

## Information Sheet on Ramsar Wetlands

1. Date this sheet was completed/updated: 15 August 2001
2. Country: Mexico
3. Name of wetland: Pantanos de Centla Biosphere Reserve
4. Geographical coordinates:

17° 57' 53" – 18° 39' 03" North latitude  
92° 06' 49" – 92° 47' 58" West longitude

5. Altitude: between minus 1 and 6 metres above sea level
6. Area: 302,706 hectares
7. Overview:

Located in southeastern Mexico, the state of Tabasco covers 2,466,700 hectares, of which 61 per cent is used for productive activities and 39 per cent is either perennial tropical forest or aquatic vegetation. In Tabasco, this is the largest area of wetlands (areas subject to flooding) in Mexico. These characteristics give it a large diversity with regard to the fauna and flora and make it one of the most representative ecosystems in the biosphere (López-Hernández and Pérez, 1993).

Two of the largest rivers in Mexico, the Grijalva and the Usumacinta, form the most important delta in North America in which is located the Pantanos de Centla Biosphere Reserve with an area of 302,706 hectares. The municipios of Centla, Jonuta and Macuspana cover 12 per cent of the total area of the state of Tabasco. It is the most important museum of living aquatic plants in Central America, with areas of *tinto*, *pukté* and other associations with 569 species of vertebrates, 123 of which are endangered or vulnerable (SEMARNAP, 2000). The population of 16,500 inhabitants is gathered in 72 communities on the shores of the Grijalva and Usumacinta rivers, where fishing, agriculture and grazing are carried out. There is extraction of natural gas from this area, which together with burning, overexploitation of fisheries and poaching are the main threats. The reserve is operated under a management plan established in 2000 and has government and private financial support.

8. Wetland type:

Marine-coastal: I and J  
Continental: M, N, O and P  
Artificial: 6 and 9

Types of wetlands by decreasing order of importance: O

9. Ramsar criteria: 1, 2 and 4

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

11. Name and address of the compiler of this form:

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12. Justification of the criteria selected under point 9, on previous page:

Criterion 1: This is a biosphere reserve, and hydrologically it is one of the most important sites in Mesoamerica, affecting the ecology from southern Mexico to northern Guatemala. The site consists of 110 bodies of fresh water (permanent and seasonal) important for fishing and flood control.

Criterion 2: The area has very important vascular aquatic flora, including 76 species of plants used by humans, 13 rare or endangered species and several species of rare or nationally or internationally endangered fauna.

Criterion 4: The coastal lagoons play a very important role in the life cycle of many marine species.

13. General location:

The Pantanos de Centla Biosphere Reserve is located in the northeastern part of the state of Tabasco, covering 302,706 hectares, which represents 12.27 per cent of the total area of the reserve. It is located between 17° 57' 45" and 18° 39' 05" North latitude and 92° 06' 30" and 92° 47' 58" West longitude. Most of it is within the municipio of Centla with 230,775 hectares (Jonuta with 65,651 hectares and the municipio of Macuspana with 6,280 hectares). The most important city in the area is Frontera on the edge of the reserve.

14. Physical features:

Geology: Pantanos de Centla is located in the geological province of Southeastern Mexico, in the subprovince of the southeastern Tertiary basin. It is one of the most important in Mexico from the geological point of view, because it is at the centre of the juncture of various tectonic faults communicating with the Yucatan Peninsula. Within this subprovince are the Tertiary basins of Tabasco. The Usumacinta delta is

of alluvial and lacustrine origin from the Quaternary. Under this accumulation of sediments is a large structural basin of marine and continental origin dating from the Jurassic-Cretaceous period, reaching depths of about 70 centimetres of land-produced clastic materials from the Cenozoic. This accumulation of sediments is the result of the interaction of processes of continuous marine transgression and regression that displaced the coastline toward the north. The reserve is represented by alluvial and paludal deposits from the Quaternary of sedimentary origin. These are the result of the Grijalva-Usumacinta river system, which drains the reserve. Along the Tabasco coast on the Gulf of Mexico, there are coastal sediments resulting from the most recent marine regression. Morgan (1973) suggested that the Usumacinta delta is a large sedimentary basin that is subsiding under the weight of sediments. However, a balance is obtained with the sediments supplied by the rivers. If the sinking is greater than the arrival of sediments, the delta will gradually sink under water.

**Hydrology:** The biosphere reserve is located in the Grijalva-Usumacinta hydrological region. It covers part of three basins: Usumacinta, to the north and central of the reserve; Laguna de Términos, to the east; and Río Grijalva-Villahermosa, to the south and west of the reserve, which is the largest. The most important rivers in the reserve are the Grijalva, with an annual volume of 27,013 million cubic metres and the Usumacinta with an annual volume of 55,832 million cubic metres, making it the largest river in Mexico. In the centre, north and east, the reserve is drained by tributaries of the Usumacinta, such as the Palizada, San Pedrito and San Pedro y San Pablo. Other important rivers are the Bitzal, Naranjos and Palmillal, which drain towards Río Grijalva in the southeast. The total length of the active rivers in the reserve is 463 kilometres (Grijalva, Usumacinta, San Pedro y San Pablo, Bitzal and Palizada), which together with the former rivers reach about 925 kilometres of rivers. The Grijalva and Usumacinta supply a suspended load of 7.6 million cubic metres. The Usumacinta supplies 47 per cent of the suspended load and 85 per cent of total annual erosion. The Usumacinta and San Pedro y San Pablo are affected by saline intrusions from the Gulf of Mexico in the dry season and during the northerly winds, 30 and 22 kilometres inland respectively. This promotes formation of riparian mangroves on the shores of the rivers.

