



FLAAR
MESOAMÉRICA

WETLANDS #7

EDIBLE PLANTS OF WETLANDS

RED MANGROVE SWAMPS

Rhizophora mangle

Municipio de Livingston,
Izabal, Guatemala

NICHOLAS HELLMUTH

EDIBLE PLANTS OF WETLANDS

RED MANGROVE SWAMPS

Rhizophora mangle



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Edible Wetlands Plants of Municipio de Livingston, Izabal

Wetland Series 1: from Swamps, Marshes and Seasonally Inundated Flatlands of Izabal



Wetland Series 2: plants that grow along the beach shore of Amatique Bay



Wetland Series 3: plants that grow alongside water: rivers, lagoons, swamps, or ocean



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GLOSSARY

Marches: Low and swampy land that floods the waters of the sea.

Mangrove: A general name for several species of halophyte (plant that grows in soils that have a high content of various salts) belonging to different families of plants (including trees, shrubs, a palm tree and a ground fern) occurring in intertidal zones of tropical and subtropical sheltered coastlines and exceeding one half meter in height.

Mangrove swamp: The ecosystem where mangroves grow.

Swamp: A seasonally flooded bottomland with more woody plants than a marsh and better drainage than a bog. Swamps develop in moist climates, generally in such places as low-lying coastal plains, floodplains of rivers, and old lake basins or in areas where normal drainage has been disrupted by glacial deposits.

Wetland: Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season.

<https://www.epa.gov/wetlands/what-wetland>

<https://www.riego.org/glosario/marisma/>

<https://www.greenfacts.org/glossary/mno/mangrove.htm>



Life on land is the Sustainable Development Goal (number 15, proposed by the United Nations) which claims to ensure the conservation of terrestrial and freshwater ecosystems. Municipio de Livingston has multiple natural areas associated to rivers and wetlands, for example.



Photo by: Victor Mendoza, FLAAR Mesoamerica, Oct. 7, 2021.
Rio Sarstun, Laguna Grande, Livingston, Izabal.

Camera: Sony RX10 IV. Lens: Sony FE 200-600mm G OSS.
Settings: 1/250 sec; f/4; ISO 400.

INTRODUCTION TO *RHIZOPHORA MANGLE*

Red mangrove is present in millions of trees along the Caribbean coast (of Mexico, Belize, Guatemala, and along the Pacific coast of Mexico and Guatemala). As we will learn in the following pages, this tree has many uses.

MY PERSONAL EXPERIENCE *WITH RHIZOPHORA MANGLE*

I experienced a lot of *Rhizophora mangle* during a dozen field trips through the mangrove swamps along the Canal de Chiquimulilla and all the lagoons west of Monterrico (inland from the Pacific Ocean coast). We went to this area more than a dozen times in the last two decades to explore water lily ecosystems and to photograph waterbirds.

Also saw lots of mangrove swamps while photographing waterbirds in recent years in Lake Izabal and Río Dulce. Now, since February 2020, we are focused on the local trees in addition to the local waterbirds.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 20, 2010. Río Negro, Livingston, Izabal.

Camera: iPhone 11 Pro Max.



FULL BOTANICAL NAME

Rhizophora mangle L. is the accepted name.

Family Rhizophoraceae



Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 20, 2010. Río Negro, Livingston, Izabal.
Camera: iPhone 11 Pro Max.

HERE ARE SYNONYMS FOR *RHIZOPHORA MANGLE*

Only two names listed as synonyms by ThePlantList.org:

- *Bruguiera decangulata* Griff.
- *Rhizophora americana* Nutt.

(www.theplantlist.org/tpl1.1/record/kew-2523199)



Photo by: David Arrivillaga, FLAAR Mesoamerica, Apr. 30, 2021.
Punta de Cocoli, Livingston, Izabal.

Camera: Sony Alpha A7R IV. Lens: Sony FE 90mm Macro G OSS .
Settings: 1/250 sec; f/10; ISO 500.

LOCAL NAMES FOR *RHIZOPHORA MANGLE*

Nombres comunes en México. Candelón (Ver., Col.,Sin.); Mangle; Mangle colorado; Mangle dulce (B.C.,Oax.); Mangle rojo; Mangle tinto (Ver.); Tabché, Tapché, Xtabché (l. maya, Yuc.).

(Vazquez et al. 1999: 219).

MAYAN NAMES FOR *RHIZOPHORA MANGLE*

Tabché ,
Tapché , Xtabché (l. maya, Yuc.).

(Vazquez et al. 1999: 219).

HABIT FOR *RHIZOPHORA* *MANGLE*

Tree

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 20, 2010. Río Negro, Livingston, Izabal.

Camera: iPhone 11 Pro Max.



HABITAT, IN WHAT ECOSYSTEM(S) CAN YOU FIND NATIVE *RHIZOPHORA MANGLE*?

MANGROVE FOREST

The Mangrove Forest occurs in brackish water along the mainland and island coasts and in tidal lagoons and swamps; it is found also in depressions, previously tidal lagoons, which still retain a high degree of salinity, but where the deposition of silt has been insufficient to raise the area to the level permitting colonization by the savanna associates. The predominant species is *Rhizophora mangle* (Red Mangrove), which forms a low covering on tidal flats, and thickets up to twelve feet in height along the sides of the drainage channels through these flats.

(Standley and Record 1936:19).

Swamp Forest. The swamp forest has originated in the brackish and fresh water savannas and on the river levees in the tidal limits. It varies in constitution according to the sites which it has colonized.

The delta and flats above high tide and the river levees in the coastal plain are colonized by an association containing, first, *Laguncularia racemosa* (White Mangrove) and *Avicennia nitida* (Black Mangrove) as well as large trees of *Rhizophora mangle* (Red Mangrove), the relics of the previous Mangrove consociation, With the later addition of *Conocarpus erecta* (Buttonwood), *ChrysoBalanus Icaco* (Cocoplum), *Pachira aquatica* (Provision Tree), and *Pterocarpus officinalis* (Kaway) to form the tidal levee forest.

(Standley and Record 1936: 21)



Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 20, 2010. Río Negro, Livingston, Izabal.

Camera: iPhone 11 Pro Max.

WHAT OTHER TREES OR PLANTS ARE OFTEN FOUND IN THE SAME HABITAT?

Four “mangrove” trees are often not far from each other (though it varies by soil, water level, etc.) Here is the traditional group of co-associated trees:

GENUS, SPECIES	PLANT FAMILY	LOCAL NAMES	USES	USEFUL PART
<i>Avicennia germinans</i>	Acanthaceae	Black mangrove	Edible	Plant parts stick up from underground
<i>Laguncularia racemosa</i>	Combretum Family, Combretaceae	White mangrove		
<i>Rhizophora mangle</i>	Rhizophoraceae	Red mangrove	edible	Stilt roots, aerial roots
<i>Conocarpus erectus</i>	Combretum Family, Combretaceae	Buttonwood, Botoncillo		

El manglar está conformado por plantas facultativas que poseen adaptaciones morfológicas y fisiológicas que les permiten tolerar la alta salinidad y por tanto colonizar terrenos inundados con agua salobre. Las especies características de esta comunidad son: el mangle rojo (*Rhizophora mangle*), mangle blanco (*Laguncularia racemosa*), mangle negro (*Avicennia germinans*) y el mangle botoncillo (*Conocarpus erectus*), que muestran un patrón clásico de zonación propio del manglar. El mangle rojo se desarrolla en las zonas con mayor tiempo de inundación, los mangles blanco y negro en los sitios de inundación estacional intermedia, mientras que el botoncillo se distribuye preferentemente en las zonas de menor inundación, donde establece un ecotono con las comunidades vegetales vecinas.

(Consortio 2013: 44).

Edible Plants of Municipio de Livingston from

Swamps, Marshes, and Seasonally Inundated Flatlands of Izabal

If you continue library research hour after hour, you find other areas of the coasts where botanists note additional trees (since each area is different elevation every several meters; not always is the coastal border totally below water). Zamora et al. 2015: 5 cite (Durán, 1995; Tun-Dzul y Durán, 2010).

I have tabulated the list to make it easier to conceive. I have put it in alphabetical order to also make it easier to keep track.

Family names change over time; so not all the plant families in a botanical textbook of year 2000 would be same family listed by Neotropical plant portal database (www.ThePlantList.org). Plant family can be capitalized or not; per your preference.

