Information Sheet on Ramsar Wetlands

Categories approved by Recommendation 4.7 of the Conference of the Contracting Parties.

NOTE: It is important that you read the accompanying *Explanatory Note and Guidelines* document before completing this form.

1. Date this sheet was completed/updated: December 1999

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DD	MM	YY	Designation date
29	02	00	

Site Reference Number
6BR006

2. Country: Brazil – State of Maranhão

3. Name of wetland: Baixada Maranhense Environmental Protection Area

Municipals covered:

Anajatuba, Arari, Bequimão, Cajapió, Cajari, Lago Verde, Matinha, Mirinzal, Palmeirândia, Penalva, Perimirim, Pindaré-Mirim, Pinheiro, Pio XII, Santa Helena, São Bento, São Vicente de Férrer, Turiaçu, Viana, Vitória do Mearim, Ilha dos Caranguejos (Cajapió).

Separated municipals:

Bela Vista do Ma	- seperated from	Vitória do Mearim
Satubinha	- seperated from	Pio XII
Central do Ma	- seperated from	Mirinzal
Tufilândia	- seperated from	Pindaré-Mirim
Bacurituba	- seperated from	Cajapió
Turilândia	- seperated from	Turiaçu/Santa Luzia do Paruá
Presidente Sarney	- seperated from	Pinheiro
Igarapé do Meio	- seperated from	Vitória do Mearim
Conceição do Lago Açu	- seperated from	Vitória do Mearim
Nova Olinda do Ma	- seperated from	Viana, Matinha, São João Batista and São Vicente de Férrer.

4. Geographical coordinates: 01°59' - 04°00' S 44°21' - 45°33' W

5. Altitude: (average and/or max. & min.) 5 to 70 meters

6. Area: (in hectares) 1,775,035.6 ha

7. Overview: (general summary, in two or three sentences, of the wetland's principal characteristics)

Low, plain, floodable lands characterized by fields, gallery forests, mangrove swamps and lacustrine basins. Clay soils with low consolidation and large water retention capacity. In the estuaries, mangrove swamps occur by penetrating the narrow natural waterways among the fields, until the place that still undergoes tidal effects. During the rainy season, from December until June, the low fields are flooded, with only some *terra firma* islands and one

area of fields on a slightly elevated terrain, the "*teso*", remaining.

It is a predominantly rural area, occupied mainly by agricultural and fishing activities, and mineral exploitation of clay and sand.

8. Wetland Type: (please circle the applicable codes for wetland types as listed in Annex I of the *Explanatory Note and Guidelines* document.)

marine-coastal: A · B · C · D · E · **F** · G · H · **I** · J · K

inland: L · **M** · **N** · **O** · **P** · Q · R · Sp · **Ss** · Tp · **Ts**
· U · Va · Vt · W · Xf · Xp · Y · Zg · Zk

man-made: 1 · 2 · 3 · 4 · 5 · 6 · 7 · 8 · 9

Please now rank these wetland types by listing them from the most to the least dominant:

Ts – Ss – M – O – I – P – F - N

9. Ramsar Criteria: (please circle the applicable criteria; see point 12, next page.)

1a · **1b** · **1c** · 1d ; 2a · **2b** · **2c** · 2d ; **3a** · **3b** · 3c ; **4a** · **4b**

Please specify the most significant criterion applicable to the site: "1c"

10. Map of site included? Please tick ***yes*** ☒ **-or-** ***no*** ☐

(Please refer to the *Explanatory Note and Guidelines* document for information regarding desirable map traits).

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Please provide additional information on each of the following categories by attaching extra pages **(please limit extra pages to no more than 10):**

12. Justification of the criteria selected under point 9, on previous page. (Please refer to Annex II in the *Explanatory Note and Guidelines* document).

1. Criteria for representative or unique wetland:

1a - It is a particularly good representative example of a natural, or near-natural

wetland, characteristic of the appropriate biogeographical region.

Along the Maranhense coast, this is a region that concentrates large fluvial and fluvial-marine plains, flat lowlands, with predominant altitudes between 5 and 15 meters, crossed by circulation canals of brackish water. The majority of the area may be considered a quasi-natural environment or relatively little affected by human activity due to the low demographic density (26 inhab/km^2).

The climate of the region is humid, with average annual precipitation registering around 1,700 to 2,100 mm and a very short dry season, of one to three months. The rainy season is concentrated in the months from December to July.

The predominant soils are hydromorphic and halomorphic, experience prolonged seasonal flooding (associated with the rainy season), presenting permanent flooding in some locales. The vegetation is of hygrophyllic fields and hydrophyllic *várzeas*, also known as alluvial fluvio-marine fields, with or without babaçu palms.

Non-flooding "islands" of variable dimensions, called "tesos", dominated by subpereniphollic forests, occur scattered throughout the floodplain.

1.b) It is an especially good representative example of a natural or near-natural wetland, common to more than one biogeographic region.

In the Northern region of Brazil, there are references to other similar areas (studies of Pará and Amapá), but due to the dimensions and characteristics of these fluvio-marine plains of Maranhão, we can consider this area to be an especially good representative example.

1.c) It is an especially good representative example of a wetland that has a significant hydrological, biological or ecological role in the natural function of an extensive hydrographic water basin or coastal system, especially when it is located in a transborder position.

This area is well irrigated, with its principal rivers being the Turiaçú, Aurá, Pericumã, Mearim, Pindaré and the Granjaú; the last three forming the island of Maranhão (more to the northeast of the EPA) and the Maranhão Gulf. The Mearim, Pindaré and Grajaú rivers, together with the São Marcos Bay, rank as a wetland of international importance in the Directory of Neotropical Wetlands (the mid and deep water portions of the São Marcos Bay are included in this EPA).

Due to the topographical characteristics of the Mearim, seawater is able to reach 170 Km upriver from its mouth, where the *pororoca* phenomenon occurs (whose velocity moving up the Mearim River was measured by Ferreira & Kjerfve (1990) to be 4.94 m/s or 9.59 knots). The influence of the ocean, associated with the increase of pluviometric increases in the interior of the state, bring about the flooding of the fluvio-marine plains. In 1974, there was a flood so severe that the three cities (Pedreiras, Ipixuna and Arari) were inundated, with more than 60,000 people suffering damages.