With regard to the lentic systems in the reserve, there are 110 bodies of fresh water with an area of 13,665 hectares. In the central and southern parts are concentrated 84 per cent of the lakes, among which the most important are Concepción, Chichicastle, El Campo, El Viento, San Pedrito, El Retiro, Tintal and Tasajera. These occupy depressions in the San Pedro y San Pablo and Usumacinta rivers. The Chochal, Alegre and Narvárez lakes are located to the east. In addition to its importance for fishing, it is also important because of landscapes and as a natural regulator for flood control. Among the coastal lagoons is the important El Cometa, which drains towards the San Pedro y San Pablo river; El Coco, towards Grijalva and El Corcho (Municipio of El Centro) which floods towards Lake Santa Anita. They are small, but play an important role in the life cycle of many marine species, in addition to their value as landscape and for fishing. An additional drainage pattern is created by the artificial drains to the east, southeast and south of the reserve, which lead to the oil wells on the lake, estimated to be 128 kilometres long.

**Soils:** The soils in the reserve are the result of the influence of three basic factors:

Accumulation of alluvial sediments, water supplied by the rivers because of heavy precipitation in the middle and upper basins and because of the types of vegetation. Based on Palma et al. (1985) and INEGI (1986) and cartographic materials carried out on the basis of field and laboratory work, five soil units were identified, within which gley soils and humic gley soils are the largest areas in the reserve.

Climate: There are three types of climate: Aw<sup>ig</sup>, Amw<sup>ig</sup> and Am(f)w<sup>(i)g</sup>, which are the meteorological stations of Frontera, Tres Brazos and Jonuta, respectively (Cuadernos Estadísticos Municipales: Centla, Jonuta and Macuspana, 1996). Average annual precipitation is 1500–2000 millimetres, with variations throughout the year during the cold and hot seasons. From May to October, there is precipitation of 1200 to 1400 millimetres and from April to November, precipitation gradually decreases to 500–600 millimetres. The monthly averages of the three meteorological stations record maximal precipitation that can be divided into a relatively dry period in July and August. March and April are the driest months. In addition, the northerly winds do not greatly affect the climate of Tabasco, but their influence is felt in the creation of a large amount of rainfall in winter. Most storms occur in December and January, with three to five northerly storms per month. Temperature can drop to 10° C, but once the cold front has passed, the weather gradually becomes warmer.

Physiography and topography: The reserve is located in the physiographic province of the coastal plain of the southern gulf and on the subprovince plains and marshes of Tabasco. The most frequent forms of barrier beaches are toward the coast and above all the coast subject to flooding. The flat topography ranges in altitude between 0 at the Gulf of Mexico and 7 metres above sea level in the south at Río Bitzal. There are also sites with minus one metre in the widespread depressions between fluvial plains (INEGI, 1989). Because of the lack of detailed topographic surveys, the elements that best characterize the physiography and relief are the morphogenic systems and geomorphologic units (Zavala, 1988 and 1993). The following units were identified in the IREBIT study (1994).

Coastal plain: Covering 9.1 per cent of the reserve and located in the northern part in a strip parallel to the coastline 6 kilometres wide in the northern part and up to 12 kilometres wide in the western part. This unit was created by the accumulation of fluvial sediments carried by the Usumacinta, San Pedro y San Pablo and Grijalva rivers. The sediments were removed and distributed by the waves, currents and winds. They are poorly consolidated sand deposits that form a plain of coastal dunes with separate morphological development, which indicate the position occupied by the coastline during the lower Quaternary until its current position. In Tabasco, this is the longest coastline and has the following geomorphologic units. Permanently flooded coastal dunes, depressions between permanently flooded bars, seasonally flooded coastal bars and coastal bars not subject to flooding.

River and marine plain: This is the smallest morphogenic unit (0.93 per cent) of the reserve (see figure 1) and is located at the mouth of the Grijalva-Usumacinta and San Pedro y San Pablo rivers. It occupies depressions subject to flooding in the coastal plain morphogenic system. This unit is composed of areas where seawater is mixed with water from inland by the tides. They form part of the productive systems and are coastal ecotones

connected with the Gulf of Mexico. The substratum is fine clastic sediments accumulated from the Tertiary by the rivers. Tectonically, it is located on a coast of marginal tides and genetically and geomorphologically they are primary coasts with subaerial deposition by rivers and with complex deltaic coasts. They have the following units: coastal lagoons, permanently flooded intertidal flatlands, mangrove vegetation and intertidal seasonally flooded flatland with herbaceous, halophytic vegetation.