GENUS SPECIES	PLANT FAMILY	INTERNATIONAL NAME	USES
<i>Acrostichum aureum</i>	PTERIDACEAE	Mangrove fern	Edible, medicinal.
<i>Annona glabra</i>	ANNONACEAE	Alligator apple	Edible fruit, medicinal.
<i>Avicennia germinans</i>	ACANTHACEAE	Black mangrove	Edible, medicinal, dye colorant.
<i>Bravaisia berlandieriana</i>	ACANTHACEAE	hulaba, hulup.	Medicinal.
<i>Bursera simaruba</i>	BURSERACEAE	Chaca, palo jiote, gumbo limbo	Medicinal, incense; Common also on hills and far inland; thus, I do not consider this a "wetlands tree".
<i>Ficus cotinifolia</i>	MORACEAE	Strangler fig	Edible (drinkable "leche") Accepted name but not in the Belize list of Balick, Nee, and Atha 2000.
<i>Laguncularia racemosa</i>	COMBRETACEAE	White mangrove	Dye colorant, tannin, medicinal.
<i>Manilkara zapota</i>	SAPOTACEAE		Edible, medicinal, but this tree is common also on hills and far inland; thus, I do not consider this a "wetlands tree".
<i>Metopium brownei</i>	ANACARDIACEAE	black poison wood, chechem, che-chen	Medicinal.

Edible Plants of Municipio de Livingston from

Swamps, Marshes, and Seasonally Inundated Flatlands of Izabal

GENUS SPECIES	PLANT FAMILY	INTERNATIONAL NAME	USES
<i>Pisonia aculeata</i>	NYCTAGINACEAE	Tiger nail emtra	Medicinal.
<i>Rhizophora mangle</i>	RHIZOPHORACEAE	Red mangrove	Edible, medicinal.
<i>Sabal yapa</i>	ARECACEAE	bay leaf palm,	Edible, medicinal.
<i>Swietenia macrophylla</i>	MELIACEAE	mahogany	Medicinal.
<i>Tabebuia rosea</i>	BIGNONIACEAE	(pink) Trumpet tree	Medicinal.

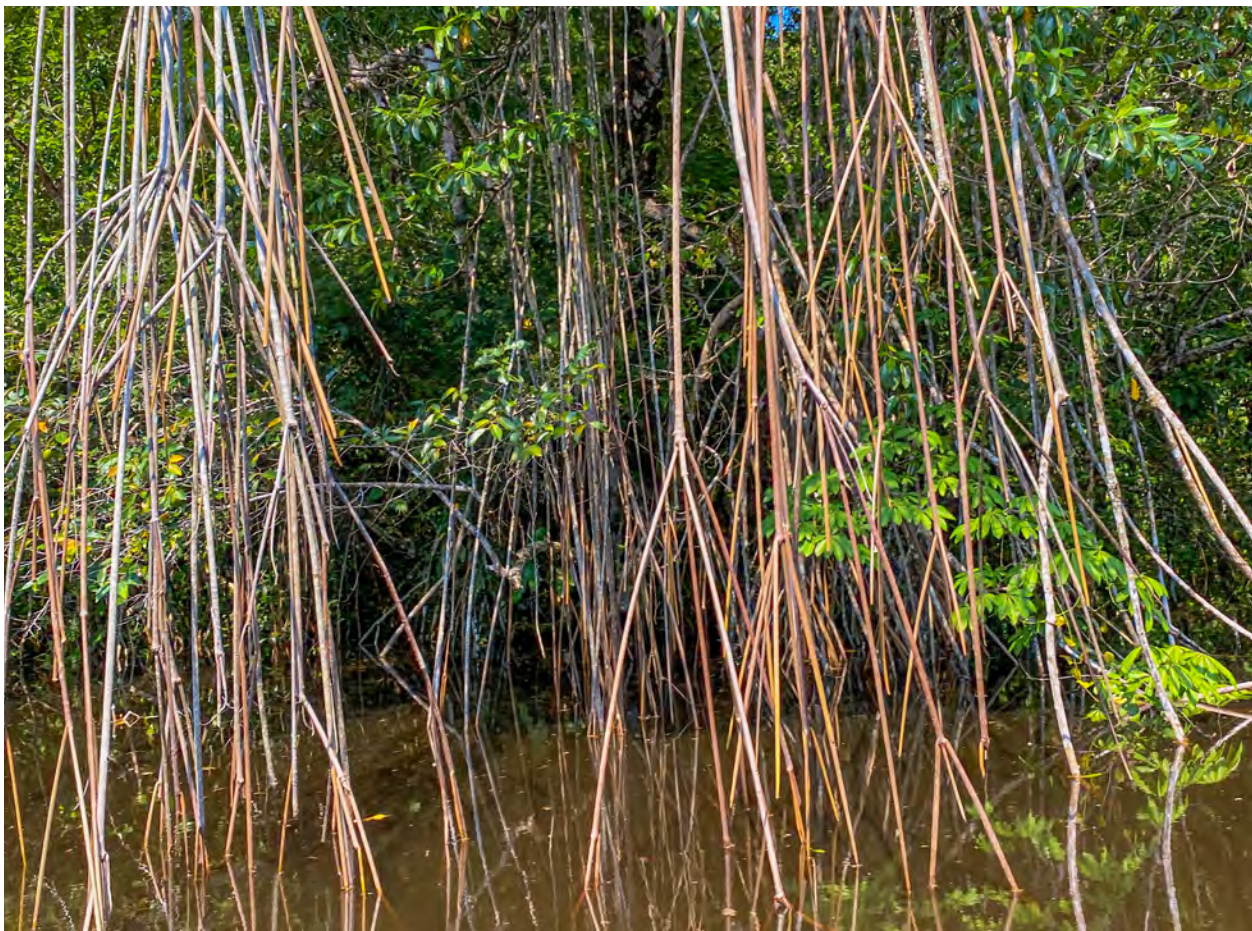


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Camera: iPhone 11 Pro Max.

BOTANICAL DESCRIPTION OF RHIZOPHORA MANGLE IN STANDLEY AND CO-AUTHORS CHICAGO BOTANICAL MONOGRAPHS

Rhizophora mangle L. Sp. Pl. 443. 1753. Mangle; mangle Colorado.

Abundant along both seacoasts, at least in many localities, often forming very dense and extensive stands, usually in association with *Conocarpus*, *Laguncularia*, and *Avicennia*. Southern Florida; from Baja California and Tamaulipas southward in Mexico, and along the whole Central American coast; West Indies; South America; Oceania. Figure 45.

A tree, sometimes 25 meters tall but usually smaller, the trunk rarely a meter in diameter, the bark thin, brownish gray, shallowly furrowed, red within; leaves petiolate, very thick and leathery, obovate or elliptic, 5-15 cm. long, obtuse, entire, deep green above, paler beneath, the nerves obsolete; stipules 2.5-4 cm. long; peduncles mostly 2-3-flowered; calyx 1 cm. long; petals yellow, 7-8 mm. long, villous inside, chiefly below the apex; stamens 8, about 5 mm. long; fruit 2.5-3.5 cm. long.

Called "red mangrove" in British Honduras; "tapche," "tabche" (Yucatan, Maya). The mangrove and its associates form an important species association mangrove swamp that characterizes many parts of the shore line of all tropical America. These swamps, often reaching to the water but sometimes separated by sandbars, contain but little vegetation other than the several "mangroves," although a few other shrubs and occasionally some herbaceous plants often are associated with them. Their branches often bear a small number of epiphytic plants. These trees are confined to salt or brackish water, and the swamps usually are flooded at high tide. *Rhizophora* is especially adapted to an aquatic habitat by its large hard stilt or prop roots that rise far above the soil and are somewhat bowed out, like an arc of a circle. Mangrove swamps are especially well developed about the mouths of streams, whence they spread rapidly seaward, taking advantage of the silt and debris lodged there by the streams. In this manner they are often important agents in extending the land area. The seeds often take root on small islets or in shoals, where they form small islands that gradually increase their area. The floor of these mangrove thickets is one vast slimy tangle of prop roots over which it is all but impossible to make one's way. The roots are often covered with oysters and other marine animals, and are much frequented by spider crabs, spiders, and large grasshoppers.

Seen from within, nothing could be less attractive than a mangrove forest. Viewed from a distance, however, it is beautiful, because of its Permanent fresh green coloring. Entering by ship the bay at Puerto Barrios, one has a comprehensive view of large areas of such swamps.

The wood is dull red or reddish brown, sometimes purplish, uniform or with darker stripes; sapwood rather thick and grayish; very hard and heavy, the specific gravity about 1.15; grain variable, from straight to very irregular, fine-textured; hard to cut, rather harsh and splintery, takes a good polish, is strong and durable. The timber is used in some regions for rafters, beams, knees and ribs of boats, and miscellaneous construction, also for posts, piling, and railway ties. In Central America it is much used for charcoal, that obtained from mangrove being said to be the best of all for the kitchen. The bark contains 20-30 per cent of tannin and is much used locally for tanning skins, especially where oak bark is not available. Large amounts of the bark or its extract are exported from tropical America to the United States and Europe. The young shoots are used for dyeing; they give red, olive, brown, or slate colors, according to the salts used in association with them.