By vast majority, the area of the *várzea* lakes are found located within the domain of the fluvial, fluvio-lacustrine and fluvio-marine deposits. The lakes receive water when the rivers (Mearim, Pindaré, Grajaús and Turiaçu) rise annually and periodically flood their banks to fill the lakes with water, which is then in part returned to the rivers when their levels fall. Due to the annual oscillations in the water levels, it is difficult to determine the volume, depth of the area occupied and the shape of the basin of these ecosystems.

The largest and most important lake is the Açu, where there is high primary productivity due to the great biomass of algae, phytoplankton and aquatic vascular

vegetation. This is one of the most productive lakes of the Baixada (including shrimp), able to produce 15 tonloads of fish during the summer, according to Lessa & Cols, 1985 *apud* Brasil 1991.

The *várzeas* of Maranhão may be considered to be important sources of carbon. Being that they are of great relevance for the ecological balance of the region. Along with the fertility of their soils, the *várzea* fields offer feeding, roosting and breeding grounds for numerous resident and migratory waterfowl.

Source: Brasil, 1991.

1.d) It is an example of a specific kind of wetland rare or unusual in the appropriate biogeographic region.

Considering the Northeast region, where the State of Maranhão is located in conformation to the political divisions of Brazil, as a biogeographic region, it is a unique environment.

The inundatable fields of the Baixada Maranhense are different from other seasonally flooded areas of the Amazon or perennially flooded areas of the Pantanal due to the marine influence and the consequent saline intrusion there observed, which result in characteristics peculiar to this region of Brazil.

2) General features based on the fauna and flora:

2.a) It supports an appreciable assemblage of rare, vulnerable or endangered species or subspecies of fauna or flora, or an appreciable number of individuals of any one or more of these species.

The manatee (*Trichechus manatus*) was studied by Domming, in 1981, who supposed that the largest remaining population of this species in Brazil was located in the estuarine area of the Mearim River.

Other species of fauna, also listed as rare or threatened with extinction are the capuchin monkey (*Cebus apella*), parrot (*Amazona pretrei*), scarlet ibis (*Eudocymus ruber*), and the panther (*Felis concolor*).

In addition, this region harbors an appreciable quantity of other animal species, the most representative of which are listed in item 18 and the annex.

In relation to vegetal species, studies are being conducted which indicate the occurrence of endemisms (data soon to be available). Among those species considered to be rare or threatened, the brazil-nut tree *Bertholletia excelsa*, is known to occur in this area, along with native palms of biogeographic importance for the region, such as the juçara (*Euterpe oleracea*), the babaçu (*Orbignya phalerata* Mart.), the buriti (*Mauritia flexuosa*), the carnaúba (*Copernicia prunifera*) and the tucum (*Astrocaryum* sp.).

Phytogeographically, according to Rizzini, the region falls within the Amazonian Province, southeast sector of the Tertiary Plain Subprovince; biogeographically, for Udvardy (1975), this region falls within the babaçu region; mapping made with Radam designate for the region, aside from the transition areas and gallery forests with buriti and juçara palms, four principal environments: alluvial fluvio-marine fields or of várzea, seasonal perenifoliar forests with babaçu stands, babaçu forests and mangroves. A record of the more representative species may be found in item 17.

2.b) It is of special value in maintaining genetic and ecological diversity of the

region through the quality and peculiarities of its flora and fauna.

Yes, as outlined in items 2a and 2c.

2.c) It is of special value, as habitat for plants or animals, during critical periods of their biological cycles.

A significant number of migrant and resident waterfowl use the wetlands of the Baixada in different seasons of the year as habitat or for feeding, roosting or breeding. Populations of native reptiles and mammals remain in these wetlands, whereas in the greater part of this hydrographic basin they have gone extinct.

2.d) It is of special value for one or more endemic species or communities of flora or fauna.

We do not have information regarding endemism, but it is certain that this region is of special value for various animals and plants as may be demonstrated through the other items of this questionnaire.

3) Specific criteria based on waterfowl:

3.a) It regularly supports 20,000 waterfowl.

Roth & Scoth (1987) noted, during their Inventory of the Avifauna of the Baixada Maranhense, the occurrence of 31,135 birds in October of 1985 of 70 different species.

Aguirre (1962 *apud* Roth & Scoth, 1987) described the hunting of snipes (*Porphyrula martinica*, *P. flavirostris* and *Gallinula chloropus*) in the region of the Baixada Maranhense and estimated the number of birds hunted annually to be between 150,000 and 200,000.

Ferraz & Bacon (1987) inventoried 91 species of waterfowl and raptors, totaling 53,463 individuals.

3.b) May regularly support significant quantities of individuals from certain groups of waterfowl, indicative of wetland values, productivity or diversity.

According to Roth & Scoth (1987) a great number of species reproduce at the end of the dry season, such as the common stilt (*Himantopus himantopus*) and the collared plover (*Charadrius collaris*). Noteworthy among resident birds are the horned screamer (*Anhima cornuta*), limpkin (*Aramus guarana*), woodstork (*Mycteria americana*), and diverse herons and egrets; the sungrebe (*Heliornis fulica*) maintains a strong population in the Baixada; the most important subregion of the Mearim for refuge during the dry season.

Furthermore, according to the above cited authors, in relation to migratory birds, the Pindaré river is particularly important for sandpipers and plovers, with over 20 species being observed; five species of sandpipers occur during the non-breeding season in the region, the most abundant in October/85 being the least sandpiper (*Calidris minutilla*). The semipalmated plover (*Charadrius semipalmatus*) can also be observed in the thousands in the Viana region. Further toward the interior and farther from the coastline, the greater and lesser yellowlegs (*Tringa melanoleuca* and *T. flavipes*, respectively), upland sandpiper (*Bartramia longicauda*) and the lesser golden plover (*Pluvialis dominica*) may be observed.

4) Specific features based on fishes:

4.a) Supports a significant proportion of subspecies, species or families of indigenous fishes, life-history stages, species interactions and/or populations representative of the wetland benefits and/or values and in this way contributes to the global biological diversity.

According to Brasil (1991) the most common fishes in the lake regions are: branquinha, curimatá, piau, surubim, pescada do piauí and traíra. Whereas in the larger rivers, the most common are: branquinha, piau, choradinha, curimatá, surubim, mandubé, bodó and pescada.

