic activities on wildlife have been poorly chronicled, complicating the design and execution of management measures.

2.3 Paso Bravo NP is located in Concepción Province, just East of the Paraguay River, and south of the Rio Apa (one of the principal tributaries of the Paraguay River). The Province has a total population of 166,946, with an area of 18,051 square kilometres and a population density of 9.24 individuals per square kilometre. 70% of the population is located in the southern portion of the Province. The nearest township to the Park, San Carlos, has a population of just 2,000 people. In the longer term, anthropogenic pressures will increase as the region to the East of the Park is settled. There is a need to secure Park boundaries and institute basic conservation measures to ensure the ecological integrity of the Park does not suffer. Limited hunting currently occurs, mainly of Caimans for commercial purposes. A small Protected Area (San Luis NP) has been established southwest of the Park, and spatial planning and management efforts need to be geared towards establishing a biological corridor between the two reserves.

3. Chaco/Pantanal Ecotone: Río Negro National Park:

3.1 Created to protect the globally unique transition between the Chaco and Pantanal eco-regions, this Park lies in the Northeastern tip of the country in Alto Paraguay province (the province occupies an area of approximately 84,349 square kilometres). The province supports a population of 11,816, equating to a density per square kilometre of only 0.14. Anthropogenic activities are mainly concentrated in the East Central section of the province, along the Paraguay River, surrounding the township of Fuerte Olimpo (some 100 kilometres south of the Park). Populations of the indigenous Chamacoco people inhabit the township of Behía Negra (total population of 315), located just south of the Park. Limited road infrastructure currently exists, and access to the region is mainly by boat along the Paraguay River, or by air. There is an influx of Brazilian settlers into the region, working ranches under contract or working on large Estancias.

3.2 This eco-region receives annual rainfall of some 1,400 millimetres per year, making it more productive than the dry Chaco for agriculture and livestock ranching. As the case with the Dry Chaco and Cerrado eco-regions in Paraguay, threats to biological diversity have historically been low. However, anthropogenic pressures in this region are changing more rapidly than in the other two eco-regions, with the development of cattle ranching and cassava farms. This development is occurring in an ad hoc manner, with limited regard to conservation values. Park establishment is needed to foreclose land use conversion within remaining wilderness areas. In order to purchase public lands, developers are compelled to register a cattle brand, or prepare an agricultural development plan, basically circumscribing land use to livestock production and/or agriculture. There is an urgent need to address this policy failure, to ensure that conservation values are not forfeited, and encourage sustainable uses of biodiversity.

3.3 Hunting is a growing problem, mainly for subsistence, though evidence exists that commercial hunting is also occurring (particularly of Caimans). In addition, hunting of Jaguars and Pumas is widespread, a situation that if allowed to prevail, would result in the longer-term in the localised extirpation of these species. Ranch owners exercise only limited control over hunting on their lands, and are also culpable. There is a lack of enforcement of conservation regulations, presently owing to the fact that DPNVS/MAG lacks a presence in the region.

4. Chaco Savannah: Daniel Cáceres/ Defensores del Chaco National Parks:

4.1 This Protected Area complex lies in the sparsely settled Paraguayan frontier region, and is spatially separated from most current development activities. The current threats to biological diversity are of a low order of magnitude. The Parks lie within Boquerón and Alto Paraguay Provinces, which cover an area of 91,669 and 84,349 square kilometres respectively but supports only a tiny fraction of Paraguay's total population. Population density is very low in the vicinity of the Parks, populations being concentrated in the south and central sections of the Chaco, 150-180 kilometres south of the southern boundary of the site. The PA complex lies in a low rainfall area, and is highly vulnerable to disturbance. Indications are that threats are likely to escalate over the longer-term, as natural systems in settled areas are degraded, causing the ecological frontier to shift. An opportunity exists to bring the area under active conservation management before damage is inflicted, protecting a representative sample of the unique ecosystems of the dry Chaco. Operationalisation of Dániel Cáceres and strengthening of management in Defensores del Chaco would create a unique Protected Areas complex, covering an ecological transect from the very dry Chaco to more humid areas– the only one of its kind globally.

4.2 The lack of economic infrastructure in the region has heretofore limited access to the Parks. But this situation is set to change. The Government plans to improve existing roads in the Province, including paving of the Pan American highway, which passes south of the Parks. Plans are presently afoot to establish an Inter-oceanic Highway, which would cut across the Chaco from West to East, running north of the site. Traffic along these roads would likely consist mainly of large cargo trucks, with limited passenger vehicles.