River-paludal plain: This morphogenic unit is the most important because its area covers 71.29 per cent of the reserve (see figure 1). They are systems that occupy large depressions between fluvial plains with characteristics such as accumulation of permanent water, shallow depth, irregular shores, substratum of fine sediments of alluvial origin, accumulation of an organic layer of several centimetres to more than one metre in thickness, without accumulations of marine salts and with emergent hydrophilic communities. Their morphology is flat with a slope of less than one per cent and with poor drainage. The landscape is interrupted by former riverbeds and narrow alluvial plains. Although the altitude varies from zero to seven metres from north to south, there are areas at minus 10 metres below sea level throughout the reserve. The importance of the fluvial-paludal plain as a freshwater reservoir together with the supply provided by the rivers is quite clear. It prevents greater penetration of salt water from the Gulf of Mexico and maintains the hydrodynamic balance. The following units within this system are evident: permanent freshwater lagoons, seasonal freshwater lagoons, permanently flooded freshwater marshes and seasonally flooded freshwater marshes.

River plain: This is the second largest morphogenic system covering 18.7 per cent of the reserve (see figure 1). It has been built up by accretion processes of sediments from the powerful Río Usumacinta and its tributaries, San Pedro y San Pablo, Palizada, Naranjos and San Pedrito. Other rivers that have deposited alluvial deposits are the Bitzel, and Grijalva together with smaller tributaries. A total of more than 450 kilometres of active streams crisscross the reserve and as many kilometres of former riverbeds for a total of 925 kilometres of rivers with alluvial plains in various degrees of development. This unit has been built during the recent Quaternary and forms part of a curved delta with low and narrow natural dykes (alluvial plains), one to two metres high and 100 to 500 metres wide. Apparently, these rivers carry insufficient sediment to build broader plains. The fluvial plains of the reserve are important for soil fertility that make farming activities possible, human settlements and the formation of terraces, because the raised plains near the riverbeds of the main rivers flood only for short periods. On the river plain, there are several units among which are active riverbeds, seasonally flooded lowland with brackish water, seasonally flooded freshwater lowlands for three to six months, seasonally flooded lowland with freshwater 1.5 to 3 months of the year and raised portions occasionally flooded up to a maximum of 1.5 months.

#### 15. Hydrological values:

The Pantanos de Centla Biosphere Reserve is located in the delta of the largest rivers in Mexico through which flows one third of the surface fresh water of Mexico. They are at the end of the largest basin in Mexico, which begins in the high forests of Chiapas and like the wetlands are important enough to justify their protection including recharging of aquifers, high biogenetic capacity for exporting nutrients for the fisheries in the Gulf of Mexico, in addition to its function as a purifier and continuous supply of organic material that makes it possible to continue accretion towards the ocean.

#### 16. Ecological features:

The aquatic vegetation in the marsh areas of Mexico has been insufficiently studied, despite the fact that this resource represents the ecosystem that is most evident and has one of the most important samples of vascular aquatic flora in Central America (Lot and Novelo, 1988). A review of the bibliography on vegetation and flora revealed that there are few studies for the lowlands of Tabasco, but there are more general other works that made possible completion of this section. Among the works on vegetation are those of West (1966) on natural vegetation of the lowlands of Tabasco and Sauer (1967) on aspects of the floristic composition of dunes and mangroves on the Río San Pedro y San Pablo in the states of Tabasco and Campeche. From the study of species collected and recorded for the area occupied by the Pantanos de Centla Biosphere Reserve, together with the research of Sol, López-Hernández and Maldonado (1993) and Boushot in 1995 and a list of the research being carried out by Dr. Alejandro Novelo on aquatic vascular plants in the reserve on a total of 568 species distributed in 118 families and gathered in eight main associations of monocotyledons and dicotyledons of the aquatic and terrestrial systems.

- (A) Hydrophilic communities
  - Association of emergent hydrophytes
  - Association of floating hydrophytes
  - Sub aquatic (unmapped)
- (B) Medium sub perennial forest of *Bucida beceras* (*puktal*)
- (C) Low subperennial forest of *Haematoxylon campechianum* (*tintal*)
- (D) Mangrove
- (E) Matorral of *Dalbergia brownii* (*muca*)
- (F) Palm groves of *Acoelorrhaphe wrightii* (*tasistal*)
- (G) Palm grove of *Sabal mexicana* (*guanal*)
- (H) Riparian vegetation
- (I) Crops and pastures

Hydrophilic communities: The hydrophilic communities occupy more than one third of the area of Pantanos de Centla and are the best-developed and most extensive formations within that area.

Emergent hydrophyte vegetation: *Neal* is in an association that occupies the greatest amount of territory within this area. *Neal* is also known in this state as *espadañal* occupies parts of two of the geomorphic areas identified in Centla: the plains of coastal dunes and its best habitat of paludal plains and freshwater lagoons. The dominant species is *neal* (*Typha latifolia*), a grass that roots in the substratum. It is

usually composed of pure stands although there are several areas where it is associated with *chintul* (*Cyperus articulatus*) and with *sibal* (*Cladium jamaicense*) with which it forms almost pure associations known locally as *sibal* (area of El Espadañal northeast of Frontera). The flora that is usually found in this association of emergent hydrophytes is composed of grasses with hydrophilic habitats or with high resistance to flooding. Some of the elements of its floral composition in the Pantanos de Centla are *Acrostichum aureum*, *Cyperus articulatus*, *C. ligularis*, *Eleocharis geniculata*, *E. cellulosa*, *Eleusine indica*, *Fimbristylis spadiacea*, *Generium sagittatum*, *Helicornia latispatha*, *Hydrocotyle umbellatus*, *Mimosa pigra*, *Panicum maximum*, *Paspalum fasciculatum*, *P. paniculatum*, *Polygonum punctatum* and *Rumex verticillatus*.

