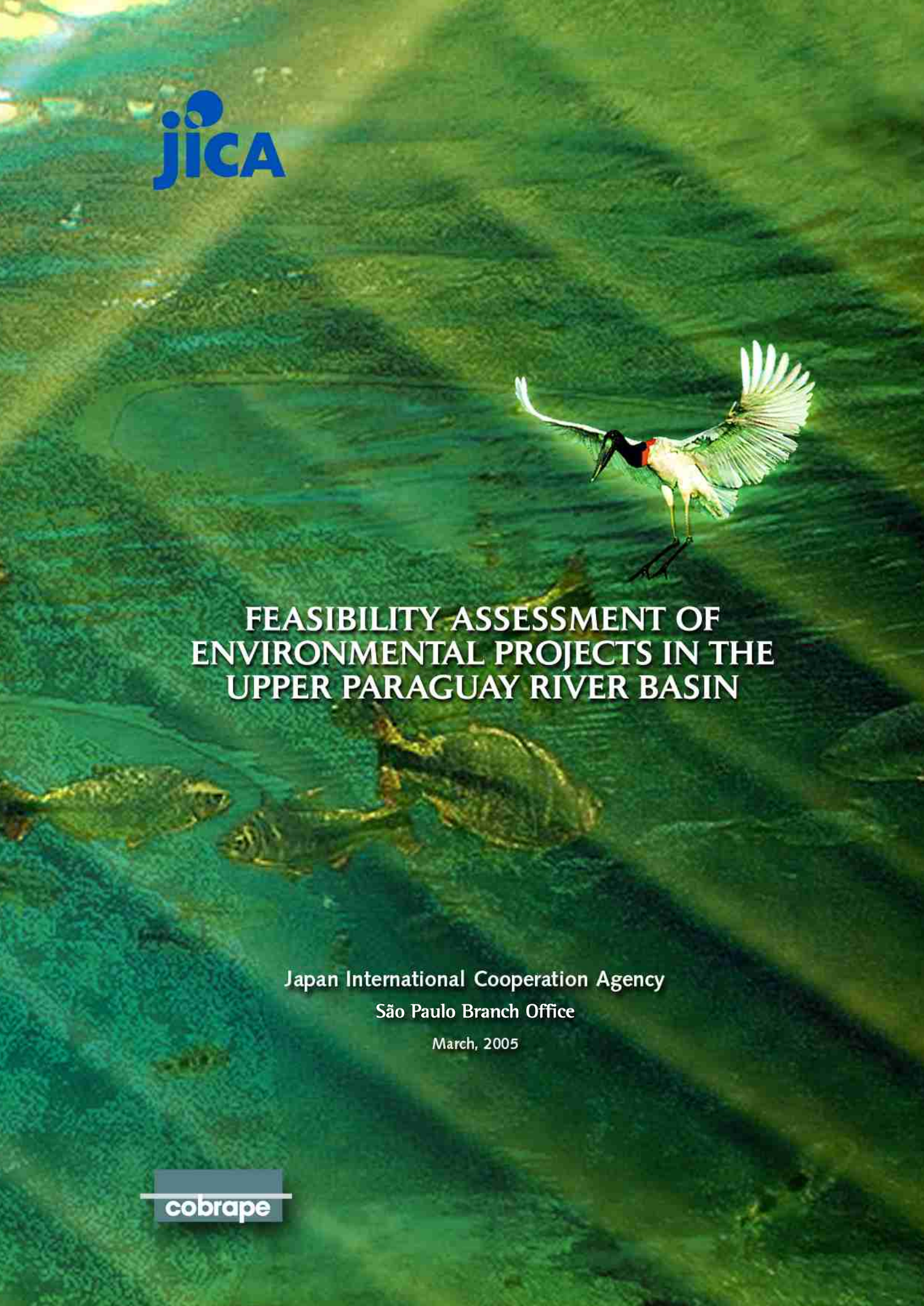

FEASIBILITY ASSESSMENT OF ENVIRONMENTAL PROJECTS IN THE UPPER PARAGUAY RIVER BASIN

Japan International Cooperation Agency
São Paulo Branch Office

March, 2005

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FEASIBILITY ASSESSMENT OF ENVIRONMENTAL PROJECTS IN THE UPPER PARAGUAY RIVER BASIN

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CONTENTS

INTRODUCTION

INTRODUCTION

This document is the result of consulting services related to the "**Feasibility Assessment of Environmental Projects in the Upper Paraguay River Basin**", compiled by COBRAPE – Cia Brasileira de Projetos e Empreendimentos on behalf of the **JICA – Japan International Cooperation Agency.**

In line with the specific aim of the services, the document is structured as follows:

- *THE UPPER PARAGUAY RIVER BASIN*

This section comprises a characterization of the study area and a survey of the Upper Paraguay River Basin's current situation, urban environment and natural ecology, including the principal threats to its ecosystems, as well as a brief description of the main bodies active in the region and the current situation of the most important envisaged programs. There is also a breakdown of the legal framework pertaining to the region's geography and environment, with specific comments on the main legislation.

- *STRATEGIES FOR THE JICA*

Based on the results of surveys and research activities, this section contains an assessment of possible technical cooperation on the part of the JICA through the selection and indication of several specific projects that would benefit from this cooperation.

In the course of drawing up this report, we examined documents published by various bodies and consulted several internet sites. We are also grateful for the important contribution from those professionals we interviewed *in loco* when visiting public bodies in Brasília, Cuiabá, Campo Grande and Corumbá .