4.3 At the present time, some hunting for subsistence purposes occurs within the Parks. Though little data exists regarding the impacts of such hunting, the limited empirical information that does exist suggests that harvests occur within the carrying capacity of most species. But infrastructural development could change the status quo. In addition, several large cattle ranches have been established immediately south of the site. Though the arid conditions imply that the area is of marginal value for livestock ranching, park establishment is needed to foreclose further allocation of wildlands to ranching. Baseline interventions aim at improving livelihoods in the region. These need to be accompanied by measures to protect important habitats and migration routes on private lands.

Table 1 provides a summary of the main threats to biodiversity in the four parks. The first column articulates the root causes mediating each threat, and the second describes how the project will address each threat. The four parks are coded as follows:

Site A: SRNP San Rafael National Park
Site B: PBNP Paso Bravo National Park

Site C: RNNP: Río Negro National Park
Site D: DDNP: Daniel Cáceres/ Defensores del Chaco National Parks

An estimate of the order of magnitude of each proximate threat and root cause is given, with 0 designating no apparent influence, 1 a low influence, 2 a medium one and 3 a high one.

Table 1: Threats, Root Causes & Proposed Actions

Root Causes of Threat	Proposed Actions
Proximate Threat : Habitat degradation due to livestock rearing and progressive expansion of the agricultural frontier. These threats are greatest in SRNP, and to a lesser extent in RNNP. Though not presently significant at the other sites, they pose a long term risk.	
<ul style="list-style-type: none"> ♦ For all intents and purposes, the four sites lack field implementation of basic conservation functions; though boundaries have been established, they need to be formalised. The lack of policing and penalisation for malfeasance provides little disincentive against potential encroachment [SRNP: 3, PBNP: 2; RNNP:2; DDNP:2]. ♦ Agriculture and livestock practices do not take conservation needs into account; in SRNP and RNNP, extensification of cultivation is a problem. In the Chaco/ Chaco Pantanal and Cerrado, the danger comes from intensification of livestock ranching. Though there are a number of current and planned baseline initiatives aimed at improving farming systems productivity and livestock husbandry practices, these do not 	<ul style="list-style-type: none"> ⇒ Clarification of boundaries and physical demarcation; operationalisation of Protected Area operations, including the establishment and enforcement of site specific regulations under the framework of detailed Management and Operational Plans. linkages with law enforcement agencies to control unauthorised activity; establish participatory management regime to involve local communities in conservation planning and management. Establish a monitoring system to gauge impacts of land use for management purposes. ⇒ Encouragement of more ecologically rational land use allocation and use (protecting key habitats and corridors on private land) in buffers. This will include integration of park management objectives into regional development planning. In SRNP and RNNP, baseline programmes would seek to intensify agriculture in a sustainable manner. In the Chaco, steps would be taken to maintain biodiversity on farms and ranches through spatial planning and the development of incentives. A review of agricultural/ livestock policies as they relate to sectoral biodiversity impacts will be undertaken with the