4.b) It is an important feeding and spawning ground for fishes, an area of development and/or a migratory route upon which populations of fishes common to other wetlands depend.

Ferraz & Bacon (1987) account a list (table below) of the most common fishes in the lower Mearim and its lakes in the fluvio-marine floodplain, having difficulties in the identification in that the same common name was occasionally used for more than one species, and many species still require taxonomic designation. The compositions of fishes from the lakes appear to be uniform, as would be expected from an area with considerable intercommunication and mixture during the floods of the rainy season.

List of fishes observed in the rivers and lakes of the Baixada Maranhense

Common name (Portuguese)	Scientific name	Family
Araçu	*Leporinus sp*	Anostomidae
Baginho		Pimelodidae
Bagre	*Rhambdia sp*	
Bagre-branco	*Bagre marinus*	
Bodo	*Plescostomus*	Loricariidae
Boi-de-carro (syn. Bodo)		
Branquinha	*Anodus ou Curimata*	Characinidae
Cachimbo	*Loricaria*	Loricariidae
Calambanye		
Cara		
Carrau		
Cascudo	*Plescostomus sp*	Loriidae
Corvina		Sciaenidae
Courimatá	*Prochilodus sp*	Characinidae
Cromatano (syn. Courimata)		
Curimatã (syn. Courimata)		
Dourado	*Salminus sp*	Characinidae
Dourado (syn. Dorado)		
Graviola		
	Platydorus costatus	Doradidae
Grumatá (? Syn. Courimata)	*Prochilodus sp*	Characinidae

Jeju	*Hoplerythrinus*	Characinidae
Liro		
Mandi	*Pimelodius clarius*	Pimelodidae
Mandube	*Ageneiosus brevifilis*	Auchenipteridae
Mussum	*Symbranchus marmoratus*	
Pescada-grande		Sciaenidae
Pescada-pequena	*Plagioscion ou Pachyurus*	Sciaenidae
Pescada-de-água-doce	*Cynoscion sp*	
Piranha-vermelha	*Serraselmus sp*	
Pirapema		
Piau (syn. Araçu)	*Leporinus sp*	Anostomidae
Piau-barbado (syn. Araçu)	*Leporinus sp*	Anostomidae
Poraquê	*Electrophorus electricus*	
Raia		Potamotrygonidae
Surubim	*Platystoma ou Pseudoplatystoma fasciatum*	
Tainha		
Tapiaca (? syn. Branquinha)		
Traíra	*Hoplias malabaricus*	Characinidae
Tubayarra		
Tubi		
Viola		

Source: Ferraz & Bacon (1987)

In the same study cited above, there is mention of an invertebrate macrofauna rich in mollusks and crustaceans, especially in the mangroves, which includes *Aratus pisonii*, *Goniopsis cruentata*, *Cardisoma guanhumi*, *Ucides cordatus*, peneid shrimps, *Balanus / pallidus*, oysters, *Mytella falcata*, *Melampus coffeus* e *Littorina angulifera*. All species are typical of estuarine environments of northern South America. In the lakes, Trichodactylid crabs and palaemontid shrimps are commonly found.

13. General location: (include the nearest large town and its administrative region)

Closest municipality: Cajapió, 46km from São Luís, capital of the state of Maranhão. The furthest municipality is Lago Verde, 266km from São Luís.

14. Physical features: (e.g. geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth
water permanence; fluctuations in water level; tidal variations; catchment area; downstream area; climate)

Geology: Geologically, the Itapecuru Formation, from the Cretaceous period, is found in the region. It is composed of fine to conglomeritic sandstone. There are alternate silt and schist beds.

Holocene fluvial alluvium, constituted of unconsolidated pebbles, sands and clays are enriched with heavy minerals such as gold, cassiterite, magnetite, tourmaline and zircon.

Geomorphology: constituted basically by floodable plains associated to the following types of soil: latosol, plinthite soils, gleysols, vertisol and mangrove soils.

Latosols are soils with low natural fertility, plain to mildly undulated relief, requiring correctives and organic and chemical fertilizers.

Plinthite soils have low natural fertility and an elevated acidity. In general, they have a flat relief appropriate for the use of mechanical agriculture.

Gleysols: somewhat humid, this class includes hydromorphic, poorly drained mineral soils formed in low terrain subject to periodic flooding and that have characteristics resulting, above all, from the influence of the permanent or temporary excessive humidity, consequent of the elevated groundwater close to or at the surface during a large part of the year.

They are mainly characterized by a superficial grayish or gray gley horizon mottled reddish-yellow. In general they are clay soils or with a middle/clay texture normally presenting the A-Cg horizon sequence.

Vertisols are formed by depositions in areas of depression or floodable fields. These soils present restrictions to agricultural activity in that they prevent the radical development of plants due to its resistance in the dry season and excess of water during a large part of the year.

Hydrology: the Baixada Maranhense rivers are typical plains rivers characterized by a gentle sloping in the middle and low stretches. The region is drained by the Mearim, Pindaré, Grajaú, Pericumã rivers and their tributaries.

The Mearim river is a brownish river since it carries a considerable amount of suspended matter. Its has a basin of approximately 97,000 km^2 and an average total flow rate of 557 m^3/s and total, surface, and underground outflow of around 15,570 Hm^3/year, 14,140 Hm^3/year and 3,430 Hm^3/year, respectively. The Mearim river is the largest basin of the state. This river presents the tidal bore (*pororoca*) phenomenon. The Mearim and its left margin tributaries, the Pindaré and the Grajaú, in addition to the São Marcos Basin, are included in the Directory of Neotropical Wetlands as a wetland of international importance.

The Pindaré river has an area of 34,030 sq. km. and discharges into the São Marcos basin after traversing an extension of 720km. It is divided into upper, mid and lower Pindaré.

The left margin tributaries of the Mearim river are the Corda and Flores rivers which have an area of 5,300 km^2 and an approximate extension of 150 km. Due to the tropical characteristics of the Mearim, tides can reach up to 170 km from the mouth which, together with the increase in rainfall in the inland of the state, lead to floods.

The Mearim basin covers 36 municipalities and has been undergoing an environmental degradation process as a result of deforestation, erosive processes, aggradation of the rivers, jeopardizing navigation and risking the ecological balance, fishing and exploitation of the alluvial plains to which it belongs.