THE UPPER PARAGUAI RIVER BASIN

1 DEVELOPMENT AND ENVIRONMENTAL CONFLITS
2 INSTITUTIONAL AND MANAGEMENT FRAMEWORK
3 RELEVANT LEGISLATION AND INTERNATIONAL AGREEMENTS

1. DEVELOPMENT AND ENVIROMENTAL CONFLICTS

1.1 Geographical Situation

The Upper Paraguay River Basin (UPRB), situated in the central region of South America, is part of the Paraná-Paraguay Basin, in turn part of the La Plata system, the continent's second largest watershed after that of the Amazon. The UPRB covers approximately 595,000 km², 61% of which in Brazil, 20% in Bolivia and 19% in Paraguay. The Brazilian part is located in the states of Mato Grosso and Mato Grosso do Sul, covering almost a hundred municipalities.

It comprises three main elements: the plateaus and higher elevations, which take in most of the Basin; the floodplain, in the central part; and the residual elevations adjacent to the plain and its depressions. In the rainy season, the swelling upland waters flow into the Pantanal in enormous volume, provoking flooding, although this is a slow process given the shallow declivity.

In Brazil, the plain is formed by tributaries of the Paraguay's left bank plain. The Paraguay is one of Brazil's most important plain rivers, being the Pantanal's only run-off. It rises in the Chapada dos Parecis, near the city of Diamantino (MT) and flows for 2,621 km (1,683 km of which in Brazilian territory) before joining the Paraná River, on the border with Paraguay and Argentina,

In addition to the Paraguay itself, the main rivers making up the UPRB sub-basins are the Cuiabá, São Lourenço, Itiquira, Correntes, Taquari, Negro, Aquidauana and Miranda.

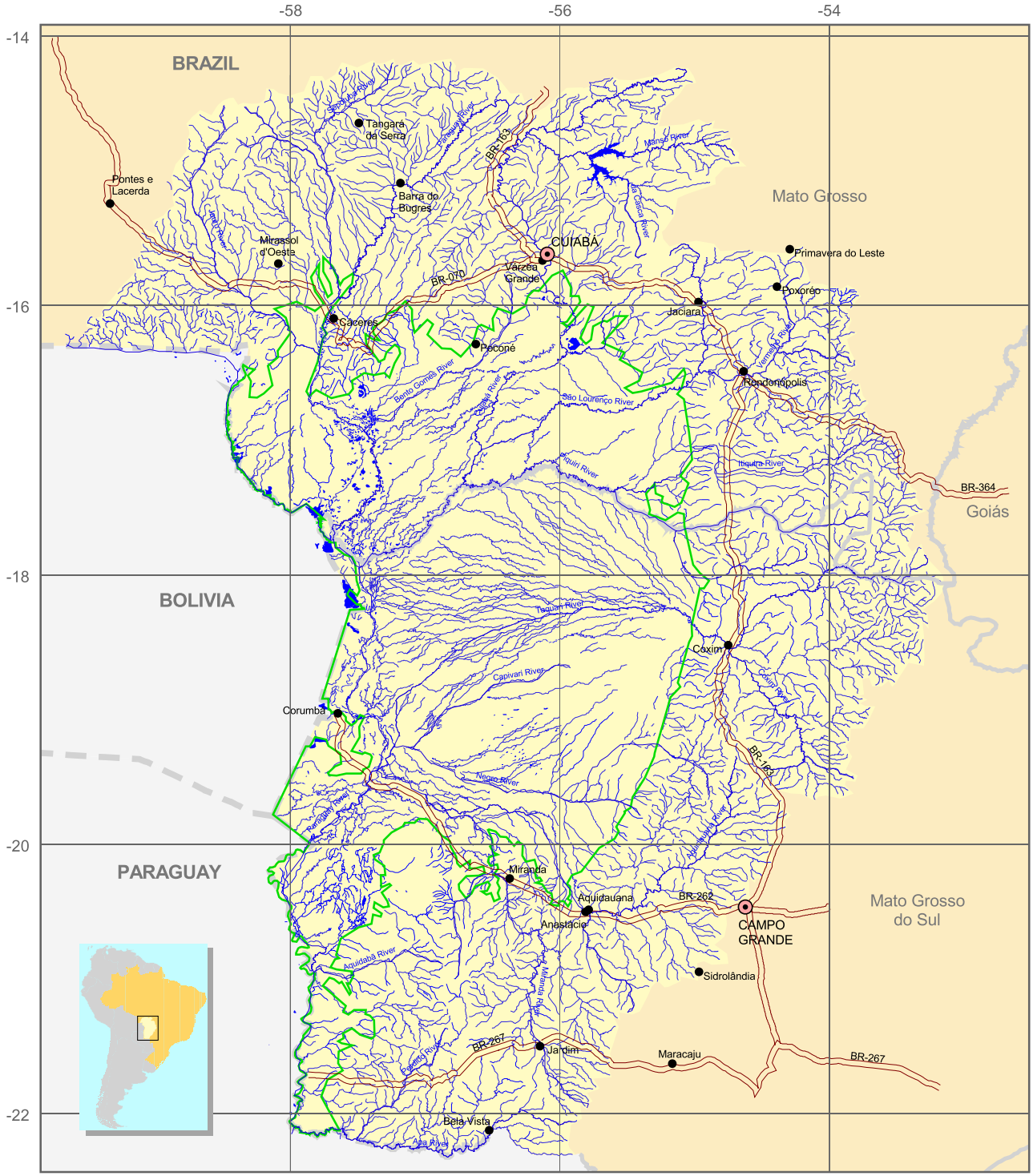
The Pantanal, which comprises the UPRB's floodplain with declivities of between 1 and 2 cm/km, occupies around 165,000 km^2, 140,000 km² of which in Brazil, in the states of Mato Grosso (35%) and Mato Grosso do Sul (65%).