Root Causes of Threat	Proposed Actions
<p>account for conservation needs in ecologically sensitive areas, such as park buffers. Weak spatial planning has resulted in the absence of integration of conservation objectives into agriculture/livestock activities. (SRNP:3; PBNP:1 ; RNNP :3, DDNP: 2]</p> <ul style="list-style-type: none"> ◆ The institute for public lands (IBR) requires registration for livestock rearing and/or agriculture as a prerequisite for the sale of public lands. Environmental mitigation plans make little provision for biodiversity protection. This serves to encourage ecologically destructive activities and discourage more conservation compatible land uses, including a reduction in stocking levels, the development of eco-tourism, and game ranching. (SRNP:0; PBNP: 1; RNNP : 3, DDNP: 1]; Weak institutional co-ordination between government agencies may result in landless peasants being encouraged to settle in buffer zones. (SRNP:3; PBNP: 1; RNNP : 1, DDNP: 1] ◆ Alternative income earning opportunities are limited, with little understanding of options, consequently there is a high dependence of the local economy on traditional agricultural and cattle rearing activities. (SRNP:3 PBNP: 1; RNNP : 2, DDNP: 1] ◆ Awareness of the adverse systems feedbacks on biodiversity of ecologically deleterious agriculture/ livestock practices is very limited; resource managers lack an understanding of the linkages between ecology and economy . (SRNP:3; PBNP: 3; RNNP : 3, DDNP: 3] ◆ Development of roads threatens to exacerbate the above-mentioned problems. Though environmental mitigation activities 	<p>objective of identifying avenues for policy reform and creation of appropriate incentives measures.</p> <p>⇒ Establishment and execution of requirements for mitigating adverse impacts on biodiversity on land abutting the Parks. Awareness raising at the national level regarding sustainable use options. Sensitising IBR Staff to opportunities for sustainable development of public lands. Raise awareness amongst decision-makers regarding the impacts of land settlement on conservation objectives.</p> <p>⇒ Identify options for sustainable use (eco-tourism and sports hunting) in designated buffer areas, including supply and demand side determinants of feasibility; Raise awareness of options amongst local entrepreneurs, agricultural extension services and credit institutions; promote information exchange between landowners and community leaders and successful eco-businesses in other countries.</p> <p>⇒ Awareness raising activities targeted at decision-makers, local communities and large landowners, and the wider public regarding natural capital values, (including functions such as soil nutrient replenishment, natural pest control, and crop pollination) and systems linkages between conservation and agricultural sector activities.</p> <p>⇒ Integration of infrastructural planning with conservation activities, with strengthening of co-ordination mechanisms between the Ministry of Public Works and DPNVS/MAG. Safeguarding areas that would otherwise face degradation through parks strengthening</p>

Root Causes of Threat	Proposed Actions
<p>are included in infrastructure projects, little holistic planning has occurred at a landscape level. Active park management is currently lacking to deal with emergent threats. (SRNP:2; PBNP: 2; RNNP : 2, DDNP: 2].</p>	
<p>Threat: Reduction in wildlife numbers due to over hunting for subsistence needs (ungulates, capybaras, agouti, javelinas, alligators) This threat is most acute in the Interior Atlantic Forest; in the other eco-regions, the problem is considered to be less serious, but empirical data on the impacts of hunting on population dynamics of target species is lacking. This threat is expected to increase as economic infrastructure is developed and access to remote areas is improved.</p>	
<ul style="list-style-type: none"> ◆ Poor control and management by government in National Parks results in open-access regime. This in turn is causing over-exploitation of wildlife resources. (SRNP:3; PBNP: 1; RNNP : 2, DDNP: 2]. ◆ Information on sustainable yields is lacking, and monitoring of harvest levels and population trends is inadequate. (SRNP:3; PBNP: 3; RNNP : 3, DDNP: 3]. ◆ Indigenous communities inhabiting the parks and buffers (who depend on game meat and animal by products for subsistence) lack formal usufruct rights, providing little incentive for self regulation of harvest levels. (SRNP:3; PBNP: 1; RNNP : 2, DDNP: 2]. ◆ Uncontrolled hunting by temporary residents such as military personnel and State workers. (SRNP:0; PBNP: 1; RNNP : 3, DDNP: 2]. 	<ul style="list-style-type: none"> ⇒ Improve planning and enforcement capacity of Protected Areas authorities to stem hunting pressures within core PAs , and develop monitoring framework to assess response to management interventions. ⇒ Collect information on hunting trends and conduct targeted research into impacts on species populations. Develop a management plan for the control of hunting, with mechanisms for involving local communities in management. Strengthen the capacity of community-based organisations to engage in hunting management. ⇒ Investigate feasibility of formalising usufruct rights for indigenous groups as an incentive for self-regulation and control of resource access. ⇒ Impart conservation values through awareness and advocacy to a wide range of civil society and decision-makers (including within the military). Strengthen law enforcement.