Floating hydrophyte vegetation: The floating hydrophytes are concentrated in places where the depth of the water is the determining factor for species that root in the substratum. They are found in clearly lacustrine environments and are invariably associated with marshes where they are found among *neal*. Some of the species that make up this type of vegetation in Centla are the following: water hyacinth (*Eichhornia crassipes*), *oreja de ratón* (*Lemna minor*), *Nymphacea amplia*, *hoja de sol* (*N. odorata*), *pitahaya* (*Nelumbo lutea*), *lechuga de pantano* (*Pistia stratiotes*), *Nymphoides humboldtiana*, *Heteranthera* sp., *Cabomba* sp. and *Salvinia* sp. Some of the hydrophytes are widely used by fishermen. This is the case of the *hojas de sol* (*Nymphaea amplia* and *N. odorata*), which are used for keeping fish fresh. The use is benign and does not represent serious damage to the plant community.

Subaquatic vegetation (submerged hydrophytes): The *sargazal* is the best type of subaquatic vegetation known locally and is represented by *sargazo* (*Ceratophyllum demersum*), *C. echinatum* and *Utricularia* spp. Another known association is the *cintillal* where two species *cintilla* (*Vallisneria americana*) and *Potamogeton* sp. are associated. It is one of the most endangered because of the introduction of exotic fish such as the Asian carp *Ctenopharingodon idellus*.

Medium sub perennial forest of *Bucida beceras* (*puktal*): The medium subperennial forest of *Bucida beceras* (*puktal*) is one of the arboreal communities that together with the hydrophyte communities and the mangrove are of great importance in the area. The *pukteal* is located in the area in wide strips, large patches and small islands among the aquatic vegetation among which it is found naturally. Occasionally, it can be found in associations with the low subperennial forest (*tintal*) or grows as a mixed forest among the mangroves. In addition, other species such as *chicozapote* (*Manilkara zapota*), *taucho* (*Dyospiros digina*), mahogany (*Swietenia macrophylla*) and cedar (*Cedrella odorata*) are often associated in this part of the canopy. The *ejido* of Tembladeras can thus be included in the category of forest. The medium stratum is formed by *guano redondo* (*Sabal mexicana*), *jahuacté* (*Bactris balanoidea*) in addition to the presence of *Erithryna* sp., *Thevetia ahouai* and an unidentified species called locally *caracolillo*. The undergrowth is poorly developed because of constant flooding in the forest. It is common to find a large number of epiphytes in the Bromeliaceae family such as *Achmea bracteata*, *Tillandsia balbisiana*, *T. usneoides* and Orchidaceae such as *Catasetum* sp. and *Laelia anceps* among others and the Cactaceae *Hilocereus undatus* and *Stenocereus testudo*. Other species found here are the ferns *Achrostricum aureum* and *Polypodium lycopodioides*, several lianas and vines such as the Bignoniaceae

*Pitecoctenium echinatum* and *Rhabdadenia biflora* and the Apocynaceae *Faramea occidentalis* and the *rompeplatos*, the local name given to the Convolvulaceae of the genus *Ipomea* spp. The impact affecting the *pukteal* is primarily the extraction of firewood, the cutting of timber for local construction of houses and for the manufacture of *cayucos* and utensils and the clearing of vegetation at several sites for seasonal agriculture (using slash and burn), cattle grazing and the extraction of petroleum through the building of roads and drainage by PEMEX.

Low sub perennial forest of *Haematoxylon campechianum* (*tintal*): The presence of *tintal* in Centla is the result of constant flooding in the region as the result of the growth of its dominant member *palo de tinte* (*campeche*) (*Haematoxylon campechianum*) at sites with flat topography or low lands of the fluvial lowlands, which is characterized by deficient drainage and clay-silt materials that allows them to maintain a high level of humidity.

Mangrove: The mangrove is composed of elements characteristic of Tabasco in the following order: *Rizophora mangle* along the edges of rivers and coastal lagoons of the Centla swamps where it is densest and occasionally around inland lagoons. This species is that which best controls the effects caused by the tides and high concentration of salts. When it is found along the edges of rivers it is very often associated with the following riparian species: *icaco* (*Chrysobalanus icaco*), *palomillo* (*Citharexylum hexangulare*), *muco* (*Dalbergia brownii*), *tucuy* (*Pithecellobium lanceolatum*) and *chelele* (*Inga fysicalix*). *Avicennia germinans* grows behind the line formed by red mangrove in pure groves, but most frequently forms mixed forests. *Conocarpus erectus* and *Laguncularia racemosa* appear where apparently salinity is low. In this case, the mangrove is clearly associated with medium-height subperennial forest (Laguna El Cometa), the *muca*, *tintal* and hydrophyte communities (*ejidos* of Tembladeras, Lagunas Librillo and Concepción) being accompanied in this case by species characteristic of the strata of the *pukteal* such as *Bactris balanoidea*, *Bucida buceras*, *Dyospiros digina*, *Callophyllum brasiliensis*, *Pachira aquatica*, *Roystonea regia* and *Sabal mexicana*, among others. The mangrove serves as a refuge for other life forms including the epiphytes such as *Achmea bracteata*, parasites such as *caballera* (*Phoradendron mucronatum*), *Helosis* sp., several climbing plants such as *Passiflora coriacea* and the characteristic fern of the mangrove *Achrostrichum aureum*. Several Cyperaceae such as *Cyperus surinamensis*, *Eleocharis geniculata*, *E. celluosa*, *Fimbristylis spadiaceae* and other species such as *Hydrocotyle umbellatus*, *Nymphaea amplia*, *Salvina* and *Lemma minos*, when the latter has been in contact with the hydrophyte communities.

