

6.5 Flora and Vegetation

An investigation of the flora and vegetation existing around the San Borja-Trinidad road section was conducted from February to June 1995. Field work was performed during the rainy and dry seasons.

6.5.1 Methods

(1) Preparation of the Vegetation Map

Two types of vegetation map were prepared in this time. One is an automatical interpretation map of the LANDSAT TM digital data, and the other is a photo-interpretation map of the JERS-1 (Japanese Earth Resources Satellite-1) optical sensor images. Both maps were prepared by referring to Goitia (1988), and the field observation results at limited locations.

a) Automatical interpretation

The specification of the LANDSAT TM data used for a semi-automatical interpretation is as follows:

Path-Row	Acquisition date	Bands combination
1-70	02/Aug./93	Natural color BGR=234
232-70	21/Sep/93	Natural color BGR=234
232-70	24/Jun/93	Natural color BGR=234

A flowchart of the satellite image analysis is shown in Figure 6-5-1.

The LANDSAT TM data obtained from the Remote Sensing Technical Center of Japan is made up of images inclining to the east by about 10 degrees, and have great breccias against the geometric position. Therefore, geometric correction entailed rectifying these differences.

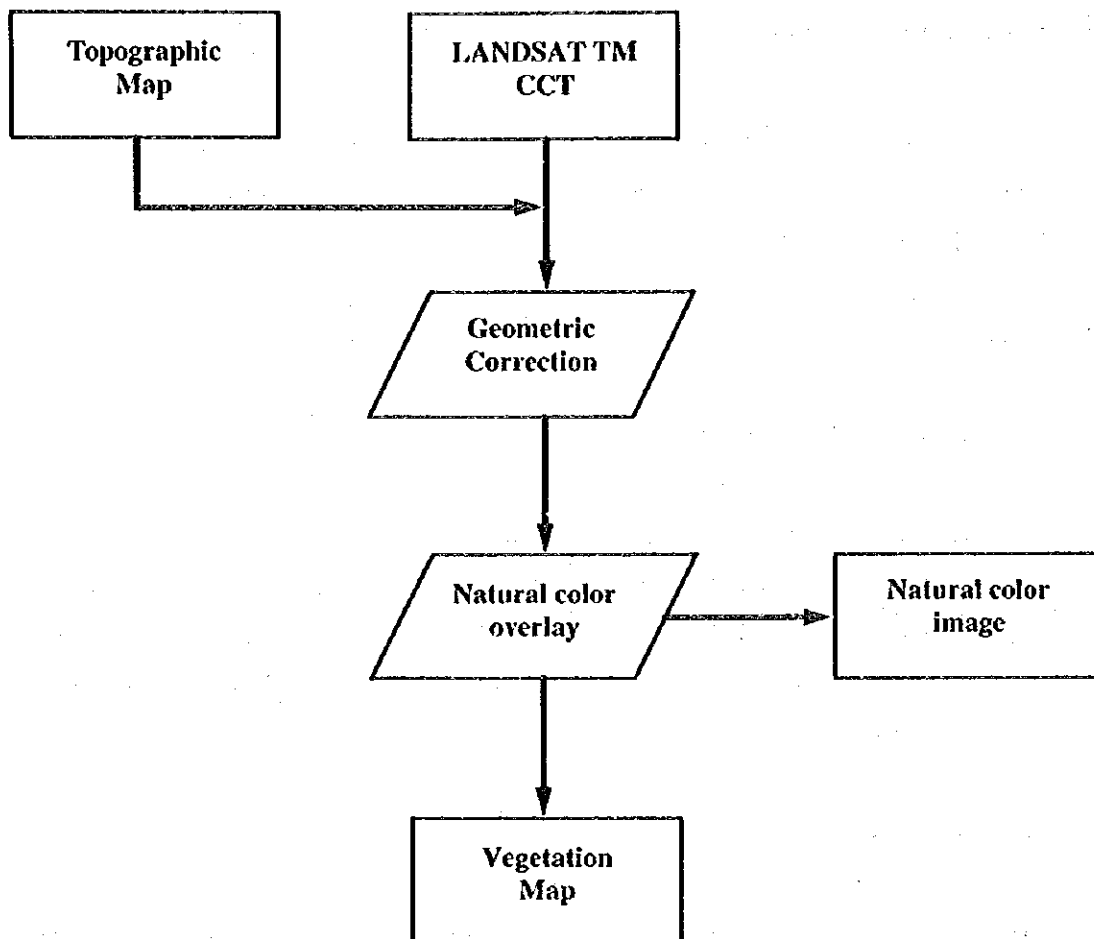


Figure 6-5-1 Flowchart of the Satellite Image Analysis

Geometric correction is a process used to eliminate the deformation of LANDSAT image and to convert the data, so that it can be coordinated with topographic maps. Through this correction, LANDSAT coordinates were converted into topographic coordinates using GCP (Ground Control Points.)

The topography of the area is flat, generally with no big relief. The legend items was determined on the basis of topographic findings. Thereafter, the vegetal land cover was classified. Automatic classification, which is the most common method, was used as the base of classification process. Finally, the vegetation map was elaborated after adding the information obtained by field investigations.

The following vegetation units are used in the vegetation map:

- Marshy vegetation
- Savanna with seasonal floods
- Savanna not flooded
- High plain savanna
- Tropical forest I
- Tropical forest II
- Tropical forest III
- Secondary vegetation
- Lake and rivers

b) Photo-interpretation

The specification of the JERS-1 optical sensor images used for the photo-interpretation is as follows:

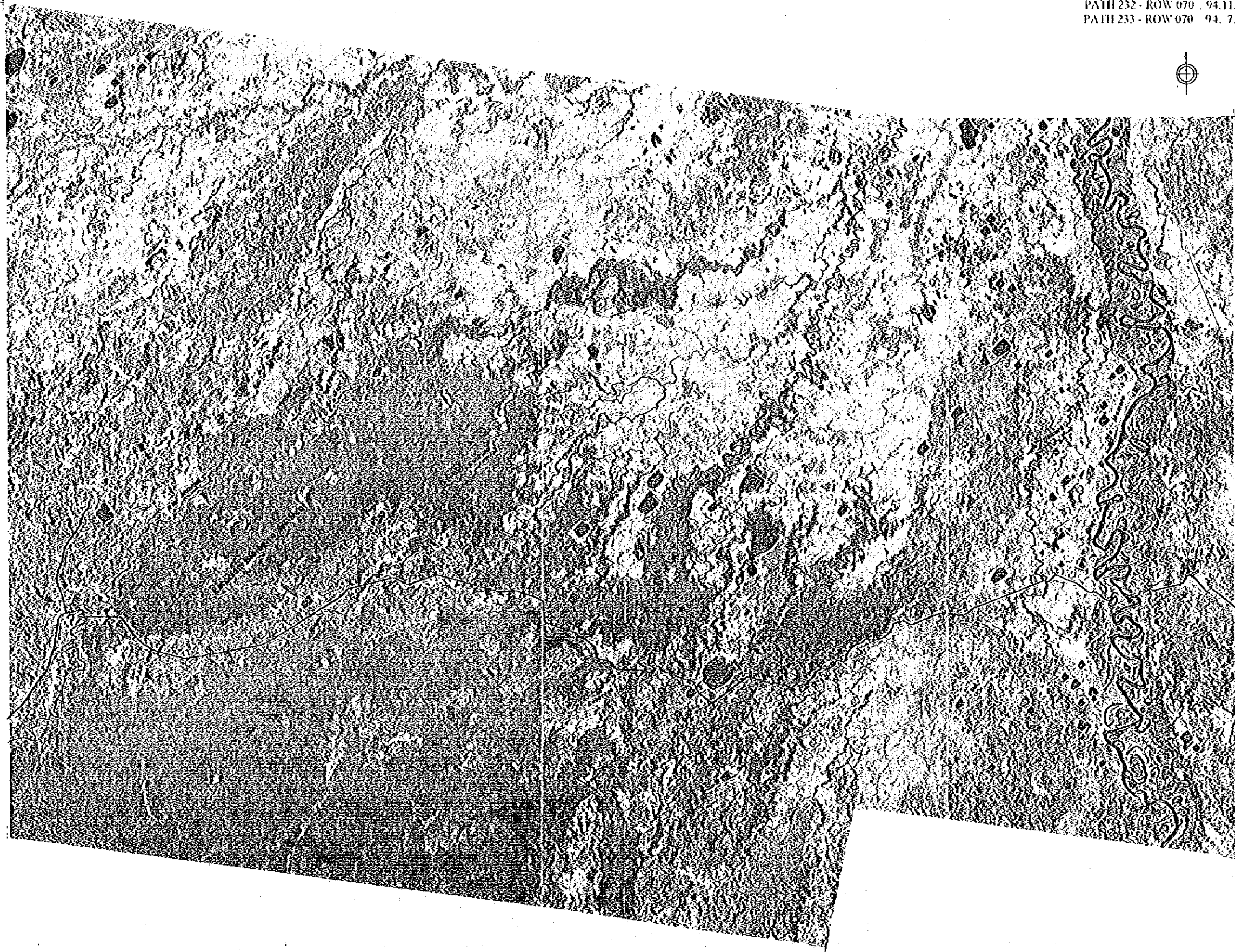
Path-Row	Acquisition date	Bands combination
D419-325	30/Aug/93	False color BGR=123
D419-326	30/Aug/93	False color BGR=123
D419-327	30/Aug/93	False color BGR=123
D419-325	18/Jul/93	False color BGR=123
D419-326	18/Jul/93	False color BGR=123
D419-325	19/Jul/93	False color BGR=123
D419-326	19/Jul/93	False color BGR=123
D419-325	16/Oct/93	False color BGR=123
D419-326	16/Oct/93	False color BGR=123

It has been proven on the field that, despite being classifications based on different sources, the delimitation of some vegetal formations are actually part of transition zonings and are therefore integrated into higher units. For instance, the formation of thickets of *Goitia* (1988) corresponds to transition edges between savannah and forest (e.g. "pampa-woodland").

Likewise, the alluvial plain forest-transitional temporarily subject to flooding, of the same author, corresponds to the alluvial plain forest seasonally flooded and which by its undulated meso-relief is shattered in low parts, where a lower forest and thick forbes are situated.

The vegetation map prepared by a photo-interpretation is shown in Figure 6-5-2.

PATH 232 - ROW 070 - 94.11.11
 PATH 233 - ROW 070 - 94. 7. 3



LEGEND	
	Marshy vegetation
	High plain savannah
	Seasonally flooded savannah
	Savannah
	Tropical forest I
	Tropical forest II
	Tropical forest III
	Secondary vegetation
	Lake and river
	Urban area

Figure 6-5-2 Vegetation Map Around the San Borja-Trinidad Road Section Elaborated by Satellite Image Analysis



Figure 6-5-2 Vegetation Map Around the San Borja-Trinidad Road Section Elaborated by Satellite Image Analysis

(2) Field Investigation

The field work was carried out during a period of 5 to 6 days, both during the rainy season (February 16-22) and the dry season (June 16-21), by traveling and prospecting sites selected from the base map.

According to the established methodology, 8-9 sites were studied for each field work. For open areas (e.g. savannas, swamps, lowlands), 4 m×25 m of lots (area : 100 m², determined in the field) were basically studied, while 10 m×10 m of lots were selected for different zoning of savannas as well as in the transition edges of different type of areas. In the case of forests and closed formations, 400 m long×1 m wide transections were made (area: 400 m².)

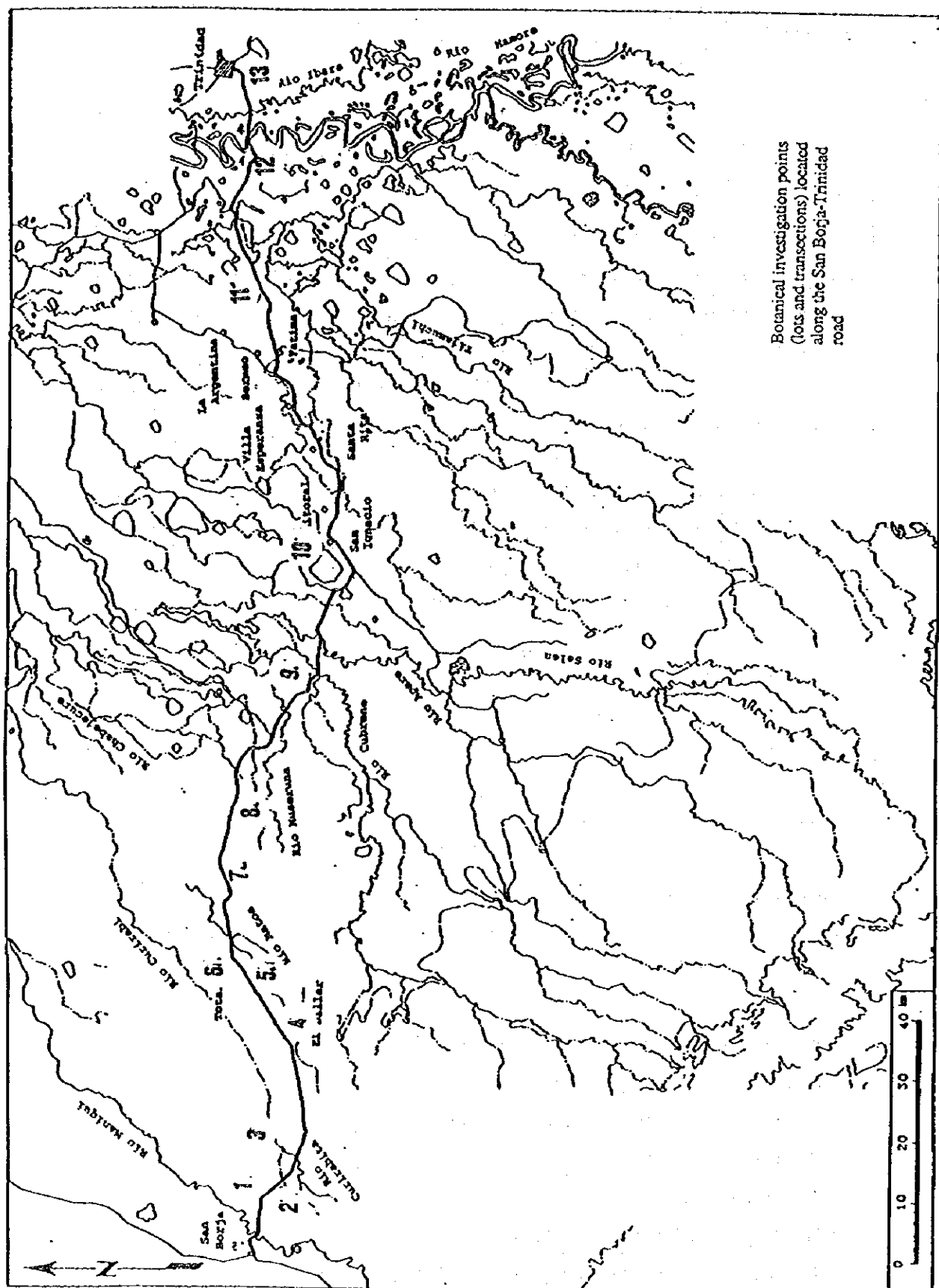
The information obtained was documented in prepared forms, with a botanical exsiccatae, for its corresponding taxonomic determination. In the case of individuals lacking of a botanical collection, their presence was recorded on the form, together with descriptive information related to their formation.

Two forms (Appendix 6.2 [1]) were used to study each site (Figure 6-5-3). These include peculiarity descriptions and details of the floristic composition (specific names, in addition to the information regarding growing features, height, and diameter.)

6.5.2 Major Vegetation Formations

Field checks permitted a better delimitation of recent photographs and an adjustment to the required extension, 50 km on either side of the road. Thus, the final vegetation map was elaborated with the following major vegetation formations:

- A : Well-drained savanna with seasonal floods
- I : Flooded savanna and marshes
- T : Forest of alluvial plain with seasonal floods
- T_B : Fragmented and flooded alluvial forest
- T_G : Gallery forests
- T_I : Forest islands with seasonal floods
- S : Secondary and anthropic vegetation (including crops, pastures, and a secondary forest)



(1) Alluvial Plain Forest and Seasonal Floods (T)

The tropical forests have been change into alluvial plain forest by the seasonal floods. The best preserved examples of such forests can be found at the southwestern part of the Biosphere Reserve-Beni Biological Station, about 12 km from San Borja in the direction of Trinidad. An intensive natural generation process was detected with a high predominance of young and dominating species along the investigated transection. Most of those species, representing the canopy, are in the growing stage, and have diameter of under 5 cm (Figure 6-5-4.)

Field work also showed that through a wide penetration trail, several adult trees of *Calycophyllum brasiliense* ("palo maría") have been cut and extracted from this forest. The most representative species are: *Hura crepitans* ("ochoó"), *Brosimum lactescens*, *Triplaris americana* ("palo diablo", "palo santo"), species of *Lauraceae*, *Guttiferae*, *Hirtella racemosa*, as well as rattan of *Bignoiaceae* and forbes of *Calathea*, and a number of species of *Heliconia* ("patuju.")