Root Causes of Threat	Proposed Actions
<p>Threat: Reduction in wildlife numbers due to over hunting for commercial purposes (hunting of ungulates, armadillos, peccaries, alligators, cats; and live trapping of monkeys, parrots, reptiles, birds). Ungulates, peccaries and armadillos are hunted for meat, for sale in Paraguay. Monkeys, parrots, reptiles, cats and alligators are hunted for the external trade in wildlife. The threat is most acute in San Rafael, and exists to a lesser extent in Río Negro (including of Caimans). The difficulty of access to the Chaco and Cerrado has attenuated pressures, at least for the time being. There is a tradition of hunting in frontier regions, but information on the extent of such activities is limited.</p>	
<ul style="list-style-type: none"> ◆ As is the case for subsistence hunting, weak management by conservation authorities contributes to an open access problem., leading to over-exploitation. Local communities have little incentive to control access to the parks by outsiders, and see little reward in controlling their own behaviour. (SRNP: 3; PBNP: 1; RNNP : 3, DDNP: 2]. ◆ Lack of information and intelligence of the extent of the wildlife trade, both internally and to markets overseas. Understanding of the determinants of trade is very limited. (SRNP: 3; PBNP: 3; RNNP : 3, DDNP: 3]. ◆ The Government has established a CITES unit to monitor and control legal access to wild resources; however linkages between this unit and border control authorities is very weak. (SRNP:3; PBNP: 3; RNNP : 3, DDNP: 3]. ◆ Cultural practice of 'Sport Hunting' by visitors from Asunción and other towns for trophy values. (SRNP: 2; PBNP: 1; RNNP : 2, DDNP: 2]. 	<ul style="list-style-type: none"> ⇒ Improve planning and enforcement capacity of Protected Area authorities to stem commercial hunting pressures. Develop a participatory management regime to encourage community involvement in law enforcement efforts, and build local intelligence networks to alert authorities to illicit hunting. Encourage mitigative action by raising awareness of the problem. ⇒ Provide resources for investigating the determinants of the problem and market chains, identifying cost-effective options for control. ⇒ Build linkages with and provide appropriate training to law enforcement personnel and customs officers to control illegal hunting and trade. Review penalty structures for malfeasance, and strengthen these if appropriate. Create awareness of the problem at the national level, and develop interpretation materials for display at border posts and airports. Strengthen trans-boundary co-operation with neighbouring countries to control trade. ⇒ Review the feasibility of establishing local sport hunting industries in designated sites as a sustainable use measure; involve local communities and indigenous groups in the control of access to the Parks and improve overall policing of Protected Area regulations.

Root Causes of Threat	Proposed Actions
Threat : Habitat loss due to charcoal production and firewood collection: Charcoal production is a threat in the Brazilian Cerrdao, and may later be an issue in the Paso Bravo area. It also occurs in the humid Chaco, and poses a potential future threat at Río Negro and the Daniel Caceros/Defensores del Chaco complex. The same holds true for firewood collection. Indigenous communities collect firewood in SRNP, but information on the intensity of use is lacking.	
<ul style="list-style-type: none"> ♦ Lack of preparation to deal with these threats in the Chaco and Cerrado eco-regions. (SRNP:2; PBNP: 2; RNNP : 2, DDNP: 2]. ♦ Lack of information and management measures in SRNP to ensure that production does not outpace the natural regenerative capacity of the forest. (SRNP:3]. 	<ul style="list-style-type: none"> ⇒ Awareness building at regional and national level of the ecological fragility of dry ecosystems, and development of anticipatory control measures as part of the Park Management Plans. ⇒ Investigation of fuelwood use trends and management of collection, with community participation, to ensure use does not lead to forest degradation. Maintain a watching brief on trends.
Threat: Potential visitor damages in Protected Areas: Again this is a potential future problem ,as road infrastructure development improves access to the parks. Substantial potential exists to develop tourism to Paraguay's wild areas, focused on national, regional and in the longer-term, international markets. But little capacity exists to deal with the threats posed by visitation.	
<ul style="list-style-type: none"> ♦ Planned road development will improve access to Protected Areas and will therefore increase the number of visitors. (SRNP:2; PBNP: 2; RNNP : 3, DDNP: 3]. 	<ul style="list-style-type: none"> ⇒ Development and operation of visitor management strategy in the operational plans of each PA. Train Protected Area staff in visitor management,
Threat: Habitat disturbance and loss due to illegal timber extraction: This threat presently only exists in SRNP, where timber extraction is presently unchecked.	
<ul style="list-style-type: none"> ♦ Poor monitoring and control of SRNP, and lack of implementation of forestry laws (that prohibit access) is leading to extraction of high valued timber species by private entrepreneurs. Indigenous communities living within the park lack a utilitarian incentive to control access. (SRNP:3]. 	<ul style="list-style-type: none"> ⇒ Enforcement of park regulations, with promotion of community involvement in controlling access to forest resources; awareness building at the community level of ecological importance and benefits of forests ; strengthen PAs regulations to check malfeasance and build linkages with law enforcement agencies. Sensitise decision-makers to the needs of Protected Areas and opportunities for conservation.