The following maps illustrate the geography of the area in question, as well as some of its characteristics.


SOUTH AMERICA AND STUDY AREA
-80
-70
-60
-50
-40
-30
10
0
-10
-20
-30
-40
-50
Caracas
VENEZUELA
Georgetown
GUYANA
Paramaribo
Cayenne
SURINAME
FRENCH GUIANA
Bogota
COLOMBIA
Quito
ECUADOR
Belém
Manaus
PERU
BRAZIL
Recife
Lima
Salvador
Brasília
BOLIVIA
Cuiaba
La Paz
Campo Grande
Pacific
Ocean
São Paulo
Rio de Janeiro
PARAGUAY
Asuncion
CHILE
Porto Alegre
ARGENTINA
URUGUAY
Santiago
Buenos Aires
Montevideo
Atlantic
Ocean
Upper Paraguay River Basin
Study Area - Upper Paraguay River Basin in Brazil
Capital
Other cities
0
400
800 km
Scale 1:40.000.000
N

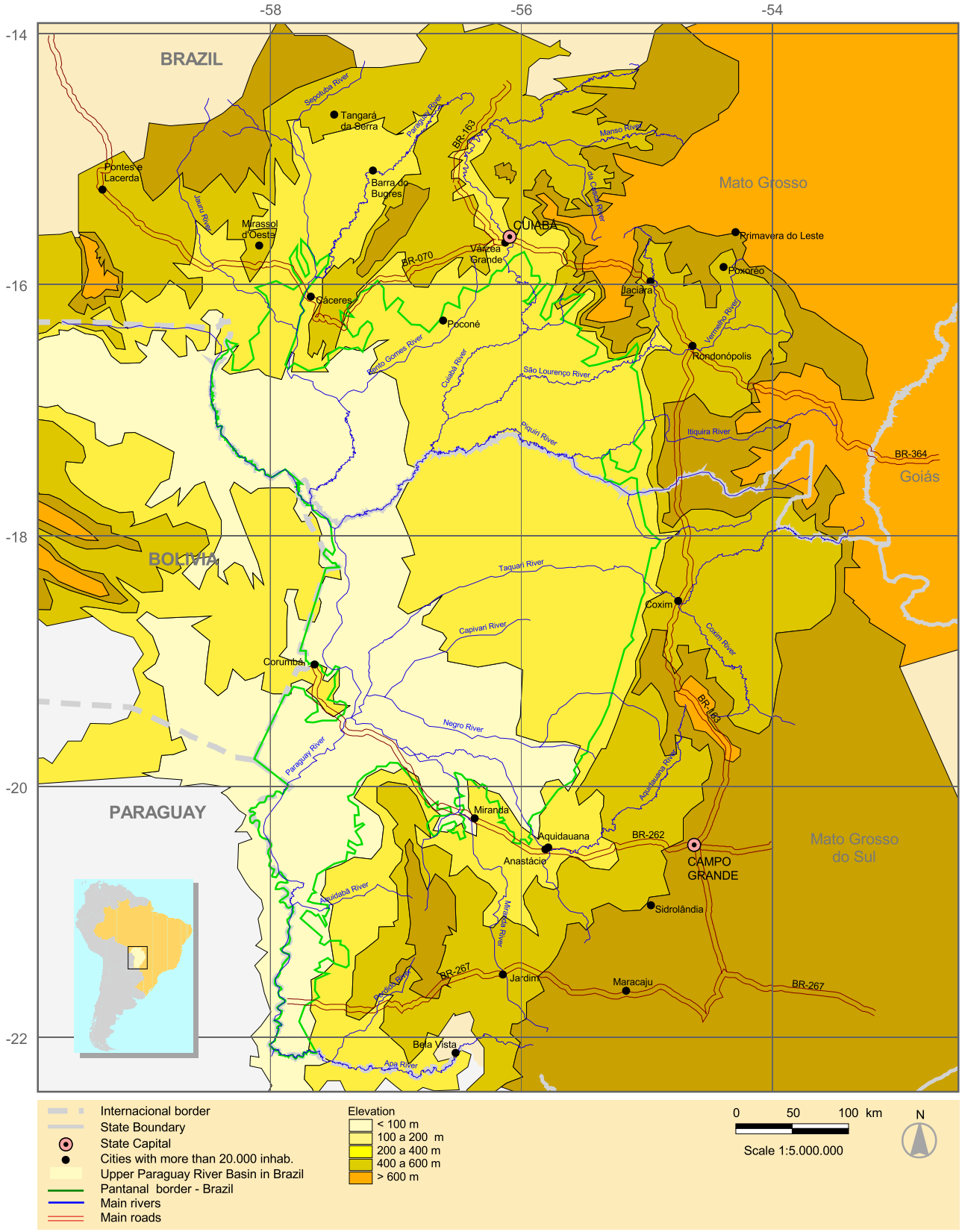
UPPER PARAGUAY RIVER BASIN IN BRAZIL

Hydrography



UPPER PARAGUAY RIVER BASIN IN BRAZIL

Elevation



1.2 Overview

Most of the Upper Paraguay is located in the plateau region. The central stretch runs through the plains, a depressed, flat area where surface run-off is jeopardized, leading to periodic flooding. Thus the Pantanal (whose name derives from *pântano*, the Portuguese word for swamp and is therefore considered inappropriate by some authors, given that its waters are in constant movement), thus constitutes an immense wetland area, the biggest such area in the world.