Matorral of *Dalbergia brownii* (*muca*): The *Dalbergia brownii* matorral is recognized throughout the region of Pantanos de Centla as its characteristic species. It grows in association with the *pukteal*, mangrove, *tintal* and hydrophyte communities with which it forms ecotones or transition areas. This formation is located above all on the banks of rivers and lagoons although it is possible to find it inland. Whenever this happens, the *muca* is usually formed by species that acquire a riparian character such as *tucuy* (*Pithecellobium lanceolatum*), *cheleles* (*Inga fysicalix* and *I. spuria*), *gusano* (*Lonchocarpus hondurensis*) and *palomillo* (*Cytarexylum hexangulare*). In addition, it is possible that elements of forest and mangrove strata and herbaceous and epiphyte species of those found throughout the region.



Palm groves of *Acoelorrhaphe wrightii* (*tasistal*): *Acoelorrhaphe wrightii* forms pure stands with heights between approximately four and five metres leaving a distance between stands very variable of approximately 10 to 15 metres. The *tasistales* are found in mud most of the year and it is assumed that perhaps the existence of palm groves is for two main reasons: first permanent flooding of its elements and second, the concentration of salts found there (López M., 1980). The *tasistal* is present in small patches and isolated strips in two parts of this area. They are south of Frontera near Arroyo Polo, where there are cultivated pastures and near El Espadañal where there is a mixture with *neal* and several hydrophyte communities. There are also several isolated specimens in the forest and mangrove.

Palm grove of *Sabal mexicana* (*guanal*): Under this name, is part of the vegetation of elements of the Palmae dominated by *Sabal mexicana*, which grows because of frequent burning for planting and flooding in its area of distribution. This coincides with areas that have been most affected by human activities and farming in the region.

Riparian vegetation: Under this category are the communities located on the edges of rivers, streams and canals in the region. This community is strongly influenced by seasonal variation of water levels. The species that mainly represent this vegetation in the area are *sauzo* (*sauce*) (*Salix chilensis*), *chelele* (*Inga spuria* and *I. fissicalyx*), *tucuy* (*Pithecellobium lanceolatum*), *gusano* (*Longchocarpus hondurensis* and *L. sp.*), *palomillo* (*Cyatharexylum hexangulare*), *tinto* (*Haematoxylum campechianum*) and *muco* (*Dalbergia brownii*).

Crops and pastures: As mentioned in the chapter on soil use, agriculture represents 1.2 per cent of the total area of the reserve and is located on the alluvial plains and coastal dunes of perennial crops such as coconut, lemon, orange, mango and *chicozapote*. Semi perennial crops are those grown in small gardens of perennial crops such as plantain (*macho* and *cuadrado*), and finally annual crops such as maize (*Zea maiz*), beans, squash, yucca, *chile habanero*, among countless species used locally as food, ornamentation and for religious purposes. The introduction and growing of pasture is perhaps the activity with greatest impact on this area because of its extension and represented with species such as *pangola* (*Digitaria decumbens*), *estrella de Africa* (*Cynodon dactylum*), *gigante* (*Pennisetum purpureum*), *privilegio* (*Panicum maximum*), *alemán* (*Echinochloa polytachya*), *camalote* (*Paspalum paniculatum*), *pelillo* (*Leersia hexandra*) and *grama amarga* (*Paspalum conjugatum*).

#### 17. Noteworthy flora:

The flora identified until now is represented by more than 568 species belonging to 118 families, which represent approximately 11.8 per cent of the total flora for the state of Tabasco of 2200 species. Of this flora, approximately 50 per cent are used in some way by man and 12 are considered endangered by IUCN. The vegetation of Pantanos de Centla forms a very important nature area because of its size and conservation status. Among its important contribution is 260 species of plants in 89 families, more than 200 of which have some utility. This marsh region is considered to be among those that have one of the most important sample of aquatic vascular flora in Central America (López-Hernández and Maldonado, 1992).

## 18. Outstanding fauna

The wide variety of plant communities serves as refuge for a rich vertebrate fauna. The most abundant groups of animals in the marsh are the fish, 60 species, plus the presence of 85 species of reptiles, 26 of amphibians, 103 of mammals and above all more than 264 species of migratory and resident aquatic birds.

The terrestrial vertebrate fauna in the area of Pantanos de Centla is well represented, because in this area there is a wide range of plant ecosystems and the close relationship that exists plants and animals provides habitat for all the groups of vertebrates. Studies of the literature show that birds are the most frequent and best represented class of animals with specimens in 43 families, 191 species including terrestrial and aquatic resident and migratory species. Indeed, the bird life of Pantanos de Centla represents one of the ecological values and the potential growth of tourism in this area. However, like the rest of the fauna, there are no detailed surveys of the bird population.