(2) Fragmented and Flooded Alluvial Forest (T_B)

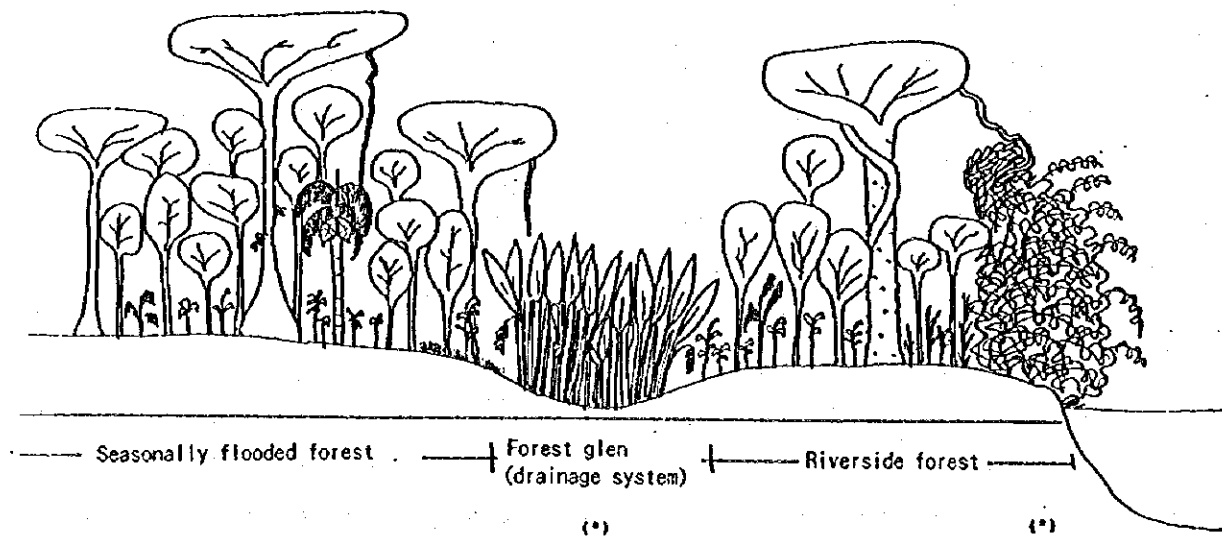
The flooded forest is integrated, including a gallery forest and an alluvial plain forest with seasonal floods, as a lower meso-relief that is also integrated into the drainage system. Its structure is more open and lower where many heliophile species predominate.

(3) Gallery Forest (T_G)

Two types of gallery forests were basically distinguished:

- ① On the Curiraba and Matos Rivers, which have firm and permanent terraces, a forest somewhat different from the alluvial plain forest with seasonal floods has developed, with more flooded forests and grasslands (*Heliconia* spp.)
- ② On the other hand, the physiognomy and floristic pattern of the gallery forest of the Mamoré River are not comparable to similar formations near other rivers, such as those near the Curiraba and Matos Rivers; however, they are comparable to those of riverside forests of the Cuberene and Apere Rivers.

DIAGRAMMATICAL PROFILE : FOREST FORMATION



DIAGRAMMATICAL PROFILE : PLAINS AND OTHER RELATED TRAININGS

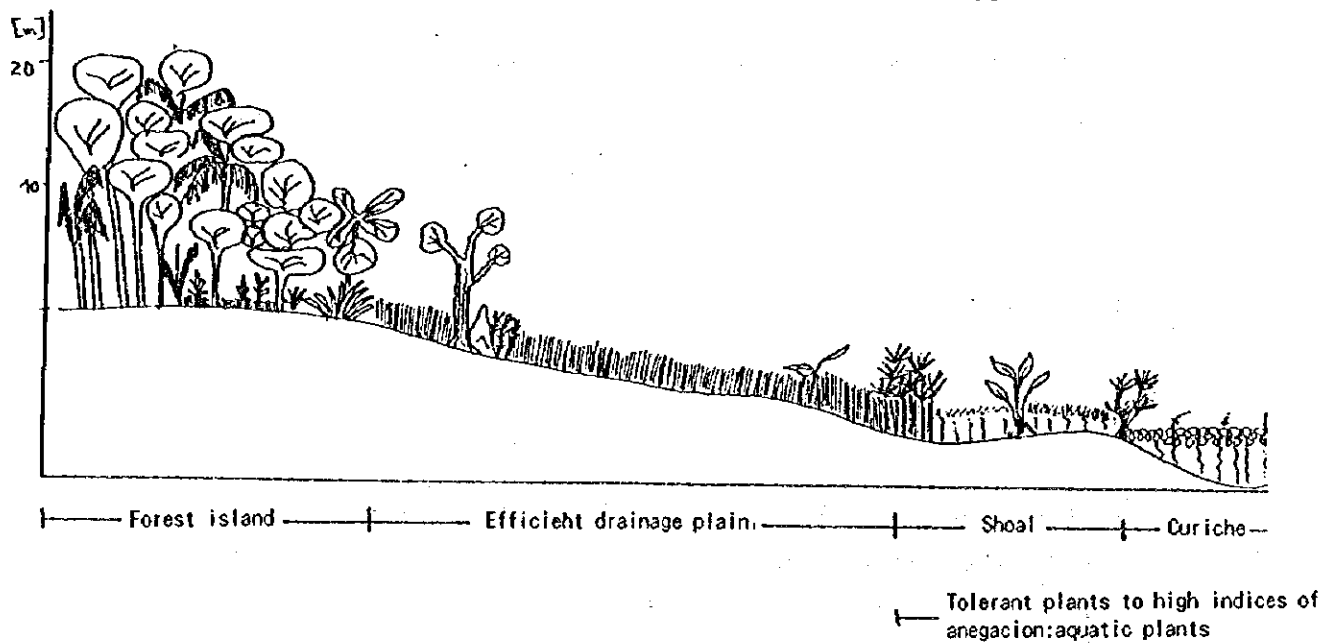


Figure 6-5-4 Schematic Profiles of the Main Vegetation Formations

In a wide area including the two riverbanks, a forest similar to the alluvial plain forest with seasonal floods has developed. However, it has a more advanced successional condition, where many species that mostly adapt themselves to mainland conditions almost do not exist. This structural difference makes this forest a lower forest with a complex mosaic of thickets, pastures and elongated small forest islands related to various water bodies, such as lagoons and abandoned meanders.

In the case of Mamoré River, other formations must be added, such as the willow (*Salix humboldtiana*) and the *Tessaria integrifolia*, typical species of the active gallery forests of the Amazon basin. These formations are located in exposed and very dynamic terraces up to 7 m high, even during the dry season.

(4) Forest Islands (T₁)

These are located in the savanna with seasonal floods and could hardly be discriminated by this field work. However, due to their number in this area and to their frequency, these islands have been physionomically classified as surplus forests of larger macro-formations. The species found in these forest islands are *Attalea phalerata*, several species of *Melochia*, *Syagrus sancona* and a number of *Ilinga* species.

(5) Well-drained Savanna with Seasonal Floods (A)

This is the most representative formation in the area, together with the different types of alluvial forests with seasonal floods. It is characterized by marked hydrodynamics during the rainy season and by efficient drainage due to depressions that remain permanently flooded, such as the ("curiches") swamps. The typical species that can be distinguished in this type of savanna are the following: *Curatella americana*, *Andropogon bicornis*, species of *Panicum* and gramineous.

(6) Flooded Savannas and Wet-lands (I)

Swampy vegetation is included in this type of savanna, which is associated with permanent or seasonal water bodies, lowlands and swamps. These are characterized by transitional zoning (Figure 6-5-4.)

a) Lowland

This is a very important and large aquatic vegetation formation located in the area, which will be influenced by the San Borja-Trinidad road. It is particularly associated with depressions that are close to gallery forests, savannas and swamps. However, it is basically seasonal. It features a number of species of Pontederiaceae, and grasses such as *Paspalum Hymenachne amplexicaulis* and *Leersia hexandra*, as well as water "patuju", *Thalia geniculata*.

b) Swamps ("curiches")

For practical purposes, secondary vegetation was combined into two units: anthropic vegetation (particularly related to fitting-out areas for farming), which remains in the symbols as part of the legend, and secondary forests, such as those bordering the road, where a number of heliophile fast-growing species are present.

c) Low forest related to water bodies: lagoons

This is a low formation, interrupted by high and dense forbes (*Heliconia* spp.), as well as other species adaptable to permanent flooded conditions.

(7) Secondary and Anthropic Vegetation (S)

Finally, the forest formations and the formations modified by human activities, located in spaces for both new settlers and Chimanes and Moxean settled in the region, include adequate areas for farming, pasturage, livestock, and the vegetation surrounding the road. The heliophiles species and fast-growing species such as the *Ochroma pyramidal*, *Cecropia* spp., *Inga* spp. and species grown on small domestic farms ("chacos") for family subsistence are all included within this class of vegetation.

6.5.3 Flower Plant Component

The formations with the greatest number of species are the fragmented and flooded alluvial forest (80 species), the gallery forest of the Matos River (77 species), the alluvial plain forest with seasonal floods (70 species), and the forest islands (50 species). The

savannas and secondary vegetation show a lesser number of species by transection and lot, even in the forests or open areas.

Several of the species represented in the area of influence of the San Borja - Trinidad road are valuable and must be conserved (see Table 6.5.1.)

Table 6-5-1 Valuable Species of Valuable Plants for Conservation Purposes

Species	Family	UICN Category*	CITES Category**	Reference
All the species	Cactaceae		II	CITES, 1990
<i>Pera benensis</i>	Euphorbiaceae	R		Foster, 1986
<i>Mayna parvifolia</i>	Flacourtiaceae	R		Sleumer, 1980
<i>Paspalum peruvianum</i>	Gramineae	R, E		Keel, 1987
<i>Calophyllum brasiliense</i>	Guttiferae	E		Keel, 1987
<i>Sparattanthelium tarapotianum</i>	Hernandiaceae	R		Foster, 1986
<i>Copaifera reticulata</i>	Leguminosae	E		Foster, 1986
<i>Cedrela odorata</i>	Meliaceae	E		Pennington, 1981
<i>Swietenia macrophylla</i>		E		Pennington, 1981
<i>Trichilia hispida</i>		R, E		Pennington, 1981
All the species	Orchidaceae		II	CITES, 1990
<i>Acroconia aculeata</i>	Palmaceae	nt, R, E		UICN, 1986
<i>Astrocaryum murumuru</i>		K		
<i>Bactris</i> spp.		K		
<i>Chamaedorea angustisecta</i>		E		UICN, 1986
<i>Geonoma deversa</i>		nt		
<i>Mauritia flexuosa</i>		nt (K)		
<i>Analea phalerata</i>		K		
<i>Socratea exorrhiza</i>		nt		
<i>Calycophyllum spruceanum</i>	Rubiaceae	K		UICN, 1986

Note - *E=Endangered : Species in danger of extinction and those that have very low probability of survival, if adverse conditions continue, both numerically reduced species and a critical level, or those whose habitats have suffered a drastic reduction or are considered to be in an immediate danger of extinction.

R=Rare : Species with a small population that actually are not in danger of extinction or are not vulnerable, but are in danger in some geographical zones, limited habitats or in wider area, but in very reduced numbers.

V=Vulnerable : These are species that will probably pass to the "E" Category in the future, if the adverse conditions persist. Species of which most or all of their population undergo a decrease due to excessive exploitation, and an extended destruction of their habitats by other environmental disturbances.

K=Non-sufficiently known : Species that are supposed to belong to other categories, but there is no information on them.

nt = Not threatened : Species that are neither rare nor threatened, and are generally combined with endemic species.

** I=Appendix I : Includes all the species in danger of extinction, which may or may not be affected by commerce.

II=Appendix II : Includes the following species: (1) all the species that although they are not in danger of extinction or threatened, could reach this situation unless their trade becomes subject to strict regulations and usage incompatible with their survival is not avoided, and (2) species that are not affected by trade, but require effective control.

III=Appendix III : Includes all the species mentioned in the above Appendixes that are already subjected to regulations to prevent or restrict their exploitation.

Source - Study Team

(1) Species that are Fragile to the Indirect Human Action (gas, waste, etc.)

- ① Generally, in aquatic formations (lagoons, swamps, and lowlands), plants are sensitive to high levels of eutrofization, where the environment is polluted with waste and

toxic gases, which directly impacts on the reduction of oxygen available in the water and thus on the metabolic processes of the plants.

② Other plant species are also highly susceptible to changes in the quality of the aquatic environment. These include the following:

- *Utricularia* spp., a floating plant with yellow flowers.
- *Eriocaulon* sp., an inconspicuous rooted plant, typically found in "curiches" (swamps).

(2) Vegetal Communities Sensitive to the desiccation

① Wetlands : The lagoons and swamps ("curiches") affected by excessive drainage and/or droughts suffer the loss of both native aquatic species and the surrounding vegetation.

② Excessive drainage and droughts destroy the buffer zone between the lowlands and the open waters.

③ Gallery forests.

(3) Communities and Species with a Scientific Value in Relation to Hydrodynamics

a) Communities

① Gallery forest, since it is a very unstable forest formation subject to continued divagating displacement.

② Species of grove forest, since its diversity is reduced by flooding.

③ Wetland communities: aquatic plants, both halophyte and hydrophyte.

b) Species

Species are described as follows according to their biogeographic value :

① Amazonian:

Curatella amazonica, *Mouriri guianensis*, *Rheedia achachairu* , *Licania parvifolia*

② Closed:

Curatella americana, *Tabebuia* spp., *Vernonia brasilian*

③ "Chaco" and swamp:

Tabebuia aurea, *Machaerium aculeatum*

Fire-resistant species : *Curatella americana*, *Tabebuia* sp., *Allagoptera leucocalyx*,
Acronomia aculeata

Fast-growing species : For forestry management and exploitation of soft timber
(e.g. for paper pulp), *Ochroma pyramidale*, *Cecropia* spp.,
Ceiba pentandra

④ Seasonal dynamics:

Seasonal dynamics allow the development of certain formations that are reduced under drier conditions, such as the lowlands, different swamps ("curiches") zones and jonquil fields: *Cyperus giganteus* and water pastures: *Thalia geniculata*.

6.6 Fauna

6.6.1 Introduction

Considering the characteristics of the area, the investigation was conducted in two phases: the first one during the rainy season, and the second one during the dry season. The first investigation conducted during the rainy season, was carried out from February 25 to March 2, 1995. The second investigation was carried out during the dry season from June 24 to July 2, 1995.

The Beni Department is one of the country's most important departments because of its wealth of fauna species. The number of mammals registered is 160 species (Anderson, 1993), accounting for 51% of all the mammals in the whole country. This wide variety of fauna is seemingly due to the presence of several land and aquatic ecosystems, as well as to the concurrence of elements from different biogeographic origins: Amazonian, Chaco, Cerrado and, to a small degree, Andean-Yungas.

In the study area, the best known region for mammal fauna is the Biosphere Reserve of the Beni Biological Station. The following studies have been conducted in the EBB and are available: Garcfa et al. (1986), Garcfa and Braza (1987), Garcfa and Braza (1988), Garcfa (1988), Garcfa and Tarifa (1989), Painter et al. (1990), Tarifa (1994), the listings elaborated by Cabot et al. (1986) and Cabot et al. (1989). In the area influenced by the study zone, the best known work is the one that was carried out by Hinojosa (1990), who was primarily concerned with the management of the Chimane territory.

Other expeditions have been conducted in order to collect small mammals in the zone; however, the results are not available because these have not yet been published or reported, except for the information provided by Anderson (1993).

Of the total of 160 species reported for the Beni Department, 62 correspond to medium-sized and big mammals, which were expected to be found in the area of study. Generally, birds are one of the best known groups of fauna. About 1,320 species are currently recorded in Bolivia, of which 624 have been recorded in the Beni Department (about 50% of the total). Also in this case, most of the species are extensively

concentrated in the area of the Beni Biological Station (Cabot et al., 1986; Flores, 1988; Hilty, 1988; Rocha, 1988; Rocha, 1990).

Most of the works are related to lists of species, but some other works have been carried out on other aspects. Other references regarding other areas in the Beni Department are known, such as the savannas of the eastern part of Rurrenabaque (Gyldenstolpe, 1945) and the wet savannas of the northern part of the department (Remsen, 1986).

According to Rocha (1990), 322 fowl species are known in the Beni Biological Station (EBB). Based on this reference, it can be considered that about 350 species in the area would be influenced by the San Borja-Trinidad road. The diversity of habitats and the confluence of zoo-geographical elements in the Cerrado, Chaco and Amazon areas bring an important wealth of fowl species to the area.

Regarding the herpetofauna, the most important works are the ones carried out by Fugler (1989), de la Riva (1990), and Fugler & de la Riva (1990). Some studies have also been conducted in the area regarding the amphibian communities of the EBB (Midendorf, 1989, 1990, unpublished) and regarding the amphibian communities of the swamps or "curiches" (Reichler, 1995, this is being implemented). A study on the herpetofauna diversity was carried out in the Chimanes Forest by Guerra et al. (1994, being edited).

In recent years, information on the ichthyologic fauna of the region has increased remarkably. The most important works have been carried out in the Mamoré River, Trinidad area (Loubens, 1984; Le Guennec, 1985; Lauzanne et al., 1985; Lauzanne and Robles, 1986; Loubens and Aquim, 1986; Lauzanne et al., 1991) and in the EBB (Sarmiento and Starnes, 1988; Sarmiento, 1991).

There is very little information regarding the use of fishing resources. Some of the better known works are those ones carried out by Lauzanne et al. (1991) and Vásquez (1994), which were carried out under the ORSTOM program in the Mamoré River basin, and mainly the evaluations provided by Walters et al. (1982), with the cooperation of the British Mission and the Beni Development Corporation ("Corporación de Desarrollo del Beni (CORDEBENI).

6.6.2 Study Areas

The study area covers the entire length of the San Borja-Trinidad road and its affected area. Three types of vegetation characterize the area: The forests extending to the area from the base of the Andes and the gallery forests on the savanna; the savannas featuring the presence of wide and rather open areas of vegetation, especially gramineous; and the marshy systems, primarily emerging systems that occupy wide areas in the zone.

The main activity in the zone is livestock, which is extensively practiced in the pastures of the savanna, and is associated with periodical land of burning. There are also peasants and indigenous communities of Chimanes, Moxean, Trinitarian and Ignatian, whose main activity is agriculture, generally on a subsistence level. Hunting is a very important source of protein for these people. On the other hand, in the Mamoré River area, fishing is an important activity, though it is practiced by a reduced segment of the population.

(1) Mammals (Figure 6-6-1)

In order to evaluate the mastofauna, the following locations were considered:

- Location 1: Galilea Community, located 15 km from San Borja (visited during the rainy season.)
- Location 2: San Borja-El Porvenir cattle ranch (EBB), located 50 km from San Borja. village adjoining El Porvenir ranch (visited during the rainy season.)
- Location 3: Totaizal Community, located 48 km from San Borja.
- Location 4: Gallery forest of the Matos River and other hunting paths adjoining the Totaizal community (visited during the rainy season.)
- Location 4: Main road from San Borja to San Ignacio. During the rainy season, the route was limited to the Cuverene River, located at 61.5 km, since it was impossible to cross the pontoon over the Apere River during this visit to the study area.
- Location 6: Paths in the Museruna creek forest, through the Cuyaval ranch. San Martín ranch, located 33.5 km from El Porveni (visited during the rainy season.)

