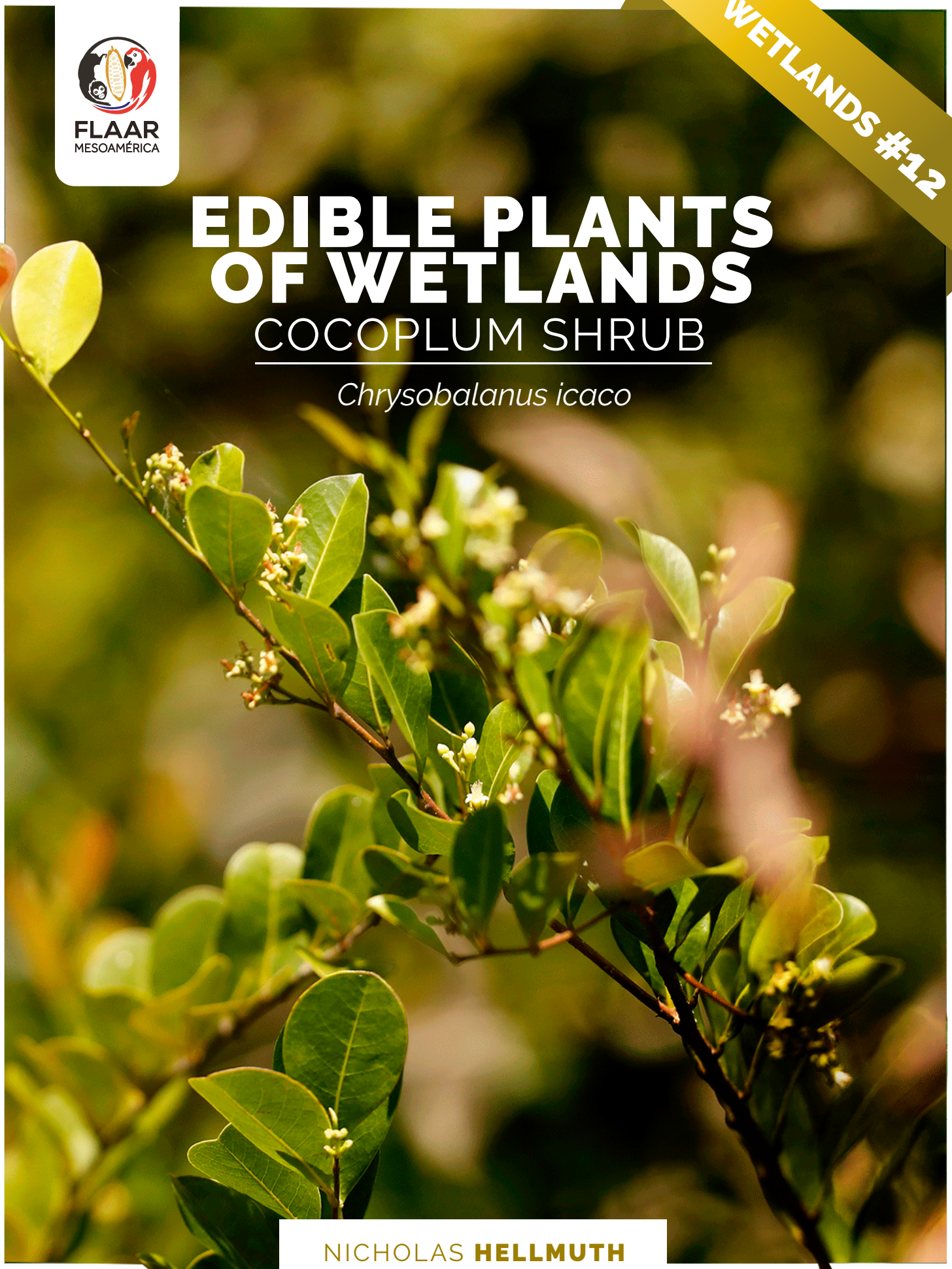
FLAAR
MESOAMÉRICA

WETLANDS #12

EDIBLE PLANTS OF WETLANDS

COCOPLUM SHRUB

Chrysobalanus icaco



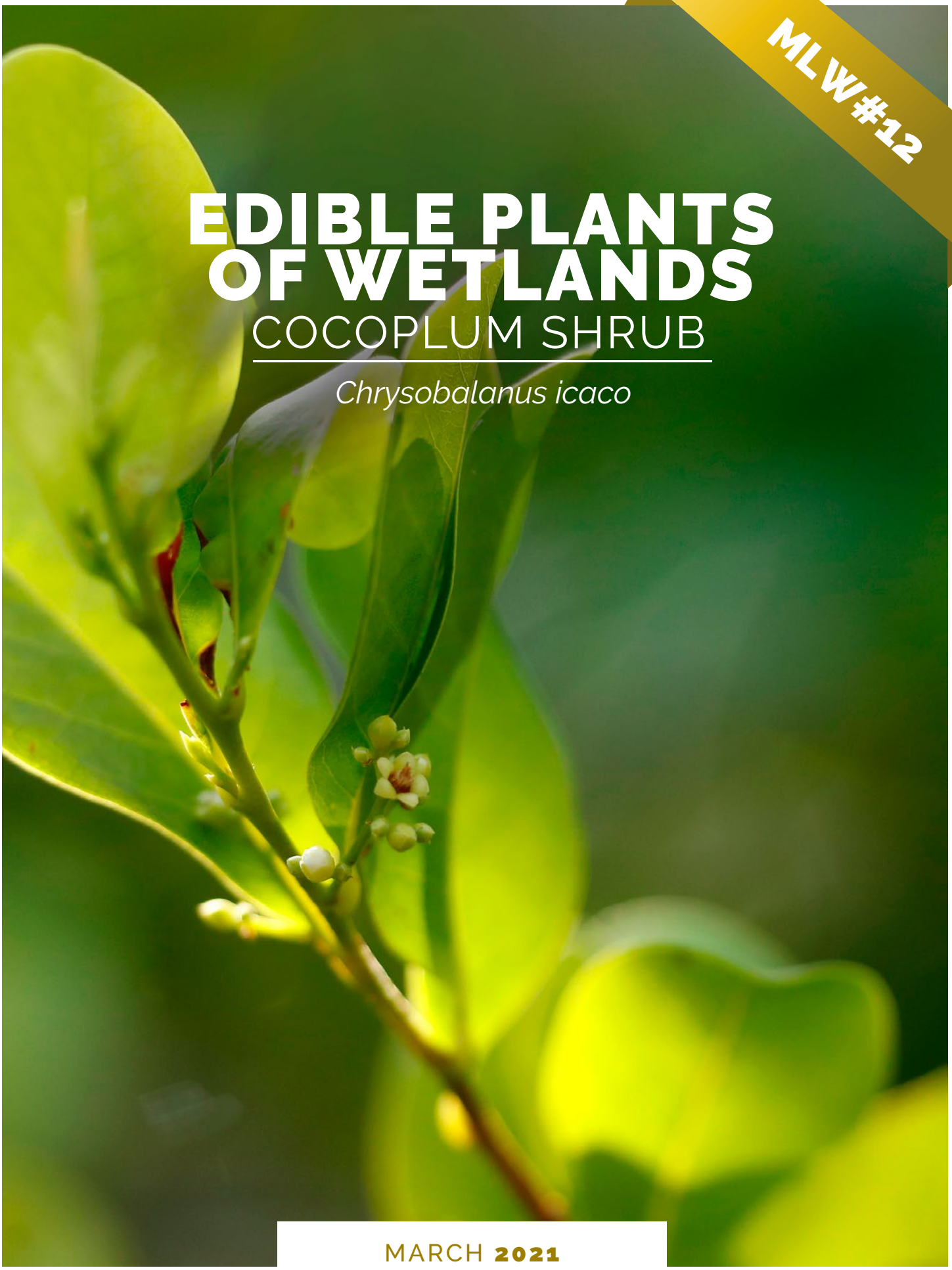
NICHOLAS **HELLMUTH**

MLW#12

EDIBLE PLANTS OF WETLANDS

COCOPLUM SHRUB

Chrysobalanus icaco



MARCH **2021**

CREDITS

The helpful individuals listed below are all part of the FLAAR Mesoamerica research and field work team. The office research team, webmaster, and web designers are additional individuals in the main office in Guatemala City. Since each report is a different plant or animal, the individuals who assist in preparing the bibliography, species identification and botanical information category are, not the same for each report.

Author
Nicholas Hellmuth

Genus Species Identification Team
Nicholas Hellmuth
Victor Mendoza
Senaida Ba

Bibliography Team
Nicholas Hellmuth
Vivian Hurtado

Editor
Vivian Díaz

Photographers
Nicholas Hellmuth
María Alejandra Gutierrez
David Arrivillaga

Photography Aassistants
Senaida Ba Mucu