The method of propagation is peculiar. While still attached to the tree, the seed develops a radicle about twice as thick as a lead pencil and 30-60 cm. long, which when detached falls like a dart and sticks upright in the mud, ready to put forth leaves and roots. If the seeds are carried away by currents they float upright until they reach a lodging place. Oviedo stated that the fruits, perhaps the radicles, were sometimes eaten by the Indians, "when they can find no better fruit (for it is somewhat bitter), and they say it is wholesome."

(Standley and Williams 1962: 266-268).



Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 20, 2010. Río Negro, Livingston, Izabal.

Camera: iPhone 11 Pro Max.

RHIZOPHORA MANGLE TREES IN BELIZE: STANDLEY AND RECORD

RHIZOPHORA L. Mangrove

Rhizophora mangle L. Red Mangrove. Mangle Colorado. Tapche (Yucatan, Maya). Common in coastal swamps, often forming large dense thickets; general on tropical American shores. A small or medium-sized tree with thin, brownish gray, shallowly furrowed bark, and often numerous stilt roots; leaves short-stalked, dark green; flowers few, in the leaf axils, stalked, the 4 narrow petals yellowish white; fruit conic, leathery, 2-2.5 cm. long. The most characteristic tree of tropical shores. The seed usually germinates on the tree, the radicle becoming 25-30 cm. long before the seed falls from the tree and takes root in the mud. The conspicuous prop roots usually are exposed at high tide, when the oysters and other marine animals may be seen attached to them. Mangrove trees are of great importance in land building, for their roots hold mud and debris brought down by streams, gradually pushing seaward and forming new land. Charcoal obtained from mangrove wood usually is considered the best of all for kitchen use. The bark is used in the North for tanning hides. The young shoots often are employed in Central America for dyeing leather and other articles. Wood red or reddish brown, very hard, heavy, strong, fine-textured, durable; used for fuel and charcoal and to some extent for construction. (See T. of T. A., pp. 472-474.)

(Standley and Record 1936: 275-276)

RHIZOPHORA MANGLE IN BELIZE (BALICK, NEE AND ATHA 2000)

Rhizophora mangle L. — **Loc Use:** PRD, TAN. — **Reg Use:** MED, PRD, FUEL, FOOD, CNST, DYE. — **Nv:** colorado, mangle colorado, red mangrove, tapche. — **Habit:** Tree



Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 20, 2010. Río Negro, Livingston, Izabal.

Camera: iPhone 11 Pro Max.

BOTANICAL DESCRIPTION OF THE *RHIZOPHORA MANGLE* BY STANDLEY IN TREES AND SHRUBS OF MEXICO

120. **RHIZOPHORACEAE**. Mangrove Family.

1. **RHIZOPHORA** L. Sp. Pl. 443. 1753.

The genus consists of about three species, widely distributed on tropical coasts.

1. ***Rhizophora mangle*** L. Sp. Pl. 443. 1753.

Common along both Mexican coasts from Tamaulipas and southern Baja California southward. Widely distributed in tropical America.

Tree, sometimes 25 meters high, with a trunk 1.2 meters in diameter, but usually much smaller; bark thin, brownish gray, shallowly furrowed, red within; leaves opposite, petiolate, obovate or elliptic, 5 to 15 cm. long, obtuse, entire, leathery, glabrous, dark green, with deciduous stipules; flowers perfect, on 2 or 3-flowered axillary peduncles; calyx leathery, 4-lobed; petals 4, yellowish-white, linear, hairy; stamens 8; fruit baccate, conic, 2 to 2.5 cm. long, leathery, brown; seed usually germinating in the fruit, the radicle pushing out and growing downward, becoming 25 to 30 cm. long before it falls from the plant and takes root in the mud; wood hard, close-grained, strong, dark red-brown, its specific gravity about 1.16. "Tab- ché," or "tap-ché " (Yucatan, Maya); "mangle" (Baja California, Oaxaca, and elsewhere, Costa Rica, Porto Rico, Santo Domingo, etc.; the word probably of Carib origin; "manglar" is a mangrove thicket); "mangle dulce" (Baja California); "mangle Colorado" (Tabasco, Tamaulipas, Oaxaca, Veracruz, Guerrero, Cuba, Panama, Guatemala, Puerto Rico, Venezuela); "mangle tinto " (Veracruz); "candelon" (Veracruz, Colima, Sinaloa, Ramirez); "mangle salado" (Panama); "mangle zapatero" (Puerto Rico); "mangle gateador" (Costa Rica).

The mangrove (sometimes known as "red mangrove") is the most abundant and conspicuous tree of tropical coasts, forming dense forests or thickets of great extent almost everywhere that the water is brackish. The plants send out numerous arching prop roots in all directions, which are covered at high tide, and these form impenetrable tangles. The roots are often covered with oysters. The mangrove is important in land building, preventing washing away of land by waves and also affording a place of protection for soil and refuse. Thus, small islands gradually increase greatly in size. The soil underneath mangrove trees usually consists of black oozy mud, and the mangrove forests are extremely repellent in appearance when seen at close hand, although when viewed from a distance they are strikingly handsome. The wood is used for fuel and for building wharfs and docks, since it is durable in water and is not attacked by the mollusk *Teredo*. Clavigero states that it was employed for making oars, and Oviedo states that "it is one of the best woods there is here (West Indies) for the poles of huts and timbers of houses, and for door and window frames." The leaves and especially the bark are rich in tannin and the latter is used for tanning leather. The bark, with salts of copper or iron, yields olive, brown, and slate dyes. Of the fruit, Oviedo (Lib. IX, Cap. VI) states that it "is tawny and within is a marrow or heart which the Indians eat when they can find no better fruit (for it is somewhat bitter), and they say it is wholesome." The bark has been employed as a febrifuge and to stop hemorrhages, also as a remedy for sore throat. Pittier reports that in Panama a red dye is obtained from the young shoots.

(Standley 1924: 1027-1028).

BOTANICAL DESCRIPTION OF THE *RHIZOPHORA* MANGLE BY STANDLEY FOR YUCATAN

RHIZOPHORAGEAE. Mangrove Family

***Rhizophora mangle* L.**

Tapche (Gaumer; reported also as "tabche")- Sp. Mangle, Mangle Colorado. Red mangrove (B. H.). Common in coastal swamps. Mangrove. A glabrous tree; leaves opposite, elliptic or obovate, leathery, entire. The wood is hard, close-grained, strong, and dark red-brown. The tree is notable for its stilt like prop-roots. The bark is rich in tannin, and is used locally, especially by the Indians, for tanning skins. It is employed also as a remedy for lepra, diarrhea, and dysentery.

(Standley 1930: 371).

Rhizophora mangle L. BCN, BCS, CAM, CHIS, COL, GRO, JAL, MICH, NAY, OAX, PUE, QROO, SIN, SON, TAB, TAMS, VER, YUC

(Villaseñor 2016: 867-868).

So *Rhizophora mangle* grows on both coasts and where the Olmec were near (Tabasco and Veracruz); where early proto-Maya areas have been found (again Tabasco); and throughout the Pacific Coast of Chiapas and Atlantic coast of the Caribbean of Campeche, Quintana Roo, and Yucatan (plus Belize and Izabal and further south).



Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 20, 2010. Río Negro, Livingston, Izabal.

Camera: iPhone 11 Pro Max.

WHERE HAS *RHIZOPHORA MANGLE* BEEN FOUND IN THE MUNICIPIO OF LIVINGSTON?

Is *Rhizophora mangle* listed for Biotopo Protegido Chocón Machacas, CECON/USAC?

Yes, it is found as the fifth most abundant species in the riparian and lacustrine forests of the area (PEREZ-Consuegra 2001: 23).

The red mangrove (*Rhizophora mangle*) is the dominant species in mangrove forest.

Is *Rhizophora mangle* listed for Tapón Creek Nature Reserve (including Taponcito Creek), FUNDAECO?

Not mentioned.

Is *Rhizophora mangle* listed for Buena Vista Tapón Creek Nature Reserve?

Not mentioned.

Is *Rhizophora mangle* listed for Cerro San Gil (south side of Río Dulce)?

Yes, it is present in floodplain forests and mangroves (Ruíz 2006: 54).

Is *Rhizophora mangle* listed for El Refugio de Vida Silvestre Punta de Manabique?

Yes, they are part of the flora of the flooded forests (FUNDARY-ONCA 2007: 24).

All four “mangrove” trees are found in the area of Punta de Manabique. Most common is *Rhizophora mangle* (Andrade et al. 2015: 31).

Is *Rhizophora mangle* listed for Ecoalbergue Lagunita Creek (Área de Usos Múltiples Río Sarstún)?

Yes, it's on the flora list of the area (Hidalgo and López 2007: 43).

Edible Plants of Municipio de Livingston from

Swamps, Marshes, and Seasonally Inundated Flatlands of Izabal

Is *Rhizophora mangle* listed for Sarstoon-Temash National Park (northern side of Río Sarstún)?

Yes, it's on the park's flora list (Meerman, Herrera and Howe 2003: 10).

Is *Rhizophora mangle* listed for Bocas de Polochic?

Not mentioned.



Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 20, 2010. Río Negro, Livingston, Izabal.

Camera: iPhone 11 Pro Max.

IS *RHIZOPHORA MANGLE* FROM THE HIGHLANDS OR FROM THE LOWLANDS (OR BOTH)?

Lowlands, from 0 to 15 meters above sea level.

WORLD RANGE FOR *RHIZOPHORA MANGLE*

R. mangle is a tropical and subtropical American species, native to a wide area on both eastern and western coasts: on the Pacific, from Baja California, Mexico, to northern Peru, and on the east, from North Carolina to Florida and around the Gulf of Mexico, the Caribbean, and along northern South America to the northeast of Brazil. However, the common name American mangrove is somewhat of a misnomer, as the species is also reported as native to West Africa, from Senegal to Nigeria. There is some confusion among authorities about whether *R. mangle* in the Pacific (Micronesia, Polynesia) is native or introduced.

<https://www.cabi.org/isc/datasheet/47509#todistribution>

DOES *RHIZOPHORA MANGLE* ALSO GROW IN HOME GARDENS?

You don't need this tree in your home garden; if you want to experience it, you move to live near the coast.

LOTS OF USES OF *RHIZOPHORA MANGLE*

Tannin for tanning animal skins.

The bark, with salts of copper or iron, yields olive, brown, and slate dyes.... Pittier reports that in Panama a red dye is obtained from the young shoots (Standley 1924: 1028).



Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 20, 2010. Río Negro, Livingston, Izabal.

Camera: iPhone 11 Pro Max.

PARTS OF THIS TREE ARE EDIBLE

Below is a list of uses that we found first in a report by Cruz; but a few minutes later we found, literally, the identical text by an earlier author (Vázquez et al. 1999: 222-223). Cruz has an excellent bibliography and cites lots of aspects constantly. But for uses there is not any reference to where the whole kit and kaboodle was copied literally word-for-word from the earlier author.

Usos.

Adhesivo/exudado (látex). Se ha utilizado como adhesivo en la fabricación de triplay.

Artisanal/madera. Bolas de boliche o de polo y artesanías en general. Artículos torneados.

Colorantes/corteza. La corteza produce un tinte azul para teñir tejidos de algodón. La recolección de la corteza se lleva a cabo de manera primitiva usando solo machete, causando gran daño al árbol al afectarse el cambium vascular, por la herida que le producen.

Combustible/madera. Leña y carbón.

Comestible/fruto. El jugo fermentado produce una bebida embriagante.

Melífera/flor. Apicultura.

Construcción/hoja, madera. Construcción rural y marina. Un uso muy extendido es la extracción de árboles juveniles de *R. mangle*, por su resistencia para ser usados como travesaños en viviendas o para la construcción de trampas para el camarón.

Usos.

Adhesivo [[exudado (látex)]]. Se ha utilizado como adhesivo en la fabricación de triplay.

Artisanal [[madera]]. Bolas de boliche o de polo y artesanías en general. Artículos torneados.

Colorantes [[corteza]]. La corteza produce un tinte azul para teñir tejidos de algodón. La recolección de la corteza se lleva a cabo de manera primitiva usando solo machete, causando gran daño al árbol al afectarse el cambium vascular, por la herida que le producen.

Combustible [[madera]]. Leña y carbón.

Comestible [[fruto]]. El jugo fermentado produce una bebida embriagante.

Construcción [[hoja, madera]]. Construcción rural y marina. En México un uso muy extendido es la extracción de árboles juveniles de *R. mangle*, por su resistencia para ser usados como travesaños en viviendas o para la construcción de trampas para camarón.

Las hojas son empleadas en los techos rurales. La dureza y resistencia de los postes y pilotes al agua de mar está ampliamente reconocida por los pescadores. La madera tiene gran demanda en construcciones ligeras.

Curtiente/corteza, raíz, semilla. La corteza y raíz son fuente importante de taninos (10 a 40 %) que se emplean en el curtido de pieles, tinción de cuerdas, redes y sedales. La cosecha de la corteza se realiza usando machetes, lo que causa un gran daño al árbol al afectarse el cambium vascular.

Implementos de trabajo/madera. Implementos agrícolas, galeras tabacaleras, mangos para herramientas.

Maderable/madera. Madera muy dura. Se utiliza para hacer puentes, pilotes, postes de casas, vigas, horcones, durmientes, muebles, diques, costillas para embarcaciones, fabricación de barcos y pisos, remos e instrumentos empleados en las artes de pesca.

Medicinal/corteza, hoja, raíz.

Corteza: febrífugo, hemostático, antidiarreico, para el asma, hemoptisis, mordedura o picadura de animales marinos venenosos, diversas heridas, tuberculosis, lepra, hemorragias, disentería, elefantiasis (Morton, 1965).

Las hojas son empleadas en los techos rurales. La dureza y resistencia de los postes y pilotes al agua de mar está ampliamente reconocida por los pescadores. La madera tiene gran demanda en construcciones ligeras.

Curtiente [[corteza, raíz, semilla]]. La corteza y raíz son fuente importante de taninos (10 a 40 %) que se emplean en el curtido de pieles, tinción de cuerdas, redes y sedales. La cosecha de la corteza se realiza usando machetes, lo que causa un gran daño al árbol al afectarse el cambium vascular. Implementos de trabajo [[madera]].

Implementos agrícolas, galeras tabacaleras (San Andrés Tuxtla, Veracruz), mangos para herramientas.

Maderable [[madera]]. Madera muy dura. Se utiliza para hacer puentes, pilotes, postes de casas, vigas, horcones, durmientes, muebles, diques, costillas para embarcaciones, fabricación de barcos y pisos, remos e instrumentos empleados en las artes de pesca. **Medicinal** [[corteza, hoja, raíz]].

Corteza: febrífugo, hemostático, antidiarreico, para el asma, hemoptisis, mordedura o picadura de animales marinos venenosos, diversas heridas, tuberculosis, lepra, hemorragias, disentería, elefantiasis.

Hoja: escorbuto, dolor de muelas, úlceras leprosas (Morton, 1965).

Raíz: la raspadura de las raíces es usada por los pescadores contra mordeduras de peces y picaduras de insectos venenosos (Kabaru & Gichia, 2001; Thangam & Kathiresan, 1997; Williams, 1999). Los embriones son ricos en taninos y se emplean machacados y cocidos como astringentes.

(Cruz 2013: 8)

Hoja: escorbuto, dolor de muelas, úlceras leprosas.

Raíz: la raspadura de las raíces es usada por los pescadores contra mordeduras de peces y picaduras de insectos venenosos. Los embriones son ricos en taninos y se emplean machacados y cocidos como astringentes. La planta tiene efecto anti-hiperglicémico y podría llegar a usarse clínicamente en el control de la diabetes mellitus.

Melífera [[flor]]. Apicultura

By earlier author

(Vázquez et al. 1999: 222-223)



Photo by: David Arrivillaga, FLAAR Mesoamerica, Apr. 30, 2021.
Punta de Cocoli, Livingston, Izabal.

Camera: Sony Alpha A7R IV. Lens: Sony FE 90mm Macro G OSS .
Settings: 1/250 sec; f/10; ISO 500.

IS THERE POTENTIAL MEDICINAL USAGE OF *RHIZOPHORA MANGLE* BY LOCAL PEOPLE?

You can find endless numbers of botanical and medicinal reports on medicinal uses of *Rhizophora mangle* by local people. Here is one example: “It is employed also as a remedy for lepra, diarrhea, and dysentery. (Standley 1930: 371).

Cruz (2013) provides enough chemical analysis of potential medicinal aspects to keep you quite busy.

WHAT ARE THE PRIMARY POLLINATORS OF *RHIZOPHORA MANGLE* FLOWERS?

R. mangle is pollinated primarily by wind and secondarily by insects.

(HOYOS-Ruiz 2021: 22)



Photo by: David Arrivillaga, FLAAR Mesoamerica, Apr. 30, 2021. Punta de Cocoli, Livingston, Izabal.
Camera: Sony Alpha A7R IV. Lens: Sony FE 90mm Macro G OSS . Settings: 1/250 sec; f/10; ISO 500.

CONCLUDING DISCUSSION AND SUMMARY ON *RHIZOPHORA MANGLE* TREES

GENUS, SPECIES	PLANT FAMILY	LOCAL NAME	USES
<i>Avicennia germinans</i>	Acanthaceae	Black mangrove	Edible
<i>Laguncularia racemosa</i>	Combretum Family, Combretaceae	White mangrove	
<i>Rhizophora mangle</i>	Rhizophoraceae	Red mangrove	Edible
<i>Conocarpus erectus</i>	Combretum Family, Combretaceae	Buttonwood, Botoncillo	

Rhizophora mangle is found along the sides of Río San Pedro (Bestelmeyer and Alonso 2000: 15), which today is “hundreds of kilometers” from the sea.

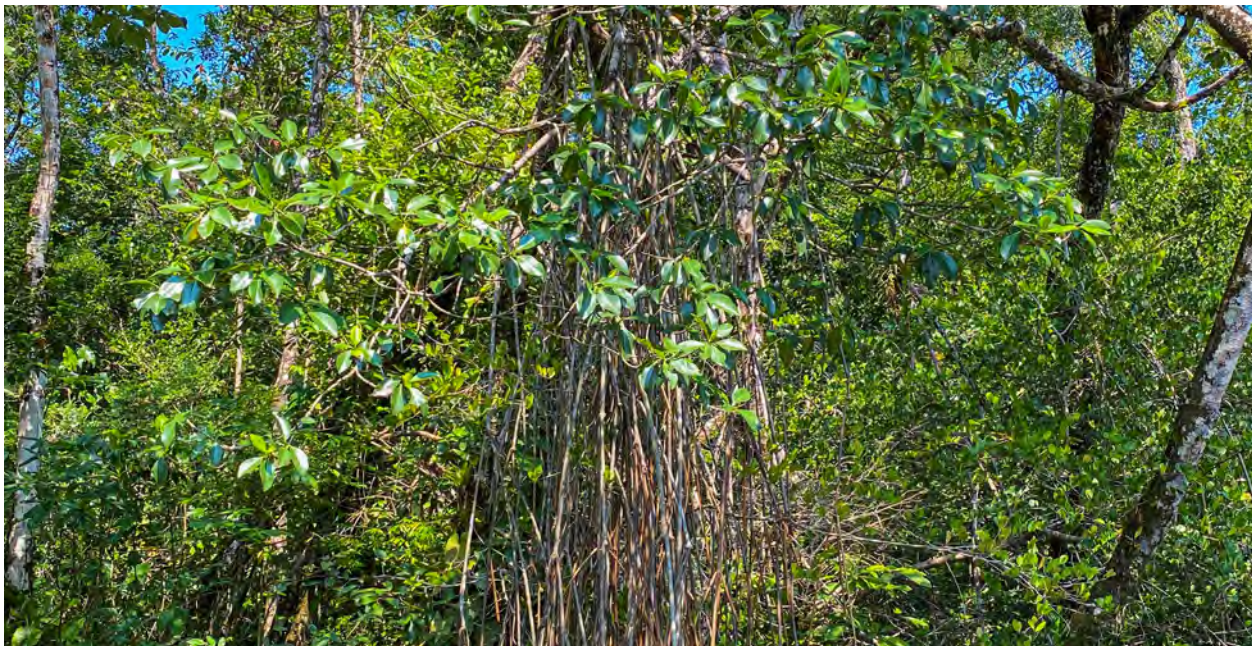


Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 20, 2010. Río Negro, Livingston, Izabal.

Camera: iPhone 11 Pro Max.

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READING ON *RHIZOPHORA MANGLE*

Most helpful report on this plant:

CRUZ, Sully M. (Principal Investigator)

2013 Evaluación del potencial agroindustrial de Mangle (*Rhizophora mangle* L.) como colorante, antioxidante y biocida distribuidos en la reserva Monterrico para su aprovechamiento sostenible y conservación. Proyecto FODECYT No. 24-2011.

But then I found it was word for word from an earlier publication (Vazquez et al. 1999). This 1999 publication is essential to download and have available. I use it every day (since I am writing about dozens of trees associated with riversides, coastal areas, swamps or marshes of the Municipio de Livingston, Izabal, Guatemala).

Another helpful book is by Bernard Rollet; if you have patience to read French in style of half a century ago (1975).

Helpful publication that includes this plant:

CONRAD, Jim

2012 101 Yucatan Trees. Jim Conrad. 192 pages

Helpful because it shows and describes all the mangrove species; plus, the photos are crisp and useful. It is so sad to see botanical monographs by capable botanists either with no illustrations or photos that are embarrassing.

Most helpful web sites on this plant:

**Note: since the present edition is a work-in-progress
this bibliography also is a work-in-progress**

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2015 Ecological linkages in a Caribbean estuary bay. Marine Ecology Progress Series. Vol. 533: 29–46, 2015.

BALICK, Michael J., NEE, Michael H. and Daniel E. ATHA

2000 Checklist of the Vascular Plants of Belize: With Common Names and Uses. Memoirs of the New York Botanical Garden Vol. 85. 246 pages.

BALICK, Michael J. and Rosita ARVIGO

2015 Messages from the Gods: A Guide to the Useful Plants of Belize. The New York Botanical Garden, Oxford University Press.

BESTELMEYER, Brandon T. and Leeanne E. ALONSO, Editors

2000 A Biological Assessment of Laguna del Tigre National Park, Petén, Guatemala, Evaluación Biológica de los Sistemas Acuáticos del Parque Nacional Laguna del Tigre, Petén, Guatemala Rapid Assessment Program, Programa de Evaluación Rápida. Conservation International Center for Applied Biodiversity Science Department of Conservation Biology.

CONAP

2001 Plan Maestro 2002-2006 Área de Protección Especial Punta de Manabique. CONAP. Fundación Mario Dary Rivera. Guatemala.

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2013 Documento Técnico Unificado Modalidad A. para El Trámite Unificado de Cambio de Uso de Suelo Forestal Proyecto: "Vista Azul". Consorcio de Ingeniería Integral S.A. de C.V. Cancún, Benito Juárez, Quintana Roo.

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- 2013 Evaluación del potencial agroindustrial de Mangle (*Rhizophora mangle* L.) como colorante, antioxidante y biocida distribuidos en la reserva Monterrico para su aprovechamiento sostenible y conservación. Proyecto FODECYT No. 24-2011. Consejo Nacional De Ciencia Y Tecnologia –CONCYT, Secretaría Nacional de Ciencia y Tecnologia-SENACYT, Fondo Nacional De Ciencia y Tecnología -FONACYT, Facultad de Ciencias Químicas y Farmacia, Universidad de San Carlos de Guatemala. 136 pages.

ESTRADA Loreto, Feliciano

- 2010 Indicadores ecológicos de la zona riparia del Río San Pedro, Tabasco, México. MS Thesis, El Colegio de la Frontera Sur. 131 pages.

Download: https://ecosur.repositorioinstitucional.mx/jspui/bitstream/1017/1656/1/100000050585_documento.pdf

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- 2013 A checklist of the vascular plants of the lowland savannas of Belize, Central America. *Phytotaxa* 101 (1): 1–119.

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HIDALGO, Hugo and Cristofer LOPEZ

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IBARRA-Manríquez, Guillermo, VILLASEÑOR, José Luis and Rafael DURÁN García

1995 Riqueza de especies y endemismo del componente arbóreo de la Península de Yucatán, México. Bol. Soco Bot. México 57: 49-77 (1995).

HELLMUTH, Nicholas M.

2013 Maya Ethnobotany, Complete Inventory, Fruits, nuts, root crops, grains, construction materials, utilitarian uses, sacred plants, sacred flowers 12th edition. FLAAR Reports, FLAAR (USA) and FLAAR Mesoamerica (Guatemala). 106 pages.

The 13th edition that followed is an update but the 12th edition has tons of material to get you started.

HELLMUTH, Nicholas M.

2014 Maya Ethnobotany, Complete Inventory, Fruits, nuts, root crops, grains, construction materials, utilitarian uses, sacred plants, sacred flowers 13th edition. FLAAR Reports, FLAAR (USA) and FLAAR Mesoamerica (Guatemala). 111 pages.

HOYOS-Ruiz, Tania Carolina

2021 Vectores de Dispersión de Polen y Diversidad de Organismos Asociados a las Flores del Mangle Rojo *Rhizophora mangle* L. Universidad Magdalena, Colombia. 47 pages.

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- 1999-a Ambiente, distribución y características estructurales de los manglares del Pacífico de Centro América: contrastes climáticos, p.51-70. In: A. Yáñez-Arancibia y A.L. Lara-Domínguez (eds.) ecosistemas de Manglar en América Tropical. Instituto de Ecología, A.C. México, UICN/ORMA, Costa Rica, NOAA/NMFS Silver Spring MD USA. 308 p.19.

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- 1999-b El manejo de los manglares en el Pacífico de Centroamérica: Usos tradicionales y potenciales, p. 275-290. In: A. Yáñez-Arancibia y A. L. Lara-Domínguez (eds.). Ecosistemas de Manglar en América Tropical. Instituto de Ecología A.C. México, UICN/ORMA, Costa Rica, NOAA/NMFS Silver Spring MD USA. 380 pages.

KANTÚN-Balam, Jesús, SALVADOR-Flores, José, TUN-Garrido, Juan, NAVARRO-Alberto, Jorge, ARIAS-Reyes, Luis and Jaime MARTÍNEZ-Castillo

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Louteridium is too often considered a shrub, so would not be expected in monographs on "TREES."

LEVY Tacher, Samuel I., AGUIRRE Rivera, J. Rogelio, GARCÍA Perez, José D. and María Magdalena MARTÍNEZ Romero

- 2006 Aspectos florísticos de Lacanhá Chansayab, Selva Lacandona, Chiapas. Acta Botánica Mexicana, núm. 77, octubre, 2006, pp. 69-98. Instituto de Ecología, A.C., Pátzcuaro, México.

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2003 Rapid Ecological Assessment Sarstoon Temash National Park Toledo District, Belize. Volume II: Appendices (Species lists and raw data). Temash Institute for Indigenous Management (SATIIM). 92 pages.

Morton, Julia F.

1965 Can the Red Mangrove Provide Food, Feed, and Fertilizer? Economic Botany, Vol. 19, No. 2:113-123. Springer on behalf of New York Botanical Garden Press.

PARKER, Tracey

2008 Trees of Guatemala. The Tree Press. 1033 pages.

Even though copy-and-paste, it helps to have 99% of the trees of Guatemala in one single volume. Although more than half the book is copy-and-paste from Flora of Guatemala, since the Parker book is year 2008, it has additional information for some trees, but not for many.

PARKS WATCH

2003 Park Profile– Guatemala Chocón Machacas Protected Biotope. Parks Watch, Strengthening Parks to Safeguard Biodiversity 16 pages.

PEÑA-Chocarro, María and Sandra KNAPP

2011 Árboles del mundo maya. Natural History Museum Publications. 263 pages.

Helpful book; contributing authors are experienced botanists. They cover 220 species of trees, more than virtually all other “Books on Trees of the Maya.” Even include tasiste (which is missing from all other books on “Trees of the Maya” except for the recent book on Árboles de Calakmul).

But if all this effort is going into a book, would help if there were more photos, larger photos, and not so much blank space at the bottom of each page. Plus, would help if the text could include personal first-hand experience with these trees out in the Mundo Maya. But even as is, it is a helpful book.

If you are doing field work you need this, plus Árboles de Calakmul, plus Árboles tropicales de México. Parker's book you need back in your office, since out in the field it's not much help due to lack of photographs. Back in your office the books by Regina Aguirre de Riojas are also helpful.

PENNINGTON, Terence D. and José SARUKHAN

2005 Árboles tropicales de México. Manual para la identificación de las principales especies. 3rd edition. UNAM, Fondo de Cultura Económica. 523 pages.

This book is a serious botanical monograph. 1968 was the first edition (I still have this), 1998 was second edition. The 3rd edition is a "must have" book. Each tree has an excellent line drawing of leaves and often flowers and fruits (though to understand flowers you need them in photographs, in full color). Each tree has a map showing where found in Mexico (such maps are lacking in most books on Trees of Guatemala or plants of Belize). But trying to fit a description of a tree on one single page means that a lot of potential information on flowering time is not present. And, this is definitely not a book on ethnobotany: for that you need Suzanne Cook.

PEREZ-Consuegra, Sergio, et al.

2001 Caracterización Ecológica de los Biotopos Chocón Machacas, Izabal y Cerro Cahú, Petén, Universidad de San Carlos de Guatemala (USAC).

ROLLET, Bernard

1975 Les utilisations de la Mangrove. Journal d'agriculture traditionnelle et de botanique appliquée, Année 1975, 22-7-9 pp. 203-235.

Lists a remarkable quantity of uses for several species of mangrove trees.

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RUIZ, CLAUDIA, et al.

2006 Plan Maestro de la Reserva Protectora de Manantiales Cerro San Gil, 2008-2012. Consejo Nacional de Áreas Protegidas (CONAP), Fundacion Para el Ecodesarrollo y la Conservación (FUNDAECO), The Nature Conservancy (TNC).

STANDLEY, Paul C.

- 1924 Trees and Shrubs of Mexico. Contributions from the United States National Herbarium, Volume 23, Part 4. Smithsonian Institution.

In this one monograph the species are not listed in alphabetical order, so it's a mental adventure finding the species you are looking for.

All monographs by Standley and co-authors can be easily found and downloaded. I would recommend finding the .pdf versions as they are easier to store, easier to copy, and easier to share with students and colleagues.

STANDLEY, Paul C.

- 1930 Flora of Yucatan. Field Museum of Natural History Botanical Series, Vol. III., Number 3, Publication 279. 492 pages.

STANDLEY, Paul C. and Samuel J. RECORD

- 1936 The Forests and Flora of British Honduras. Field Museum of Natural History. Publication 350, Botanical Series Volume XII. 432 pages plus photographs.

STANDLEY, Paul C. and Louis O. WILLIAMS

- 1962 Flora of Guatemala. Fieldiana: Botany, Volume 24, Part VII, Number 2. Chicago Natural History Museum.

TREJO-Torres, J. C. and J. RODRÍGUEZ

- 2014 Listas para Usarse: Lista de árboles del Mayab, (Campeche, Quintana Roo y Yucatán), v. 1. The Institute for Regional Conservation – Programa para la Península de Yucatán. 40 pages.

VÁZQUEZ Yanes, Carlos, BATIS Muñoz, Ana Irene, ALCOCER Silva, Maria Isabel, Martha GUAL Díaz and Cristina SÁNCHEZ Dirzo

- 1999 Árboles y Arbustos Nativos Potencialmente Valiosos para la Restauración Ecológica y la Reforestación. Proyecto J-084 – CONABIO. Instituto de Ecología, Universidad Autónoma de México. 311 pages.

Even with zero photographs, zero drawings, zero maps; this is one of the single most helpful books on trees of Mexico (and of course helpful for our research on trees of Guatemala).

VILLASEÑOR, José Luis

2016 Checklist of the native vascular plants of Mexico. Catálogo de las plantas vasculares nativas de México. Revista Mexicana de Biodiversidad 87 (2016) 559–902.

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1981 Foods for Early Man. CEIBA, Vol. 24 Núm. 1-2, Escuela Agrícola Panamericana, Zamorano.

HELPFUL WEB SITES FOR ANY AND ALL PLANTS

There are several web sites that are helpful even though not of a university or botanical garden or government institute.

However most popular web sites are copy-and-paste (a polite way of saying that their authors do not work out in the field, or even in a botanical garden). Many of these web sites are click bait (they make money when you buy stuff in the advertisements that are all along the sides and in wide banners also). So, we prefer to focus on web sites that have reliable information.

<https://serv.biokic.asu.edu/neotrop/plantae/>

Neotropical Flora data base. To start your search, click on this page:

<https://serv.biokic.asu.edu/neotrop/plantae/collections/harvestparams.php>

<http://legacy.tropicos.org/NameSearch.aspx?projectid=3>

This is the main SEARCH page.

<https://plantidtools.fieldmuseum.org/pt/rrc/5582>

SEARCH page, but only for collection of the Field Museum herbarium, Chicago.

<https://fieldguides.fieldmuseum.org/guides?category=37>

These field guides are very helpful. Put in the Country (Guatemala) and you get eight photo albums.

<http://enciclovida.mx>

CONABIO. The video they show on their home page shows a wide range of flowers pollinators, a snake and animals. The videos of the insects are great.

www.kew.org/science/tropamerica/imagetdatabase/index.html

Kew gardens in the UK is one of several botanical gardens that I have visited (also New York Botanical Gardens and Missouri Botanical Gardens (MOBOT), in St Louis, the botanical garden in Singapore and El Jardín Botánico, the open forest botanical garden in Guatemala City).

www.ThePlantList.org

This is the most reliable botanical web site to find synonyms. In the recent year, only one plant had more synonyms on another botanical web site.

SERIES FOR THE MUNICIPALIDAD DE LIVINGSTON

IF YOU WISH OUR FLORA AND/OR FAUNA

MATERIAL AS A POWERPOINT PRESENTATION

Dr Nicholas (Hellmuth) is flown all around the world to lecture. He has spoken in Holland, Belgium, Germany, Austria, Greece, Italy, Serbia, Croatia, Bosnia, Russia, UK, Dubai, Abu Dhabi, Thailand, Korea, China, Japan, Canada, USA, Mexico, Panama, Guatemala, etc.

He can lecture in Spanish, German, or English (or simultaneously translated to your language). He has lectured at Harvard, Yale, Princeton, UCLA, Berkeley and dozens of other universities, colleges, museums, alumni clubs, etc.

He also writes cartoon books on plants and animals of Guatemala so gives presentations to primary school, high schools, etc. www.MayanToons.org shows our educational material for children.

IF YOUR CLUB, ASSOCIATION, INSTITUTE, BOTANICAL GARDEN, ZOO, PARK, UNIVERSITY, ETC WISHES HIGH-RESOLUTION PHOTOS FOR AN EXHIBIT IN YOUR FACILITY ANYWHERE IN THE WORLD

The Missouri Botanical Garden (MOBOT) has had two exhibits of the FLAAR Mesoamerica photos on Neotropical flowering plants of Guatemala. Photos by the FLAAR team have also been exhibited at Photokina in Germany and in Austria, Guatemala, and elsewhere. For use of these photos in a book or exhibit, naturally we need to discuss how to share the costs.