In order of importance because of number of species, there are 86 species of mammals in 25 families. Among the mammals important as a source of food, there is the armadillo (*Dasypus novemcinctus*), manatee (*Trichechus manatus*), *tepezcuintle* (*Agouti paca*) and the white-tailed deer (*Odocoyleus virginianus*). This group is usually hunted when the river floods because the terrestrial animals move to the higher land for protection from flooding. These places are well known to the local inhabitants who take advantage of to hunt them there. The species most traded are fish, including *róbal* (*Centropomus* sp.), *mojarras* (*Cichlasoma fenestratum*, *C. urophthalmus* and *Petema splendida*) and the *pejelagarto* (*Atractosteus tropicus*).

As for reptiles, they are represented in the area by 14 families with 72 species. As part of the diet of the local inhabitants there are the Central American river turtle (*Dermatemys mawii*), *pochitoque* (*Kinosternos leucostomum*), *hicotea* (*Pseudemys scripta*), *guao* (*Staurotypus triporcatus*), *chiquigao* (*Chelidra serpentina*) and to a lesser extent the *mojina* (*Rhinoclemys areolata*). The Morelet's crocodile (*Crocodylus moreletii*) is also used for food. The amphibians are also represented by six families and 25 species among which the *Bufo horribilis*, *B. valliceps*, *Rana pipiens*, *R. palmipes* and *Rhinophrynus dorsalis* stand out. Of great importance is the fact that we can still find species whose populations have been seriously decreased locally, nationally and worldwide to the degree that some are endangered. This is the case of the manatee, crocodile, turtle and the migratory birds, the Peregrine falcon (*Falco peregrinus*) and osprey (*Pandion haliaetus*), which are endangered. The jaguar (*Panthera onca*), ocelot (*Leopardus pardalis*) and the Guatemalan howler (*Alouatta pigra*) are considered to be vulnerable. It is also known that the *jabiru* (*Jabiru mycteria*) runs the risk of disappearing from Central America.

## 19. Social and cultural values:

Fisheries production: Fishing is the most important primary activity in the reserve because of its economic importance, which represents a direct source of food or a complementary activity. It is practised on a small scale or with modern technology by most adults. The exploitation of fisheries in the reserve during the past eight years

reached a total of 12,732.54 tons, which represent 19.3 per cent of output in the state, without taking into consideration the oyster and marine species. The most frequently captured species were *róbalo*, *mojarra (paleta, castarrica)* and *tilapia*, *bobo*, *bagre*, *pejelagarto*, *acamaya* and langoustine among other species.

**Use of the flora:** The use of the flora in the Pantanos de Centla Biosphere Reserve represents one of the main values that justify its protection. The flora represents ancestral knowledge about the management of this resource and permits adoption of viable strategies for its conservation and sustainable use. The use of plants is a possible alternative for the local population, including for food, medicine, construction of houses, manufacture of domestic utensils and ornaments. Each of the plant communities in the reserve has an important role. From them a large part of the means of subsistence is obtained. Of the flora known and used locally, the local inhabitants have considerable experience in the management, as is evident in the use of many useful species. Two hundred species have been identified with one or more uses for the local inhabitants.

**Other values:** The reserve is a living museum of the most important aquatic plants in Central America. It produces nutrients for a large fauna that includes part of the fisheries of the Gulf of Mexico and migratory species. It mitigates the effect of water pollution. It preserves knowledge about the use of swamp resources, using about half of the known plant species in the area, obtaining almost all of their animal protein directly from the environment and three harvests of maize per year. About 19 per cent of fisheries production of the state (without taking into account oysters) and 21 per cent of natural gas in the southern region are extracted here. There is a great socio-economic potential through ecotourism, aquaculture and production systems of *traspatio*.

#### 20. Land tenure/ownership of:

The total area of the reserve is made up of *ejidal* land, private property, public land, surrounding federal land and miscellaneous. The most numerous are *ejidal* land that occupy 53.1 per cent of the total area, followed by public land with 20.6 per cent, private property with 15.4 per cent, federal land with 6.8 per cent, the rest with 2.1 per cent and miscellaneous with 2 per cent. The *ejidal* lands are distributed in 60 *ejidos* of which the most important are: E. Luis Echeverría Alvarey, El Palmar, Nueva Esperanza, El Porvenir, Carlos A. Madrazo Becerra, N.C.P.E. Lázaro Cárdenas and Ribera Alta de Quintín Arauz, Tres Brazos, Tembladeras, El Faisán, Bitzal, El Naranjo, San José, Chichicastle and Los Güiros, among others whose area is between 200 and 2000 hectares. Private property in the reserve according to the land survey office in 1993, was formed by 801 small owners most of whose properties ranged from 1 to 40 hectares.