Manager of Design and Layout
Andrea Sánchez Díaz

Layout of this English Edition
Jaqueline González

APPRECIATION

Assistance for local Access, Municipio de Livingston
Daniel Esaú Pinto Peña, Alcalde of Livingston (Izabal, Guatemala).

Initiation of the Project of Cooperation, February and March 2020
Edwin Mármol Quiñonez, at that time head of the Coordinación de Cooperación de Livingston (Izabal, Guatemala)

Assistance for Knowledge of Plants of Alta Verapaz
Don Chuz, Fabio Jesus Ical Xo

Assistance for Knowledge of plants of Peten
Teco, Moises Daniel Perez Diaz, park ranger, PNYNN

Assistance for Knowledge of plants at Tapon Creek and Taponcito Creek FUNDAECO
Lucas Cuz

Lancheros from Muelle Municipal to Field Trip Base Camp & Back
Omar Suchite
Keneth William De La Cruz

Lancheros and Guide Buena Vista Tapon Creek
Edgar Alexander Cuz Choc

PHOTO FROM FRONT COVER
Typha domingensis.
Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica, March. 22, 2021. Livigston, Izabal
Camera: Canon 1D X Mark II. Lens: Canon EF 300mm IS II USM. Settings: 1/1000 sec; f/8; ISO 800.

PHOTO FROM TITLE PAGE
Typha domingensis.
Photo by: David Arrivillaga.
FLAAR Mesoamerica, March. 22, 2021. ivingston.
Camera: Sony Alpha A7R IV. Lens: Sony FE 200-600mm G OSS. Settings: 1/1000 sec; f/9; ISO 800.

CONTENTS

FLAAR
MESOAMÉRICA

FLAAR MESOAMÉRICA

FLAAR MESOAMÉRICA

Starting in January 2021, we will have two different series of FLAAR reports on plants of Guatemala.

One series will be focused on the area where we found and photographed the species, with basic list of suggested reading. The purpose of this 1st edition is to help provide our photographs and information on where botanists, students, and interested members of the public can find and visit this plant themselves.

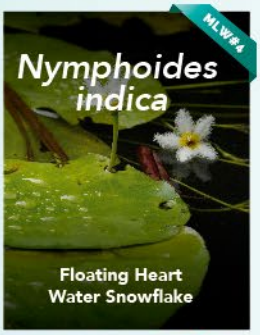
Once our team has time (and funding) we will then do a 2nd edition with comparative comments about the same tree or vine in other areas of Guatemala and adjacent parts of Mesoamerica, especially: Chiapas, Tabasco, Campeche, Yucatan, Quintana Roo, and Belize.