We have material for entire exhibits on:

- Orchids of Guatemala (including aquatic orchids),
- Dye colorants from Mushrooms and Lichens of Guatemala,
- Bromeliads of Guatemala,
Trees of Guatemala,
- Treetop Ecosystems of Guatemala (includes arboreal flowering cacti, bromeliads, and orchids),
- Cacao Cocoa Chocolate and their Maya and Aztec Flavorings.

We naturally appreciate a contribution to help cover the costs our office expenses for all the cataloging, processing, and organization of the photos and the field trip data.

LIVINGSTON: THE CARIBBEAN BIODIVERSITY WONDERLAND OF GUATEMALA

Izabal, one of the regional departments of Guatemala that offers a variety of recreational activities, is home to numerous nature parks and diverse natural landscapes. There are white sandy beaches a short boat trip away, with tall jungle-covered mountains in the background, and the Mesoamerican Reef System in the Caribbean Sea on the horizon in front of you. Mangrove swamps, seagrass, islands, cenotes, caves, karst geology canyons and streams of crystal clear water abound along the Rio Dulce and Lake Izabal coast or inland. All this together makes Livingston one of the destinations for tourists wanting to do bird-watching, explore caves, and get healthy exercise hiking through trails in the rainforest. In addition to the incredible flora and fauna that the municipality offers, three different cultures coexist in the ecosystem (Mayan Q'eqchi', Garifuna and Ladinos).

In order to conserve the biodiversity found in the municipality and that continues to be of benefit to the ecosystem, it is necessary to have an updated record of the species that inhabit it and thus be able to detect changes in the species population. Thanks to the efforts of different institutions focused on environmental improvement projects at various sites in Livingston (FUNDAECO working in Río Sarstun, CONAP covering Río Dulce, CECON-USAC in Chocón-Machacas, and ARNPG with more than ten private reservers, among many others) are records of species of flora, fauna and ecosystems of this municipality of Izabal.

Using this information in the most efficient way and using the potential of digital technology, the database for the municipality can be supplemented with photographic records of flora, fauna, and ecosystems. The FLAAR Mesoamerica team, in cooperation with the municipal authorities, have begun to produce this educational material using the photographic records generated during the cooperation project to account for the flora, fauna and ecosystems that can be seen in Livingston. This will be accomplished in order to provide information to schools, families and institutions already working to protect the environment.

We hope to attract the attention of professors, botanical garden clubs, orchid and bromeliad societies, students, tourists, experts, explorers, photographers and nature lovers who want to get closer, to marvel at the species of flowering plants, mushrooms and lichen that FLAAR Mesoamerica finds during each field trip each month.



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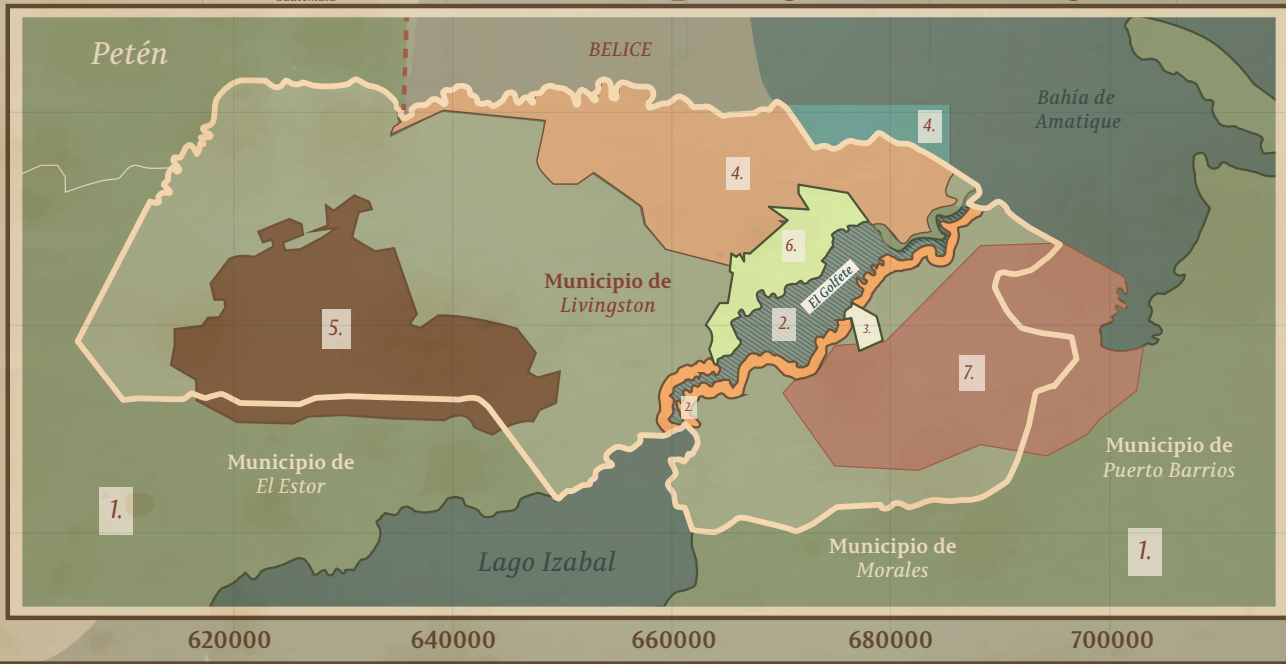
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Áreas naturales protegidas de Livingston



Izabal

- 1. Área sin protección
- 2. Parque Nacional Río Dulce
- 3. El Higuerito
- 4. Área de Usos Múltiples Río Sarstún
- 5. Sierra de Santa Cruz
- 6. Biotopo Protegido Chocón Machacas
- 7. Reserva Protectora de Manantiales Cerro San Gil



ACKNOWLEDGEMENTS TO FLAAR MESOAMÉRICA

The reports are a joint production between the field trip team and the in-house office team. So here we wish to cite the full team:

Flor de María Setina is the office manager, overseeing all the diverse projects around the world (including FLAAR-REPORTS research on advanced wide-format digital inkjet printers, a worldwide project for over 20 years). We also utilize the inkjet prints to produce educational banners to donate to schools.

Vivian Díaz environmental engineer, is project manager for flora, fauna projects (field work and resulting reports at a level helpful for botanists, zoologists and ecologists, and for university students). Also coordinates activities at MayanToons, division where educational material for kids is prepared.

Victor Mendoza identifies plants, mushrooms, lichen, insects, and arachnids. When his university schedule allows, he also likes to participate in field trips on flora and fauna research.

Vivian Hurtado is part of our bibliography team. In addition, she also prepares blogs and articles for our websites with helpful information about the flora and fauna we document in our field trips and other topics we interested in.

Andrea de la Paz is a designer who helps prepare the master-plan for aspects of our publications. She is our editorial art director.

Norma Estefany Cho Cu helps with preparing the camera equipment for each field trip and helps in the office (and on field trips) as cook.

Byron Pacay handles GPS mapping of where we hike or go in the lancha (boat) each field trip day. He also lists where we stop to take photos and what each one of us is photographing and then has that tabulation ready each night.

Jaqueline González is a designer who puts together the text and photographs to create the actual report (we have several designers at work since we have multiple reports to produce).

Roxana Leal is Social Media Manager for flora and fauna research and publications, and MayanToons educational book projects.

María Alejandra Gutiérrez is an experienced photographer, especially with the Canon EOS 1D X Mark II camera and 5x macro lens for photographing tiny insects, tiny flowers, and tiny mushrooms. Work during and after a field trip also includes sorting, naming, and processing. And then preparing reports in PDF format.

David Arrivillaga is an experienced photographer and is able to handle both Nikon and the newest Sony digital cameras. Work during and after a field trip also includes sorting, naming, and processing.

Juan Carlos Hernández takes the material that we write and places it into the pertinent modern Internet software to produce our web pages (total network is read by over half a million people around the world).

Paulo Núñez is a webmaster, overlooking the multitude of web sites. Internet SEO changes every year, so we work together to evolve the format of our web sites.

Valeria Avilés is an illustrator for MayanToons, the division in charge of educational materials for schools, especially the Q'eqchi' Mayan schools in Alta Verapaz, Q'eqchi' and Petén Itzá Maya in Petén, and the Q'eqchi' Mayan and Garifuna schools in the municipality of Livingston, Izabal.

Josefina Sequen is illustrator for MayanToons and also helps prepare illustrations for Social Media posts and for animated videos.

Rosa Sequen is also an illustrator for MayanToons and also helps prepare illustrations for Social Media posts and for animated videos.