The Pericumã river discharges into the Cumã basin, occupying 4,500 sq. km. in the interior of the Baixada Maranhense.

Lakes: the meadow lakes situated in the Baixada Maranhense and their area are dominated by fluvial-lacustrine and fluvial-marine deposits. The alluvial fields of the Baixada are drained by the courses of the lower Pindaré, Grajaú, Mearim and tributaries that flow into the São Marcos Basin.

The lakes receive water annually when the rivers rise and flood, returning some water to the rivers when their levels drop. Due to annual oscillations in water levels, it is difficult to determine the volume, depth and the shape of the basin of these ecosystems.

The basic types of lakes in the Baixada are: oxbow lakes resulting from old, abandoned meanders; mid-sized fluvial lakes, situated in flooded areas of the regional rivers or in fluvial paleocanals; lakes found in inland *rias* or re-entrances.

Source: (SUDENE/UFPE, 1989)

Among the most significant lakes are the Itans, Açu, Jardim and Santa Maria on the left margin of the Mearim; the lacustrine region of the Penalva with the Viana, Capivari, Lontra and Formoso lakes and the Cajari lagoon in the Lower Pindaré. In the mid-course of the Pericumã river are found the Cafundoca, Laguinho, Faucina, Grande and Burigiativa lagoons. In the mid-course of the Turiaçu river is the Santa Helena lacustrine region, composed of a heterogeneous variety of lakes.

The largest and most important lake is the Açu, where a large predominance of algal biomass, with respect to vascular aquatic vegetation is found.

Climate: According to Köppen's classification, the regional climate is type AW', defined as tropical, with a dry winter and the rainy season coming later in the fall. There is little variation in temperature along the year, oscillating between 25.4°C and 27.4°C.

The regional climate is characterized by two clearly different seasons in terms of rainfall: the rainy season with monthly averages higher than 100mm, from January to June, and the dry season, from July to December.

According to SUDENE data, in the period from 1965 to 1985, the minimum rainfall varied from 400 to 1000mm a year, while the maximum rainfall oscillated between 3,000 to 6,000mm a year.

Source: (SUDENE, 1985)

15. Hydrological values: (groundwater recharge, flood control, sediment trapping, shoreline stabilisation etc.)

The soils and vegetation cover allow a greater or lesser degree of water storage potential in the Mearim basin, an area where the annual rainfall varies from 1,850 to 2,000mm/year, enabling the formation of sources that supply the rivers in a balanced manner throughout the hydrological year. The rains, although abundant, are not evenly distributed throughout the year, presenting drought periods in the Mearim and Grajaú areas, comparatively milder in the Pindaré region, where the dry season lasts only three months.

During the floods, the rivers overflow and numerous lakes are formed, that often last the whole year, in spite of large fluctuations in their level throughout the hydrological year.

The impermeability of the Baixada soils, together with the strong tides of four to six meters that occur in the area, as well as the slight slope, all contribute to the formation of swampy areas.

The Mearim river makes several changes in relation to hydrodynamic conditions such as width, depth and size of the carried particles. Its waters present characteristics that change in accordance with the particular stretch of the river. At the confluence with the Corda river, it is clear and limpid, changing to a yellow color after it joins with the Flores river. After the Bacabal, the color darkens, until the Arari. (See table 1).

As for the other rivers, no data was found on the physical-chemical qualities of the waters.

The lakes, in their own respect, are very important in maintaining the regional trophic system. According to Barbieri and Cols, 1989, "there is a large predominance of algal biomass with respect to the vascular aquatic vegetation, where the phytoplankton is the greatest contributor of particulate organic carbon to the system, resulting in a high primary production".

Source: Maranhão Atlas - Diagnosis of Maranhão's main environmental problems.

16. Ecological features: (main habitats and vegetation types)

1. Fluvial-marine or meadow alluvial fields, with a vegetation cover consisting mainly of cyperaceae (*Ciperos sp* and *Heliocharis sp*), followed by grasses especially *Panicum sp* and

herbaceous plants.

2. Perennial, seasonal, open forests with palm forests (*babaçual*), characterized by large trees, with open spaces, and a large quantity of sarmentose phanerogams.

3. Palm tree forest (*babaçual*): for Ab'Saber (1971) and Eiten (1977) the palm tree groves are a transition vegetation between the Cerrado/Caatinga/Amazon Forest, without, however, belonging to any of these.

4. However, more recent studies have considered the palm tree forest, in its current state of expansion, as a type of secondary vegetation, resulting from human action through farming, grazing, fire etc.
Source: RADAM/BRASIL, 1973; COPENAT/INEB, 1981

There are two species of babaçu palms: *Orbignya martiana* and *Orbignya oleifera.*

In the groves of nut palms, embrophylla and subhydrophyllaceae species are found in association: *Cassia reticulata* (golden lantern), *Euterpe oleracea* (assai palm), *Phenaskospermum guianensis*, *Mauritia vinifera* (buriti palm), *Mauntra armata, Cecropia sp, Fagara sp, Croton sp, Inga sp, Octea sp,* etc.

5. Mangroves - vegetation: *Avicenia Schaweriana, Avicenia germinans, Rizophora, Langucularia Racemosa*

17. Noteworthy flora (indicate for example endemic, rare, threatened or biogeographically important species):

We still do not have definitive information available, but studies which indicate the occurrence of endemisms are under way (data soon to be available), but at least one species considered to be rare or threatened, the brazil-nut *Bertholletia excelsa*, is known to occur (following item 2c).

The plant species listed below are considered to be biogeographically important, several even being highly used by the local communities, like the buriti (the fruit is used to make a dessert, the leaves are used to make ornaments and thatch the roofs of homes and fishing shelters, along with the trunk being used in civil construction), the juçara (a pulp, which is extremely important in the local diet, is extracted from the fruits and the heart-of-palm may also be utilized, although this is rare due to the value of the fruits), the junco, pau d'arco (furniture and civil construction) and the babaçu; the last being the most important due to the industries related to the nut of this palm. Nowadays, many workers have already organized themselves into cooperatives. Along with the nut of the babaçu, byproducts, such as oil, flour from the mesocarp (entirely edible) and bar soap are already being exported.

Plant species found in the Baixada Maranhense.

Common name	Specific name	Common name	Specific name
Babaçu	*Orbignya martiana, O . phalerata*	Arroz brabo *	*Luzida spruciana*
Capim-açu		Aturiá *	*Machaerium lunatus*
Capim-marreca *	*Paratheria prostata* ou *Panacium trichanhum*	Canarama *	*Panicum sp*
Carnaúba	*Copernicia prunifera)*	Capim-do-Pará *	*Panicum numidianum*

Aguapé	*Eichornia crassipes, Salvinea sp,Neptunia sp*		*Thalia geniculata* *
Remela de macaco	*Combretuam sp*		*Talia multifora* *
Lacre		Lírio d'água *	*Nymphaea rudgena*
Ciperáceas	*Eleocharis cariboea, E. interstinata*	Junco *	*Cyperus articulatus*
Junco*	*Juncos sp*	Junco ou Piri *	*C. giganteus*
Buriti	*Mauritia sp*	Junco de 3 quinas *	*Heleocharis mutata*
Juçara	*Euterpe sp*	Mururu	*Eichornia zurea, E. sp, Pontederia cordata, Salvinia auriculata*
Siriba	*Avicenia germinans*	Alface d'água	*Pistia stratioides*
Mangue branco	*(Laguncularia racemosa*	Lentilha d'água	*Lemma valdiviana*
Mangue vermelho	*Rhizophora mangle*	Cabomba	*Cabomba cf. piauhiensis*
Marisma tropical	*Blutaparon sp, Spartina sp, Batis maritima, Sesuvium sp*	Ninfeáceas	*Nymphae spp, Nymphoides sp*
Castanheira	*Bertholletia excelsa*	Onagráceas	*Jussiena sp, Ludwigia spp*
Gameleira	*Ficus insipida*	Mofumbo	*Crombetum sp*
Embaúba	*Cecronia sp*	Tucum	*Astrocaryum tucumoides*
Cedro	*Cedrela sp*	Pau d'arco	*Iabebuia sp*
Aninga	*Montrichardia sp*	Bromeliáceas terrestres	

* Most common species of the flooding fields of the Baixada Maranhense.

Source: Brasil, 1991.

18. Noteworthy fauna:

Animal species found in the Baixada Maranhense.

Common name	Specific name	Common name	Specific name
Scarlet ibis	*Eudocimus ruber**	Collared peccary	*Tayassu tajacu*
Turquoise fronted parrot, Red-spectacled parrot	*Amazona aestiva, Amazona pretrei**	Capybara	*Hydrochaerus hydrochaerus*
Tinamous	*Tianus sp*	Paca	*Cuniculus paca*
Owls	*Lophostrix sp*	Common squirrel	*Saimiri sciurius*
Yellow-rumped cacique	*Cacius cela*	Dolphins	
Tanagers	*Tachyphonus sp*	Boas	*Eunectes murinus, Helicops sp*
Blue-black grassquit	*Volatinia jacarina*	Cayman	*Caiman crocodylus*
Jacana	*Jacana jacana*	River turtle	
Black-fronted nunbird	*Monasa nigrifons*	Lizards	*Ameiva sp, Dracena guianensis, Tupinambis teguixim*
Snipes	*Porphyrula spp*	Rays	*Elipesurus stiongy lopterus and Potamontry gon*
Howler monkey	*Alouatta sp**	Branquinha	*Curimata ciprinoides*
Capuchin monkey	*Cebus apella**	Juritis	*Leotolila sp*
Tufted-ear marmoset	*Callitrix jaccus*	Crab	*Aratus pisonii*
Southern anteater	*Tamandua tetradactyla*	Caranguejo-Uça	*Ucides cordatus*
Sloths	*Bradypus sp*	Goniopses	*Goniopsis cruentata*
Crab-eating fox	*Dusicyon vetulos*	Guaiamu	*Cardisoma guanhumi*
Crab-eating racoon	*Procyon cancrivorus*	Oysters	*Mytella falcata, Melampus coffeus*
Panther	*Felis concolor**	Barnacles	*Littorina angulifera*
West Indian manatee	*Trichechus manatus**	Shrimp	

Pampas deer	*Ozotocerus bezoarticus**	Mussels	*Crupturellus dulatuus*

* Rare or threatened with extinction.
Source: RADAM/BRASIL, 1974; PROSPEC, 1977; BRASIL, 1991; FERRAZ & BACON, 1987.

Tables 1, 2, 3, 4 are annexed with the zooplankton and avifauna of the Baixada Maranhense.

19. Social and cultural values: (e.g. fisheries production, forestry, religious importance, archaeological site etc.)

Tourism potential:

- Ecotourism
- Natural attractions
- Fisheries - Event: Fish Festival
- Subsistence agriculture
- Ranching

Cultural values:

- Historical heritage
- Handicrafts
- Cooking
- Folkloric and religious manifestations
- Events: Fish Festival and Watermelon Festival

Environmental problems observed in the region include extensive buffalo ranching, fishing and predatory hunting, deforestation of mangroves (principally for brick works and construction), damming of some rivers, burning for pastures and crops and the use of agrotoxins on the larger ranches.

Noteworthy among traditional, beneficial uses of this area include the tending of juçarais (*Euterpe oleraceae*) stands, which provide a fruit whose juice is a staple in the local diet. The exploitation of babaçu (*Orbignya phalerata*) includes the harvest of nuts, from which the following products are derived: a readily edible endosperm, sauce for fish, seasoning for meat, cooking oil, soap, lamp oil, animal rations, shells which are used for charcoal and cooking fuel, a cassava substitute flour that can also be used to prepare a chocolate-like beverage, gastrointestinal medicine, hunting bait. The leaves of this palm are also used to produce fiber, baskets, mats, fans, sieves and construction materials, such as thatch for roofs and walls, fiber for adobe and fencing. Burned leaves are also used to enrich soil and control pests. The sap is used as a lacquer, and an antiseptic may also be extracted from it. The trunks of babaçu are used in the construction of bridges, foundations, and terraces, while an extract from the heart-of-palm is used to ripen bananas.

20. Land tenure/ownership of:

(a) site:

The legal condition of the lands in the Baixada Maranhense is as follows: 11.12% are privately owned, 41.86% are leased, 15.2% belong to public entities, 22.6% belong to the state and 9.4% belong to corporations.
Source: (IBGE, Censo Agropecuário, 1985)

(b) surrounding area:

According to Silva *et al.* (1993), large properties dominate the surrounding area. Demographic density is very low (4 inhab/Km^2).

21. Current land use:

(a) site:

The Baixada Maranhense has a population of 517,413 inhabitants (IBGE census, 1991). The main human activities in the area are:

- Subsistence agriculture, whose main crops are: rice, corn, cassava and beans.

- Fisheries: Most fished species: *branquinha or tapioca, curimbatá (gn. Prochilodus), surubim, traira (Hoplias malabaricus), mandir, acará, piau pintado, piau cabeça gorda, lírios, pescada do Piauí-Fresh water croaker (Plagioscion squamosissimus)*

- Plant exploitation: Babaçu *(Orbignya phalerata)* - from which the nut is exploited to extract oil and the sludge for animal feed. In the upper and mid stretches of the main rivers, which make up the Mearim and Pindaré basins, timber exploitation is the main activity. Deforestation of mangroves occurs not only for subsistence, but also for commercialization purposes, in brick making factories, bakeries, ceramic factories and construction.

- Industrial activities: small brick making and ceramic factories.

- Ecotourism: The Maranhão lakes region is located within this area, with its beautiful surroundings and landscape. Visits must be made mostly during the rainy season (January to July).

(b) Activities which could have a direct influence over the environment:

*Extraction of sand and clay
*Hunting and the exploitation of wildlife
*Extensive buffalo ranching
*Uncontrolled fishing with drag-netting

22. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land use and development projects:

(a) at the site:

Factors adversely affecting site:

(i) Pressure from urban expansion:

In particular in the municipalities of Anajatuba, Vitória do Mearim, Arari, Pindaré, Santa Inês part of the Carajás corridor.

(ii) Pollution of water courses:

The Mearim basin concentrates in its area 20.2% of Maranhão's industries including saw mills, furniture factories, refrigerated warehouses, dairy products, tanneries, and alcohol distilleries. Since this EPA is situated in the lower Mearim, this region may suffer the effects of pollution in the upper river.

(iii) Construction and other activities that influence fisheries:

- construction of dams, leading to interruption in breeding.
- use of timbó (*Paullinia pinata* - a woody vine whose bark contains fish poison) as fishing resource.
- removal of forests (resulting in the degradation of water courses, disfavoring larger fishes, thereby making smaller fishes more vulnerable).

(iv) Soil instability:
Caused through the extraction of clay for ceramic and brick making factories; slash and burn practices for agriculture; buffalo ranching that causes trampling of grasses and cyperaceae, increasing water turbidity, leading to desertification of soils and decrease of fishing productivity; removal of clay/mud from river margins.

Potential adverse factors:

(i) Destruction of specific ecosystems:
- mangrove swamps
- fields
- lacustrine basins
- cerrados
- gallery forests

(ii) The area is crossed by the Carajás Railway, future site for concentration of large-scale industries (metal works, steel mills, etc.)

(iii) environmental damage resulting from mineral exploitation activities

(iv) in the mid-Mearim/Pindaré a pig-iron processing plant is being implemented, besides activities of brick making and ceramics factories, clay and sand extraction also occur in the lower Mearim/Pindaré.

(b) surrounding area:

The principal adverse factors observed in the region are deforestation and burning, erosion processes, silting of rivers, use of agrotoxins and the construction of dams to meet human water needs.

23. Conservation measures taken: (national category and legal status of protected areas - including any boundary changes which have been made: management practices; whether an officially approved management plan exists and whether it has been implemented)

Only periodic inspections are conducted.

In the last two years, environmental education activities have been developed with the participation of rural labor unions and babaçu harvest cooperatives, counting on the support of Unicef.

24. Conservation measures proposed but not yet implemented: (e.g. management plan in preparation; officially proposed as a protected area etc.)

With the support from Pró-Água, through the Ministry of the Environment, an Ecological Economic Zoning Project is being elaborated for this EPA, to be implemented in the year

2000. An additional project, developed through a partnership with the Gerência Adjunta de Saúde, "Prevention and control of hydrically transmitted diseases, with an emphasis on cholera", has been approved and awaits repass of funds. This project aims to promote important inventories in the region, since a large part of the municipals with high indices of illness are found in this region.

25. Current scientific research and facilities: (e.g. details of current projects; existence of field station etc.)

- Monitoring of piscicultural species in different types of water bodies of the Baixada Maranhense EMAPA/SUDAM (Açu and Viana Lagoons)
- Project to Study the Baixada Maranhense Ecosystem aims to diagnose the true status of the area, analyzing the impact of buffalo breeding in the lake region, by LABOHIDRO/UFMA under the coordination of Professor Maria do Socorro Rodrigues Ibanez.

- Study of the Penalva/Viana/Cajarí lacustrine system in the Pindaré basin; the lakes and floodable fields of the Pericumã basin and the marginal lakes of the Turiaçu basin, with the aim of obtaining databases that support and encourage the program of sustainable use of the region's resources, under the coordination of the biologist Ricardo Barbieri of LABOHIDRO/UFMA. As for facilities to support field work, none are available in this area.

26. Current conservation education: (e.g. visitors centre, hides, information booklet, facilities for school visits etc.)

We have two leaflets available, distributed in the "O Imparcial" newspaper:
- VIVA, a special ecology series, year I, nos. 1 and 6
- folder about the Coastal Zone Management Program in Maranhão.

27. Current recreation and tourism: (state if wetland is used for recreation/tourism; indicate type and frequency/intensity)

- The Maranhão lake region is situated in this area. Visits should be made in the rainy season, from January to July.

- Natural landscape attractions:

Natural beauty of the Pindaré/Mearim river basins, Cajuri Lagoon, Formoso Lake with a floating isle and Viana Lake with its beautiful fields that are covered with flowers in the summer.

- Cultural attractions:

Historical heritage, churches, sugar mills, Viana town center with buildings from the colonial period.

- Handicrafts:
* weaving: baskets, mats, hampers, sieves, slippers.
* ceramics: jugs, pots, pans, bowls.
* woodcrafts: spoons, cups, bowls, tables, chairs.
* leather: bermuda-shorts, vests for cowboys, slippers, hats, rafts
* metalworks: bracelets, rings and other artifacts
*cooking: dishes with freshwater fishes, dried meats, corn gruel, "arroz maria isabel", "baião de dois", "paçoca".

- Events: Fish Festival in Viana and Watermelon Festival in Arari

- Folkloric and religious manifestations: *Bumba-meu-boi, tambor de crioula, quadrilha, dança do coco, novena do divino, pau de sebo e mata-o pato, pastores, cordões de reis, baile de São Gonçalo*

28. Jurisdiction: (territorial e.g. state/region and functional e.g. Dept of Agriculture/Dept. of Environment etc.)
State Government

29. Management authority: (name and address of local body directly responsible for managing the wetland)
Secretary/Secretariat of Environment and Water Resources of the State of Maranhão

30. Bibliographical references: (scientific/technical only)

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BRASIL. 1991. Diagnóstico dos principais problemas ambientais do Estado do Maranhão. (*Diagnosis of the main environmental problems of the State of Maranhão)* Instituto Brasileiro de Meio Ambiente e dos Recursos Naturais do Estado do Maranhão – Programa Nacional de Meio Ambiente/Secretaria de Estado do Meio Ambiente e Turismo do Ma. S. Luís, LITOGRAF. 194 pág.

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FERRAZ, G. C e BACON, P. R., 1987. Managing The Wetlands of Maranhão. In Seminário sobre desenvolvimento econômico e impacto ambiental em áreas do trópico úmido Brasileiro. A experiência da CVRD, Secretaria Especial do Meio Ambiente, IWRD e CVRD, Rio de Janeiro

BRASIL, Ministério das Minas e Energia. Departamento Nacional de Produção mineral. Projeto RADAM 1973, Folhas 5 a 23 São Luís e parte da Folha 5 a 24. Fortaleza: geologia, geomorfologia, solos, vegetação e uso potencial da terra. Rio de Janeiro, Vol. II e III (Levantamento de recursos naturais 3, MME e DNPM).

ATLAS DO MARANHÃO. IBGE. Rio de Janeiro. 1984

TABLE 1 – Average morning temperatures (°C), dissolved oxygen (mg/l), Ph, transparency (mm) and average numbers of some minerals in the chemical composition (mg/l) of the waters of the Mearim river in its upper, mid and lower stretches and also the estuarine region in the dry and rainy seasons

MEARIM	Temp		0_2		pH		Transp.		Ca		Mg		Cl		Fe	
	D	R	D	R	D	R	D	R	D	R	D	R	D	R	D	R
Upper	22.6	26.4	-	7.3	-	5.4	1.44	0.93	1.81	2.88	1.77	5.10	3.00	2.50	0.32	3,77
Mid	28.1	27.3	2.9	6.1	6.4	5.3	0.30	0.66	1.77	5.30	1.71	5.40	4.36	7.40	3.09	2.60
Lower	27.4	28.3	2.9	2.0	6.4	5.4	0.14	0.33	2.82	6.80	3.66	3.66	12.0	32.0*	13.5*	6.78
Estuary	27.9	28.8	4.3	4.9	7.0	6.8	0.17	0.31	283*	111*	971*	271*	14401	3314*	27.9	12.93

Source: SUDENE, 1981 (Adapted by Rodrigues)

D – dry season R – rainy season

* Approximate number

TABLE 2

Zooplankton of the Baixada Maranhense region:

Açu Lake

Rotifera	Crustacea	
Epihanes davulata logirostris	*copepoda*	*cladocera*
E. macrourus fasciculata	*notodiapto-musbrandorffi*	*bosina*
Brachinous budapestinesio	*mesocyclops meridianus*	*latonopsis*
B. calicyflorus amplhiceros	*ergasilidae sp*	*ceriodaphiniacornuta*
B. caudatus insuetos		*bosminopsisdeitesi*
B. caudatus personatus		
B. falcatus		
B. lavanaensis		
B. mirus reductus		
Karatella americana		
K.cochleparis		
K. lemzi		
Mytilinaventralis cacracantha		
M. ventralis michelangellii		
Mytilina sp		
Lecani curvicornis		
L. proeicta		
L. (manistylla) bulla		
L. (M). cornuta oidipus		
Notommata peridia		
Trichocerca chattano		
T. (diurella) dixon-muttani		
T. m. hauerensis		
Lacinularia elliptica		
Ptygura sp		
Sinantherina semibulatta		
Felinia longiseta		
F. pejleri		
F. saltator		

Source : TURNER et al. 1988

TABLE 3 – Zooplankton of the Baixada Maranhense region

Viana Lake.

Rotifera	Crustacea	
Brachionus mirus fasciculata	*copepoda*	*cladocera*
Keratella americana	*oithonabjorn-bergae*	*lotonopsis*
Lecane hastata	*thermocyclopos-minutus*	*ceridaplhia cornuta*
Polyarthra vulgaris		
Hexathra intermedia brasiliensis		
Filinia longiseta		

Source: TURNER et al. 1998.

TABLE 4 – Avifauna of the Baixada Maranhense region

Scientific Name	Common Name (Portuguese)
Crypturella parvirostris	inhambuzinho
Crypturella undulatuus	sururina
Crypturela seui	tururim
Phalacrocorax olivceus	biguá
Onhinga anhinga	meuá
Florida caerulea	garça morena
Bubulcus ibis	garça branca grande
Egretha thula	garço branca pequena
Tigrisoma lineatum	socó-boi
Butoris stiatus	socozino
Aramus guarauna	carão
Eudocimus ruber	jabiru
Dendrocygn viduata	guará
Dendrocygna bicolor	paturi
Sarkidiornis melamotos	marreca-peuá
Chorostilbom ef. Mehsugus	mutrião
Chloroceryle inde	beija-flor-verde
Monsa nigrifans	marim-pescador da mata
Pteroglossus aracari	bico-de-brosa
Selenidera gouldié	araçari de bico-branco
Ramphastus vitellinus ariel	araçari-poca
Ramphastus tucanus	tucano de bico-preto
Pitangus sulfuratus	tucano grande de bico preto
Tachycieata albiventer	andorinha-do-rio
I cterus icterus	corrupião
Agelaius ruficapillus	graúna
Psarocolius bifasciata	japu
I cterus cayanesis	pega
Dacna cayana	saia azul
Cianocompsa cuyanoides	azulão da amazônia
Cryzoborus maximiliani	bicudo
Sporophila linela	bigodinho
Seroplhila bourreuil	caboclinho
Sperophila cf. schistacea	cigarra
Oryzoborus angolensis	curió
Passer Domestico	pardal
Coragyps atratus	urubu (comum)
Cathartes aura	jereba
Ortalis superciliares	aracuã
Penelope superciliaris	jacu