- Location 7: Navigation on the Museruna creek (during the dry season.)
- Location 8: Main road from San Ignacio to Trinidad (visited during the dry season.)
- Location 9: San Ignacio-La Chonta sawmill road, located 35 km from San Ignacio on the main road to Cochabamba (visited during the dry season).
- Location 10: San Miguel del Apere community, located 35 km from San Ignacio on the main road to Cochabamba (visited during the dry season.)
- Location 11: Santa Rita community, located 16 km from San Ignacio on the main road to Trinidad (visited during the dry season.)
- Location 12: Villa Esperanza community, located 27 km from San Ignacio on the main road to Trinidad (visited during the dry season.)
- Location 13: Fátima community, located 39 km from Trinidad on the main road to San Ignacio (visited during the dry season.)
- Location 14: Bermeo community, located 44 km from Trinidad on the main road to San Ignacio (visited during the dry season.)

(2) Fowl (Figure 6-6-2)

Different investigation transections were carried out in forest formations, savanna and marshy systems, after considering the areas that would be greatly affected by the road and, in some cases, the areas which would not be effected directly. During the first phase of investigation, the work was carried out in three zones:

- Colonization area of the gallery forest of Maniqui, located between the Maniqui Bridge and the Curiraba del Monte creek (approximately 10 km.)
- Area of the El Porvenir ranch (EBB), including the forest and savanna formations.
- Area of the San Martín ranch (located about 110 km from San Borja), including the forest and savanna formations.

For the second phase of investigation, considering that traffic conditions were greatly improved, a more extensive survey was conducted, including the route evaluated during the first phase (San Borja-Cuverene) and, mainly, the second part of the route between San Ignacio and the city of Trinidad. During this campaign, the following work was carried out:

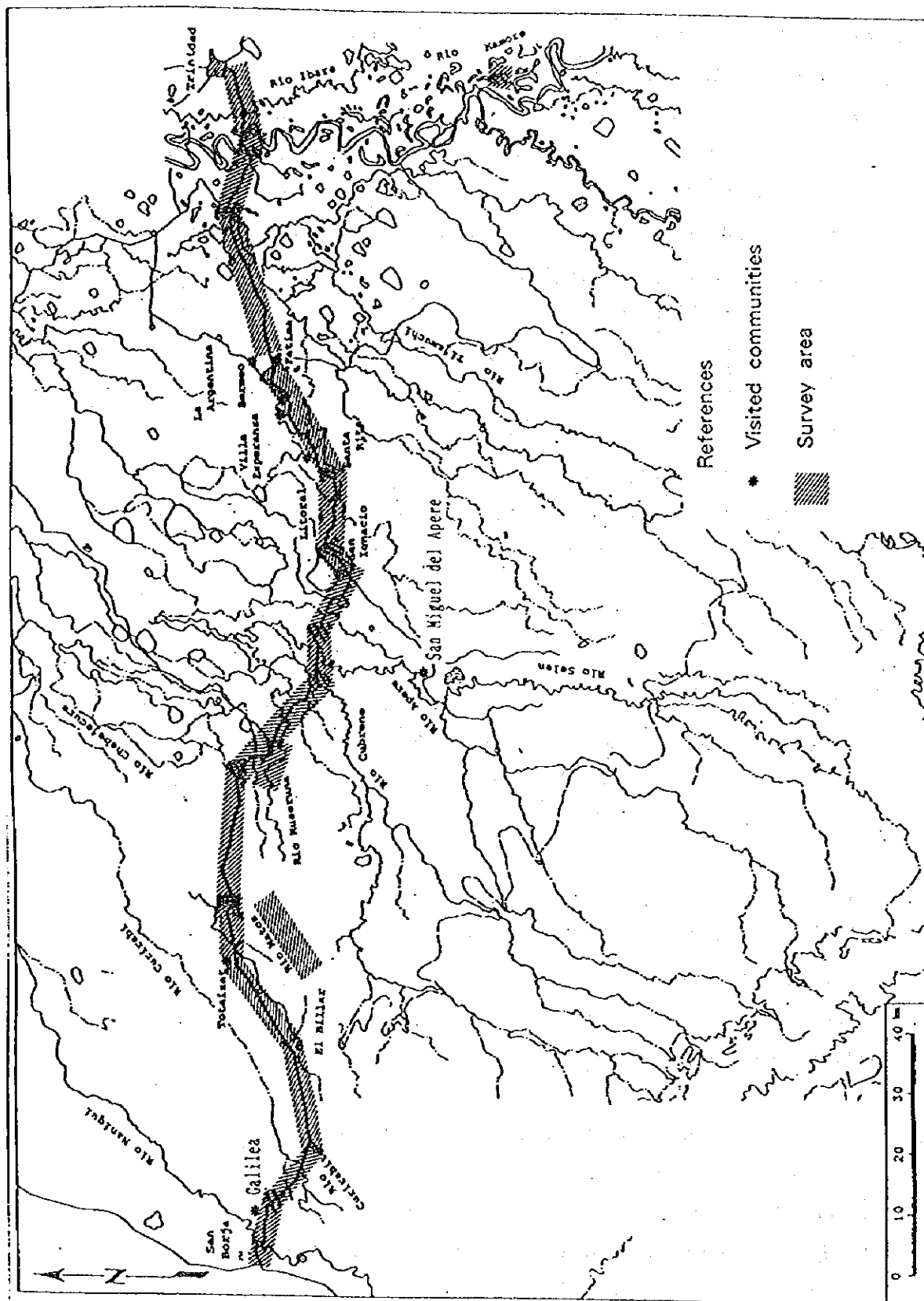


Figure 6-6-1 Location Map of the Investigated Areas and Visited Communities : Mammals

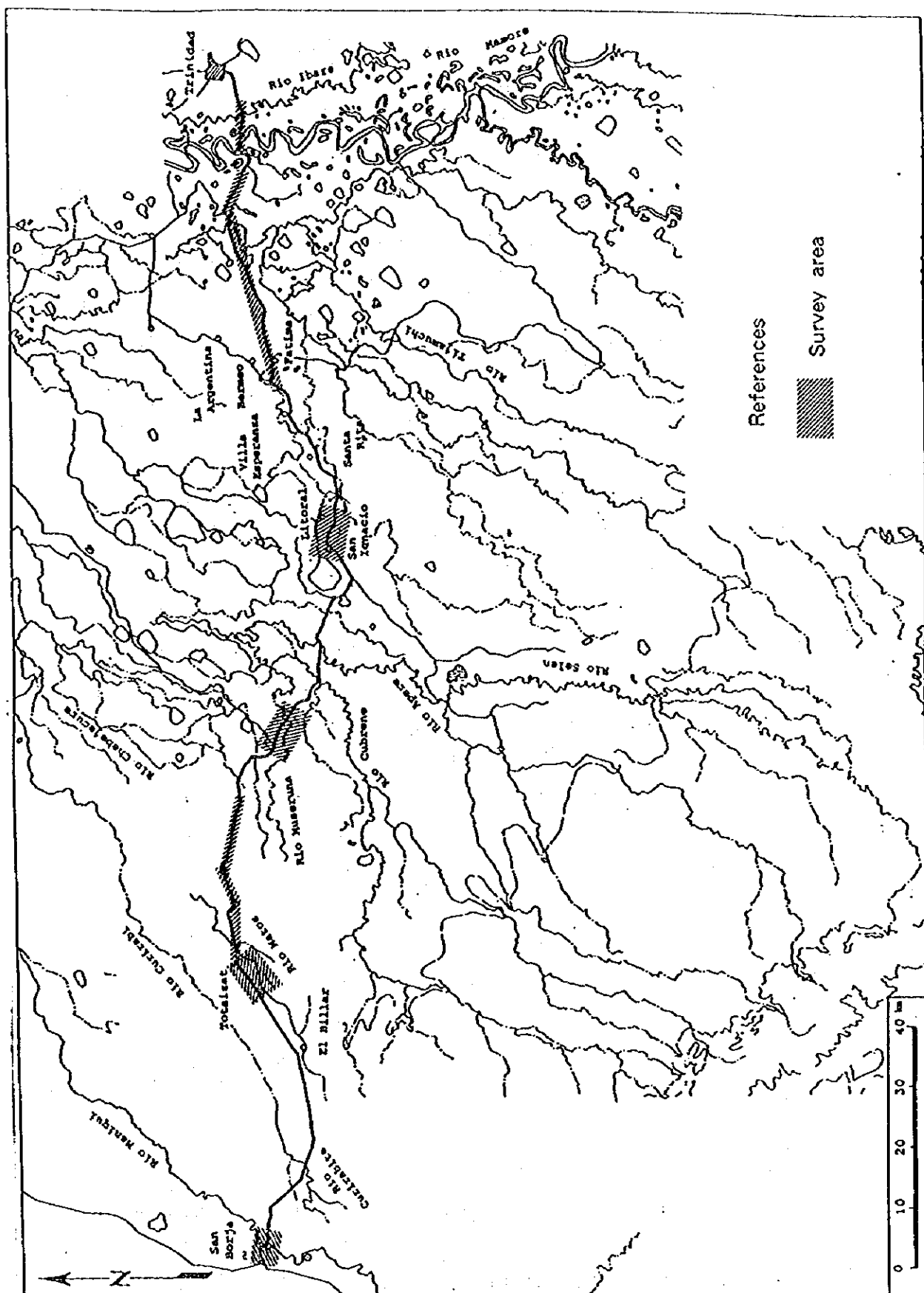


Figure 6-6-2 Location Map of the Investigated Areas : Fowl

- A quick evaluation of the EBB zone, including the gallery forest of the Matos river and the savanna located along the road to San Ignacio.
- The San Ignacio area, including the Isirere lake zone, wood formations near San Ignacio, and visits to two communities with agricultural activity, located 16 km and 27 km from San Ignacio.
- The Trinidad area, including the gallery forest of Mamoré River and a road survey from San Ignacio to Trinidad, mainly, to observe aquatic fowl.

(3) Reptiles and Amphibians (Figure 6-6-3)

Herpetofauna (reptiles and amphibians) collections were conducted in following locations:

- Location 1: Area of banana cultivation, located 1.5 km South of the Totaizal community.
- Location 2: Totaizal community, located about 48 km from San Borja.
- Location 3: El Porvenir Ranch, located 50 km East from San Borja, using the road.
- Location 4: Overflow of the Matos River at the bridge by the crossroads.
- Location 5: Overflow of the Chevejecure creek at the bridge area.
- Location 6: Lowlands located on the road between the San Martín Ranch and the Patujuzal Ranch.
- Location 7: Swamp lagoons ("curiches") located around the San Martín Ranch.
- Location 8: Road between El Porvenir Ranch and the bridge over the Museruna River.
- Location 9: Museruna river near the San Martín Ranch.
- Location 10: Ditch reservoirs at the El Porvenir Ranch area.
- Location 11: Road between El Porvenir Ranch and San Ignacio.
- Location 12: Swamp lagoon at the road edge between the Cuberene and Museruna rivers.
- Location 13: Santa Rita community.
- Location 14: Villa Esperanza community.
- Location 15: Road to Cochabamba, 10 km from the detour of the Apere River-San Ignacio road.
- Location 16 : San Ignacio-Tijamuchi River road.

- Location 17: Swamp lagoon located in the Trinidad-Puerto Varador road.
- Location 18: Trinidad-Puerto Varador road.
- Location 19: Swamps lagoons ("curiche") at the edge of the road between the Mamoré and Tijamuchi Rivers.
- Location 20: Wetlands located at the edge of the road between Tijamuchi River and San Ignacio.
- Location 21: Road between the Cuberene and Museruna Rivers.

(4) Fish (Figure 6-6-4)

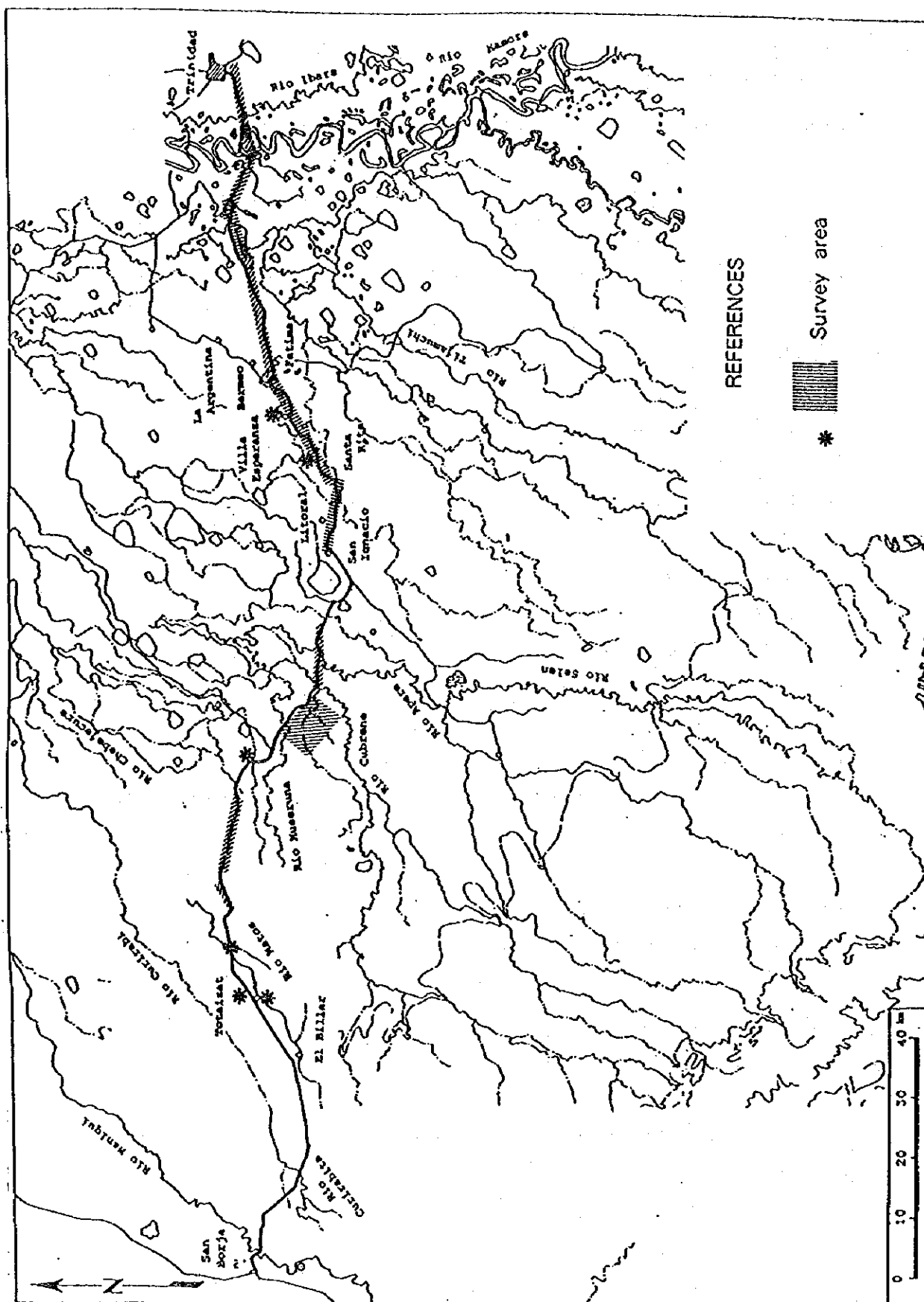
The first phase of the investigation, carried out during the rainy season, was performed at the road section between the San Borja and Cuberene Rivers. The following communities were selected:

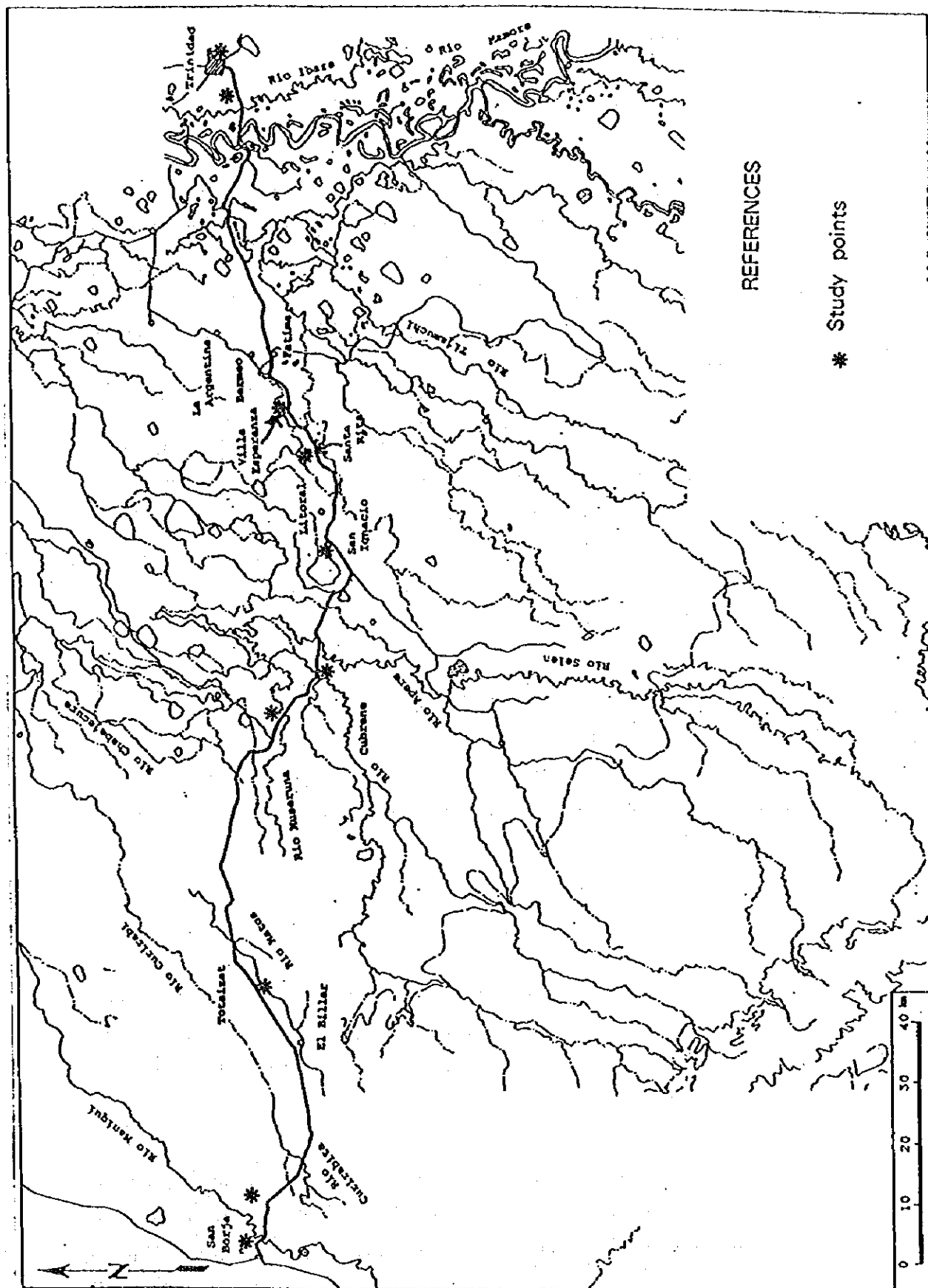
- Galilea, located 5 km from San Borja, corresponding to the colonization zone in the gallery forest of the Maniqui River.
- Totaizal, located 50 km from San Borja, on the Matos River banks.
- Crossing point of Cuverene River, located 110 km from San Borja.

The second phase of the investigation, carried out during the dry season, was performed at the road section between San Borja and Trinidad. The following communities were selected:

- Totaizal, located 50 km from San Borja.
- San Ignacio, located 135 km from San Borja.
- Santa Rita community, located 16 km from San Ignacio.
- Villa Esperanza, located 27 km from San Ignacio.
- Trinidad and Puerto Varador.

Locations were selected on the basis of the existence of human settlements along or near the road.





6.6.3 Investigation Methodology

(1) Mammals

This evaluation considered all the medium-sized and large mammal species registered for the Beni department. Data sheets were designed to include the taxonomy, common name, habitat, evidence, number of observations or their frequency, hours (in the case of visual records), and impact on the mammals. These data sheets are presented in Appendix 6.3(1) as field data sheets. The data was obtained using the different methods described below:

- Visits to the communities settled along the road, (Galilea and Totaizal), where evidence of mammals living in the zone was sought. Data was collected from reliable local sources. To enable local people to easily understand our inquiries, we used a species identification method based on illustrations in the Emmons and Peet Field Guide(1990.) Doubtful species and those whose features were erroneously described were excluded from the field records.
- Walks along the trails of the Matos River forest and Museruna creek, where evidence of mammals and their relative abundance was sought.
- Canoe journeys along the river or creek courses (Museruna creek.)
- Drives along the main road between San Borja and San Ignacio, and between San Ignacio and Trinidad to directly observe the mammals, especially to conduct daytime and night-time censuses.

(2) Fowl

A field data sheet was designed to register the information obtained. Information regarding the locality and a list of the different fowl species, indicating their habitat, position of their forage area, number of individuals, etc. These data sheets are presented in Appendix 6.3(2.)

The field work was conducted along transects of different lengths in order to directly observe the species. In the case of species situated far from the observation site, tape recordings of their sound were made. In the case of important species of aquatic fowl,

trips were taken along long sections of the road to observe as many individuals as possible.

(3) Reptiles and Amphibians

Field investigation work was conducted using the free-capture method, which consisted of daytime and night-time walks through areas where certain species were likely to be found. Moreover, a survey system was also used, involving both canoe and vehicle journeys, to observe larger groups of reptiles (Chelonians and Alligatorides.)

Villagers were interviewed to collect data regarding the presence or absence of different reptile groups. During such interviews, common names were used. All the obtained information was recorded in data sheets, and included the following items: habitat, abundance, evidence, and impact. (Appendix 6.3[3.])

The collected specimens were preserved and transported, according to standard systems. Specimens were identified using the taxonomic codes of Gallardo (1987), Peters et al. (1986), De la Riva (1993), Dixon and Soini (1986), Cei (1976) and Duellman (1978). Then, these specimens were bibliographically described and compared with certain specimens kept in the Bolivian Collection of Fauna ("Colección Boliviana de Fauna.")

(4) Fish

Regarding fish, the study primarily focused on the utilization of the fishing resources. In order to obtain the necessary information, a survey was designed, including different aspects: utilized species, fishing methods, fishing seasons, frequency, etc. (Appendix 6.3[4.])

The field work consisted of inquiries to various family heads, depending on the community size (minimum 2 persons and maximum 15.) As much as possible, persons who regularly fished were interviewed.

In addition to the surveys, researchers in this area (MVZ René Vásquez), authorities related to fishing activities (Mrs. Alicia Bruno, President of the Fishers Association of Trinidad; Dr. José Luis Aquín, Regional Director for the Amazonian Basin of the Fishing

Development Center), and companies involved in fishing activities ("Empresa de Fomento Pesquero" CORDEBENI [EMFOPESCOR], a fishing promotion company and ZOO-MUNDO) were interviewed.

6.6.4 Results

(1) Mammals

During the investigation work, seven communities were visited along the San Borja-Trinidad road. The walks through each community, covered a total of 38 km, the canoe journeys covered about 8 km, and vehicle journeys totaled 1,701 km (609 km during the rainy season and 1,092 km during the dry season.)

The mammals found in the study area mainly correspond to the Amazonian Domain, with Chaco and Cerrado influences.

From a total of 62 species of medium-sized and large mammals expected to be found by this investigation work, 44 species were recorded from the evidences obtained, representing 71% of the expected fauna. Details on the mammal fauna in the area are shown in Table 6-6-1.

Seasonal differences do not affect the composition of mammal fauna in the area, however, during the rainy season, the animals are concentrated in specific areas that are more protected from seasonal floods (highlands), while during the dry season, the animals tend to spread, looking for water, and eventually tend to accumulate around permanent watercourses. In order to characterize mammal communities, three large ecosystems can be distinguished in the study area: forests, savannas or pampas, and wetlands (lowlands or marshes, rivers, creeks, lagoons.)

The mammal communities of the forests are the most diverse and complex, depending on the type of forest. It should be mentioned that the outstanding species with economical and preservation importance are the following: the primates (*Ateles paniscus*, *Alouatta* spp.), forest pigs (*Tayassu tajacu* and *T. pecari*), elk or tapir (*Tapirus terrestris*), jochi (*Agouti paca*), huazo (*Mazama americana*), urina (*Myrmecophaga tridactyla*), badger (*Nasua nasua*) and felines (*Panther onca*, *Felis pardalis*, *Felis concolor*.)

Table 6-6-1 List of Mammals (1)

Order / Family / Species	Local name	Habitat	Evidence	Abundance	Impact	Locality
Marsupialia						
Didelphidae						
<i>Didelphis marsupialis</i>	Carachupa or Comadreja	Bosque, Pa	RV, RL	Nd	NI	2,4,5,6,10,11,12,13,14
<i>Phylander opossum</i> (?)	Comadreja	Bosque	RV, RL	Hd	NI	5,10,11,13,14
Primates						
Cebidae						
<i>Aotus azarae</i>	Mono nocturno or Cuatro ojos	Bosque, Ib	RI(1), AR(1988), RA, RL	Nd	MA	5,6,10,12,13,14
<i>Callicebus</i> sp.	Faca-faca o Ururo o Bururo	Under Bosque, Ch	RL	Nd	MA	6,10,13,14
<i>Alouatta seniculus</i>	Manechi	Bosque, Ib	RA, RI(3), AR(1993), RL	Fe	CS, MA	4,5,6,10,11,12,13,14
<i>Alouatta caraya</i>	Manechi negro	Ib	RL	Nd	CS	10,11,12,13,14
<i>Cebus apella</i>	Sitibador	Bosque, Br	RV, RL, AC, AR(1993)	Co	CS, MA, CO	1,3,4,5,6,10,11,12,13,14
<i>Saotiri boliviensis</i>	Chichilo	Bosque	RV, AC, RL	Co	CS, MA	3,4,5,6,10,11,12,13,14
<i>Ateles paniscus</i>	Marimono	Bosque	RV, RO, AR(1993), RL, AC	Fe	CS, MA	3,5,6,10,11,12,13,14
Xenarthra						
Myrmecophagidae						
<i>Myrmecophaga tridactyla</i>	Oso bandera	Bosque	RO, RL	Nd	CO	4,5,10,11,12,13,14
<i>Tamandua tetradactyla</i>	Oso hormiga o Oso hormiguero	Bosque	RV, RL	Ex	CS	1,4,5,8,10,11,12,13,14
<i>Cylopes didactylus</i>	Osito oro o Oso oro	Bosque	RL	Nd	CO	4,10,12,13
Bradyrodidae						
<i>Bradypus variegatus</i>	Perico or Perezoso	No data	AR(1988), RL, RI(4)	Nd	NI	8,10,11,12,13,14
Dasypodidae						
<i>Euphractus sexinctus</i>	Peji	Cu, Pa	HU, RL	Ex	CS	6,10,11,12,13,14
<i>Priodontes maximus</i>	Pejichi	Pa	RV, HU, RL	Ra	CS	5,6,10,11,12,13,14
<i>Dasypus novemcinctus</i>	Tatu	Pa, Low land, Bosq	RV, HU, RL	Fe	CS	2,4,5,6,10,11,12,13,14
Carnivora						
Canidae						
<i>Canis familiaris (domestic)</i>	Petto		RV	Co	NI	
<i>Chrysocyon brachyurus</i>	Borocho	Pa	RV, HU, RL	Ex	CO	4,5,6
<i>Cedocyon thous</i>	Zorro	Pa, Low land, Bosq	RV, HU, RI(2), RL	Co	CO	2,4,5,6,8,9,10,11,13
Procyonidae						
<i>Procyon cancrivorus</i>	Zorrino	Pa, Low land, Bosq	RV, HU, RI(1), RL	Co	CO	2,4,5,6,9,10,13
<i>Vasua nasua</i>	Tejón	Bosque	RV, CA, HU, RL	Ra	CS, MA	3,4,6,8,10,11,12,13,14
<i>Potos flavus</i>	Mono or mono michi	Bosque	AC, AR(1993)	Ex	MA	1,3
Mustelidae						
<i>Eira barbara</i>	Melero	Bosque	RV, HU, RI(2), RL	Ra	SD	5,6,10,11,12,13,14
<i>Lutra longicaudis</i>	Lobito	Low land	RP, RL, AR(1988)	Nd	DO	6,10,11,13,14
<i>Pteronura brasiliensis</i>	Londra	No data	RL	Nd	SD	10,11,13
Felidae						
<i>Felis catus (domestic)</i>	Gato		RV	Fe	NI	
<i>Felis concolor</i>	León	Bosque	HU, RL	Ra	CO	5,6,10,11,12,13,14
<i>Felis pardalis</i>	Tigrecillo	Ib, Bosque	RV, RP, HU, RL	Fe	CO, CP	1,4,5,6,12,13,14
<i>Felis wiedii</i>	Gato montes	Bosque	RO, RP, RL	Ex	CO	5,6,10,11,13,14
<i>Felis yagouaroundi</i>	Gato gris	Bosque, Ib	HU, RL, RI(1)	Ra	SD	4,6,11,13
<i>Panthera onca</i>	Tigre	Bosque	RV, RO, RL	Ra	CO	3,5,6,10,11,12,13,14

HABITAT

Ba = Low land
Bg = Gallery forest
Bo = Forest
Bs = Secondary forest
Cu = Cultivated field
Ch = Oak forest
Ib = Forest island

Pa = Plain or savanna
Ri = River

EVIDENCE

AC = Animal in captivity
AM = Dead animal
AR = References of other field work by same investigator
AZ = Hunted animal
CA = Meat of animal
HU = Trace
RA = Auditory record
RI = Reference of other investigators
RL = Local reference
RO = Skull and other bones
RP = Leather record
RV = Visual record (alive animal)
RI(1) = Steffen Reichler, Natural History Museum of Stuttgart
RI(2) = Jaime Samudio and Soraya Barrera, Bolivian Collection of Fauna
RI(3) = Jaime Aparicio y Javier Corro, Bolivian Collection of Fauna
RI(4) = Monica Morales, National Sample of Bolivia

ABUNDANCE

Co = Common (Daily recorded)
Fe = Frequent (Not daily recorded)
Ra = Rare (Recorded in sometime during the study)
Ex = Exceptional (Recorded only one time during the study)
Nd = Not determined (insufficient data)

RECORD LOCALITY

1 = Community "Galilea" to 15 km of San Borja
2 = Principal road of San Borja - Farm "El Porvenir" (EBB) to 50 km of San Borja
3 = Community "El Totalal" to 48 km of San Borja
4 = Gallery forest of Mates River and other foot path for hunting, bordering to the Community "El Totalal"
5 = Principal road between San Borja and San Ignacio
6 = Foot path in the forest of Museruna Creek to across the farm "Cuyaval", Farm "San Martín" to 33.5 km of "El Porvenir"
7 = Navigation along the Museruna Creek
8 = Principal road between San Ignacio and Trinidad
9 = Road between San Ignacio and sawmill "La Chonta" to 35 km of San Ignacio, on the principal road for Cochabamba
10 = Community "San Miguel de Apere" to 35 km of San Ignacio, on the principal road for Cochabamba
11 = Community "Santa Rita" to 16 km of San Ignacio on the principal road for Trinidad
12 = Community "Villa Esperanza" to 27 km of San Ignacio on the principal road for Trinidad
13 = Community "Fatima" to 39 km of Trinidad on the principal road for San Ignacio
14 = Community "Bemeco" to 44 km of Trinidad on the principal road for San Ignacio

Table 6-6-1 List of Mammals (2)

Perissodactyla						
Tapiridae						
<i>Tapirus terrestris</i>	Anta	Bosque	HU,AR(1993),RA,RL	Ra	CS,MA	3,4,5,6,10,11,12,13,14
Equidae						
<i>Equus caballus (domestic)</i>	Caballo		RV	Co	NI	
Artiodactyla						
Suidae						
<i>Sus scrofa (domestic)</i>	Puerco		RV	Co	NI	
Dicotylidae						
<i>Tayassu pecari</i>	Chanchito o Tropero	Bosque	RV,RO,HU,RL	Fe	CS,CC	3,5,6,10,11,12,13,14
<i>Tayassu tajacu</i>	Taitetu	Bosque	RO,RP,HU,RL,CU	Co	CS,CC	1,3,4,5,6,10,11,12,13,14
Cervidae						
<i>Blastocerus dichotomus</i>	Ciervo	Low land,Pa	RP,HU,RL,RI(1)	Ra	CS,DO	3,4,5,6,10,11,12,13,14
<i>Mazama americana</i>	Hoaza o Guazo	Bosque	RV,AC,HU,RP,RL	Co	CS,MA,DO	1,3,4,5,6,10,11,12,14
<i>Mazama gouazoubira</i>	Urina	Bosque,Pa	RV,HU,RO,RP,RL	Fe	CS	3,4,5,6,10,11,12,13,14
Bovidae						
<i>Bos taurus</i>	Vaca		RV	Co	NI	
Lagomorpha						
Leporidae						
<i>Sylvilagus brasiliensis</i>	Tapiti or Conejo silvestre	Pa	HU	Ex	SD	2
Rodentia						
Sciuridae						
<i>Sciurus spadiceus</i>	Ardilla or Masi	Bosque	RV,RP,RL	Co	CS,CB,CO,MA	4,6,10,11,13,14
<i>Sciurus aestivus</i>	Ardilla or Masi	Bosque	RL	Nd	SD	10,12,13
Hydrochaeridae						
<i>Hydrochaeris hydrochaeris</i>	Capibara o Capiguara	Low land	RV,RL	Co	CO	5,8,9,11,12,13,14
Dasyproctidae						
<i>Dasyprocta punctata</i>	Jochi colorado or Jochi cabucha	Bosque	RV,RO,HU,RP,RL	Co	CS	1,4,5,6,10,11,12,13,14
Cuniculidae						
<i>Agouti paca</i>	Jochi pintado	Bosque	RV,HU,CA,RL	Fe	CS,ME	2,4,5,6,10,11,12,13,14
Erethizontidae						
<i>Coendou prehensilis</i>	Puerco espin	Pa, Bosque	AR(1987),RL	Nd	SD	4,12
<i>Coendou bicolor</i>	Puerco espin	Bosque	RL	Nd	SD	10,11,13,14
Odontoceti						
Iniidae						
<i>Inia geoffrensis</i>	Bufo	Ri	RL	Nd	SD	Matos, Apere, Senero, Tijamuchi, Mamore

HABITAT

Ba =Low land
Bg =Gallery forest
Bo =Forest
Bs =Secondary forest
Cu =Cultivated field
Ch =Oak forest
Ib =Forest Island

Pa =Plain or savanna
Ri =River.

EVIDENCE

AC =Animal in captivity
AM =Dead animal
AR =References of other field work by same investigator
AZ =Hunted animal
CA =Meat of animal
HU =Trace
RA =Auditory record
RI =Reference of other investigators
RL =Local reference
RO =Skull and other bones
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RECORD LOCALITY

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- 3= Community "El Totatral" to 48 km of San Borja
- 4= Gallery forest of Manos River and other foot path for hunting, bordering to the Community "El Totatral"
- 5= Principal road between San Borja and San Ignacio
- 6= Foot path in the forest of Moseruna Creek to across the farm "Cuyaval". Farm "San Martin" to 33.5 km of "El Porvenir"
- 7= Navigation along the Museruna Creek
- 8= Principal road between San Ignacio and Trinidad
- 9= Road between San Ignacio and sawmill "La Choeta" to 35 km of San Ignacio, on the principal road for Cochabamba.
- 10= Community "San Miguel de Apere" to 35 km of San Ignacio, on the principal road for Cochabamba.
- 11= Community "Santa Rita" to 16 km of San Ignacio on the principal road for Trinidad.
- 12= Community "Villa Esperanza" to 27 km of San Ignacio on the principal road for Trinidad.
- 13= Community "Fatima" to 39 km of Trinidad on the principal road for San Ignacio.
- 14= Community "Borneo" to 44 km of Trinidad on the principal road for San Ignacio.

Although the mammal communities in the savannas or pampas are less diverse than those in forests, the species restricted to these habitats are economically important and must be preserved. These include deer (*Blastoceros dichotomus*) and borocho (*Chrysocyon brachyurus*.)

In the mammal communities of the wetlands, among the outstanding species with economical and preservation importance, mention can be made of the "lobito" or river wolf cub (*Lutra longicaudis*), londra (*Pteronura brasiliensis*), whose numbers are actually very small due to hunting, capybara or water hog (*Hydrochaeris hydrochaeris*), and the porpoise or dolphin (*Inia geoffrensis*) in rivers and creeks with a substantial flow volume.

Most of the species are not completely restricted to a specific area; on the contrary, they are characterized by associations between the environment and the species. For example, the deer (*Blastoceros dichotomus*) and the borocho (*Chrysocyon brachyurus*) are associated with the pampas or savannas and the wetlands; the urina (*Mazama goazoubira*), with the pampas and forests, and the flag bear (*Myrmecophaga tridactyla*), also with the pampas and forests.

The use of the wild fauna is very important for the Beni department because it constitutes a source of animal protein for human settlements (local communities, ranch owners, and other settlements with productive purposes.) The wild fauna also has other uses, as domestic and recreational (pets) animals, as a source of medicine, and as barter to obtain additional income.

The last above-mentioned activity was very important in the department during the 1960s, when the leather of different mammal species had a high value on international markets. This activity caused the reduction of some species populations, such as the londra (*Pteronura brasiliensis*), which has not yet recovered. Local villagers have reported that this animal is very scarce.

Actually, there is a small trade in leather. This trade is directed to buyers that casually visit the communities, and it accounts for some additional income. However, but this situation does not justify the hunting of certain species.

The supply of animal protein from subsistence hunting is the main product of mammal fauna. Studies carried out about the use of fauna as a food supply indicate that about 70 species are used for this purpose. This represents 43% of all mammal species (Redford and Robinson, 1991.)

In this investigation, the species reported by the local communities (peasants) visited are shown in Table 6-6-2. The most intensive use is concentrated in a small number of species, which puts their populations under risk. These species are especially susceptible to disturbance from other such as the destruction of their natural habitats.

Among the mammal species recorded in the study, various species are endangered, and their preservation takes priority (Table 6-6-3.) Some of them are species considered in the Annexes of CITES (Convention on International Trade of Endangered Species of Wild Fauna and Flora.)

A brief investigation such as this one, does not permit, in the case of mammals, the collection of sufficient data regarding the relative abundance of these species in the area. However, records emphasize a number of species must be preserved and are very important for the local economy; therefore, future studies on mammals in this area would prove to be very interesting.

It is important to mention that most of the species recorded in the area are found in depressed populations in other Bolivian regions. Therefore, fauna preservation in this area is exceptionally important.

(2) Fowl

This investigation work led to the creation of a list of birds in this area (Table 6-6-4.) One hundred thirty two species were registered, which represents about 40% of all those known to exist in the EBB. However, a more detailed study, focusing mainly on forest formations, would probably discover a much greater number of species. The results of the evaluations conducted during the different transects are shown in the data sheets of Appendix 6.3 (2.)

Table 6-6-2 Mammal Species Used by Local People

Order / Family / Species		Local name	Use
Primates			
	Cebidae		
	<i>Aloatta seniculus</i>	Manechi	Meat, Mascot
	<i>Cebus apella</i>	Sibador	Mascot, Bait
	<i>Saimiri boliviensis</i>	Chichilo	Mascot
	<i>Ateles paniscus</i>	Marimono	Meat, Mascot
Xenarthra			
	Dasypodidae		
	<i>Dasypus novemcinctus</i>	Tatu	Meat
Carnivora			
	Procyonidae		
	<i>Nasua nasua</i>	Tejon	Meat
	Musstellidae		
	<i>Lutra longicaudis</i>	Lobito	Handicraft
	Felidae		
	<i>Felis concolor</i>	Lebito	Hunting
	<i>Felis pardalis</i>	Tigrecillo	Leather
	<i>Felis wiedii</i>	Gato montes	Leather
	<i>Panthera onca</i>	Tigre	Leather
Perissodactyla			
	Tapiridae		
	<i>Tapirus terrestris</i>	Anta	Meat
Artiodactyla			
	Dicotylidae		
	<i>Tayassu pecari</i>	Chanco o Tropero	Meat
	<i>Tayassu tajacu</i>	Taitetu	Meat
	Cervidae		
	<i>Blastocerus dichotomus</i>	Ciervo	Meat, Handicraft
	<i>Mazama americana</i>	Huazo	Meat
	<i>Mazama gouazoubira</i>	Urina	Meat
Rodentia			
	Dasypodidae		
	<i>Dasypodacta punctata</i>	Jachi colorado o Jochi calucha	Meat
	Cuniculidae		
	<i>Agouti Paca</i>	Jochi pintado	Meat

Table 6-6-3 Mammal Species with Preservation Priority

Oder / Family / Species	Local name	*Appendix CITES
Primates		
Cebidae		
<i>Aotus azarae</i>	Mono o nocturno o Cuatro ojos	II
<i>Callicebus</i> sp.	Faca-faca o Ururo o Bururo	II
<i>Aloautta seniculus</i>	Manechi	II
<i>Aloautta caraya</i>	Manechi negro	II
<i>Cebus apella</i>	Silbador	II
<i>Saimiri boliviensis</i>	Chichilo	II
<i>Ateles paniscus</i>	Marimono	II
Xenarthra		
Myrmecophagidae		
<i>Myrmecophaga tridactyla</i>	Oso bandera	II
Dasypodidae		
<i>Priodontes maximus</i>	Pejichi	I
Carnivora		
Canidae		
<i>Chrysocyon brachyurus</i>	Borocho	II
Musstellidae		
<i>Lutra longicaudis</i>	Lobito	I
<i>Pteronura brasiliensis</i>	Londra	I
Felidae		
<i>Felis concolor</i>	Leon	II
<i>Felis pardalis</i>	Tigrecillo	I
<i>Felis wiedii</i>	Gato montes	I
<i>Felis yagouaroundi</i>	Gato gris	II
<i>Panthera onca</i>	Tigre	I
Perissodactyla		
Tapiridae		
<i>Tapirus terrestris</i>	Anta	II
Artiodactyla		
Dicotylidae		
<i>Tayassu pecari</i>	Chancho o Tropero	II
<i>Tayassu tajacu</i>	Taitetu	II
Cervidae		
<i>Blastocerus dichotomus</i>	Ciervo	I

*Appendix CITES (Convention on International Trade in Endangered Species of Wild Fauna Flora)

I: includes all species in danger of extinction, which may or may not be affected by trade

II: includes: (1) all species that although currently not extinction - endangered, could reach that situation unless the trade of species becomes subject to a strict regulation and a use that is incompatible with its survival be avoided, and (2) species not affected by trade but requiring an effective control on trade

III: includes all species of the above Appendices that are already subjected to regulation for preventing or restricting its exploitation

The number of species known in the area represent a great treasure. For example, the 322 species registered in the EBB, one part of the total area, represents a very high number, compared with the 403 registered in Alto Madidi (Parker & Bailey, 1991) and with the list of 203 species reported by Remsen (1986) by the wet savanna at the northern part of the Beni Department. The presence of different vegetation formations and ecosystems favors the existence of such a large number of species, compared especially with the location studied by Remsen (1986.) Different groups of species associated with three large units, forest, savanna and wetlands, can be recognized.

The presence of important forest masses similar to the area across the Andes base or the gallery forests favors the presence of Amazonian species. Most of these species are associated with riverside habitats (*Opisthocomus hoatzin*, *Hypocnemoides maculicauda*, *Fluvicola leucocephala*, *Paroaria gularis*) or are characterized in that they come from riparian or secondary growth habitats (*Taraba major*, *Todirostrum latirostre*, *Thraupis palmarum*, *Saltator coerulescens*.) However, species associated with the forests having a stable ground can also be found (*Lypaugus vociferans*, *Cephalopterus ornatus*, *Tangara chilensis*, *Tangara nigrocinta*.)

A very conspicuous element is the presence of important areas of open formations of savannas, where several species (birds and other groups) are found, which constitute elements of Chaco and Cerrado that are characterized by open formations (*Rhea americana*, *Tapera naevia*, *Guira guira*, *Crotophaga ani*, caprimulgid species of the *Nyctidromus* and *Hylocharis* genus, hummingbirds, such as the *Eupetomena*, *Anthracothorax*, *Hylocharis*, woodpeckers of the *Picumnus* and *Colaptes* genuses, *Molothrus bonariensis*, *M. badius*, *Icterus icterus*, *Thraupis* spp., etc.)

Within this complex of open formations, there is an important area of marshy systems and other aquatic systems. Associated with these types of formations, birds are generally species with a wide distribution, such as *Phalacrocorax brasilianus*, *Anhinga anhinga*, *Tigrisoma lineatum*, *Ardea cocoi*, *Casmerodius albus*, *Egretta thula*, *Syrigma lineatum*, *Mycteria americana*, *Jabiru mycteria*, *Platalea ajaja*, *Chamuna torauqata*, *Cairina moschata*, *Busarellus nigrocollis*, *Rostrhamus sociabilis*, *Aramides cajanea*, *Ceryle torquata*, *Donacobius amazona*, *Fluvicola leucocephala*, *Oitangus lictor*, *Donacobius atricapillus*. Some of these species correspond to the most common species or those ones that are present in a higher number.

Table 6-6-4 List of Birds (1)

FAMILY / Species	Local name	Habitat	Feeding place	Abundance	Evidence	Locality
RHEIDAE						
<i>Rhea americana</i>	Nandu	S	s	r	h, p	12
TINAMIDAE						
<i>Crypturellus undulatus</i>	Perdiz	Ba, Bg	s	f	o	6, 15
PHALACROCORACIDAE						
<i>Phalacrocorax brasiliensis</i>	Pato aguja	P	a	r	v	14
ANHINGIDAE						
<i>Anhinga anhinga</i>	Pato aguja	P	a	r	v	11, 13, 14
ARDEIDAE						
<i>Casmerodius albus</i>	Garza	P, EC	a	c	v	1, 2, 3, 4, 8, 11, 13, 14
<i>Egretta thula</i>	Garza	P, EC	a	f	v	1, 3, 13
<i>Butorides striatus</i>		P, EC	a	c	v	2, 4, 8, 9, 11, 13, 14
<i>Nycticorax nycticorax</i>	Huaco	P	a	f	v	2, 4, 9, 11
<i>Ardea cocoi</i>	Garza morena	P, EC	a	c	v	3, 7, 8, 11, 14
<i>Syrigma tibitatrix</i>	Garza	P	a	c	v	4, 9, 10, 11, 14
<i>Ptilerodius pileatus</i>		P	a	e	v	9
<i>Tigrisoma lineatum</i>		P	a	f	v	11, 13, 14
<i>Bubulcus ibis</i>	Garza bueyera	S	s	f	v	12, 13
THRESKIORNITHIDAE						
<i>Theristicus caudatus</i>	Bandurria	P, S	s	r	v	3, 9
<i>Theristicus caerulescens</i>		P, S	s	r	v	7, 10
<i>Phimosus intuscutus</i>		P, S	s	r	v	11
<i>Platotea ajaja</i>	Garza morena	P	s	c	v	
CICONIIDAE						
<i>Euxenura maguari</i>	Ciguena	P, EC	a	f	v	4, 7, 11, 13
<i>Jabiru mycteria</i>	Bato	P, EC, Br	a	f	v	4, 11, 14
CATHARTIDAE						
<i>Coragyps atratus</i>	Sucha	Bs, Ib, S	s?	c	v	1, 2, 10, 11, 14
<i>Cathartes burrovianus</i>	Peroti	S, Ib		c	v	2, 4, 8, 10, 11, 14
<i>Cathartes aura</i>	Sucha	S	s?	r	v	11
ANIMIDAE						
<i>Chauna torquata</i>	Chaja	S, P	s	r	v	11, 14
<i>Cairina moschata</i>	Pato negro	P	a	r	v	4, 12, 13
<i>Amazonetta brasiliensis</i>		P	a	r	v	12, 13, 14
ACCIPITRIDAE						
<i>Buteo magnirostris</i>	Chuvi	Bb, S	?	f	v	2, 3, 13, 14, 15
<i>Heterospizias meridionalis</i>		S	?	r	v	6, 11
<i>Geranoospiza caerulescens</i>		S	?	r	v	8
<i>Busarellus nigricollis</i>		S	?	r	v	11
<i>Accipitridae sp.</i>		S	?	r	v	13

HABITAT

S Savanna
Ba High forest
Bm Medium forest
Bg Gallery forest
Bb Margin of forest
Br Forest along the river and creek
Bs Secondary forest
Ib Forest Island
r River and creek
p Lake
EC Pond along the road
A Cave

FEEDING PLACE

s soil
a water
v air
d dosel
sd subdosel
sb bush
as isolated tree in savanna
m bush in savanna
gr gramineas
e emergency in lake

LOCALITY

The locality number corresponds to the No. shown in the data sheets.

FREQUENCY

c = Common
f = Frequent
r = Rare
e = Exceptional

EVIDENCE

v = Visual record
o = Sound record
rl = Local reference
h = Eggs
p = Feather

Table 6-6-4 List of Birds (2)

FAMILY / Species	Local name	Habitat	Feeding place	Abundance	Evidence	Locality
FALCONIDAE						
<i>Rosthamus sociabilis</i>	Halcon caracolero	P, EC, S	a, s?	c	v	1,2,3,4,7,8,9,11
<i>Polyborus plancus</i>	Caracara	S, Bb	s?	c	v	1,2,3,8,13,14
<i>Milvago chimachima</i>	Chuvi	S, Bb	?	f	v	4,13
<i>Falco temoralis</i>		S, Ib	v	r	v	10
CRACIDAE						
<i>Ortalis sp.</i>	Pava	Bb	sd	r	v	11
RALLIDAE						
<i>Aramides cajanea</i>		P, EC	a, e	f	v	3,4,9,11
<i>Porphyrio martinica</i>		P, EC	a, e	f	v	10,11,13
ARAMIDAE						
<i>Aramus guarauna</i>	Carao	S, P, EC, Br	a	c	v	1,2,4,6,7,9,11,13,14
PSOPHIIDAE						
<i>Psophia leucoptera</i>	Trompetero, Yacami	Ba, Br	s	r	r(TT)	12
CHARADRIIDAE						
<i>Vanellus chilensis</i>	Tero tero	S, A	s	c	v	3,5,7,8,9,11,13
<i>Vanellus cyaneus</i>		S, A	s	f	v	3,5,7,11,14
SCOLOPACIDAE						
<i>Tringa flavipes</i>		S, A	s	r	v	3,7
<i>Scolopacidae sp.</i>		S	s	r	v	10
<i>Gallinago gallinago</i>		P, S	s, a	e	v	13
JACANIDAE						
<i>Jacana jacana</i>	Gallareta	P, EC	a	c	v	2,3,7,9,11,13,14
COLUMBIDAE						
<i>Columbina talpacoti</i>		Bb, S	s	f	v	2,3,7,14,15
<i>Columba speciosa</i>	Peloma	Ba	d	r	o	6
<i>Columbidae sp.</i>		Ba	sd	r	o	15
PSITTACIDAE						
<i>Brotogeris cyanoptera</i>	Paculita	P, Ba	d	f	v	1,15
<i>Ara severa</i>	Parabachi	S, Ba, Ib, Bg	d	c	v	3,4,6,7,9,11,15
<i>Aratinga aurea</i>		S	d, m	f	v	4,11
<i>Brotogeris versicolurus</i>		S	d	r	v	4
<i>Beotogeris sanctithomae</i>		S	d	r	v	4
<i>Beotogeris sp.</i>		Bg	d	r	v	6
<i>Ara chloroptera</i>	Paraba ala vercio	Bg, Bb	d	f	v	6,12,14
<i>Aratinga weddellii</i>		Bb	d	r	v	15
<i>Amazona tatarinosa</i>				r	v	15

HABITAT

S Savanna
Ba High forest
Bm Medium forest
Bg Gallery forest
Bb Margin of forest
Br Forest along the river and creek
Bs Secondary forest
Ib Forest Island
r River and creek
p Lake
EC Pond along the road
A Cave

FEEDING PLACE

s soil
a water
v air
d dosel
sd subdosel
sb bush
as isolated tree in savanna
m bush in savanna
gr gramineas
e emergency in lake

FREQUENCY

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Table 6-6-4 List of Birds (3)

FAMILY / Species	Local name	Habitat	Feeding place	Abundance	Evidence	Locality
CARDINALIDAE						
<i>Saltator caeruleus</i>		Bb	sd	r	v	15
THRAUPIDAE						
<i>Ramphocelus carbo</i>		Bb, A, Bg, Br	sb	c	v	2,8,15
<i>Schistoclamys melanotis</i>		S, lb	m	c	v	3,4,9,10
<i>Dacnis cayana</i>		Bb	as, d	r	v	6
<i>Thraupis sayaca</i>		S, lb	sd	f	v	7,10
<i>Eucometis penicillata</i>		Ba	sb	f	v	15
<i>Thraupis episcopus</i>		Bb	sd	f	v	15
<i>Thraupis palmarum</i>		Bb	sd	f	v	15
ICTERIDAE						
<i>Molothrus bonariensis</i>		Bb, S, Br	sb, sd	f	v	2,3,6,15
<i>Icterus sp.</i>		S	as		v	4
<i>Psarocolius decumanus</i>		lb, Ba	d	f	v	4,10
<i>Cacicus cela</i>		lb, Ba, Br, Bg	d	f	v	4,8,11
<i>Icterus cayanensis</i>		Bg, Br	d	r	v	8
<i>Leistes superciliosus</i>		S	gr, m	f	v	13
<i>Cacicus solitarius</i>		Br	sd	r	v	15
<i>Psarocolius bifasciatus</i>		Bb	d	r	v	15

HABITAT

S Savanna
Ba High forest
Bm Medium forest
Bg Gallery forest
Bb Margin of forest
Br Forest along the river and creek
Bs Secondary forest
lb Forest Island
r River and creek
p Lake
EC Pond along the road
A Cave

FEEDING PLACE

s soil
a water
v air
d dosel
sd subdosel
sb bush
as isolated tree in savanna
m bush in savanna
gr gramineas
e emergency in lake

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Table 6-6-4 List of Birds (4)

FAMILY / Species	Local name	Habitat	Feeding place	Abundance	Evidence	Locality
FORMICARIIDAE						
<i>Thamnophilus doliatus</i>	Tiluchi	S, Bb	m	f	v	4,15
<i>Formicivora grisea</i>		S, Bb	m	r	v	4
<i>Formicariidae</i> sp.		Bb	m	r	v	6
TYRANNIDAE						
<i>Tyrannus melancholicus</i>		S, Bb, A	v	c	v	1,2,3,4,7,9,11,15
<i>Pitangus sulphuratus</i>	Cristo frio	S, Bb, P	v	c	v	1,2,14,15
<i>Myiodynastes maculatus</i>		Ba	v	r	v	1
<i>Tyrannus savana</i>		S, Bb, A	v	c	v	2,3,4,6,7,9,11,14,15
<i>Machetornis rixosus</i>		A	s, v	r	v	2
<i>Fluvicola leucocephala</i>		S, Bb, P	v	f	v	3,4
<i>Xolmis irupero</i>	Monjita	S, A	v	r	v	3
<i>Tyrannidae (coloracion similar a conopias)</i>		Ib, Bb	v	r	v	7
<i>Megarhynchus pitangus</i>		Bb	v	r	v	12
<i>Pitangus liotor</i>		EC	v	f	v	15
<i>Tityra inquisitor</i>		Bb	v	r	v	15
COTINGIDAE						
<i>Querula purpurata</i>		Br	sd	r	v	6
PIRIPIDAE						
<i>Pipridae</i> sp.		Br	sd	r	v	15
HIRUNDINIDAE						
<i>Progne tapera</i>	Golondrina	Ba, Bs, Bm, P	v	f	v	1,2
TROGLODYTIDAE						
<i>Campylorhynchus turdinus</i>	Chopochora	S	m	f	v	3,4,15
<i>Donacobius atricapillus</i>		P, EC	a, e, m	f	v	4,14,15
<i>Troglodytes sedon</i>		A, S	m	f	v	4
CORVIDAE						
<i>Cyanocorax cyanomeias</i>	Cuervo	Bg, S	sb, sd	f	v	6,9,11,15
<i>Cyanocorax crysops</i>		Bb, Bm	sb, sd	r	v	12
EMBERIZIDAE						
<i>Paroaria gularis</i>	Cardenal	P	s	e	v	1
<i>Sporophila americana</i>		A, S	gr, s	c	v	2,3,4,9,11
<i>Sporophila castaneiventris</i>		A, S	gr, s	f	v	2,4
<i>Volatinia jacarina</i>		S	gr	f	v	3,4,9
<i>Sporophila hypochroma</i>		S, A	gr, s	c	v	3,4,7,9,10
<i>Ammodramus humeralis</i>		S, A	gr, m, s	c	v	4,7,9,10,11,19
<i>Sporophila plumbea</i>		S, A	gr, m, s	r	v	4,10
<i>Emberizoides herbicola</i>		S, A	gr, m, s	c	v	4,9,10,12,13
<i>Embernagra platensis</i>		Bb	gr, m	r	v	6
<i>Emberizidae</i> sp.		S	gr, m	r	v	9
<i>Oryzoborus angolensis</i>		S	gr, m	r	v	15

HABITAT

S Savanna
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r River and creek
p Lake
EC Pond along the road
A Cave

FEEDING PLACE

s soil
a water
v air
d dosel
sd subdosel
sb bush
as isolated tree in savanna
m bush in savanna
gr gramineas
e emergency in lake

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Table 6-6-4 List of Birds (5)

FAMILY/Species	Local name	Habitat	Feeding place	Abundance	Evidence	Locality
CUCULIDAE						
<i>Crotophaga ani</i>	Cucarachero	S, Bb, A, Br	sb	c	v	1,2,3,4,6,7,11,14
<i>Tapera naevia</i>		S	m	f	v	3,15
<i>Playa minuta</i>		Bg	sd	r	v	6
<i>Guira guira</i>	Serere	S	m, as	f	v	12,14
<i>Playa cayana</i>		S	m	r	v	14
OPISTHOCIMIDAE						
<i>Opisthocomus hoatzin</i>	Serere de agua	P	sb, sd	r	v	11
STRIGIDAE						
<i>Speotyto cunicularia</i>	Lchuza	S	s	r	v	10
CAPRIMULGIDAE						
<i>Nyctidromus albicollis</i>	Cuyabo	S, A	v	c	v	5
TROCHILIDAE						
<i>Phaethornis hispidus</i>		Bg	sb	f	v	8,15
TROGONIDAE						
<i>Trogon sp.</i>		Bg	sd		v	6
<i>Trogon melanurus</i>	Atirora	Bg, Ba	sd	f	v	6,15
<i>Trogon curucui</i>	Atirora	Ba	sd	f	v	15
ALCEDINIDAE						
<i>Ceryle torquata</i>	Martin pascador	r, Br, EC, P	a	f	v	1,2,3,6,11,13
<i>Chloroceryle amazona</i>		Br, r, P	a	f	v	6,9,11,14,15
BUCCONIDAE						
<i>Monasa nigrifrons</i>		Bg, Br	s, sd	f	v, o	6,15
GALBULIDAE						
<i>Galbula ruficauda</i>		Br	sb	r	v	15
RAMPHASTIDAE						
<i>Ramphastos toco</i>	Tecaii	Ba, Br, Ib, Bg	d	f	v, o	7,8,9
<i>Pteroglossus castaneotis</i>	Tucanechi	Bb, Ib	d	f	v	8,11
PICIDAE						
<i>Colaptes campestris</i>	Carpintero	S	sd, d	f	v	4,7,11
<i>Venihornis tumigatus</i>		Bg	sd	r	v	6
<i>Dryocopus lineatus</i>		Ib, Bb	sd	f	v	9,10
<i>Meilanerpes cruentatus</i>		Bb	sd, d	r	v	15
<i>Picumnus minutissimus</i>		Bb	sd	r	v	15
DENDROCILAPTIDAE						
<i>Deconychura longicauda</i>	Trepatorcos	Bm	sd	r	v	12
FURNARIIDAE						
<i>Furnarius rufus</i>		S, A	s	c	v	1,2,3,4,11,14,15
<i>Synallaxis gujanensis</i>		Ib	sb	f	v	10,15
<i>Furnariidae sp.</i>		S, Bb	m		v	11

HABITAT

S Savanna
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EC Pond along the road
A Cave

FEEDING PLACE

s soil
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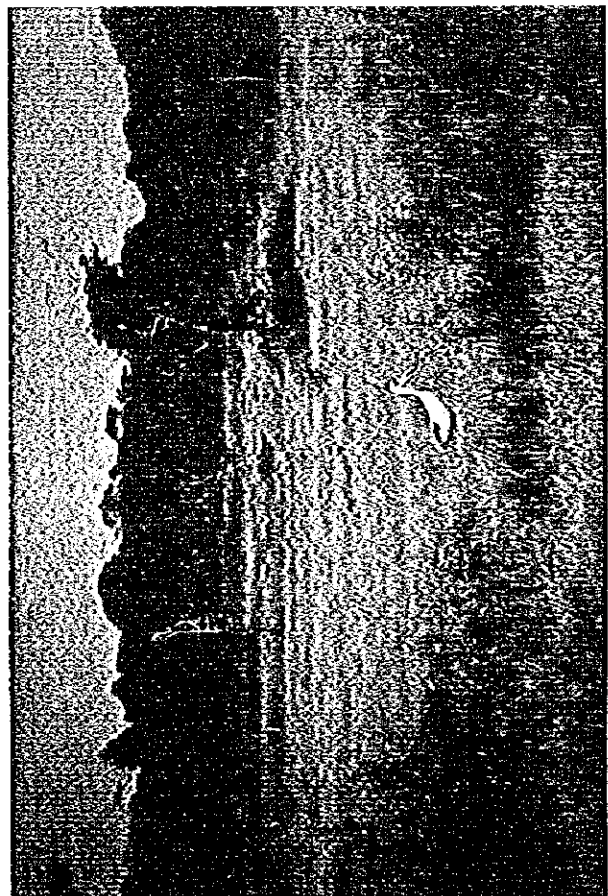
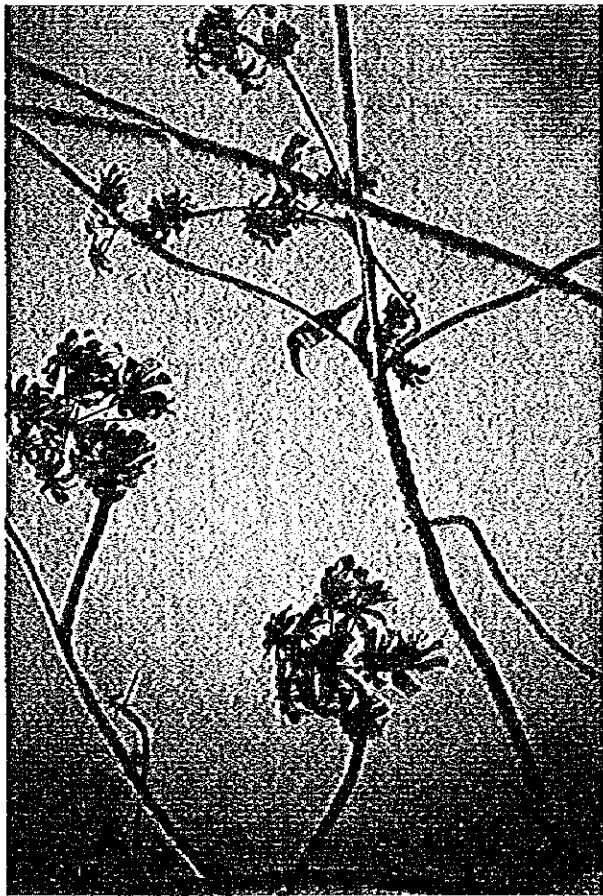
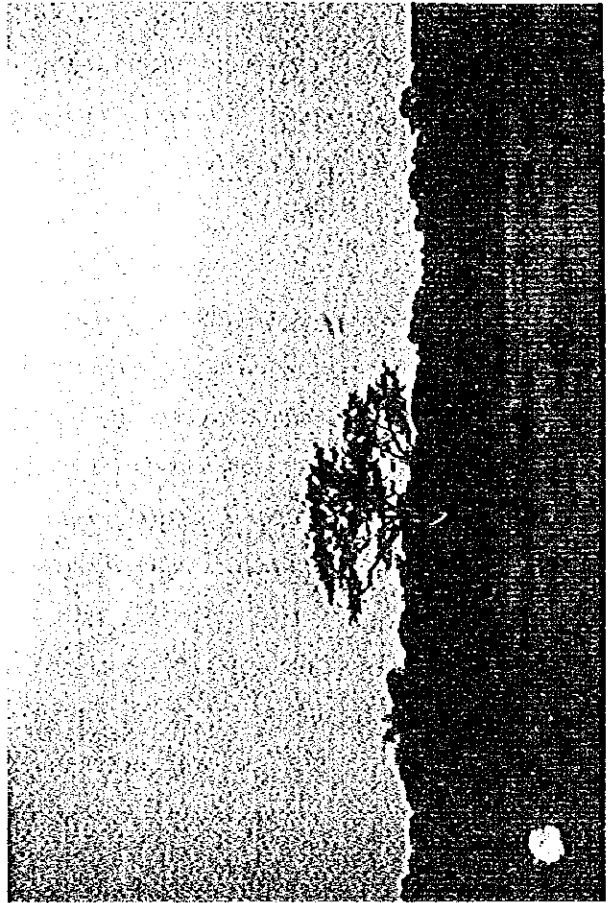
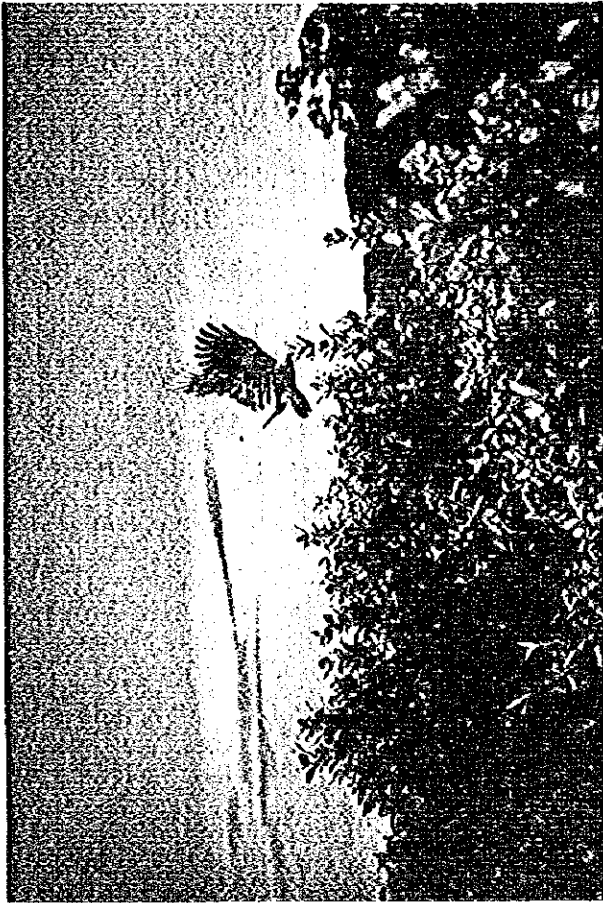


Photo 6-6-1 Birds in the Project Area

The fowl community includes a number of migratory species from the North, such as *Pandion haliaetus*, *Bartramia longicauda*, *Tringa melanoleuca*, *Tringa flavipes*, *Actitis macularia*, *Calidris minutilla*, *Calidris melanotos*, *Coccyzus americanus*, *Tyrannus tyrannus*, *Progne subis*, *Catharus fuscens*, *C. ustulatus*, *Piranga olivacea*, *Dendroica petechia*, and also migratory species mainly from the South (*Columbina picui*?, *Podager naciunda*?, *Caprimulgus parvulus*, *Hydropsalis brasiliensis*?, *Melanerpes candidus*?, *Myiopagis viridicata*, *Elaenia spectabilis*, *E. parvirostris*, *Serpophaga subcristata*?, *Inezia inornata*, *Pyrocephalus rubinus*, *Knipolegus hudsoni*, *K. aterrimus*, *Myodynastes maculatus*, *Epidonotus varius*, *Tyrannus melancholicus*, *T. savanna*, *Progne tapera*, *P. chalybea*, *Riparia riparia*, *Turdus amaurochalinus*, *Vireo olivaceus*, *Sporophila caerulescens*, *Leistes superciliosus*.) (Armonia, 1995.)

Several of these species are included in the IUCN RDB (1992) and their preservation is considered a priority (Table 6-6-5.) Fourteen species recorded in this zone are in the category of species with a declining population, such as *Thea americana*, *Agamiagami*, *Neochen jubata*, *Harpyhaliaetus solitarius*, *Harpia harpyja*; three other species are included in the endangered category, and *Turdus haphlochromus* is a species endemic to EBB (Armonia, 1995.) The Red Book of Vertebrates in Bolivia, which is now in the process of being completed, details 14 species distributed in the different categories, including seven species that are considered to be endangered (Rocha & Quiroga, 1995.) Species of parrots (*Psittacidae*) are shown in the Annexes of CITES, on the trade regulation of species.

During the investigation phases, a wide variety of aquatic fowl was classified (*Ardea cocoi*, *Casmerodius albus*, *Egretta thula*, *Tigrisoma lineatum*, *Ptilerodius pileatus*, *Syrigma sibilatrix*, *Mycteria americana*, *Jabiru mycteria*, *Platalea ajaja*, *Amazonetta brasiliensis*, *Cairina moschata*, *Rostrhamus sociabilis*, *Opisthocomus hoazin*, *Aramus guarauna*, species of *Rallidae*, etc.)

Occasionally, during the investigation phase carried out during the dry season, large concentrations of herons and storks were mainly found in areas where a drop in the water level increased fish density, the major food source of these species. However, it seems that these are occasional groupings related to the drop in water level and the increase in fish density. During the investigations carried out, large temporary resting places used by these species were found; no heron reproduction sites were found.

Table 6-6-5 Fowl Species with Preservation Priority

FAMILY/Species	*CITES	RED DATA BOOK(1992)	LIBRO ROJO DE VERTEBRADOS DE BOLIVIA
RHEIDAE <i>Rhea americana</i>	Appendix II	In declination	Vulnerable
ARDEIDAE <i>Zebrilus undulatus</i> <i>Agamia agamia</i>		In declination In declination	Rare
ANATIDAE <i>Cairina moschata</i> <i>Neochen jubata</i>		In declination	Vulnerable
CICONIDAE <i>Jabiru mycteria</i>	Appendix I		
ACCIPITRIDAE <i>Accipiter pollogaster</i> <i>Harpia harpyia</i> <i>Harpyhaliaetus coronatus</i> <i>Harpyhaliaetus solitarius</i> <i>Morphus guianensis</i> <i>Spizastur meiaoieucus</i> spp.	Appendix I Appendix II	In declination In declination Danger In declination In declination In declination	Rare Vulnerable Vulnerable Rare Vulnerable Rare
FALCONIDAE <i>Falco deiroieucus</i> spp.	Appendix II	In declination	
CRACIDAE <i>Pipile pipile</i> <i>Crax mitu</i>	Appendix I Appendix I		
RALLIDAE <i>Micropygia schomburgkil</i>		In declination	Insufficiently known
TYRANNIDAE <i>Knipolegus hudsoni</i> <i>Alectrurus tricolor</i>		In declination In declination	
TURDINAE <i>Turdus hapiochrous</i>		In declination	Vulnerable
EMBERIZIDAE <i>Sporophila hypochroma</i> <i>Sporophila ruficoilis</i>		Danger In declination	Vulnerable
PSITTACIDAE <i>Ara ararauna</i> <i>Ara chloroptera</i> <i>Ara macao</i> spp.	Appendix I Appendix II		Comerc threatened Comerc threatened Vulnerable
TYTONIDAE <i>Tyto alba</i>	Appendix II		
STRIGIDAE spp.	Appendix II		

*CITES (Convention on International Trade in Endangered Species of Wild Fauna Flora)

Appendix I includes all species in danger of extinction, which may or may not be affected by trade

Appendix II includes: (1) all species that although currently not extinction - endangered, could reach that situation unless the trade of species becomes subject to a strict regulation and a use that is incompatible with its survival be avoided, and (2) species not affected by trade but requiring an effective control on trade

Appendix III includes all species of the above Appendices that are already subjected to regulation for preventing or restricting its exploitation

Several species of *Cracidae* were recorded in the zone (*Ortalis guttata*, *O. motmot*, *Penelope jaquacu*, *Pipile pipile*, *Crax mitu*.) These species were recorded quite frequently, and sound recordings were made daily. An abundance of *Penelope jaquacu* and other *Cracidae* were also recorded, especially in the San Ignacio area. Even though several of these species are hunted by settlers and native people, their populations in the area are apparently quite large.

The number of *Psittacidae* species is not very high, but large groups of *Ara severa*, *Aratinga aurea* and *Aratinga leucophthalmus* species were found during the dry season. These species could eventually become a target for hunters, and they are already frequently found as pets in villages and communities. The blue and yellow macaw (*Ara ararauna*) is frequently found, but the other two species are less frequent. The large numbers of *Aratinga aurea*, during the rainy season, seem to be associated to the harvest season of numerous guayaba trees (*Psidium guajaba*) and ambaibo trees (*Cecropia* sp.) situated along the road.

During the investigation phases, since these were carried out mainly along the road and in the potentially affected areas nearby, few fowl concentrations were detected. There is an *Ara severa* resting place at El Porvenir Ranch of the EBB, in which there is an important concentration of this species, probably consisting of several hundred individuals.

Large groups (several hundreds) of *Aratinga aurea* can be found near the road during the rainy season, and their presence is seemingly associated with the harvest season of guayaba and ambaibo. During the dry season, large and medium-sized groups of *Aratinga leucophthalmus* can be found in the high trees of gallery forests and forest islands.

The marshy ecosystems, including those of an antropic origin located at the edge of the road, are very important, especially for aquatic fowl. Storks, herons, snail-eating falcon (*Rostrhamus sociabilis*), carao (*Aramus guarauna*), etc., regularly use these areas as feeding and shelter areas. In such systems, near the gallery forests, the following birds were detected: water serere (*Opisthocomus hoazin*), needle duck (*Anhinga anhinga*), kingfisher (*Ceryle torquata*, *Chloroceryle americana*), etc.

In the case of herons and storks, some additional areas used as temporary resting places were found, however, these groups were not very large, although sporadic large concentrations (3000-4000 individuals) were seen, seemingly related to the supply of abundant food.

Birds, especially the medium-sized ones (Cracidae and Tinamidae) are an important source of subsistence for the local population (mainly Chimanes and settlers.) The species most frequently used for this purpose are *Penelope jacquacu*, *Pipile pipile* and *Crax mitu*. Other species, mainly parrots and macaws, are frequently found as pets in settler homes or in villages. It is unknown if any fowl are exported from this area.

Although there are variations in the number of some species as migratory species are constantly moving, it can be considered that the fowl composition is similar in the dry and rainy seasons.

(3) Reptiles and Amphibians

During this investigation work, a total of 40 reptile and amphibian species were registered (60% amphibians, 22.5% serpents, 7.5% saurian, 7.5% chelonian and 2.5% alligatorides), representing 70% of all species found in the zone. Considering the short periods of the investigation phases and taking into account the size of the area, this percentage is very significant. (Tables 6-6-6 and 6-6-7)

Twenty four species of amphibians were registered, corresponding to 10 genus and 5 families (*Hylidae*, *Laptodactylidae*, *Bufo*nidae, *Microhylidae* and *Pseudidae*.) Nine serpent species were found, corresponding to 8 genus and 4 families (*Colubridae*, *Elapidae*, *Viperidae* and *Boidae*.) The saurians are represented by 3 species belonging to 3 genus as of the *Teiidae* family.

A seasonal analysis of these species reveals a clear difference between the rainy season and the dry season. Consequently, it can be considered that the area's high climatic variation greatly influences herpetofauna distribution and presence.

Table 6-6-6 List of Reptiles

Oder / Family / Species	Local name	Habitat	Evidence	Abundance for season		Impact
				Humid	Dry	
Saurios						
Teiidae						
<i>Ameiva ameiva</i>		Aa,C	1, 4	c	f	
<i>Cercosaura</i> sp.		Aa,C	4	r		
<i>Tupinanmbis teguixin</i>		Aa,C,Bs,Ib	4	c	r	II
Serpentes						
Boidae						
<i>Eutectes munnus</i>		C,Cu	1		c	II
Colubridae						
<i>Chironius flavolineatus</i>		Aa,Ib,S	3,4	f		
<i>Helicops leopardinus</i>		Aa,Ib,Ch	3,4	f		
<i>Liophis</i> sp.		Aa,Ib,S,Ch	3,4	f		
<i>Thammodynastes pallidus</i>		Ch,Ib	1	f		
<i>Xenodon rabdocephalus</i>		Aa,S	3,4	f		
Viperidae						
<i>Botryops</i> sp.		Ib,S,Ch,Aa	3,4	f		II
Elapidae						
<i>Micrurus lemniscatus</i>		Aa,Bs,Ib	1	r		
<i>Micrurus sunn</i> ???		C			f	
Testudines						
Pelomedusidae						
<i>Podocnemis unifilis</i>		A,L,R	3,4	f		I
Chelidae						
<i>Platemys platycephala</i>		A,L	3	r		II
Testudidae						
<i>Geochelone denticulata</i>		Bt	2,4	r		I
Crocodylia						
Alligatoridae						
<i>Caiman yacare</i>		Cu,Ch,C,R	2,4	f	c	II

HABITAT

Aa Area antropica opened.
A Creek
Bg Gallery forest
Bs Secondary forest
Bt Forest in firm ground
C Highway and road
Ch Swamp
Cu Gutter
Ib Forest Island
I Lake
R River.
S Savanna

ABUNDANCE

c Common
f Frequent
r Rare
e Exceptional

IMPACT

I Frequent hunt
II Occasional hunt
III Destruction of habitat

EVIDENCE

1 Collected specimen
2 Photographic record.
3 Local reference
4 Visual record
5 Bibliographical reference.
6 Sound record

Table 6-6-7 List of Amphibians

Family / Species	Local name	Habitat	Evidence	Abundance for season		Impact
				Humid	Dry	
Bufonidae						
<i>Bufo granulosus</i>		C,Aa	1	c	f	
<i>Bufo paracnemis</i>		C,Aa,Ch	4,6	f	c	
Leptodactylidae						
<i>Leptodactylus fuscus</i>		Aa	1	f		
<i>Leptodactylus podicipinus</i>		Aa	1	r		
<i>Leptodactylus chaquensis</i>		C,Aa,Ch	1	c		
<i>Leptodactylus</i> sp.(jurvenil)		Ch	1	r		
Hylidae						
<i>Hyla fasciata</i>		Cu,Bg	1	f		III
<i>Hyla leali</i>		Cu,Ib,Ch,Bg,Br	1	c		
<i>Hyla leucophyllata</i>		Ch,Cu,Bs	6,4	c		
<i>Hyla nana</i>		Cu,Ch	1	c		
<i>Hyla punctata</i>		Ch,Cu	6	f		
<i>Hyla raniceps</i>		Ch	6,4	f		
<i>Phyllomedusa venulosa</i>		Cu,Bs,Bg	1	f		
<i>Phyllomedusa hypocondrialis</i>		Ch	1	f		
<i>Phyllomedusa cf.boliviana</i>		Br,Bt,Bg	1	c		III
<i>Phyllomedusa</i> sp.		Br,Bt,Bg	1	r		III
<i>Scinax rubra</i>		Ch,Aa	1	f		
<i>Scinax cf.fuscovaria</i>		Cu	1	c		
<i>Scinax</i> sp.		Cu	1	f		III
<i>Sphaenorhynchus lacteus</i>		Ch,Cu	1	c		
Microhylidae						
<i>Elachistocleis bicolor</i>		Aa	1	r		

HABITAT

Aa Area antropica opened.
A Creek
Bg Gallery forest
Bs Secondary forest
Bt Forest in firm ground
C Highway and road
Ch Swamp
Cu Gutier
Ib Forest Island
L Lake
R River.
S Savanna

ABUNDANCE

c Common
f Frequent
r Rare
e Exceptional

IMPACT

I Frequent hunt
II Occasional hunt
III Destruction of habitat

EVIDENCE

1 Collected specimen
2 Photographic record.
3 Local reference
4 Visual record
5 Bibliographical reference.
6 Sound record

Eleven species were registered in both seasons, such as *Bufo mini*, common during the rainy season and frequent during the dry season; *Hyla nana*, common during the rainy season and frequent during the dry season; *Leptodactylus podicipinus*, rare during the rainy season and frequent during the dry season; etc. Only five species are present during the dry season, including *Leptodactylus ocellatus* and *Micrurus surinamensis*, which are frequent. From the registered species, only 25 are present during the rainy season, of which we can mention *Careens flavoliniatus*, frequent; *Micrurus lemniscatus*, rare; *Geochelone denticulata*, rare; *Hyla leucophyllata*, common.

Chelonians are represented by 3 species, 3 genres, and 3 families, while the Alligatorides are represented by one family with one genus and only one species.

This study was mainly directed at habitats close to the road: ditches, swamp lagoons ("curiches"), gallery forests, secondary forests, and anthropic open areas. Although less time was dedicated to it, a study was also carried out in forests with stable ground, forest islands, rivers and creeks. Most of the recorded species are located in the swamps ("curiches") near the gallery forests. The swamps were been excavated during road construction and their water now comes from the overflow of rivers.

The importance of the gallery forest crossed by the road at various sites is fundamental, as it permits the survival of species that are susceptible to disturbances, such as the *Phyllomedusa boliviana*. It also helps to maintain small bodies of water during the dry season, enabling the survival of other species.

The zone of permanent wetlands, such as those found between San Ignacio and the Tijamuchi River, also enables many species of amphibians and reptiles to survive during the dry season. It has been possible to find evidence of almost all the common and conspicuous species. However, no evidence of species with more restricted habitats could be found because of the short investigation time.

Notwithstanding, commercially important species were found, such as *Caiman yacare* and *Eumeces marinus*. Other locally consumed species, such as the *Geochelone denticulata* and species that indicate disturbed environments, such as the *Ptychocheilus venulosus* were also found.

Generally, direct recording of the species was considered more important than evidence provided by villagers, since information about the study area is scarce, and tends to be out of date.

The road evidently destroyed a number of primary habitats, such as the gallery forest, and as a result decreased the number of species with restricted ecological characteristics. At the same time, the distribution range of the herpetozoo species were easily extended with a great adapting capacity. Therefore, herpetozoo species came into direct competition for limited resources with species with restricted habits.

Access to commercial hunters was also facilitated, causing a decrease in certain groups, especially alligatorides. Also, since more farmers have been allowed in, and since they use the system of "chaqueo" (cut and burn), that has been a tremendous negative impact on reptile and amphibian populations.

(4) Fish

Most of the settlers surveyed were not professional fishers, and were not dedicated to commercial fishing. Only subsistence fishing is practiced in the communities of San Borja, Totaizal, Cuberene, San Ignacio, Santa Rita and Villa Esperanza, although this area is characterized as having several aquatic systems and a large ichthyodiversity.

Subsistence fishing is an activity carried out regularly throughout the year. Most of the persons surveyed answered that they fish at least once a week. Fishing is mainly practiced by Chimane, Moxean and Yucarare natives, as well as mestizo peasants ("cambas"), who are settled in the area influenced by the San Borja-Trinidad road. Only one commercial fisher is registered, and he runs a fish store in San Ignacio; however, his sales are very low as he sells exclusively to foreign visitors.

In the zone adjoining San Borja, the surveyed persons emphasized the absence of large species or species of a commercial interest. In the zones surrounding the Trinidad region, mainly in the Mamoré River, commercial fishing is practiced especially since several ornamental and consumption species are found there. In this zone, fishers belong to the Fishers Association of Mamoré ("Asociación de Pescadores de Mamoré"), which classifies its members as follows:

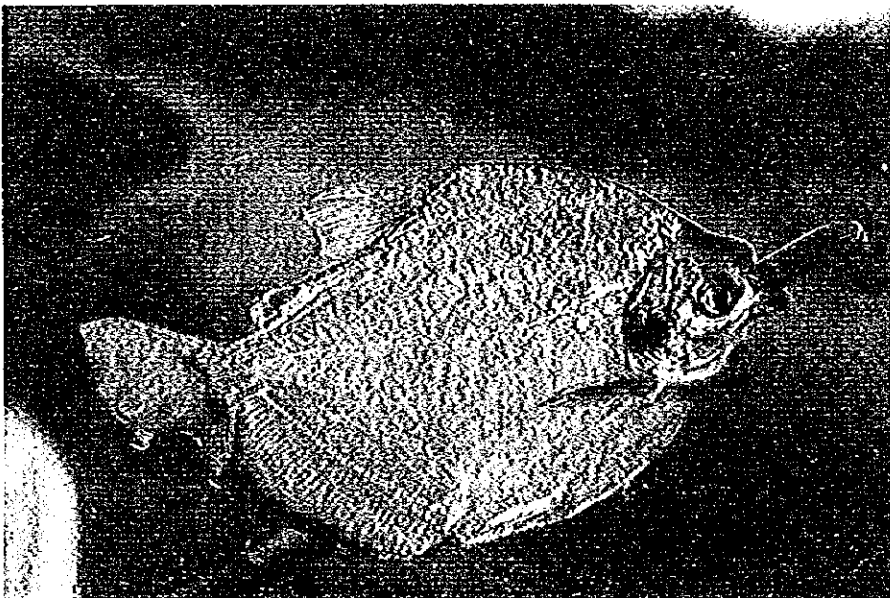
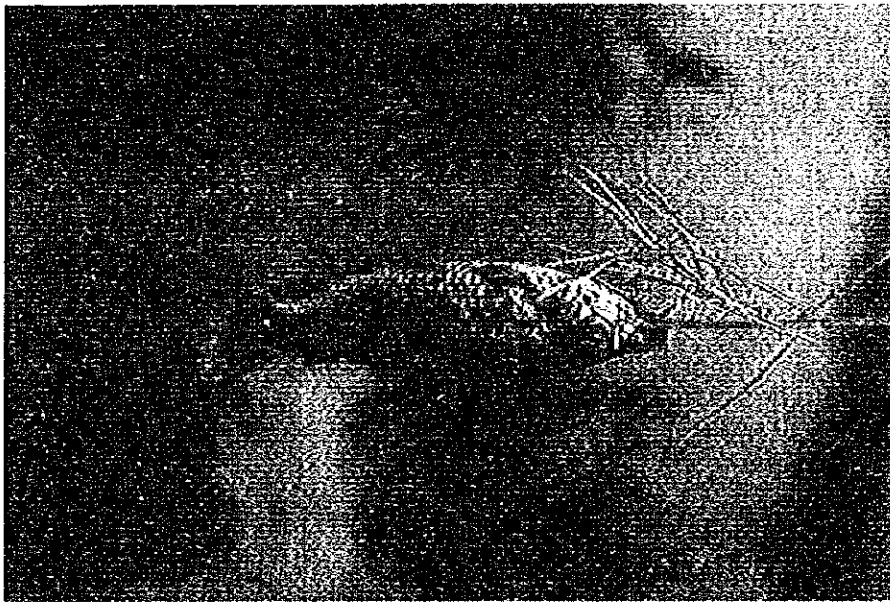
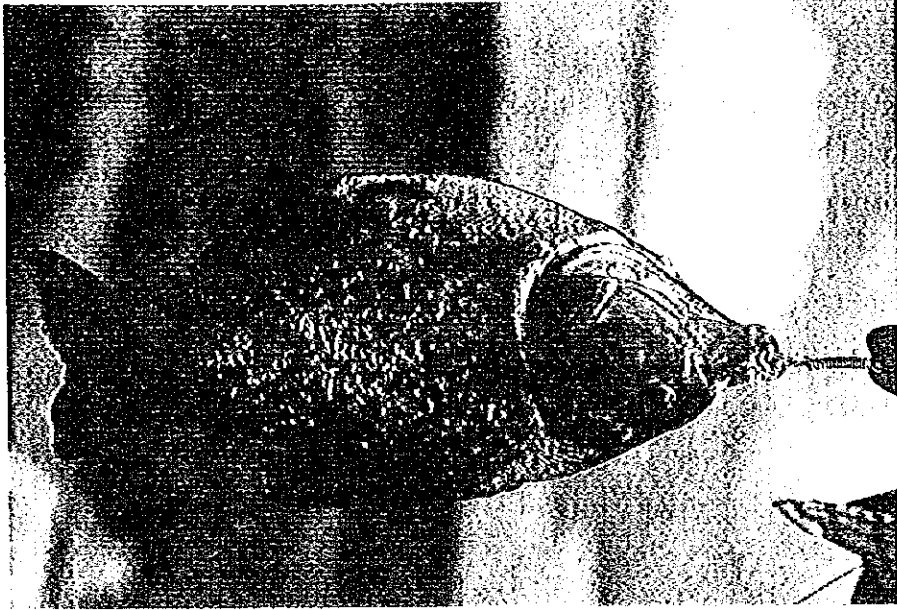


Photo 6-6-2 Fishes in the Project Area

- Small fishers (those who own 2 to 5 nets measuring 50-80 m in length)
- Medium-sized fishers (those who own 8 to 10 nets measuring 50-80 m in length)
- Large fishers (those who own 20 to 25 nets measuring 50-80 m in length)

There is a semi-governmental company, Company for the Fishing Promotion ("Empresa de Fomento Pesquero CORDEBENI [EMFOPESCOR"]), CORDEBENI, operating six large fishing vessels with 30 nets measuring 60 m in length. There are also two private companies in the zone (ZOOMUNDO and Bolivian Tropical Fish), which export ornamental fishes.

The zones where subsistence fishing takes place all have human settlements. The villagers of San Borja, Totaizal, and individuals at a number of nearby ranches mainly fish in the Curiraba creek, Matos River, Caimanero creek, ditches along the road, and in the Cuverene creek. The villagers of San Ignacio, Santa Rita and Villa Esperanza fish in the Apere, Cuverene and Senero Rivers, as well as in ponds located along the road. Fishers in the Trinidad zone fish for ornamental species in the Mamoré, Tijamuchi, Grande, Isiboro and Secure Rivers, as well as in ditches located along the road. Commercial fishing has a more extended scope of action because fishing trips usually take 7 to 15 days.

The fishing activity is greatest during the dry season (November to April), since due to the decrease of water on most rivers and creeks, there is a higher concentration of fish, which facilitates fishing. However, generally fishing activity is carried out throughout the year, mainly by the commercial companies (EMFOPESCOR, ZOOMUNDO and Bolivian Tropical Fish.)

The fishing method used by most of the surveyed persons is the "lineada", which consists of a hook of different sizes with a plastic mono-filament line of various thicknesses. The baits used with for the lineada method are amphibians, small fish, big insect larvae and, occasionally, beef or primate meat.

Only one of the persons surveyed used a hauling net. The native groups of the area (Chimanes, Moxean and Yuracarean) use arch and arrows, as well as some plants, ichtyotoxics (mulleins, such as sachá and ochoó), traps or "chapapas", hand nets or "chipas" and the lineada. Some mestizo settlers also use arches and arrows, bought

from the natives. In the case of the commercial fishing for consumption, the fishing method used is the gill-net and fishing line, while to capture ornamental species, they use fine-mesh hauling nets.

Some of the fishers and persons surveyed in the region of Trinidad mentioned in the past four years there has been a decrease of some large species, such as the surubí, chuncuina, tambaquí, and pacú. They also indicated that these decreases are associated with the drought periods. For this reason, an annual six-month (October- March) fishing ban was implemented starting in 1955.

Most of the fishers in the Trinidad region operate under the "habilito" system, which consists in acquiring loans, boats, food, equipment, etc., from the some people who own all the fishing equipment. Another percentage of fishers that have their own capital, work under the supporters system, which consists of associations of 2 or more persons, in which the owner of the vessel receives 50% of the total catch.

According to data published in 1992 by the Ministry of Peasant and Husbandry Affairs ("Ministerio de Asuntos Campesinos y Agropecuarios"), fishing production in the Trinidad region for 1992 was 164,949 kg. From this total, 133,013 kg were sold in the city of Santa Cruz. According to data obtained from the Fishing Development Center of the Beni Department ("Centro de Desarrollo Pesquero del Beni"), fishing production from the Mamoré River zone was 73,920 kg from January to June of this year, of which 80% was sold in the city of Santa Cruz. During the same months, 490 ornamental species were caught for export. According to information given by EMFOPESCOR, the annual production of this company is about 200 tons.

Commercial fishing is carried out on a selective basis, focusing on a few large species, such as the pacú (*Colossoma macropomum*), tambaquí (*Piaractus brachipomus*), surubí (*Pseudoplatystoma fasciatum*), chuncuina (*Pseudoplatystoma tigrinum*) and general (*Pharatocephalus hemiliopterus*.)

Subsistence fishing targets a larger number of species, although there is a preference for the species included under commercial fishing. The reported species include the bentón (*Hoplias malabaricus*), yeyú (*Hopleryttrinus unitaeniatus*), piranha (*Serrasalmus* spp.), catfish (*Pimelodus* sp., *Pimelodella* sp. and *Rhamdia* sp.), shad (*Prochilodus nigricans*),

pacú (*Colossoma macropomum*), tambaquí (*Colossoma brachyponum*), pacucillo (*Mylossoma duriventre*), surubí (*Pseudoplatystoma fasciatum*), chuncuina (*Pseudoplatystoma tigrinum*), blanquillo (*Callophysus macropterus*), general (*Phractocephalus hemiliopterus*), piraiba (*Brachyplatystoma filamentosum*), buchere (*Hoplosternum thoracatum*), serepapa (*Cichlasoma boliviense*), tucunaré or samapi (*Cichla* sp.), and sardines (*Astyanax* sp. and *Triportheu* sp.). (Table 6-6-8)

6.6.5 Conclusions

(1) Mammals

The number of species registered during the investigation was significant, compared with the number registered by other short investigations. Therefore, the area is considered to be important for its diversity of mammals. This diversity of species is, undoubtedly, due to the diversity of environments and to the confluence of biogeographic zones.

Among the outstanding mammal species that are must be preserved, are the following: *Chrysocyon brachyurus* (borochi), considered endangered, others like the *Blastocerus dichotomus* (deer), *Ateles paniscus* (marimono), *Panthera onca* (tiger), *Felis pardalis* (small tiger), *Tayassu tajacu* (taitetu), *Tayassu pecari* (troop pig), *Priodontes maximus* (pejiche), which are considered to be vulnerable and urgently require preservation and management plans.

These mammal species are important for the local subsistence economy. Hunting is a daily activity of the local communities settled in the area. The preservation of this fauna is a priority in the area, both because of its ecological importance, and because of the role it plays in the for the subsistence of the local population.

Seasonal distribution of the species was not observed, although undoubtedly, during the rainy season, the seasonal floods of the ditches and lowlands close to the road, increase the number of species that prefer these environments, such as the water hog (*Hydrochaeris hydrochaeris*.)

Table 6-6-8 Fish Species Used by Local People

FAMILY/species	Local name	Use
CHARACIDAE		
<i>Astyanax</i> sp.	Sardines	subsistence
<i>Colossoma brachypomum</i>	Tambaqui	subsistence/comercial
<i>Colossoma macropomum</i>	Pacu	subsistence/comercial
<i>Mylossoma duriventre</i>	Pacucillo/Espejo/Lisa	subsistence
<i>Serrasalmus nattereri</i>	Palometa	subsistence
<i>Serrasalmus</i> spp.	Palometa/Prana	subsistence
<i>Triportheus</i> sp.	Sardina	subsistence
ERYTHRINIDAE		
<i>Hoplias malabaricus</i>	Benton	subsistence
<i>Hoplerethrinus unitaeniatus</i>	yeyu	subsistence
PROCHILODONTIDAE		
<i>Prochilodus nigricans</i>	Sabalo	subsistence/comercial
PIMELODIDAE		
<i>Brachyplatystoma filamentosum</i>	piraiba/saltador	subsistence/comercial
<i>Callophysus macropterus</i>	Blanquillo	subsistence
<i>Phractocephalus hemiliopterus</i>	General	subsistence/comercial
<i>Pimelodella</i> sp.	Bagre	subsistence
<i>Pimeloduo</i> sp.	Bagre	subsistence
<i>Pseudoplatystoma fasciatum</i>	Surubi	subsistence/comercial
<i>Pseudoplatystoma tigrinum</i>	Chuncuina	subsistence/comercial
<i>Rhamdia</i> sp.	Bagre	subsistence
<i>Sourubim lima</i>	Paleta	subsistence/comercial
CALlichthyidae		
<i>Hoplosternum thoracatum</i>	Buchere	subsistence
CICHILIDAE		
<i>Cichlasoma boliviense</i>	Serepapa	subsistence
<i>Cichlasoma monoculus</i>	Samapi/Tucunare	subsistence
<i>Cichlasoma ocellaris</i>	Samapi/Tucunare	subsistence

The forest environments are important in the area influenced by the road, where an important number of mammal species were recorded during the study. Therefore, for the preparation of mitigation measures for environmental protection related to the road improvement, it is necessary to consider this situation. In addition, it is also necessary to minimize the arrival of settlers that could affect these environments, by clearing the forests in order to create them in agricultural areas for subsistence. Within the zones of special importance are the forests of the zone of the Muscruna creek, the Management Area of the Chimane forest near San Ignacio, the forests of the Bermeo, Santa Rita, Villa Esperanza communities, and the gallery forests near the rivers of the zone.

Ensuring a corridor for the mammal fauna, from the adjoining areas to the interior of the protected area of the Biosphere Reserve of the Beni Biological Station (EBB) is a priority to preserve the fauna in the zone, and thus to avoid its isolation. During the study, it was observed that there is a permanent flow of species from one side of the road to the other. The forest must be kept as far as possible from the sides of the road, in order to preserve appropriate habitats for the fauna.

Undoubtedly, it is a priority to preserve other environments, savannas and, especially, wetlands as the habitats of currently endangered species that live in these communities. Road improvement activities should mitigate the effects on large wetland extensions.

(2) Fowl

The number of species is quite high compared to other savanna areas and to areas that are considered to have a high diversity, and more detailed studies may increase the number of species recorded. In part, this high diversity may be attributed to the confluence of different biogeographic regions and to the high diversity of ecosystems and ecotones.

One important aspect is that, despite the important presence of human populations, important Cracidae species and a number of other species that must be preserved have been recorded. Although birds are an important part of the local subsistence diet (settlers and natives), these people only catch them when necessary. The journey along the road and its affected area revealed widely distributed common species.

Nevertheless, many species have moved away due to the noise and forest clearing activities.

The presence of the road is characterized in that it has a rather high slope compared to the general level of the area. Therefore, it has caused the formation of artificial pools and permanent or temporary flooded areas that favor aquatic species and satisfy their feeding needs.

On the other hand, this slope construction has caused the discontinuity of certain formations. The most conspicuous case is that of forest islands or gallery forests cut by the road. This problem tends to be aggravated by the fact that people consider the forests to be the most appropriate areas for agriculture. The clearing of these types of forests or their transformation into secondary vegetation, in some cases, constitutes a great obstacle, mainly to small species or species extensively associated with the primary forest.

This situation could eventually cause the isolation of the forest areas located in the northern part of the road, cutting the connection with the forest mass at the foot of the forest and with the area of the Chimane forest. In this case, an important aspect that must be considered is the presence of the Beni Biological Station (EBB) in the area affected by the road. This effect of ecosystem discontinuity may also occur in the marshes crossed by the road, causing modifications to the hydraulic system. Modification of these types of ecosystems will have an important effect on fowl species, such as herons and storks, as well as other species from other vertebrate groups.

Although the road created pools with variable extensions and permanently flooded areas due to the effect of the embankment elevation, no large number of aquatic fowl could be found. Although the number of species is important, usually, the number of individuals was very small.

(3) Reptiles and Amphibians

A total of 40 species of herpetozoos were recorded. Most of these species had adapted to habitat changes that took place when the road was first constructed a long time ago, since this road had destroyed part of the primary habitats in the zone.

Notwithstanding the present road conditions, because use of the road was limited to certain seasons, in certain areas such as the wetlands and gallery forests, many reptiles and amphibian species with more restricted habitats had time to adapt and survive.

The short period of time allotted to the study and the extension of the area did not allow a better investigation of the herpetofauna of the zone. It is therefore recommended that more detailed studies be conducted in the future, especially in the region between San Ignacio and Mamoré river due to the current unavailability of herpetological information.

It is important to point out that the dry season influences the existence and distribution of herpetozoos, causing a clear decrease in their number, compared with the rainy season.

(4) Fish

Subsistence fishing, which is practiced to meet the demand for meat, especially when hunting is unsuccessful or prohibited, and because it is the surest way of obtaining meat in any season of the year, is a major resource for the various human groups that take advantage of it (natives, mestizos, traders, fishers, etc.) This type of fishing is extensively practiced in all areas.

On the other hand, commercial fishing is mainly centered in the city of Trinidad. An important sector of settlers takes advantage of it, trading and generating employment sources and resources for the local population throughout the year.

According to a study conducted by the British Mission (Walters et al., 1982), the level of the actual extraction of fish is very low. The potential catch in the Trinidad region is 7,924 tons per year, while actually only 165 tons per year are exploited. This amounts to only 2%. However, it should be taken into account that this figure refers to total production, while exploitation is limited to very few highly selective species. The main exploited species are the following: pacú (*Colossoma macropomum*), tambaquí (*Colossoma brachyponum*), surubí (*Pseudoplatystoma fasciatum*), chuncuina (*Pseudoplatystoma tigrinum*), general (*Phractocephalus hemiliopterus*), paleta (*Surubim lima*) and piraiba (*Brachyplatostome filamentosum*.)

There are two major problems, the almost total absence of reliable fishing statistics and the lack of control by the authorities of the region, especially the lack of control over

ornamental species exportation. Moreover, there is no control over the fishing of commercial species (fishing bans, size of fishes, spawning season, etc.)

The export records lists of ornamental fish are included in the reports of the Fishing Development Center in Trinidad, which include only partial lists of exported species. Among these species there are some species that, according to the Red Book of the Vertebrates in Bolivia, are classified under the category of insufficiently known, in which can be included the following: *Catoprion mento*, *Carnegiella strigata*, *Nannostomus trifasciatus*, *Entomocorus benjamini*, *Corydoras bolivianus*, *Corydoras geryi*, *Apistogramma linkei*, *Apistogramma luelingi*, *Apistogramma staecki*, *Bujurquina oenolaemus* and *Papiliochromis altispinosa*.

The San Borja-Trinidad road section crosses various aquatic ecosystems (rivers, creeks, "yomonos" (quacking bogs) and swamps), interrupting their flow and causing hydrological changes. This interruption of the natural and temporary flow (dry season and rainy season), and the reduction of the aquatic ecosystems may affect several local fauna species, such as reptiles, amphibians and aquatic mammals, mainly because during the rainy season these ecosystems become major reproduction and growing shelters, as well as natural corridors of ecosystems (migrations associated with reproduction.)

However, the artificial ponds that were excavated to raise the platform along the road are important because they form aquatic systems or permanent flooded areas, establishing major habitats for several fish species throughout the year. These ponds are very important during the dry season because they become major feeding sites for ichthyophagous fowl, due to the high concentration of fish contained therein. The ecosystems are also used by local people, especially natives, since these are the nearest and surest sites for fishing, either using "lineadas" or "chipas" (hand nets.)

Another sector that takes advantage of the artificial ponds is the fishing sector that focuses on ornamental species, and who extract these species throughout the year.

It has been observed that the fishing production and demand have increased in recent years. The fact that the San Borja-Trinidad road section is interrupted during half of the year (rainy season), affects the fishing trade, preventing production from being transported to and sold in other departments and cities.

6.7 Landscape

6.7.1 Landscape Regarding the Forests

The present landscape of the forests cut by the road between San Ignacio and the Apere River is shown in Photograph 6-7-1, while the actual landscape between the Chevejecure and Matos Rivers is shown in Photograph 6-7-2.



Photo 6-7-1 Present Landscape of the Forests Cut by the Road



Photo 6-7-2 Actual Landscape between the Chevejecure and Matos Rivers

6.7.2 Landscape Around the New Road Alignment

The actual landscape of area that will be crossed by the new road, as a part of the road improvement plan, approximately 1 km from the Apere River to San Ignacio, is shown in Photograph 6-7-3. Additionally, the landscape of the new road crossing near the Ibare River, is shown in Photograph 6-7-4.



Photo 6-7-3 Actual Landscape of Area 1 km from the Apere River to San Ignacio



Photo 6-7-4 Landscape of the New Road Crossing Near the Ibare River

6.7.3 Landscape Around the Artificial Ponds

The landscape around the ponds that have been excavated to raise the platform along the road crossing Yacuma Regional Park is shown in Photos 6-7-5 and 6-7-6. The artificial ponds are in accordance with the surrounding landscape.



Photo 6-7-5 Landscape around Ponds in the Yacuma Regional Park



Photo 6-7-6 Landscape around Ponds in the Yacuma Regional Park

6.7.4 Landscape around the Planned Bridge

The Landscape around the western side of Tijamuchi River, where a bridge is planned to be constructed, is shown in Photo 6-7-7. This photo was taken during the wet season.

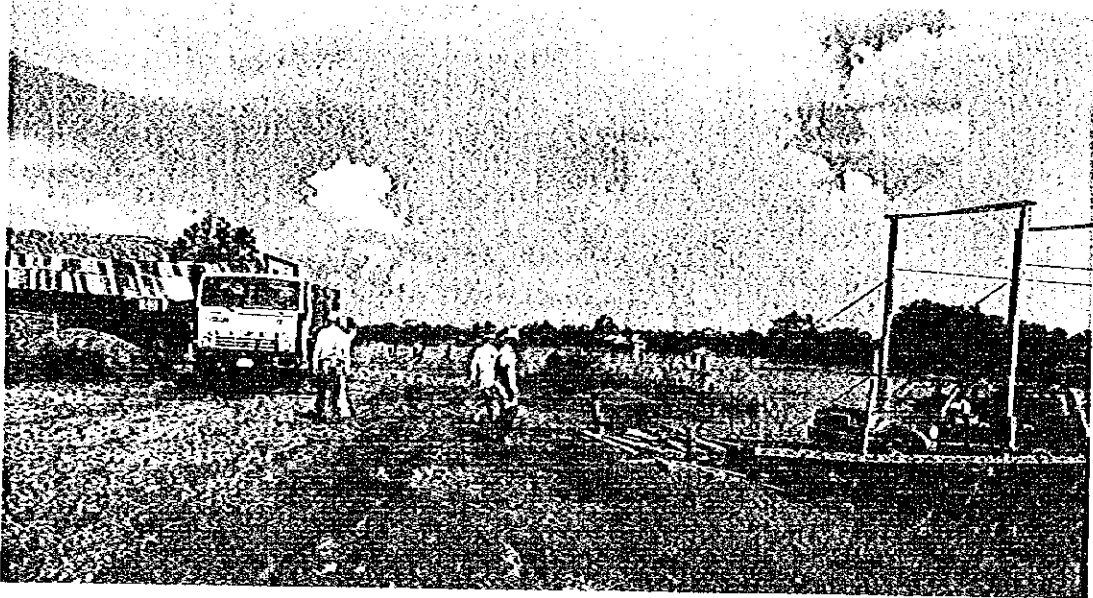


Photo 6-7-7 Landscape around the Western Side of Tijamuchi River

6.7.5 Landscape around the Road Across the Flooded Area

The road across the flooded area to the west of Tijamuchi River during the wet season is shown in Photo 6-7-8. The landscape during the wet season is quite different from the one during the dry season.



Photo 6-7-8 Landscape around the Road Across the Flooded Area

6.7.6 Excellent Landscape

There are a lot of beautiful scenarios, which are desirable to be preserved, along the project road, as shown in Photos 6-7-9 and 6-7-10.



Photo 6-7-9 Beautiful Scenarios around the Museruna Bridge



Photo 6-7-10 Beautiful Scenarios around the Museruna Bridge