#### 21. Current land use:

A) At the site: Difficult access and constant flooding have been factors that have decreased growth of conventional anthropogenic activities within the reserve. However, although these represent a high cost in labour, the advance of the agricultural, grazing and urban (industrial) frontiers within the reserve are gradually being extended. Current land use is as follows:

Farming represents 1.2 per cent of the reserve and is located primarily on the alluvial plains less subject to flooding and well-drained beach areas. Agriculture is seasonal characterized by little or no use of fertilizers and farm machinery and of little commercial importance (Palma et al., 1985). Farming is divided into:

a) Perennial crops, which remain in the ground for periods of usually more than ten years (INEGI, 1989) in soils and well-drained areas and subject to less flooding. The main areas are the coconut groves on coastal land not subject to flooding, mango on the high plain of the Río Palizada, association of coconut and cacao on the upper plain of the Río Grijalva and coconut on the *vega* of Río Usumacinta. They are usually small discontinuous areas among fruit trees such as citrus fruits, *chicozapote* and *guavaban guanábana*.

b) Association of perennial and semi perennial crops. The semi perennial crops remain in the ground for two to ten years (INEGI 1989) and are located on the upper alluvial plains of the Grijalva and Usumacinta rivers. In addition, perennial crops are grown among small gardens of *plátano macho* and *cuadrado* coinciding with human rural settlements.

c) Annual crops, which remain in the ground for periods of no fewer than one year (INEGI, 1989), although they represent only 0.7 per cent of the reserve. This is the main type of agriculture because it occupies 60.5 per cent of land use. It is located on alluvial plains chiefly next to Río Usumacinta, but can be found on plains subject to flooding during three to six months. The main crop is maize with an average yield of 1.5 tons/year in three cycles *tornamil* in December on the highest plains, *marceño* on the semi-flooded alluvial plains and *milpa de año* in April on the plains more subject to flooding that at this time of the year do not have that limitation. There are other crops of lesser importance such as bean (frijol), rice, yucca, chilli and squash that always accompany maize. Most of the crops are used for home consumption (Larios, 1992).

Cattle raising: This is the most widespread human activity, covering 14.4 per cent of the reserve. The pastures are used for the extensive raising of cattle, both for fattening and reproduction and beef-milk production (Palma et al., 1985). Most frequent are pastures adapted to low areas subject to seasonal and permanent flooding, often interspersed with annual crops (Larios and Hernández, 1992). According to the definition of INEGI (1989), the following types of grazing are practised.

- a) Cultivated pasture, among which are improved pastures such as *pangola* (*Digitaria decumbens*), *pasto de Africa* (*Cynodon lemfuensis*), *estrella de Africa* (*Cynodon dactylum*), the most widespread, *gigante* (*Pennisetum purpureum*), *privilegio* (*Panicum maximum*) and *alemán* (*Echynocloa polytachya*). This is found on the upper and lower alluvial plains that are subject to flooding and coastal strips flooded for short periods.
- b) Introduced pasture, predominantly native pastures such as *camalote* (*Paspalum paniculatum*), *pelillo* (*Leersia hexandra*) and *grama amarga* (*Paspalum conjugatum*). They are founding 8.3 per cent of the reserve and

57.4 per cent of the use for grazing, on the alluvial plains of the San Pedro y San Pablo and Usumacinta rivers. They are usually flooded for three to six months.

- c) Cultivated pasture and introduced pasture are on the alluvial plains subject to flooding for 1.5 to three months. Management and control of weeds is moderate to low and is scattered with areas of annual crops.
- d) Introduced grassland and emergent rooted hydrophyte communities are located on the low alluvial and coastal plains where there are flooded depressions on coastal strips. Grazing is limited to the dry season.

Other uses represent 5.76 per cent of the reserve such as urban areas, especially in the southern portion of the city of Frontera and settlements such as Quintín Arauz, José María Pino Suárez, El Faisán and Boca de Chilapa. The industrial sector is represented by the extraction of petroleum with more than 55 fields in this area and drainage installations and pipelines for transporting petroleum.

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

Water pollution is caused by discharge of wastewater, industrial waste, disposal of solid waste, agricultural activities and oil from outboard motors. There is loss of biodiversity caused by poaching and overexploitation of fisheries. Tourism leads to discharge of waste water, the spread of disease, solid water disposal, deforestation, farming activities, discharge of industrial waste, roads and canals. The hydrodynamics of the area have been changed by the construction of canals and roads and extraction of materials. Soils have been degraded by farming activities, deforestation, disposal of solid waste, canals and discharge of wastewater.

23. Conservation measures taken:

The Pantanos de Centla Biosphere Reserve was created on 6 August 1992 with a requirement of the creation of a management plan for the reserve by publication in the Diario Oficial. The reserve has a general management plan established in consultation with users in the area and legal status in 2000. It sets out administrative rules for development of protection, conservation, restoration and sustainable use activities for natural resources with medium and long-term activities.

24. Conservation measures proposed but not yet implemented:

The biosphere reserve has had since 2000 a general management plan for conservation, restoration and use activities to be implemented in the short, medium and long terms within the reserve. Under that programme are the following generic activities.

Identification of the Pantanos de Centla Biosphere Reserve as an environmental unit in which three levels of government and society converge coordinately and actively;

Permanent conservation of the genetic diversity of species of fauna and flora in the reserve ensuring balance and continuity of the evolutionary ecological processes;

Promotion of the regional socio-economic development of the Pantanos de Centla Biosphere Reserve through application of criteria of sustainability in the use of natural resources;

Countering of environmental degradation in the reserve through use of development models that guarantee conservation, restoration and sustainable use of natural resources based on integrated knowledge of its components and strict application of existing legislation;

Promotion of self-sufficient management of the reserve using existing means and services;

Consolidation of management of the reserve as a unit that coordinates and regulates management activities.