Mitu mitu tuberosa	mutum cavalo
Crax fasciolata pinima	mutum-pinima
Porphyrula martinica	jaçanã
Jacana jacana	japiaçoca
Hinantopus himantopus	pernilongo
Bhurinus bistriatus	téu-téu da savana
Leptotila verreauxi	juriti
Columbina talpacoti	rola
Deroptyus acciopitrinus	curicantã
Ara maracana	maracanã
Amazona amazonica	curau
Guira guira	anu-branco
Crotophaga ani	anu-preto

TABLE 5 – Avifauna of the Baixada Maranhense region

Scientific Name	Common Name (Portuguese)
Himantopus himantopus	pernilongo
Charadrius collos	batuíra de coleira
Anhim cornuta	inhauma
Aramus guarauna	carão
Aramidis cajanea	-
Mycteria americana	jabiru
Heliornis fulica	pica-porra
Calidris minutilla	maçariquinho
Calidris fuscicollis	maçariquinho
Calidris melanotos	maçariquinho
Calidris pusilla	maçariquinho
Gallinago paraguae	-
Charadrius semipmatus	batuíra-de-banho
Tringa melanoleuca	maçarico der perna amarela
Tringa flavipes	maçarico de perna amarela
Tringa solitaria	-
Actitis macularia	-
Batramia longicauda	maçarico de campo
Pluvialis dominica	batuiruçu
Pluvialis squatarola	-
Jacana jacana	japiaçoca
Porphyrula matimica	jaçanã
Porphyra flavirostris	jaçanã
Vanellus chilensis	-
Arenaria interpres	-
Hoploxipterus cayanus	batuíra de esporão

Phaetusa simples	gaivota de cabeça cinza
Gelachehidon nilotica	trinta-réis
Sterna superciaris	trinta-réis
Cathartes burrovianus	trinta-réis
Rostrhannus saciabilis	urubu de cabeça amarela
Ceryle torquata	gavião caramujeiro
Chlorocery amazona	martim-pescador
Chloroceryle americana	martim pescador
Chloroceyle inda	martim pescador
Ophisthoconnus hoazin	cigarra
Helicolestes hanatus	gavião
Busarelluys nigricollis	gavião belo
Pandion plancus	águia-pescadora
Falco rufigularis	falcão
Rynchopos niger	carta-água
Phalacro corax olivaceus	biguá
Anhinga anhinga	meuá
Ardea cocai	-
Csmerodius ablus	-
Buluculus ibis	garça boiadeira
Florida caerulea	garça morena
Butorides atriatus	socozinho
Philherodius pileatus	-
Nycticorax nycticorax	-
Tigrisoma lineatum	-
Mesembrinibis cayenenses	-
Ajaja ajaja	-
Dendrocygna viduata	paturi
Dendrocygna autommalis	paturiaçu
Amazonetta brasilienseis	-
Sarkidiornis melanotos	-
Cairina moschata	pato do mato
Coragyps atratus	urubu-comum
Cathartes aura	jereba
Grampsonyx awainsonii	-
Leptodon cayanensis	-
Buteo magnirastris	gavião-carijó
Buteo nitidus	-
Heterospizias meridianolis	-
Buteogallys urubitinga	-
Geranospiza caerulesceuns	-
Herpetother cachinans	-
Dendorocygna biocolor	marreca cneleria

Ixobrichus exilis	socó-vermelho
Tryngiter subruficollis	maçarico-amarelado
Buteo albicaudatus	gavião de rabo-branco
Falco peregrinus	falão peregrino

Source: (Roth and Scott, 1987)

c) **Ongoing Projects:**

BITTENCOURT, J.B. & COURA, M.F. 1994. Programa Estadual de Gerenciamento Costeiro. Convênio 008/94 MMA/PNMA/PNGC e Sema/Ma.

Annex I - Maps that include the Baixada Maranhense EPA

Item	Name of the Map	Scale	Year	Origin	Type	Area Covered	Contents
01	Nautical Map 400	1:317.010	1970	DHN	Planialtimetric	Mouth of the Gurupi river to Santana island.	Navigation guide points (navigation buoys and lighthouses), access canals, ports and moorings and details of maritime coast and logistic support information.
02	Sectorization of the Maranhão coastline for a GERCO/MA study	1:1.250.000	1997	DER/ MA Road Map	Thematic	Mouth of the Gurupi river to the mouth of the Parnaíba river	Sectorization of the Maranhão coastline.
03	Protected areas of the Maranhão Coastal Zone	1:1.250.000	1997	DER/ MA Road Map	Thematic	Mouth of the Gurupi river to the mouth of the Parnaíba river	Protected areas of the Maranhão coastline
04	Climatic characterization, climatic differentiation*	1:2.000.000	1995	Sudene	Thematic	Mouth of the Gurupi river to the mouth of the Parnaíba river	Climatic differentiation

05	Climatic characterization-nebulosity*	1:2.000.000	1995	Sudene	Thematic	Mouth of the Gurupi river to the mouth of the Parnaíba river	Nebulosity
06	Climatic characterization-maximum rainfall*	1:2.000.000	1995	Sudene	Thematic	Mouth of the Gurupi river to the mouth of the Parnaíba river	Maximum rainfall
07	Climatic characterization-minimum rainfall*	1:2.000.000	1995	Sudene	Thematic	Mouth of the Gurupi river to the mouth of the Parnaíba river	Minimum rainfall
08	Climatic characterization-average rainfall*	1:2.000.000	1995	Sudene	Thematic	Mouth of the Gurupi river to the mouth of the Parnaíba river	Average rainfall

*** Maps prepared and digitized by the Coastal Zone Management Group/MA, with support form consultants in interpreting the thematic areas, in the GERCO/MA Geoprocessing Lab.**