Laura Morales is preparing animated videos in MayanToons style since animated videos are the best way to help school children how to protect the fragile ecosystems and endangered species.

Heidy Alejandra Galindo Setina joined our design team in August 2020. She likes photography, drawing, painting, and design.

Maria José Rabanales she is part of the team for editing photographic reports and educational material of Flora and Fauna since September 2020. She works together with others of the team to prepare the finished pdf editions of the material of the Yaxha, Nakum and Naranjo Project.

Alejandra Valenzuela, biology student is now part of Flora y Fauna's photographic report and educational material editing team since September 2020.

Alexander Gudiel designer who join the editorial design team on December 2020. He will combine the text, pictures and maps into the FLAAR Mesoamerica editorial criteria.

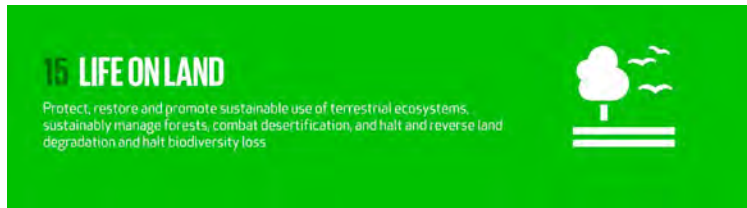
Cristina Ríos designer student who join the editorial design team on December 2020. She will combine the text, pictures and maps into the FLAAR Mesoamerica editorial criteria.

Carlos Marroquín is a USAC graphic design student who volunteered to do his professional practice with the Editorial Design Team. We are very grateful with people like him who join our team and bring his knowledge and work.

Sergio Jerez prepares the bibliography for each subject and downloads pertinent research material for our e-library on flora and fauna. All of us use both these downloads plus our in-house library on flora and fauna of Mesoamerica (Mexico through Guatemala into Costa Rica).

Edible Plants of Municipio de Livingston from

Swamps, Marshes, and Seasonally Inundated Flatlands of Izabal



The current Alcalde of Livingston, Mr. Daniel Pinto, together with his team of International Cooperation division, Mr. Edwin Mármol, have set the goal of achieving the municipality development in the years 2020-2024 based on the goals and indicators proposed by the 2030 Agenda for Sustainable Development. From this agenda, FLAAR Mesoamerica will collaborate to achieve Sustainable Development Goal (SDG) number 15 "Life on Land".

Throughout this cooperation project, different materials have been prepared, like this Photo Essay, that helps to collect information on species, different ecosystems: terrestrial, wetlands and fresh water biodiversity. This information would also be useful as part of a strategy to protect threatened species and prevent their extinction. The municipality's goals include to promote the sustainable use, conservation and research of the species of flora and fauna of the terrestrial, wetlands and aquatic shore and coastal ecosystems of the Guatemalan Caribbean. Learn more about this project and the SDG indicators at: <https://flaar-mesoamerica.org/rain-forests-rivers-lakes-bays-ocean-caves-canyons-livingston-the-caribbean-biodiversity-wonderland-of-guatemala/>

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www.maya-ethnozoology.org
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www.FLAAR-Mesoamerica.org

This report may be cited with this information:

Hellmuth, N. (2021) Edible Plants of Wetlands, Red Mangrove Swamps, *Rhizophora mangle*. Livingston, Izabal, Guatemala: FLAAR Mesoamerica.

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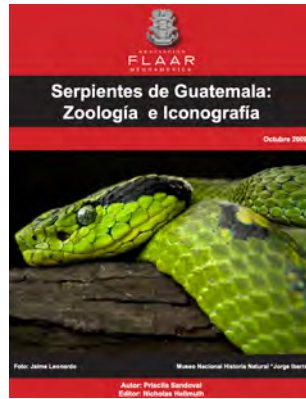
Any website in or related to the Municipio of Livingston, is also welcome to post this PDF on their web site (no fee). This permission includes travel agencies, hotels, guide services, etc. And you do not need to write and ask permission; but we do appreciate it when you include a link back to one of our web sites. CECON-USAC, CONAP, FUNDAECO, Plantemos, AIESEC, are welcome to publish our reports, at no cost.

All national parks, nature reserves, and comparable are welcome to have and use our reports at no cost. USAC, UVG, URL, Universidad Rural, INTECAP and other Guatemalan universities, and high schools, and schools, are welcome to post our reports, at no cost.

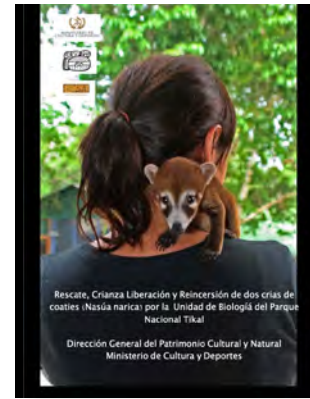
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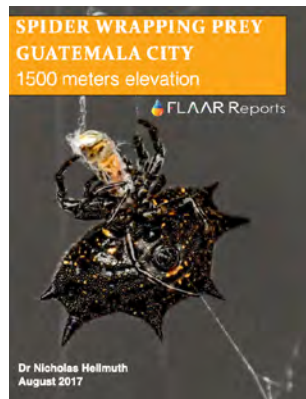
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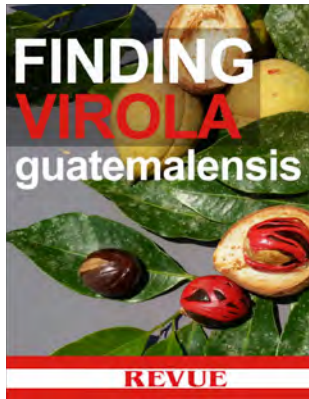
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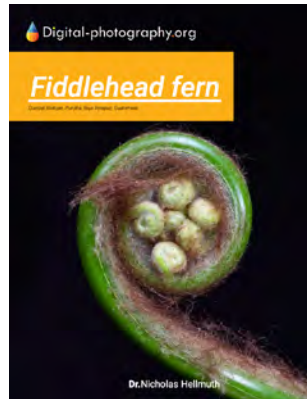
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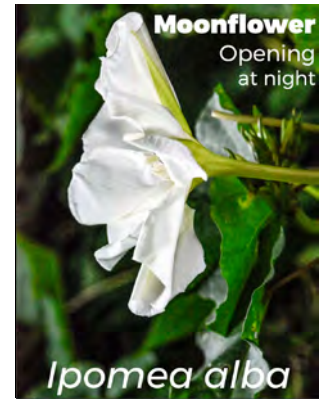
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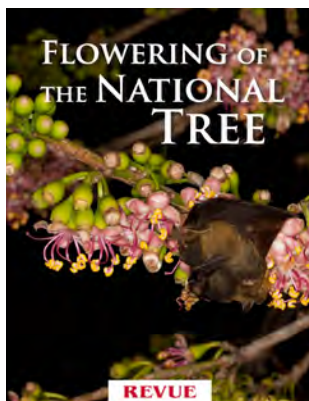
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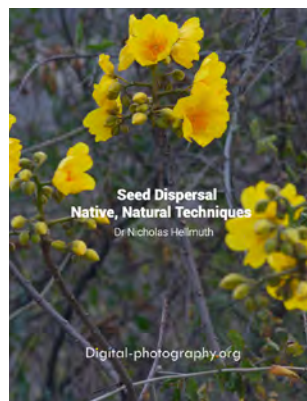
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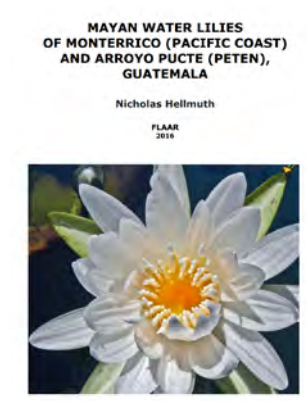
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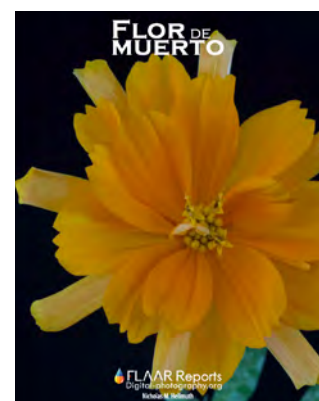
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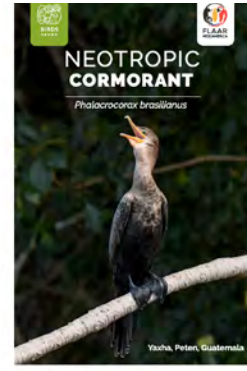
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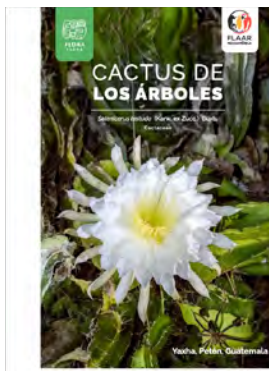
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