Root Causes of Threat	Proposed Actions
Threat : Over-extraction of flora (Orchids, bromeliads, medicinal plants). This problem is currently mainly a problem in SRNP, through future trade is unique species in the other eco-regions may increase, as species become more well known in the trade.	
<ul style="list-style-type: none"> ◆ Open-access is leading to depletion of wild floral resources (SRNP:3). ◆ Information barriers exist to the implementation of sustainable management and use paradigms (SRNP: 3). ◆ Understanding of use opportunities in the other eco-regions is very limited, and managers are little prepared to address threats as they arise. (PBNP: 1; RNNP : 2, DDNP: 2]. 	<ul style="list-style-type: none"> ⇒ Improve enforcement capacity to stem collection pressures within core Protected Areas and clarify usufruct rights for indigenous groups as a management measure. Improve understanding amongst customs officials of issues relating to the trade in endangered plant species. Review and strengthen the law regulating harvests, and raise awareness amongst stakeholders of the provisions of the law. ⇒ Demonstration of viable sustainable use models (focusing on eco-tourism and medicinal plants). Support removal of barriers to sustainable use; conduct site-specific trials of management methods and document the results. ⇒ Investigate potential use opportunities, and document harvest trends as a basis for determining management needs.

Annex VII: Project Co-ordination and Implementation Arrangements

1. **Execution and Implementation Arrangements:** The Project would be executed by the Government of Paraguay, with overall responsibilities for execution vested with the Ministry of Agriculture and Livestock. The National Parks and Wildlife Directorate (DPNVS/MAG) under the Secretariat for Natural Resources and Environment (SSERNMA) will implement the Project with partner NGO's, and local community participation. In order to ensure a joint programming of GEF interventions with parallel initiatives, formal and informal inter-agency linkages will be maintained; most baseline programmes are being executed by the same Ministry, SSERNMA/MAG. In addition, technical appraisal workshops will be established, in order to appraise project impacts, share results, and exchange data.
2. **Steering Committee:** A Project Steering Committee will be established at the national level to provide guidance to the project and monitor progress and performance. The PSC will facilitate inter-agency co-ordination and work to integrate the lessons learned from implementation of the project into other programmes. The Committee will include representatives from: SSERNMA, UNDP/Paraguay, Ministry of Foreign Affairs, Technical Secretariat for Planning, Governors from Itapúa, Caazapá, Concepción, Alto Paraguay and Boquerón Departments, Local Producers, Indigenous Communities, Women Representatives and Conservation NGO's.
3. **Public Participation in Site Management:** A multi-stakeholder Parks Management Committee will be constituted at each of the 4 sites. Extensive preparations have been made to facilitate stakeholder involvement during the design phase (PDF B). Stake holders include: local farmers and ranchers (represented by farming and livestock associations) plus representatives of indigenous groups. These groups are on the whole well organised, with appointed community leaders and spokesmen.
4. The project would foster stakeholder participation in the determination of Management Objectives, preparation and implementation of Master Plans in the four PAs, preparation of micro-plans, zoning of areas for multiple uses, and activity implementation. This will, as a first step, involve the use of participatory assessment tools, such as participatory rural appraisal, and social mobilisation approaches to identify and map local resources plus identify barriers to community involvement in conservation.
5. The respective Management Plans would clearly delineate responsibilities for implementation by stakeholder group. Park regulations will be established, including a schedule of sanctions. The possibility of stakeholder self-enforcement of regulations will be explored, as a complement to formal law enforcement.
6. Procedures for participatory monitoring and evaluation will be established, describing the process, methods and periodicity of monitoring activities (which will cover operational as well as impact monitoring aspects).
7. Training would be provided to Committee Members and Parks personnel in conflict management, providing a basis for local level resolution of disputes. Training needs for community actors will also be identified at an early stage, with appropriate training modules and materials designed to suit local needs and circumstances.
8. Extensive consultations were undertaken through the formulation of this project

with Paraguay's NGO community. NGO's will be represented on the PSC, as well as on the Parks Management Boards. They will also take responsibility for the implementation of awareness and advocacy activities, supporting demonstrations of sustainable use, and backstopping the community outreach activities of DPNVS/MAG. NGO staff will also benefit from training, serving to enhance institutional capacities in the conservation arena.

9. **Buffer Area Management Structures:** There is no simple modus operandi for the establishment of a Management framework for Park buffers. An iterative process will be effected to identify options and review constraints involving stakeholder participation. Major stakeholders to be included in the planning forum include representatives of provincial authorities, the IBR, law enforcement agencies, credit agencies, representatives from producer organisations and landowner groups, and indigenous groups. Detailed stakeholder evaluations will be conducted to further clarify the needs and priorities of different groups, and to ensure that a broad constituency is involved in the initiative.
10. Detailed guidelines for stakeholder participation at all levels will be developed prior to the end of month 3 of implementation, with indicators identified to monitor the quality of participation. There have been few instances of effective public participation in conservation and development initiatives within Paraguay, bar a number of small NGO sponsored programmes. The project would break new ground in establishing and implementing public participation arrangements. A process would be established to foster participation; this would be subject to regular review to facilitate fine-tuning.
11. **Institutional Profiles:** The following table provides a brief description of the functions of the different institutions functioning within the conservation arena. The role of the various entities as regards the execution and implementation of the project, is also described.

Institution	Role in Project
Government Agencies:	
1. The Ministry of Agriculture & Livestock (MAG) executes government policies in the agriculture and livestock sectors. Its functions-- specified in Law No. 81 of 1992-- are broadly defined, and include a mandate for environmental management and conservation of biological diversity. In terms of its organisational structure, MAG operates through three Sub-secretariats: Agriculture, Livestock & Fisheries, and Natural Resources and the Environment (SSERNMA). ♦ Sub-secretariat for Agriculture/MAG: Established in 1989. It is responsible for the implementation and administration of agricultural sector policies. Policy co-ordination with other Sub-secretariat's within the Ministry	⇒ The Ministry will be the national entity responsible for executing the project, accountable to UNDP for the delivery of agreed outputs. ⇒ The sub-secretariats for Agriculture and Livestock/ Fisheries manage a number of baseline interventions that have a bearing on conservation. Both entities would be involved in planning

<p>occurs through the Agricultural Co-ordination Council; there are five Divisions: Agricultural Research, Seeds, Extension, Agrarian Education, and Sanitation.</p> <ul style="list-style-type: none"> ◆ Sub-secretariat for Livestock & Fisheries/MAG – Established in 1989. It develops and implements policies and strategies relating to the livestock and fisheries sectors. There are three divisions, namely, Animal Research and Production, Food Control and Standards for Animal Products, and Animal Husbandry. Internal Policy co-ordination within MAG occurs through the Livestock and Fisheries Co-ordination Council. ◆ Sub-secretariat for Natural Resources and the Environment (SSERNMA): Established in 1989. It encompasses the forestry service, DPNVS/MAG, and the Environmental Management Directorate. SSERNMA is responsible for developing, implementing and administrating plans, programmes and projects as they relate to renewable natural resources and land use management. ◆ The National Forestry Service - Established in 1973, controls and oversees management of forestry resources. It issues permits for harvest, transport, marketing and export of timber. The Service is responsible for implementing the Reforestation Law, and administering incentives and sanctions provided for under the legislation. ◆ Directorate for Environmental Management – Established in 1989, its objectives are to design and supervise plans, programmes and projects for environmental management. ◆ Directorate for National Parks and Wildlife – Established in 1987, the Directorate is responsible for establishing and managing Protected Areas and overseeing the hunting, breeding, and trade in wildlife products. Administration of the System of Protected Areas (SINASIP) is regulated by Law No. 352, 1994, which circumscribes land use activities on both public and private lands. Within DPNVS/MAG, the Conservation Data Centre (established with support from TNC) is responsible for managing biological data. The 	<p>efforts (in buffers) and responsible for the execution of management recommendations. The Co-ordination councils provide an avenue for agricultural/ conservation policy integration at a national level.</p> <p>⇒ SSERNMA will provide a Secretariat for the Project Steering Committee, organising meetings and reporting to the Office of the Minister on major policy and institutional issues.</p> <p>⇒ The Service would be responsible for implementing management recommendations arising from the planning process in buffers. Under Paraguayan Law, the Service is not responsible for forest management within PAs, but controls licensing for timber harvesting in buffer areas.</p> <p>⇒ The Directorate will provide geographic and environmental data for planning, and would regulate development activities outside the parks to ensure congruence with management objectives.</p> <p>⇒ DPNVS/MAG would implement the project together with NGOs and other partner agencies. The Directorate will be the lead agency as regards the execution of conservation policies and strategies, within the parks and their immediate buffers. In addition, the Directorate would chair the Parks Management Committees. The CDC, assisted by the National Museum would co-ordinate biological inventory work at</p>
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National Museum, also within DPNVS/MAG, is responsible for documenting the country's biological diversity and maintaining national collections of fauna and flora.	the project sites.
2. Paraguayan Indigenous Peoples Institute (INDE): Created in 1981 under the umbrella of the National Defence Minister, the Institute is responsible for implementing and upholding Government policies for indigenous peoples. Its functions include the provision of legal and economic assistance to indigenous communities, execution of periodic censuses, and co-ordination of social and economic interventions to improve the livelihoods of indigenous groups.	⇒ INDE would be represented on the Project Steering Committee; DPNVS/MAG would work out a modus operandi for integrating government policies on conservation and indigenous people in the Protected Areas.
3. Lands Institute (IBR): Established as an autonomous agency in 1963, the Institute is responsible for executing the Government's policies on land distribution and agrarian reform. It owns Public lands on behalf of the State, and is responsible for the auction of these properties. The IBR is a member of the Advisory Council of INDE, and is responsible for acquiring land for indigenous peoples.	⇒ The project would work to strengthen linkages between The IBR and DPNVS/MAG, to ensure that the allocation of public lands is in accordance with conservation needs. The Institute would be represented on the PSC.
4. Department Authorities: These are subsidiary to national government, and are responsible for implementation of approved Government policies, under the guidance of central line ministries. Provincial authorities work through local or Municipal governments, which are responsible for the planning and execution of cross-sectoral interventions.	The respective roles and responsibilities of SSERNMA/MAG and Provincial and Municipal authorities as regards the management of resources outside of National Parks and their immediate buffers has yet to be fully clarified by government policy. The Government is committed to a process of administrative decentralisation, which would provide these institutions with a greater stake in the conservation arena. The project would assist the main actors to clarify roles, and strengthen mechanisms for inter-agency collaboration. The Authorities would be represented on the Parks Management Committees.
<p style="text-align: center;">Non-government Agencies</p> <p>[n.b. The specific responsibilities of NGOs in project implementation would be determined once final approvals have been obtained, following due processes established for nationally executed projects. The following analysis articulates the possible roles of different NGOs, though this is not binding.]</p>	
1. Moisés Bertoni Foundation (FMB): The largest Paraguayan conservation NGO, FMB aims at creating and supporting management of a	⇒ FMB would be represented on the PSC, and would play a key role in

<p>network of private reserves. Established in 1988, it complements the work of DPNVS/MAG. In 1991 it created the Mbaracayú Natural Forest Reserve, designating the upper Jejuí River watershed as a buffer. The Reserve's Governing Council includes UNDP, the Government, FMB, The Nature Conservancy, and representatives of the Aché indigenous group. The Nature Conservancy has supported FMB since its establishment, Mbaracayú Reserve being included in its Parks in Peril Programme.</p>	<p>conservation planning. Staff would benefit from training provided through the project. The NGO may also be involved in community outreach and training activities in the parks, as well as in socio-economic process and impact monitoring.</p>
<p>2. Desdelchaco: the Sustainable Development Foundation for the Paraguayan Chaco. This is a recently established NGO, mandated with promoting sustainable development in the Chaco. Desdelchaco will participate in the TNC/USAID funded initiative to strengthen management of the Defensores del Chaco PA..</p>	<p>⇒ This NGO would work with TNC in Defensores del Chaco NP, and would be involved in conservation awareness work, community outreach and planning activities in Río Negro and Daniel Cáceres. It would be invited to sit on the respective Parks Management Committees.</p>
<p>3. Alter Vida: This NGO (established in 1982) promotes community-based natural resource management in the Paraguayan Orient . Activities are organised into 3 programmes, namely : advocating government policy reform, influencing public opinion, and environmental research, training and communications. It runs a radio program, as part of its environmental advocacy activities.</p>	<p>⇒ Altervida has a potential role to play in conservation advocacy work.</p>
<p>4. CECTEC: The Eco-development Studies and Training Centre, works to foster sustainable agriculture by up-skilling high school students from peasant families in the Eastern region (35-40 students are trained each year). It emphasises the use of native plant and tree species as well as the cultivation of medicinal plants.</p>	<p>⇒ The Training Centre (located to the northeast of SRNP in Itapúa province) may be used for workshops and training sessions organised by the project. In addition, the NGO may have a potential role to play in training for sustainable use activities (NTFP's).</p>
<p>5. The Nature Conservancy has been working in Paraguay for nearly two decades, supporting the work of FMB (including fund raising and capacity building activities). TNC has also supported establishment of the CDC within DPNVS/MAG, and has sponsored training activities.</p>	<p>⇒ TNC would help execute biological inventory and monitoring activities in the 4 sites– using local resource people. The agency would also be responsible for implementing park strengthening activities in Defensores del Chaco NP drawing on USAID and internal funds.</p>
<p>6. Paraguay Rural Association: This well established group works as a lobby and advocacy outfit-- promoting the interests of the livestock industry. A number of regional chapters of the Association have been established in both eastern and western</p>	<p>⇒ DPNVS/MAG would consult with the Association in moulding policies and strategies that impact the livestock sector.</p>