#### 25. Current scientific research and facilities:

Until 1997, little research was carried out in the reserve on the fauna and flora, even more so integrated that would allow understanding the entire ecosystem and its interaction with society. Since 1998, a total of 28 studies have been carried out in the reserve of which 11 have been completed and 17 are under way.

<b>Classification</b>	<b>Number of studies</b>	<b>Natural resource studied</b>
Invertebrates	5	Insects, crustaceans, molluscs
Mammals	2	Chiroptera, primates
Fish	4	<i>Pejelagarto</i> , survey of fish, <i>mojarra</i> , <i>paleta</i> and <i>castarrica</i>
Reptiles	1	Freshwater turtles
Vegetation	6	Hydrophytes, forest and mangrove
Birds	2	Bird life in general and Anatidae
Basic ecology	5	Distribution, structure of habitats, impacts, biological systems
Biological-physical-chemical	1	Water quality
Environmental analysis	1	Vegetation, fauna
Biotechnology	1	Molecular biodiversity
Socio-economic	1	Reserve population

#### Research:

1. Insects in the reserve
2. Inventory of macro crustaceans
3. Population study
4. Crustacean parasites in fish
5. Study of aquatic habitat as a feeding site
6. Monitoring and water quality

7. Survey of aquatic fauna
8. Socio-economic and study and economic evaluation
9. Lygaeidae (*Hemiptera heteroptera*) associated with *Ficus* spp (Moraceae) and its effect on the plunder of seeds near the Gulf of Mexico
10. Composition and structure of the bird life in the Pantanos de Centla Biosphere Reserve
11. Survey of vascular aquatic vegetation in the reserve
12. Flora of the Pantanos de Centla Biosphere Reserve
13. Access to the microbial molecular biodiversity
14. Fish fauna of the Pantanos de Centla Biosphere Reserve
15. Taxonomic study of freshwater molluscs in the Maya region of Mexico (RBPC)
16. Description of the natural regeneration of mangroves in the RBPC
17. Effects of roads on the forest in the RBPC
18. Study of the wetlands in southeastern Mexico
19. Current situation of Anatidae in the RBPC
20. Biological study of northeastern RBPC
21. Improvement in the management of fisheries and aquaculture of two species of Cyadaceae
22. Chiroptera in the RPC
23. Study of the factors that can be included in the structural changes of ecosystems in the RBPC
24. Study of biological systems
25. Experimental primatology
26. Hydrophilic vegetation of the coastal dunes
27. Effect of fire on aquatic vegetation at three sites of the reserve
28. Ecological restoration of the habitat of freshwater turtles affected by burning in the RBPC

The research described in items 5, 13-15, 17-23 and 26 have been completed. The persons involved belong to UNAM, UAM, the Instituto de Biología de Xalapa (Veracruz), ITESM, Universidad Autónoma de Chapingo, Colegio de Postgraduados and the Universidad Juárez Autónoma de Tabasco (UJAT).

Infrastructure: From 5 June 1994, the state government inaugurated the area at the junction of the Grijalva, San Pedrito and Usumacinta rivers, Estación Central “Tres Brazos” to support activities related to management of the reserve with accommodations for 32 persons, a laboratory for collecting, treating, preserving and transporting samples, a multi-use room, an administrative area with a library, storage room and dock. These installations are being used by the management of the reserve under a coordination agreement between the national government and the state government on 24 July 1997. Work was begun this year on construction of an interpretation centre in which there are plans to introduce and involve visitors in the concept of the reserve. The importance of the goods and services obtained from them as well as resources used by the local communities.

26. Current conservation education:

Management plan for the reserve provides for an environmental education programme in the formal aspects of the didactic guide prepared by the state

government for primary schools. In the informal part, there is a mobile unit that visits the local communities holding workshops on local topics and there are 11 spots transmitted on television on the importance of the area. Two itinerant expositions have been created on the reserve, which are presented in the national and state contexts (fairs and expositions) and in secondary schools of the reserve and its area of influence. Didactic materials have been prepared for the general public to promote awareness about the importance of the reserve. By the end of 2001, the interpretation centre will be ready and presentations are expected to attract up to 20,000 visitors, presenting the importance of the reserve.

#### 27. Current recreation and tourism:

Tourism is just beginning, mainly during vacation periods with an annual average of 2500 tourists. Several observation towers are being built for scenic observation and bird watching, and two lodges are being built that will increase up to 20,000 the number of visitors per year. There is interest among local investors and the local population in general for development of tourism in the area. A tourist agency in Ciudad de Villahermosa has begun to take domestic and foreign tourists to the area. There are also local groups, primarily fishermen and the inhabitants of several towns that provide ecotourism services. The administration of the reserve has agreed with the Instituto de Turismo of the state government a training programme of ten courses at the end of which the Instituto de Turismo grants a certificate of tourist host to those who complete the courses. There are now more than 30 hosts and two groups of local inhabitants that provide tourist services in the reserve.

#### 28. Jurisdiction:

Management is the responsibility of the Secretaría de Medio Ambiente Recursos Naturales (SEMARNAT) through the Comisión Nacional de Areas Naturales Protegidas (CONANP) both part of the federal government. In addition, the government of the state of Tabasco and the municipalities of Centla, Jonuta and Macuspana participate, each supporting the processes of conservation of the reserve.

#### 29. Management authority:

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30. References: