



FLAAR
MESOAMÉRICA

WETLANDS #13

EDIBLE PLANTS OF WETLANDS

BLACK MANGROVE TREE

Avicennia germinans

Swamps and Marshes
of Livingston, Izabal

NICHOLAS **HELLMUTH**

WETLANDS #13

EDIBLE PLANTS OF WETLANDS

BLACK MANGROVE TREE

Avicennia germinans

MAY 2021



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Avicennia germinans

Photo by: Brandon Hidalgo, FLAAR Mesoamerica, Oct. 11, 2021. Livigston, Izabal. Camera: iPhone 12 Pro Max.

PHOTO FROM TITLE PAGE

Avicennia germinans

Photo by: Brandon Hidalgo, FLAAR Mesoamerica, Oct. 11, 2021. Livigston, Izabal. Camera: iPhone 12 Pro Max.



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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





GLOSSARY

Bog: I thought these were primarily in Ireland, but I hiked through a bog within the Savanna “of 3 Fern Species” in Parque Nacional Yaxha, Nakum y Naranjo (PNYNN), Petén. I estimate there were areas of bog within the Savanna East of Nakum as well. We (Teco, Lorena, and I) even found “bog moss” all over the ground in one area of the Savanna of 3 Fern Species, a savanna I discovered from aerial photographs of IGN.

Marsh: usually has water all year but has no total tree cover. Grasses, reeds and low plants are more common; plus, underwater plants and floating plants.

Riparian: the bank of a river or stream. In a location such as the Municipio de Livingston, it would help to have a single word for the bank of a river, stream, and lagoon. I will use shoreline or comparable.

Swamp: usually has water all year but has lots of trees. During the rainy season the water simply gets deeper. Petén has more marshes than swamps; Izabal has both. You get mangrove swamps all around the Caribbean coast and parallel to the Pacific Ocean coast (several impressive mangrove swamp areas inland from the Pacific coast of Guatemala).

Wetland: to me is a generic word to cover swamps, marshes, and seasonally inundated areas. Each ecologist and geographer and botanist use their own academic terms. But, Holdridge (life zone systems) never hiked through the Savanna of 3 Fern Species nor the Savanna East of Nakum nor took a boat up all the rivers entering into El Golfete. And if he cruised up Arroyo Petexbatún, he (and Lundell and all other capable scholars who accomplished fieldwork in Petén) did not get out of their seats on the lancha to hike through the swamps to see what was 100 to 200 meters inland.



Life of Land: is the Sustainable Development Goal (number 15) which claims to insure the conservation of terrestrial and freshwater ecosystems. Municipio de Livingston has multiple natural areas associated to rivers and wetlands for example.



Avicennia germinans.

Photo by: Brandon Hidalgo, FLAAR Mesoamerica, Oct. 11, 2021. Livingston, Izabal.
Camera: iPhone 12 Pro Max.

INTRODUCTION TO *AVICENNIA GERMINANS*

Much of the coast of Tabasco and the Yucatán Peninsula, Belize, Izabal, and Honduras (and down south) are mangrove swamps. Similar on the Pacific Coast of Mesoamérica. So, the proto-Maya of Izabal and the Olmecs of Tabasco surely had access to mangrove swamps. Would be interesting to learn how the subsequent Classic Maya interacted with these swamps. A first step in learning about this is to realize that Black Mangrove (*Avicennia germinans*) and red mangrove (*Rhizophora mangle*) both have edible parts.

A year 2019 article by Hector Neff, Paul H. Burger, Brendan J. Culleton, Douglas J. Kennett and John G. Jones is a good start to remind us that early “pre “Maya”” people settled in areas adjacent to mangrove swamps, *Izapa’s Industrial Hinterland: The Eastern Soconusco Mangrove Zone During Archaic and Formative Times*. Same is documented for the mangrove swamps on the Guatemalan side of the Chiapas border. The edible and useful aspects of *Avicennia germinans* have been available to local people for thousands of years. Botanists know these uses; let’s introduce this information to ecologists and archaeologists.

MY PERSONAL EXPERIENCE WITH *AVICENNIA GERMINANS*

We have undertaken field trips to the mangrove swamp areas near Monterrico, parallel to the Pacific Ocean coast for more than a decade (one to two field trips most years). Our goal was to study waterbirds and water lilies. Lots of different species of mangroves here.

Now that we have been doing field work in the Municipio de Livingston since February 2020, we have seen lots of mangrove swamps in the Caribbean coastal area. These mangrove swamps go a considerable distance inland: most of El Golfete area and all the lagoons on both the north and south side have mangrove areas.

There are mangrove swamps along the edge of Río Dulce as well. Would be interesting someday to see how far upstream mangrove trees can be found.

FULL BOTANICAL NAME

Avicennia germinans (L.) L. is the accepted name

Family Acanthaceae (ThePlantList.org).

In earlier years the family the Avicenniaceae (Standley and Williams 1973: 176).

A decade ago the family was named Verbenaceae (Balick, Nee and Atha 2000: 131)

HERE ARE SYNONYMS FOR **AVICENNIA GERMINANS**

Avicennia africana P.Beauv.
Avicennia elliptica Thunb.
Avicennia elliptica var. *martii* Moldenke
Avicennia floridana Gand.
Avicennia floridana Raf.
Avicennia germinans f. *aberrans* Moldenke
Avicennia germinans f. *brasiliensis* Moldenke
Avicennia germinans var. *cumanensis* (Kunth) Moldenke
Avicennia germinans var. *germinans*
Avicennia germinans var. *guayaquilensis* (Kunth) Moldenke
Avicennia germinans f. *venezuelensis* Moldenke
Avicennia lamarckiana C.Presl
Avicennia meyeri Miq.
Avicennia nitida Sessé & Moc. [Illegitimate]
Avicennia nitida Jacq.
Avicennia nitida var. *trinitensis* Moldenke
Avicennia oblongifolia Nutt. ex Chapm.
Avicennia officinalis var. *lanceolata* Kuntze
Avicennia officinalis var. *nitida* Kuntze
Avicennia tomentosa Jacq.
Avicennia tomentosa var. *campechensis* Jacq.
Avicennia tomentosa var. *cumanensis* Kunth
Avicennia tomentosa var. *guayaquilensis* Kunth
Bontia germinans L.
Hilairanthus nitidus (Jacq.) Tiegh.
Hilairanthus tomentosus (Jacq.) Tiegh.

(www.theplantlist.org/tpl1.1/record/kew-18443)

MAYAN NAMES FOR ***AVICENNIA GERMINANS***

Not many mangrove swamps inland; so only the languages on the coastal areas would tend to have names for mangrove trees.

LOCAL NAMES FOR ***AVICENNIA GERMINANS***

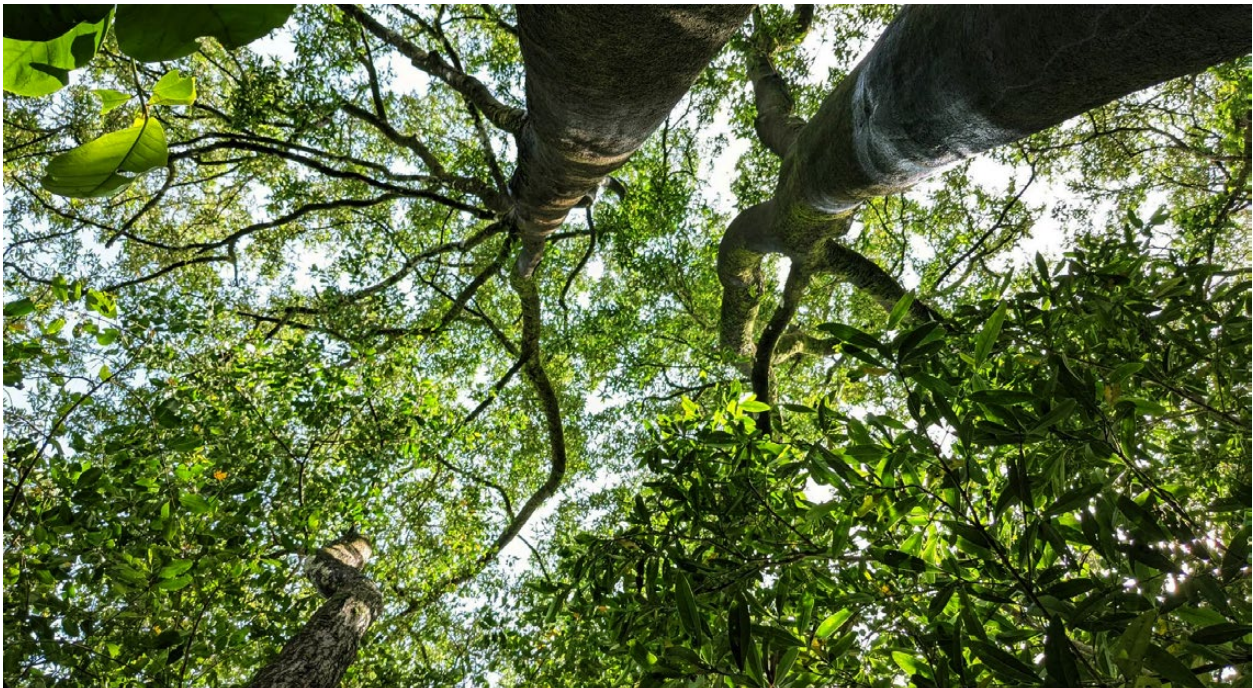
Mangle blanco, Mangle prieto, Mangle negro. Black mangrove.

HOW MANY OTHER PLANTS OF GUATEMALA HAVE **THE SAME SPANISH NAME?**

White mangrove is the name by which the species is generally called *Laguncularia racemose*.

HABIT FOR ***AVICENNIA GERMINANS***

Tree or shrub.



Avicennia germinans

Photo by: Brandon Hidalgo, FLAAR Mesoamerica, Oct. 11, 2021. San Juan Sarstún, Livingston, Guatemala.
Camera: iPhone 12 Pro Max.



Avicennia germinans

Photo by: Brandon Hidalgo, FLAAR Mesoamerica, Oct. 22, 2021. San Juan Sarstún, Livingston.
Camera: iPhone 12 Pro Max.



Avicennia germinans

Photo by: Brandon Hidalgo, FLAAR Mesoamerica, Oct. 22, 2021. San Juan Sarstún, Livingston.
Camera: iPhone 12 Pro Max.

HABITAT FOR *AVICENNIA GERMINANS* AND WHAT OTHER TREES OR PLANTS ARE OFTEN FOUND IN THE SAME HABITAT

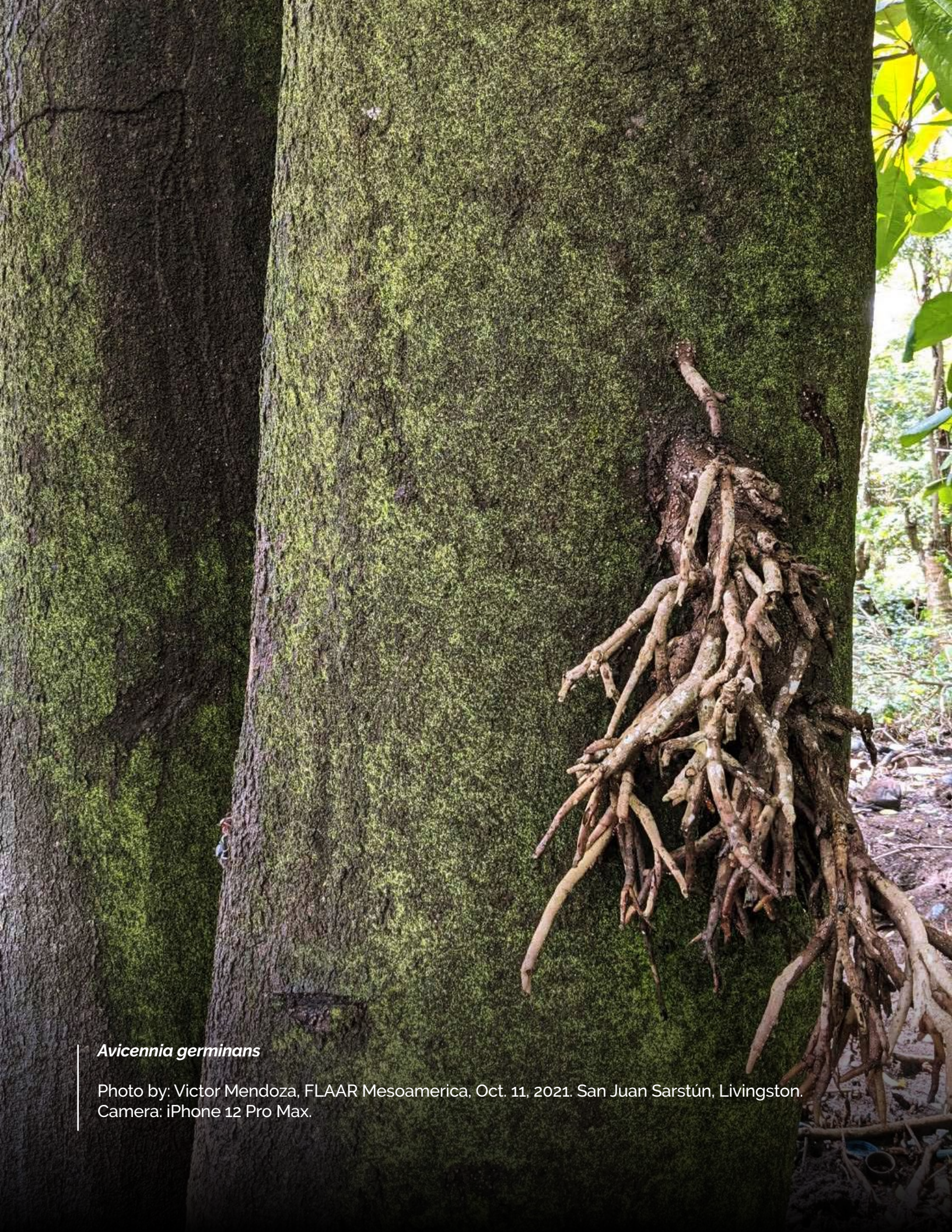
En la zona de muestreo de la laguna Yucateco y del río Chicozapote la vegetación sobresaliente corresponde al manglar dominado por tres especies de mangle. El mangle colorado o rojo (*Rhizophora mangle*) ocupa el borde de la laguna en las zonas expuestas al oleaje, mientras que el mangle negro (*Avicennia germinans*) y el mangle blanco (*Laguncularia racemosa*) ocupan las partes internas del manglar.

(Bueno et al. 2005: 123)

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)



Avicennia germinans

Photo by: Victor Mendoza, FLAAR Mesoamerica, Oct. 11, 2021. San Juan Sarstún, Livingston.
Camera: iPhone 12 Pro Max.

BOTANICAL DESCRIPTION OF *AVICENNIA GERMINANS* IN STANDLEY AND CO-AUTHORS CHICAGO BOTANICAL MONOGRAPHS

Avicennia germinans (L.) L. Sp. PL ed. 3. 2: 891. 1764, pro parte typica; P. Br. Civ. Nat. Hist. Jam. ed. 2, index I: 12, II: 7. 1789; Steam, Kew Bull. 1958: 34. 1958; Compere, Taxon 12: 150. 1963. *Bontia germinans* L. Syst. Nat. ed. 10: 1122. 1759; Sp. PL ed. 2, 2: 891. 1763, pro parte typica. *Avicennia nitida* Jacq. Enum. PL Carib. 25. 1760. *A. africana* P. Beauv. Fl. Oware 1: 79-80, L 47. 1806. Black mangrove (British Honduras).

Common at or near sea level, in salt marshes, tidal flats, mangrove swamps of both coasts; Escuintla; Izabal; Retalhuleu; San Marcos. Florida; Mexico; British Honduras to Panama; along seashores of South America and the Old World tropics.

Large shrubs or small trees, said to sometimes attain a height of 15 m., usually smaller in Central America; the bark shallowly fissured, dark, orange-red within, the young branchlets pale, densely and minutely puberulent; leaves on short, stout petioles, the blades coriaceous, oblong or oblong-lanceolate, 3-12 cm. long, 1-4 cm. wide, obtuse or acute, acute or attenuate to the base, grayish above and glabrous or finely pubescent or puberulent, whitish or grayish beneath, and densely and minutely pulverulent beneath, the veins usually conspicuous; inflorescences short, forming panicles 2-5 cm. long, the flowers sessile, glomerate at the ends of the rachises: bracts and bracteoles ovate-acute, imbricate; corolla greenish, cream, or white, the tube 3-4 mm. long, glabrous, the lobes 3-5 mm. long, rounded, sericeous inside and outside, one lobe often bifid; style usually 1-2 mm. long at anthesis, sometimes attaining 3 mm. by the time the corolla falls; capsule obliquely oblong, ovate, or oblong-ovate, laterally compressed, 2-3 (4) cm. long, pale green, finely pubescent.

[Continue in the next page]

Although the corollas have been described by some authors as 10-20 mm. long, I have seen none more than 8.5 mm.

This is one of the plants that characterize most tropical seashores. In Guatemala it is one of the most abundant trees of coastal swamps. The long, heavy roots grow in entangled arches, making almost impassable obstructions, and send to the surface of the mud large masses of irregular asparagus-like aerial roots. The seeds usually germinate on the tree and are growing and ready to take root when they fall into the tidal mud. The flowers are said to be much visited by bees and to supply a good grade of honey.

(Gibson 1970: 177-179)

AVICENNIA GERMINANS TREES IN BELIZE: **STANDLEY AND RECORD (1936)**

AVICENNIA L.

Avicennia nitida Jacq. Black Mangrove. Mangle Negro. Frequent about mangrove swamps; widely distributed in tropical America. A shrub or rather small tree; leaves petioled, oblong, obtuse, entire, thick, whitish and puberulent beneath; flowers small, white, in dense paniced spikes. Heartwood dark brown, oily; very hard, heavy, tough, of medium texture and interlocked grain, laminated, durable, but tending to split apart at phloem layers in wood; little used. (See T. of T. A., pp. 527-528.)

(Standley and Record 1936: 340)

AVICENNIA GERMINANS IN BELIZE

Avicennia germinans (L.) L. — **Syn:** *Avicennia nitida* Jacq. — **Loc Use:** CNST. — **Reg Use:** PRD, POIS, MED, GUM, FUEL, FORG, FOOD, DYE, CNST. — **Nv:** black mangrove. — **Habit:** Tree or shrub.

Uses are from Balick, Nee and Atha 2000: 131.

Genus species	Names	Habit	Uses
Avicennia germinans	Black mangrove	Inland a bit	PRD, POIS, MED, GUM, FUEL, FORG, FOOD, DYE, CNST
Laguncularia racemosa	White mangrove	Inland a bit. Can be found in same areas as <i>Rhizophora mangle</i> , <i>Conocarpus erecta</i> and <i>Avicennia germinans</i> (Standley 1924: 1031) (even though <i>Rhizophora mangle</i> is supposedly near the shore and the others are supposedly inland?) land a bit	PRD, FUEL, CNST, DYE, MED, TAN.
Rhizophora mangle	Red mangrove	Near the shore	MED, PRD, FUEL, FOOD, CNST, DYE.
Conocarpus erecta Botoncillo, button wood, kanche,	Also called mangle Colorado, mangle negro, white mangrove, but is "not a tree mangrove tree."	Grows in <i>Avicennia germinans</i> mangrove swamps	MED, FUEL, PRD, CNST. TAN

AVICENNIA GERMINANS MENTIONED IN TREES AND SHRUBS OF MÉXICO, STANDLEY

1. **Avicennia nitida** Jacq. Enum. Pl. Carib. 25. 1760.

In mangrove swamps along both coasts of Mexico, from Baja California and Tamaulipas southward. Widely distributed in tropical America. Shrub or tree, sometimes 25 meters high, with a trunk 60 cm. in diameter; bark thin, dark brown, shallowly Assured; leaves opposite, sbort-petiolate, oblong or oblong-lanceolate, 5 to 10 cm. long, obtuse, acute at base, leathery, entire, green and glabrate above, beneath very minutely and densely white puberulent; flowers in headlike axillary and terminal cymes; calyx campanulate, 5-lobate; corolla white, sericeous, the tube short, the limb 5-lobate, about 1 cm. broad; fruit an oblique 2-valvate capsule; wood hard, close-grained, dark brown, its specific gravity about 0.91. "Mangle blanco" (Veracruz, Oaxaca, Tabasco, Yucatan, Porto Rico, Cuba); "mangle prieto" (Cuba, Colombia); "mangle negro" (Cuba); " culumate " (Costa Rica); "chine de vaca," "mangle bobo" (Porto Rico); " palo de sal" (Nicaragua, Costa Rica); "manglecito" (Colombia);" puyequé " (Sinaloa); "mangle," "mangle salado " (Panama); "arbol de sal," "istaten," "ishtaten" (El Salvador). The wood is used for many purposes, and the bark is employed in tanning. The flowers are much sought by bees. The usual English name of the plant is " black mangrove."

(Standley1924: 1251)



Avicennia germinans

Photo by: Victor Mendoza, FLAAR Mesoamerica, Oct. 11, 2021. San Juan Sarstún, Livingston.
Camera: iPhone 12 Pro Max.

BOTANICAL DESCRIPTION OF THE **AVICENNIA GERMINANS FOR MÉXICO**

VERBENACEAE. Verbena Family

Avicennia nitida Jacq. *A. officinalis* Millsp. FMB. 1: 42. 1895, 1: 316. 1896, 1: 386. 1898, not L.

Sp. Mangle blanco, Mangle prieto, Mangle negro. Black mangrove (B. H.). Abundant in mangrove swamps. A shrub or tree, usually less than 20 m. high; leaves opposite, petioled, oblong, obtuse, entire, thick, whitish and puberulent beneath; flowers white, in small headlike cymes. The wood is hard, close-grained, and dark brown. The flowers are much visited by bees. A decoction of the bark is employed both externally and internally for hemorrhoids, sores, and diarrhea.

(Standley 1930: 399)

Avicennia germinans (L.) L. BCN, BCS, CAM, CHIS, COL, GRO, JAL, MICH, NAY, OAX, QROO, SLP, SIN, SON, TAB, TAMS, VER, YUC

(Villaseñor 2016: 592)

CLOSE RELATIVE(S) OF **AVICENNIA GERMINANS**

There are 42 species of family Acanthaceae in Izabal alone (46 in Peten and 51 in Alta Verapaz) (Daniel 2010: 297).



Avicennia germinans

Photo by: Victor Mendoza, FLAAR Mesoamerica, Oct. 11, 2021., San Juan Sarstún, Livingston.
Camera: Sony RX10 IV. Lens: Sony FE 200-600mm G OSS. Settings: 1/125 sec; f/4; ISO 400.

WHERE HAS *AVICENNIA GERMINANS* BEEN FOUND IN THE **MUNICIPIO OF LIVINGSTON BY OTHER BOTANISTS?**

- > Is *Avicennia germinans* listed for Biotopo Protegido Chocón Machacas, CECON/USAC?
Not Mentioned
- > Is *Avicennia germinans* listed for Tapón Creek Nature Reserve (including Taponcito Creek), FUNDAECO?
Not Mentioned
- > Is *Avicennia germinans* listed for Buena Vista Tapón Creek Nature Reserve?
Not Mentioned
- > Is *Avicennia germinans* listed for Cerro San Gil (south side of Río Dulce)?
Not Mentioned
- > Is *Avicennia germinans* listed for Ecoalbergue Lagunita Creek (Área de Usos Múltiples Río Sarstún)
Not Mentioned
- > Is *Avicennia germinans* listed for Sarstoon-Temash National Park (northern side of Río Sarstún)
Avicennia germinans is in the list of flora of the area.
- > Is *Avicennia germinans* listed for El Refugio de Vida Silvestre Punta de Manabique?
Avicennia germinans is listed for Amatique Bay (Andrade et al: 2015: 31), I would assume this listing is more for the Manabique side (though *Avicennia germinans* is also on the Municipio de Livingston shore of Amatique Bay).
- > Is *Avicennia germinans* listed for Bocas de Polochic
Not Mentioned
- > Is *Avicennia germinans* from the Highlands or from the Lowlands (or both)?
Lowlands, from 0 to 15 meters above sea level

WORLD RANGE FOR ***AVICENNIA GERMINANS***

Coasts of Florida, down through Mesoamerica to south America and also Western Africa.

DOES *AVICENNIA GERMINANS* **ALSO GROW IN HOME GARDENS?**

Unlikely in home gardens.



Avicennia germinans

Photo by: Victor Mendoza, FLAAR Mesoamerica, Oct. 11, 2021. San Juan Sarstún, Livingston, Guatemala.
Camera: Sony RX10 IV. Lens: Sony FE 200-600mm G OSS. Settings: 1/640 sec; f/4; ISO 400.



Avicennia germinans

Photo by: Victor Mendoza, FLAAR Mesoamerica, Oct. 11, 2021., San Juan Sarstún, Livingston.
Camera: Sony RX10 IV. Lens: Sony FE 200-600mm G OSS. Settings: 1/125 sec; f/4; ISO 400.

USES OF **AVICENNIA GERMINANS**

Arbol de sal (Tico Ethnobotanical Dictionary, Duke n.d.)

Bark has tannins

(Mabberley 1997)

Coastal fishing families like the charcoal for smoking fish. The charcoal gives the fish an agreeable flavor.

(Bogan, Bogan, and Swindal 2012: 64)

Wood ash, Nigeria Wood ash from *Rhizophora racemosa* and *Avicennia germinans* has long been used in Nigeria and neighbouring countries in West Africa (Loto & Fakankun, 1989). The solution from wood ash (odoro) has very wide application in the cooking of food such as yam, plantain and bean. It gives added taste to the food, aids in softening the food and accelerates the cooking time. Salt is extracted from roots of *Rhizophora racemosa* and *Avicennia germinans* (Adegbehin, 1993). The extraction process involves burning the wood to obtain the white ash, which is then boiled with water in a pot. The ash precipitate is filtered away and the ash solution is sun-dried to obtain the salt. The mangrove roots act as the source of material for salt making and serve as fuel wood for extracting the salt.

(Baba et al. 2013: 30)

Propagules are eaten after peeling, soaking and boiling

[Click here to see more information](#)

The sprouting propagules of the Black Mangrove, *Avicennia germinans*, (av-ih-SEN-ee-uh JER-min-ans) can also be used as a famine food, if cooked. They are toxic raw and resemble huge pointed lima beans. The Black Mangrove's leaves are often coated with salt, which makes collecting convenient should you be needing salt

[Click here to see more information](#)

Notice the comment, "if cooked." Uncooked seeds are toxic. But remember, the cashew nuts that we all love around the world (my #1 most favorite nut), has to be heated to get rid of chemicals you do not want to eat.

The ashes, when added to water produce a soap substitute (Les 2018: no pagination in this Google book).

Produces a red dye (Cano 2007: 17). Another report says it produces a dye of color café:

MANGLE: *Rizophora mangle*, *Avicennia germinans*, *Laguncularia racemosa*, *Conocarpus erecta*. Combretáceas. La raíz se muele y se macera durante una semana —o bien, únicamente se macera junto con hojas frescas de piñón durante diez días—, se cuele, se depositan en el caldo las madejas y se hierve durante una hora. Pinta color café; si se quiere un color más oscuro, se añade cal. También sirve la corteza, útil para curtir pieles por su alto contenido de taninos.

Es recomendable recolectar sólo la madera o raíces de árboles muertos, ya que es una especie en peligro de extinción.

(Terrazas 2013: no pagination)

DYE COLORANT AND TANNIN

Red mangrove and black mangrove are each different dye colorants.

Avicennia germinans (L.) L. Sp. Pl. ed. 3. 2: 891. 1764.

Mangle, mangle salado, palo de sal, culumate, white mangrove, black mangrove. Characteristic of brackish tidal areas along all the Central American coasts and around much of the tropical world. The bark of this and of other *Avicennias* contains considerable tannin and is occasionally exploited locally as a tanning material.

(Williams 1981: 331)

IS THERE POTENTIAL MEDICINAL USAGE OF **AVICENNIA GERMINANS** BY LOCAL PEOPLE?

Yes, lots of medicinal use by local people in various countries. Enough to make this a separate report. But missing from one key book on medicinal plants of Belize. It is often that a plant is used for medicine in another country but not by the people who have arrived in Belize in recent centuries.

WHAT ARE THE PRIMARY POLLINATORS OF **AVICENNIA GERMINANS** FLOWER

Bees

CONCLUDING DISCUSSION AND SUMMARY ON *AVICENNIA GERMINANS*

No stilt roots on *Avicennia germinans* trees; so if you see the aerial roots hanging down, this is not likely an *Avicennia germinans* mangrove. The leaves produce salt (can they be prepared to use like a “salt shaker”?).

The Olmecs had access to mangrove swamps in Veracruz and Tabasco (and in areas where they had long-distance trade). The proto-classic Izapa people had access to mangrove swamps on the Pacific Coast of Chiapas.

Most long-distance trade from México through the Costa Sur down to Costa Rica was not inside the mangrove swamps, but the Olmec traders and then the Teotihuacan traders (and then the Toltec and the Aztec) would have learned about the mangrove swamps closer to the Pacific Ocean coast.

The Classic Maya of the Yucatan Peninsula had access to mangrove swamps around the coasts of Campeche, Yucatan, and Quintana Roo. Lots of mangrove swamps for the Classic Maya of Belize. Izabal had mangrove swamps going up the Rio Dulce a considerable distance. Plus all the mangrove swamps along the Pacific Coast of Guatemala and adjacent Chiapas, México. So clearly these indigenous people, with thousands of years experience with mangrove ecosystems, would have utilized as many assets as possible.

Balick, Nee and Atha (2000) provide the most helpful documentation of the potential of the four species of mangrove that could also have been utilized by the Olmec and Maya and people of the coasts multiple thousands of years ago:

Genus species	Common name	Uses (Balick, Nee and Atha 2000)
<i>Avicennia germinans</i>	Black mangrove	PRD, POIS, MED, GUM, FUEL, FORG, FOOD, DYE, CNST
<i>Laguncularia racemosa</i>	White mangrove	PRD, FUEL, CNST, DYE, MED, TAN.
<i>Rhizophora mangle</i>	Red mangrove	MED, PRD, FUEL, FOOD, CNST, DYE.
<i>Conocarpus erecta</i>	Botoncillo, button wood, kanche, Also called mangle Colorado, mangle negro, white mangrove, but is “not a tree mangrove tree.”	MED, FUEL, PRD, CNST. TAN

- **Dye** = dye colorant, for fibers, bark paper, cotton, clothing, etc.
- **Tan** = tannin for curing hides of deer, jaguars, and along the coast caiman or crocodiles (no alligators in Mesoamerica).
- **PRR** = products for household use and/or for selling
- **CONST** = material to help build your house or at least your troje for storing maize

Now you can see why the team of FLAAR (USA) and FLAAR Mesoamerica (Guatemala) is inspired to prepare an annotated bibliography of each of these four trees of the mangrove swamps. Then we go into the swamps to photograph them. We undertake library research to learn what other species of trees grow in the same swamp areas, especially what other swamp trees produce edible fruit or seed pulp.

In the essential archaeological excavations (Coe 1961) and discussions of Coe and Flannery 1954, Neff et al. 2006 and Neff et al. 2018 the focus is on edible mollusks (for Coe) and when did maize arrive (for Neff et al. 2006 and Neff et al. 2018).



WHAT IF...

What if at least two of the mangrove trees that surround the areas worked in by Coe, Flannery, Neff and colleagues produce edible parts?

What if any of these sedges or other wetland plants were growing en masse: *Cyperus esculentus*, *Eleocharis geniculata*, *Typha latifolia*? What if early arrivals in the coastal swamp areas of Guatemala and adjacent Izabal had lots to eat before maize arrived!

Just look at all the uses of just one single species of mangrove: *Avicennia germinans* in my section on uses. Yet so far I have not noticed any archaeological discussion of any of the early people who lived in or near mangrove swamps mention *Avicennia germinans* at all. Only mollusks and maize. Understandably the focus was on artifacts and settlement pattern: and when did maize arrive. No discussion by archaeologists of all the other wild native plants of the swamps, marshes, riversides and lakesides that are edible (and require no agricultural engineering and no labor).

Yes, maize was important; yes mollusk remains are in middens all over the place (near places where people lived thousands of years ago near the Pacific Ocean coast of México and Guatemala). But... let's rescue

1. *Avicennia germinans*
2. *Rhizophora mangle*

And also, let's rescue knowledge all the edible reeds, sedges, and grasses (and underwater plants and algae) of the marshes of Guatemala. These are the projects being worked on my FLAAR (USA) and FLAAR Mesoamerica (Guatemala) during field trips one-week-per-month in the wetlands, rivers, lagoons, lakes, and coast of the Municipio de Livingston, Izabal, Guatemala.

If you are a botanist looking for locations to undertake projects, we are open to sharing our findings. If you are a student looking for a thesis or PhD topic, we can share your findings. If you are an individual or botanical society interested in visiting un-touristed locations, the Municipio of Livingston has lots of rivers where, in all our field trips, we have not seen one single solitary tourist (nor botanist nor student). Tourists stay in the water-taxi and stay on the shore of Lake Izabal, Río Dulce, El Golfete, Canyon Río Dulce, Amatique Bay or the coast.

We are inspired and motivated to find lancheros who enjoy taking us to places they know but they also know no tourist or professor has visited before. We cooperate and coordinate every trip with local Q'eqchi' Mayan people inland and the Q'eqchi and Garifuna people on the coast.

Same in the Municipio of Sayaxché area of Petén: we have been studying flora and fauna here for decades; and in the 1970's-1980's-1990's brought tour groups here. So the local lancheros and local guides know us, literally for a half century. So when they began to notice that we no longer wanted to go to tourist areas, when they noticed we wanted to find, photograph, and write about not only individual species but also entire ecosystems, they took us to areas that they said "no botanist, no ecologist, no archaeologist" has been to where we will take you, because it is deep in the swamps." So we found two different tasistal ecosystems which, to our knowledge, have never before been published.

Same at Parque Nacional Yaxha, Nakum and Naranjo. We found a savanna that was part marsh, part swamp, part bog (even had bog moss) and part savanna (tasiste and nance trees widely spread). This was the "Savanna of 3 Fern Species." The local PNYNN park rangers said they cried when they saw the amazing diversity of plants and habitats here because they said that none of them had been here in-person before. I cried all the way down the hill when I saw the extensive wide-open area of the Savanna East of Nakum; it had different plants every 50 to 80 meters.

We wish to reintroduce the foods available to the Classic Maya

- More than the super-helpful list of Cyrus Lundell (we have found about 400% more)
- The concept of 4 to 5 root crops of Bronson (we have found more than I can count)
- The concept of ramon nuts of Puleson (based on Lundell): we have found so many hundreds of edible tree fruits, nuts, and pulp (around the seeds) that this list is amazing.

Most of us work in Petén; the heartland of the Classic Maya of Guatemala; but now we are learning that the Municipio of Livingston has plants not found inland. Even some of the edible plants of the coastal and brackish inland lake and river areas here are not found on the Pacific Coast (the mangrove swamps yes, but lots of other edible plants of the Caribbean are not found in the Monterrico areas inland from the Pacific Ocean). We definitely need to make a comparative tabulated chart.

A lot more work to do. A lot more FLAAR reports are in-progress.

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

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2018 Árboles de Calakmul. ECCOSUR, Chiapas. 245 pages.

It is amazing that there is no such book for Parque Nacional Tikal, nor El Mirador. Even though it includes only half the estimated number of "trees," it has more tree species than Schulze and Whitacre for Tikal (they estimated about 200 but list only about 156 (their lists of species and list by plant family are not identical).

The entire book is a totally free download, however you can't copy and paste so is difficult to add to your discussion.

In the future would be helpful to have a photographer with high-resolution equipment available and a book producer that can put these photos at a resolution that allows you to see the details. The photos of the overall tree have almost no visible detail. Nonetheless, the authors all have botanical experience and this book is a good start. A second edition would be helpful. Also would help to have more than one page per photo.

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

http://aleph.ecosur.mx:8991/exlibris/aleph/a22_1/apache_media/74R92GMRSJSEPFDEE5NJY4SJI2I8AK.pdf

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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.

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 Economica. 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 México (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.

RUIZ, CLAUDIA, et al.

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

SCHULZE, Mark D. and David F. WHITACRE

- 1999 A Classification and Ordination of the Tree Community of Tikal National Park, Peten, Guatemala. Bulletin of the Florida Museum of Natural History. Vol. 41, No. 3, pp. 169-297.

Even though 20 years ago, it's the best list of trees of Tikal that I have found. There is a web site with plants of Tikal but they are not separated into trees, vines, shrubs, etc., so harder to use. The new monograph on *Arboles de Calakmul* is better than anything available so far on Tikal (and the nice albeit short book by Felipe Lanza of decades back on trees of Tikal is neither available as a scanned PDF nor as a book on Amazon or ebay).

Download on the Internet.

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.

- 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.

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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/imagedatabase/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. Also 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.

WEB PAGES THAT INCLUDE PHOTOS OF **INFORMATION ON *AVICENNIA GERMINANS***

<https://backyardnature.net/yucatan/blakmang.htm>

Excellent photos of the pneumatophores emerging from mud at low tide is shown below.

<https://www.jeffpippen.com/plants/florida-plants.htm>

Super-helpful photos and text about mangrove swamp plants. This kind of material needs to be provided for mangrove swamps of Guatemala.

<https://www2.palomar.edu/users/warmstrong/pldec398.htm>

Explains why some plants are in Africa and Guatemala (because the seeds drift across the oceans). This article (it's many pages long) is worth reading. Good text and helpful photos and drawings and maps.

<http://tropical.theferns.info/viewtropical.php?id=Avicennia+germinans>

Cites where he obtains his information; in this case Africa; so not based on Mesoamerica (but this black mangrove is wild up and down the coasts of the Americas also)

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 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).

Sergio Jerez prepares the bibliography of each topic and download the pertinent research material for our electronic library on flora and fauna. We all use these two downloads plus our internal library on Mesoamerican flora and fauna (México through Guatemala to Costa Rica).

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.

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 Áviles 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 Sequén is illustrator for MayanToons and also helps prepare illustrations for Social Media posts and for animated videos.

Rosa Sequén 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.

María 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. He will combine the text, pictures and maps into the FLAAR Mesoamerica editorial criteria.

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.

620000

650000

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Livingston, Izabal



Áreas naturales protegidas de Livingston



Izabal

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

678000

680000

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684000

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1748000

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1742000

Bahía de Amatique

Aldea Plan Grande Tatín, Livingston



Izabal

- 1. Reserva Protectora de Manantiales Cerro San Gil
- 2. Biotopo Protegido Chocón Machacas
- 3. Área sin protección
- 4. Parque Nacional Río Dulce
- 5. Área de Usos Múltiples Río Sarstún
- Acceso terrestre (dashed red line)
- Acceso de tierra (dashed yellow line)



Información de referencia:
 - Límites departamentales de Guatemala. (IGN)
 - Instituto Geográfico Nacional (IGN) (Hojas 2463 IV y 2463 III)
 - Google Map data 2020. Shapes:
 - Sistema Guatemalteco de Áreas Protegidas 2017.
 - Cuerpos de agua. Ministerio de Agricultura Ganadería y Alimentación (MAGA)
 - Dirección de Análisis Geoespacial del (CONAP), Marzo/2017.

Edible Wetlands Plants of Municipio de Livingston, Izabal

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

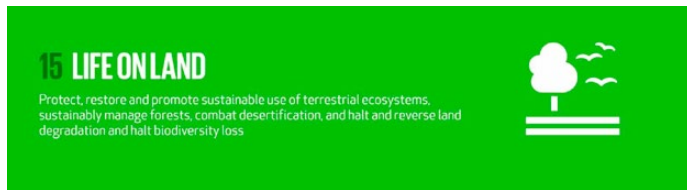
<p>Cyperus esculentus</p> <p>Chufa, Yellow Nutsedge, Earth Almond</p> <p>MLW#1</p>	<p>Eleocharis geniculata Eleocharis caribaea</p> <p>Caribbean Spike-Rush</p> <p>MLW#2</p>	<p>Montrichardia arborescens</p> <p>Camotillo Water Chestnut</p> <p>MLW#3</p>	<p>Nymphoides indica</p> <p>Floating Heart Water Snowflake</p> <p>MLW#4</p>
<p>Pachira aquatica</p> <p>Zapoton</p> <p>MLW#5</p>	<p>Pontederia cordata</p> <p>Pickereel Weed</p> <p>MLW#6</p>	<p>Sagittaria latifolia</p> <p>Water Potatoes</p> <p>MLW#7</p>	<p>Typha domingensis</p> <p>Cattail</p> <p>MLW#8</p>

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

<p>Amphitecna latifolia</p> <p>Black calabash</p> <p>MLW#9</p>	<p>Coccoloba uvifera</p> <p>Uva del mar</p> <p>MLW#10</p>	<p>Manicaria saccifera</p> <p>Confra, Manaca</p> <p>MLW#11</p>	<p>Chrysobalanus icaco</p> <p>Coco Plum</p> <p>MLW#12</p>	<p>Avicennia germinans</p> <p>Black Mangrove</p> <p>MLW#13</p>	<p>Rhizophora mangle</p> <p>Red Mangrove</p> <p>MLW#14</p>
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Wetland Series 3: plants that grow alongside water: rivers, lagoons, swamps, or ocean

<p>Glossary of Wetland Terms</p> <p>Bibliography of Wetlands Habitat Names</p> <p>MLW#15</p>	<p>Acoelorrhaphe wrightii</p> <p>Pimientillo, Tasiste, Palmetto Palm</p> <p>MLW#16</p>	<p>Acrostichum aureum</p> <p>Mangrove Fern</p> <p>MLW#17</p>	<p>Annona glabra</p> <p>Alligator Apple</p> <p>MLW#18</p>	<p>Bactris major</p> <p>Huiscoyol Palm</p> <p>MLW#19</p>	<p>Diospyros nigra</p> <p>Zapote negro</p> <p>MLW#20</p>
<p>Grias cauliflora</p> <p>Palo de Jawuilla</p> <p>MLW#21</p>	<p>Inga vera Inga multijuga Inga thibaudiana</p> <p>River Koko</p> <p>MLW#22</p>	<p>Pithecellobium lanceolatum</p> <p>Bastard Bully Tree Chucum Red Fowl</p> <p>MLW#23</p>	<p>Coccoloba belizensis</p> <p>Papaturro</p> <p>MLW#24</p>	<p>Symphonia globulifera</p> <p>Barillo</p> <p>MLW#25</p>	<p>Crataeva tapia</p> <p>Matasanillo, Granadillo, Tortugo</p> <p>MLW#26</p>



The current Alcalde of Livingston, Mr. Daniel Pinto, together with his team of International Cooperation division, 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 (USA) and FLAAR Mesoamerica (Guatemala) 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/>

SERIES OF MUNICIPIO OF LIVINGSTON



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HELLMUTH, Nicholas
 2021 Black Mangrove Tree *Avicennia germinans*, Mangrove Swamps of the Municipio de Livingston, Izabal, Guatemala. Wetland Series MLW2: Edible Plants of Municipio de Livingston that grow along the beach shore of Amatique Bay, Number 6 (MLW2 Number 6), Wetlands Report #14. FLAAR (USA), FLAAR Mesoamerica (Guatemala).

BACK COVER PHOTO *Avicennia germinans*.

Photo by: Brandon Hidalgo, FLAAR Mesoamerica, Oct. 11, 2020. Livingston, Izabal.
 Camera: iPhone 12 Pro Max.

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About 47 years later, I revisited stingless bees in Tikal while studying the biodiversity of Tikal under national park staff biologist...

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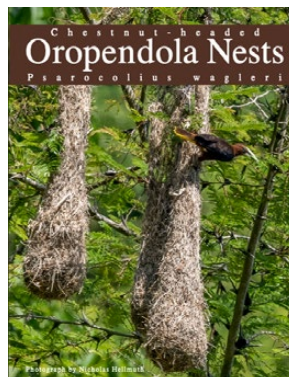
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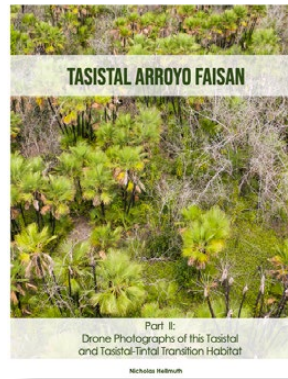
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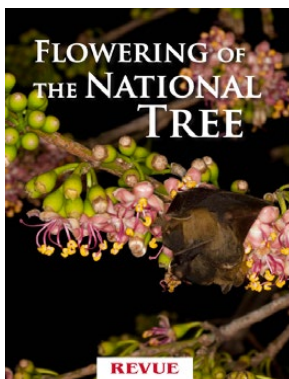
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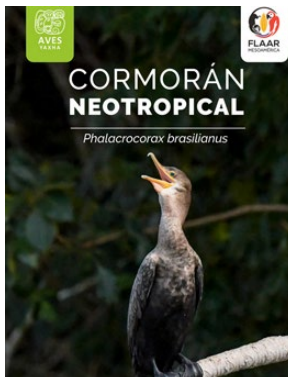
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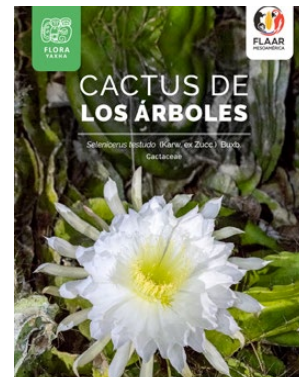
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