Wetlands or floodlands are exceptionally diverse environments occupying zones of transition between higher, well-drained areas and permanently flooded ones. Their delimitation is extremely difficult given that their borders are diffuse due to the seasonal variations in water levels and human use of the land, which alters the vegetation, the soil and the rainfall cycle.

Wetland hydrology creates conditions that differentiate these areas from both other land environments and deepwater ones. The hydrological systems vary greatly in terms of flooding frequency, duration of the hydrological cycle and the depth of the water. There is a wide variety of flooding patterns associated with the world's leading floodlands. And it is the regularity of these patterns that is responsible for maintaining the structure and functioning of the environment. Without this regularity, fish productivity, vegetation growth cycles and animal migrations would be seriously affected.

Rainfall in the region ranges between 1,000 and 1,500 mm p.a. and can reach as much as 300 mm per month in December and January.

Soils are acidic and weak, with a low nutrient content. Clay-type soil predominates in the south and sandy types in the central part. In general, fertility is greater in those areas influenced by the sediments carried by the Paraguay and its tributaries, decreasing as the distance from the major water courses becomes greater.

The vegetation, unlike the typically homogeneous formations, resembles a mosaic composed of representatives from three distinct regions: the Amazonian, the cerrado (savannah) and the chaco (flatland) . All in all, there are around 1,500 species of plants, whose physical characteristics are categorized as the "Pantanal complex".

The variety of the vegetation, the topography and the enormous quantity of water in the Pantanal ensure food, shelter and breeding locations for all the fauna in the floodplain itself and its surroundings. It is considered one of the main breeding centers in the Americas, where animal diversity is among the highest of the world.

The region's rivers are also rich in fish, with 263 species, the most famous being the *dourado* and the *jaú*, a giant catfish weighing more than 100 kilos. Aside from the alligator, the 50 known species of reptile include the gigantic yellow anaconda, which can grow up to 6 m in length. There are also around 650 known bird species, which unite in huge flocks during the flood season, feeding on fish and other animals in the channels and lakes. Among the biggest is the *tuiuiú*, a kind of stork with a wingspan of up to 3 m, which has become the avian symbol of the Pantanal. The Pantanal is also host to flocks of migratory birds from the Arctic on their way to the Antarctic. There are around 80 species of mammal, including the Americas' largest carnivores – the spotted jaguar and the puma – who constitute a constant threat to cattle and even humans. They are much feared and have given rise to a series of myths.

From the physiographic point of view, the Pantanal is usually divided into 11 compartments, or *pantanais*, each comprising several municipalities, as shown in the table below.

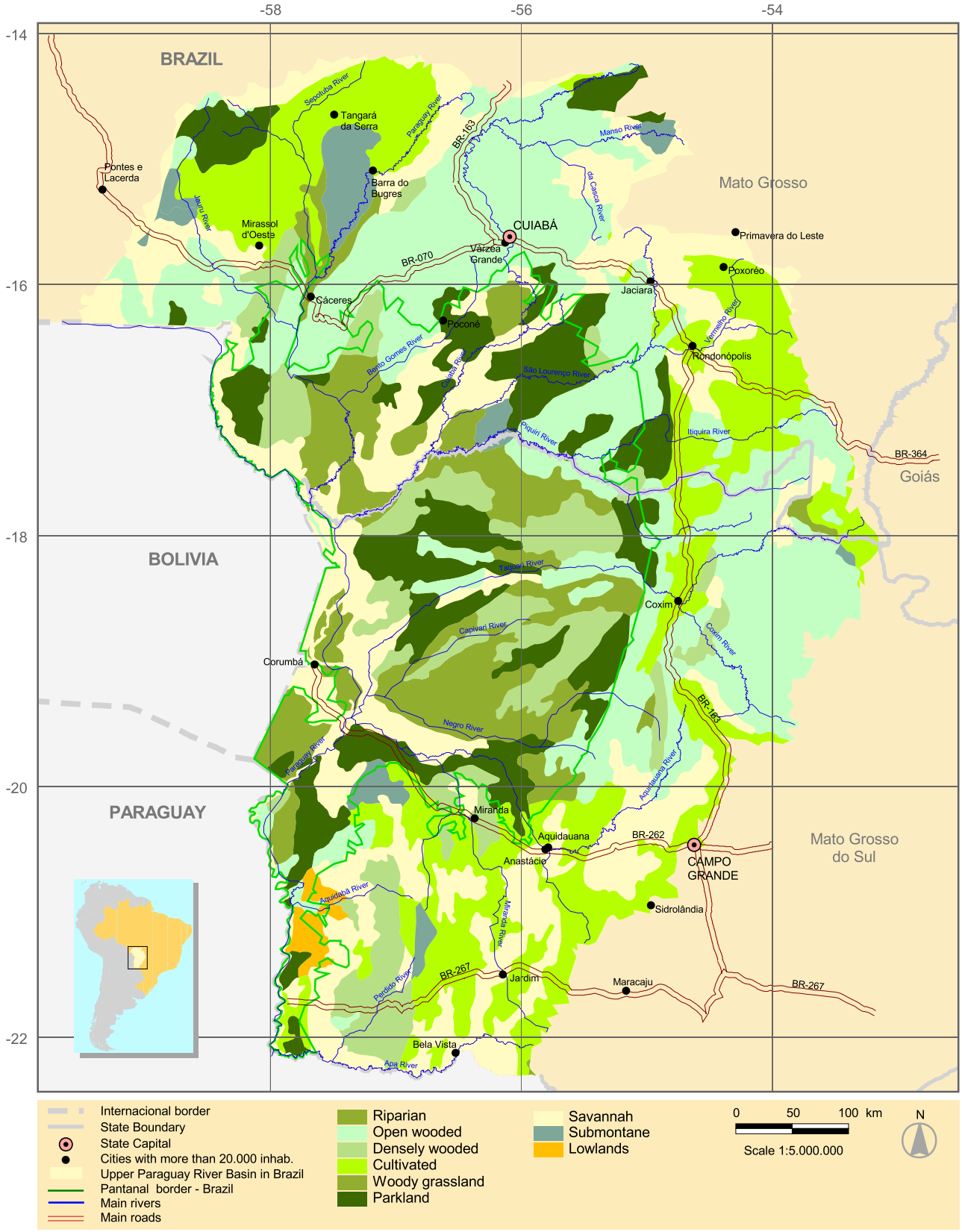
Table 1.1 – Pantanal - physiographic compartments

Compartment	Area (km^2)	Municipalities
Poconé	16,000	Cáceres, Poconé, N.S. do Livramento, Barão de Melgaço, Sto. Antônio de Leverger
Cáceres	12,000	Cáceres
Barão de Melgaço	18,000	Barão de Melgaço, Santo Antônio de Leverger
Paraguai	10,000	Corumbá, Ladário, Poconé
Paiaguás	27,000	Corumbá, Sonora, Coxim
Nhecolândia	27,000	Rio Verde de Mato Grosso, Aquidauana, Corumbá
Abobral	3,000	Aquidauana, Corumbá
Aquidauana	5,000	Aquidauana
Miranda	13,000	Aquidauana, Bodoquena, Miranda
Nabileque	13,000	Corumbá, Porto Murtinho
Porto Murtinho	4,000	Porto Murtinho

The following maps show, respectively, vegetation and soil types in the UPRB and the physiographic divisions of the Pantanal.

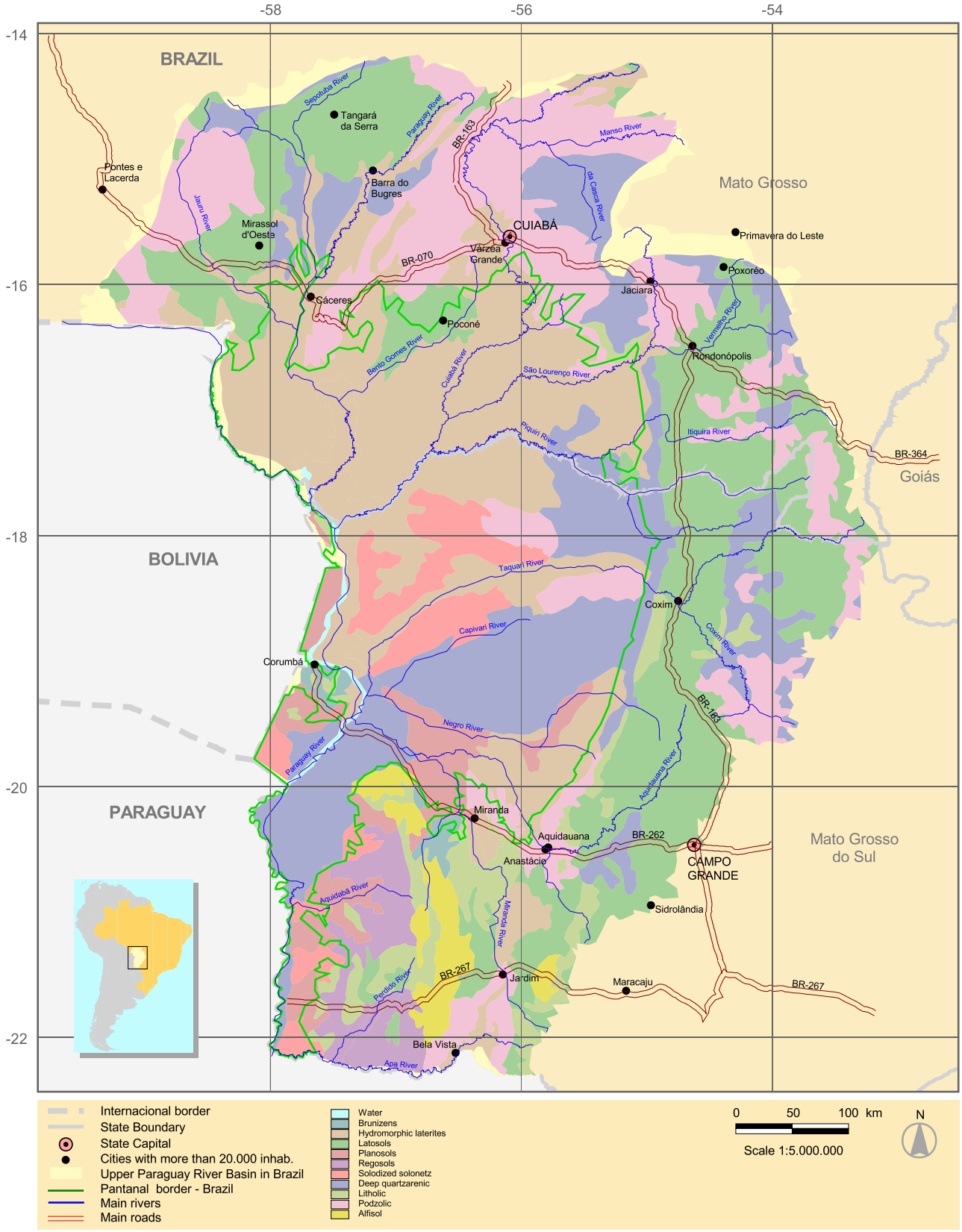
UPPER PARAGUAY RIVER BASIN IN BRAZIL

Vegetation



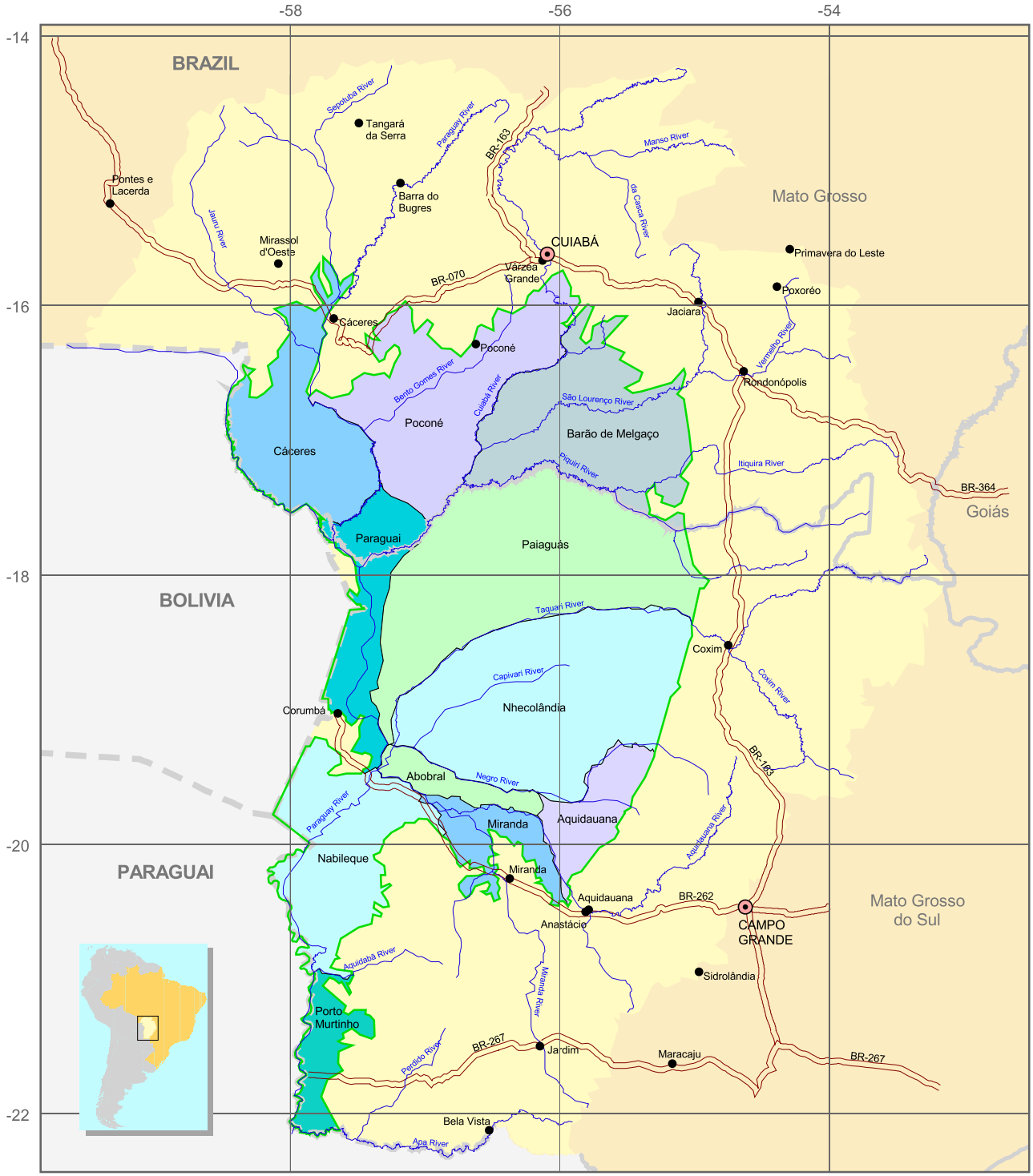
UPPER PARAGUAY RIVER BASIN IN BRAZIL

Soils



UPPER PARAGUAY RIVER BASIN IN BRAZIL

Physiographic Compartments



1.3 Population

The resident population of the UPRB is distributed over dozens of municiipalities in the states of Mato Grosso and Mato Grosso do Sul, comprising around 3 million inhabitants, most of whom live in urban areas. A breakdown of the figures is given in the following tables, where the total population numbers refer to 2004 estimates by the IBGE, which also estimated the average overall total population growth of these municipalities at around 1.9 % p.a. The rural/urban distribution was obtained by applying the same distribution as in the 2000 Census. Note that the figures refer to the total area of each municipality and not just that part located in the basin, which is estimated at around 1.9 million.