<p>Paraguay. An environmental unit has been created to provide members with information on forest and water management issues.</p>	
<p>7. ECOVIDA: Established in 1992 to provide agricultural extension services in the buffer zone of San Rafael National Park. The NGO works through intermediary farmers' committees. It receives some of its funding from the World Bank funded Natural Resources Management project.</p>	<p>⇒ This NGO would work mainly with partner agencies (baseline initiatives) in the buffer zone of SRNP. It would participate in the Planning process, and may be represented on the Parks Management Committee in San Rafael.</p>
<p>8. Two large Producer Associations exist in the buffer to San Rafael, providing a number of support services to members (marketing, distribution, storage, input supply etc.).</p>	<p>⇒ These Associations provide a forum for representing farmers' interests in the planning process within buffer areas.</p>
<p>9. Indigenous Groups: Indigenous communities are organised via a vis different development projects and have well defined leadership and spokespeople. The Paraguayan Indigenous Association is a well-established NGO (formed in 1942) to promote indigenous peoples concerns, provide legal advocacy support, and undertake anthropological work.</p>	<p>⇒ Indigenous groups would play a major role in park management, working with DPNVS/MAG to control access to project areas. Usufruct rights and management responsibilities would be clarified and formalised in the process of implementation. Leaders would be represented on the Parks management Committees.</p>
<p>10. The Association for San Rafael Mountains (PROCOSARA), was created in 1998 by a group of strong conservation advocates, with the aim of supporting conservation in San Rafael National Park.</p> <p>Another NGO -- with links to the Association-- has been formed. Guyra Paraguay would focus on bird conservation in San Rafael-- with formal linkages with the ICPB.</p>	<p>⇒ The Association and Guyra Paraguay provide potentially potent vehicles for biodiversity conservation in SRNP and its environs, and would be represented in the Parks Management Committees. The establishment of the NGO's provides an exciting conservation opportunity, providing an incipient foundation for integrating conservation and development objectives and processes.</p>

Annex XIII: Project Categorisation Sheet

Focal Area Categories					
Biodiversity		Climate Change		International Waters	Ozone Depletion
Conservation ✓		Energy conservation (prod./distribution)		Transboundary Analysis	Monitoring:
in situ ✓	ex situ	ESCO's	Efficient Designs	Strat. Action Plan Development	ODS phase out (Production)
Sustainable Use ✓		Solar:		Freshwater Basin	ODS Phase Out (Consumption)
Benefit-sharing		Biomass:		Marine Ecosystem	Other:
Agrobiodiversity		Wind:		Wetland Habitat	
Trust fund		Hydro:		Ship-based	
Ecotourism ✓		Geothermal:		Toxic Contaminants	
Biosafety		Fuel cells:		GPA Demonstration	
Policy & Legislation ✓		Methane recovery:		Fisheries Protection	
Buffer Zone Dev. ✓		Other:		Global Support:	
b. Categories of General Interest					
Investment		Technical Assistance ✓		Targeted Research	Land Degrad.
Technology Transf.		Small Islands		Info/Awareness ✓	Private Sector ✓
c. Community & NGO Participation					
<i>involvement type</i>	<i>project design</i>	<i>Implementation</i>	<i>info/awareness</i>	<i>consultation</i>	
<i>Names of Communities and NGOs involved</i>	Altervida, CECTEC, FMB PROCASARA TNC; GUYRA Paraguay, Producer and Landowner Associations	TNC Altervida Prodechaco CECTEC, FMB PROCOSARA Indigenous groups	FMB, CECTEC PROCOSARA	TNC National NGOs Producer and landowner Associations	

Annex IX: List of References

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