Table 1.2 – Municipalities wholly or partially located in the UPRB (Mato Grosso)

Municipality	Area (km^2)	Total Population	Urban Population	Rural Population	Rural Density ($inhab/km^2$)
Acorizal	841	6,078	2,897	3,181	3.78
Alto Araguaia	5,538	11,738	9,332	2,406	0.43
Alto Garças	3,660	8,350	7,260	1,090	0.30
Alto Paraguai	2,052	6,590	4,994	1,596	0.78
Alto Taquari	1,395	5,226	4,284	942	0.68
Araputanga	1,603	14,247	11,262	2,985	1.86
Arenápolis	415	10,608	9,779	829	2.00
Barão de Melgaço	11,182	6,566	3,107	3,459	0.31
Barra do Bugres	7,161	31,095	23,940	7,155	1.00
Cáceres	24,713	87,708	67,889	19,819	0.80
Campo Verde	4,795	22,991	17,442	5,549	1.16
Chapada dos Guimarães	6,227	17,272	10,362	6,910	1.11
Cuiabá	3,971	524,666	517,269	7,397	1.86
Denise	1,271	8,869	7,787	1,082	0.85
Diamantino	7,736	19,903	15,335	4,568	0.59
Dom Aquino	2,205	8,243	6,268	1,975	0.90
Figueirópolis D'Oeste	891	3,752	1,531	2,221	2.49
Glória D'Oeste	846	2,792	1,753	1,039	1.23
Guiratinga	5,358	11,562	10,527	1,035	0.19
Indiavaí	600	2.073	1.269	804	1.34
Itiquira	8,639	9,813	3,232	6,581	0.76
Jaciara	1,659	26,363	22,980	3,383	2.04
Jangada	1,022	8,112	3,140	4,972	4.87

Municipality	Area (km^2)	Total Population	Urban Population	Rural Population	Rural Density ($inhab/km^2$)
Jauru	1,217	12,843	6,162	6,681	5.49
Juscimeira	2,205	12,635	8,296	4,339	1.97
Lambari D'Oeste	1,713	3,876	1,464	2,412	1.41
Mirassol d'Oeste	1,130	22,663	18,709	3,954	3.50
N. S. do Livramento	5,229	12,988	4,169	8,819	1.69
Nobres	7,314	15,432	12,318	3,114	0.43
Nortelândia	1,351	5,798	5,245	553	0.41
Nova Brasilândia	3,548	4,967	3,497	1,470	0.41
Nova Marilândia	1,947	2,798	1,853	945	0.49
Nova Olímpia	1,513	17,917	16,066	1,851	1.22
Pedra Preta	4,193	14,835	11,305	3,530	0.84
Planalto da Serra	2,454	2,939	1,715	1,224	0.50
Poconé	17,261	31,243	22,666	8,577	0.50
Pontes e Lacerda	13,123	40,830	27,600	13,230	1.01
Porto Esperidião	5,815	10,719	3,732	6,987	1.20
Porto Estrela	2,065	4,283	2,128	2,155	1.04
Poxoréo	6,923	18,056	12,661	5,395	0.78
Primavera do Leste	5,472	53,881	49,395	4,486	0.82
Reserva do Cabaçal	361	1,907	1,227	680	1.89
Rio Branco	529	4,762	3,251	1,511	2.86
Rondonópolis	4,165	163,824	154,675	9,149	2.20
Rosário Oeste	8,500	17,990	10,427	7,563	0.89
Salto do Céu	1,295	3,387	1,744	1,643	1.27
Sto Antônio do Leverger	11,828	15,459	5,524	9,935	0.84
São José do Povo	444	3,113	1,536	1,577	3.55
S. José Quatro Marcos	1,281	18,504	13,058	5,446	4.25
São Pedro da Cipa	344	3,596	3,054	542	1.57
Sto. Afonso	1,168	2,378	1,138	1,240	1.06
Tangará da Serra	11,728	68,191	59,678	8,513	0.73
Tesouro	4,017	2,402	1,947	455	0.11
Várzea Grande	901	242,674	238,171	4,503	5.00
TOTAL	**234,815**	**1,691,507**	**1,468.050**	**223,457**	**0.95**

Table 1.3 - Municipalities wholly or partially located in the UPRB (Mato Grosso do Sul)

Município	AREA (km2)	População Total	População Urbana	População Rural	Dens. Rural (hab/km^2)
Alcinópolis	4,400	2,426	1,521	905	0.21
Anastácio	2,949	23,779	18,266	5,513	1.87
Antônio João	1,144	7,804	6,633	1,171	1.02
Aquidauana	16,959	45,543	35,453	10,090	0.59
Bandeirantes	3,116	6,556	4,625	1,931	0.62
Bela Vista	4,895	23,113	19,140	3,973	0.81
Bodoquena	2,507	8,494	5,302	3,192	1.27
Bonito	4,934	17,681	13,480	4,201	0.85
Camapuã	10,758	14,141	9,125	5,016	0.47
Campo Grande	8,096	734,164	725,637	8,527	1.05
Caracol	2,939	4,932	2,964	1,968	0.67
Corguinho	2,641	3,547	1,470	2,077	0.79
Corumbá	64,965	99,441	89,510	9,931	0.15
Coxim	6,410	32,630	28,986	3,644	0.57
Dois Irmãos do Buriti	2,345	9,636	4,503	5,133	2.19
Guia Lopes da Laguna	1,210	12,114	9,875	2,239	1.85
Jaraguari	2,913	5,847	1,535	4,312	1.48
Jardim	2,202	24,193	22,487	1,706	0.77
Ladário	340	17,023	14,985	2,038	5.99
Maracaju	5,299	27,871	22,525	5,346	1.01
Miranda	5,479	24,459	12,820	11,639	2.12
Nioaque	3,924	17,153	6,914	10,239	2.61
Pedro Gomes	3,651	8,646	6,605	2,041	0.56
Ponta Porã	5,329	66,054	58,969	7,085	1.33
Porto Murtinho	17,735	13,577	8,502	5,075	0.29
Rio Negro	1,818	5,344	3,678	1,666	0.92
Rio Verde Mato Grosso	8,152	19,710	16,752	2,958	0.36
Rochedo	1,561	4,787	2,742	2,045	1.31
São Gabriel do Oeste	3,854	19,277	15,621	3,656	0.95
Sidrolândia	5,286	27,519	18,588	8,931	1.69
Sonora	4,076	11,423	9,664	1,759	0.43
Terenos	2,841	12,516	6,098	6,418	2.26
TOTAL	**214,727**	**1,351,400**	**1,204,975**	**146,425**	**0.66**

Part of the basin's population is made up of native peoples, totaling some 33,000 individuals in 26 indigenous reserves. The following are the main ethnic groups:

- Guató: a people believed to have been extinct for 40 years, they were rediscovered in 1977 on the island of Bela Vista do Norte. They are nomadic, settling in huts only during the rainy season;

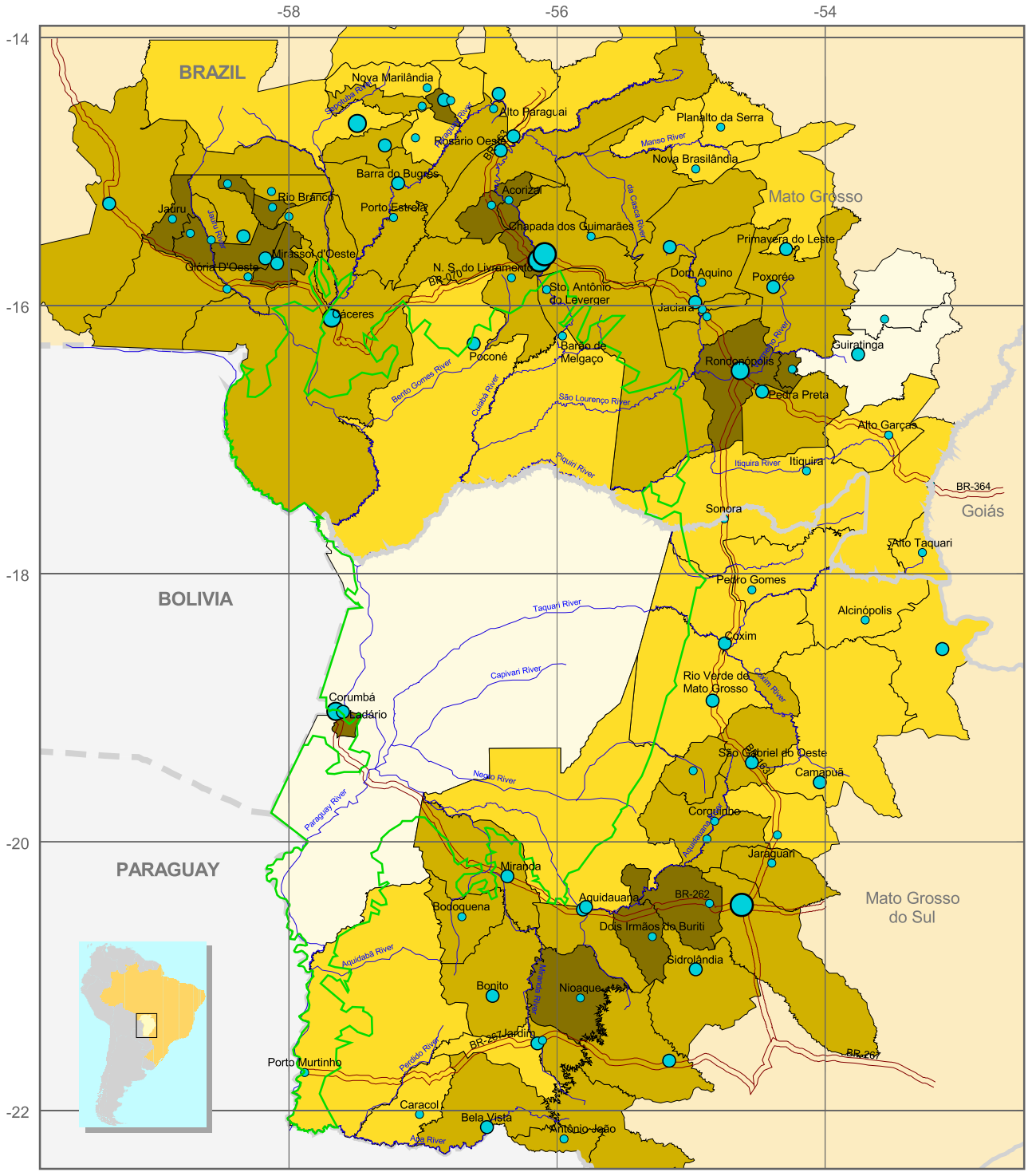
- Terena: most of the Terena, around 12,000 individuals, live on 8 reserves in the west of Mato Grosso do Sul;

- Kaiowaá: a community of more than 16,000 inhabiting 23 officially recognized areas, only 3 of which are situated in the UPRB.

The two maps below show the basin's population distribution. in the first one, dealing with the populations in the preceding table, one can note the difference between the impact of the urban populations on the basin (represented by the size of the symbols) and that of the rural populations (represented by different colors in line with population density). The following map shows the location of the indigenous areas and villages.

UPPER PARAGUAY RIVER BASIN IN BRAZIL

Population



UPPER PARAGUAY RIVER BASIN IN BRAZIL

Indigenous Reserves