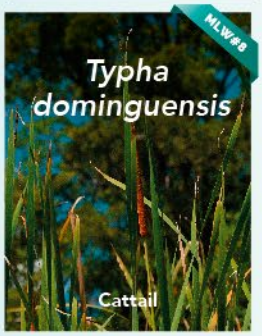
FLAAR MESOAMÉRICA

WETLANDS

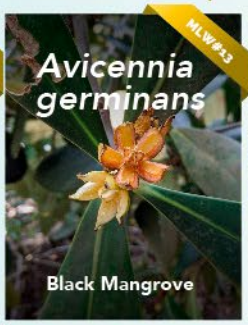
Edible Wetlands Plants of Municipio de Livingston, Izabal

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

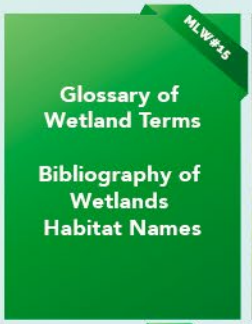


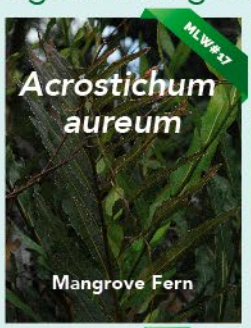


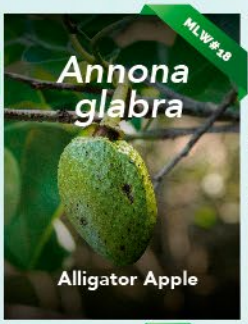
Wetland Series 2: plants that grow along the beach shore of Amatique Bay

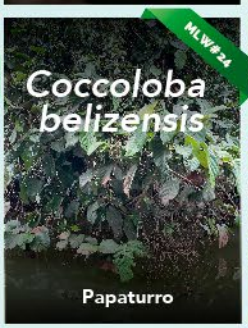


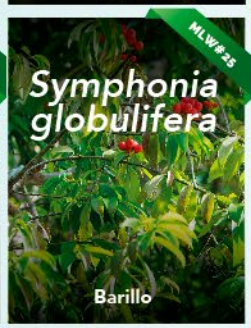
Wetland Series 3: plants that grow alongside water: rivers, lagoons, swamps, or ocean











FLAAR

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) wich claims to insure the conservation of terrestrial and freshner ecosystems. Municipio de Livingston has multiple natural areas associated to rivers and wetlands for example.

***Chrysobalanus icaco* L.**. Therefore, in past years *Chrysobalanus icaco* was not a tree I was very familiar with, especially since most of my field work of the recent years is in Alta Verapaz and Peten.

Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica, Mar. 22, 2021. Livingston, Guatemala. Camera: Canon 1D X Mark II. Lens: Canon EF 300mm IS II USM. Settings: 1/3200 sec; f/3,5; ISO 1,250.

INTRODUCTION TO ***CHRYSOBALANUS ICACO***

If you have dedicated most of your life to field work in Peten, Alta Verapaz, and in past decades in central Yucatan and Campeche, you would not be familiar with a tree that grows above beach level facing the Caribbean Sea.

Chrysobalanus icaco is missing from most books of "Árboles of Mexico". Yet this tree produces food, dye colorant, medicinal material and wood to make products (plus fuel for your kitchen fire) (Balick, Nee and Atha 2000). My goal is to rescue knowledge of this overlooked tree and put it back on the map and into tabulations of foods available to the Classic Maya (even if not all the inland Maya; there were plenty of Maya and pre-/proto-Maya living near the coasts).

MY PERSONAL EXPERIENCE **WITH *CHRYSOBALANUS ICACO***

There is an average of between 180 and 220 species of trees in most individual ecosystems in Guatemala, plus about 1800 to 2200 other plants (not counting mushrooms, liches, etc.).

In past years *Chrysobalanus icaco* was not a tree I was very familiar with, especially since most of my field work of the recent years is in Alta Verapaz and Peten.

FULL BOTANICAL **NAME**

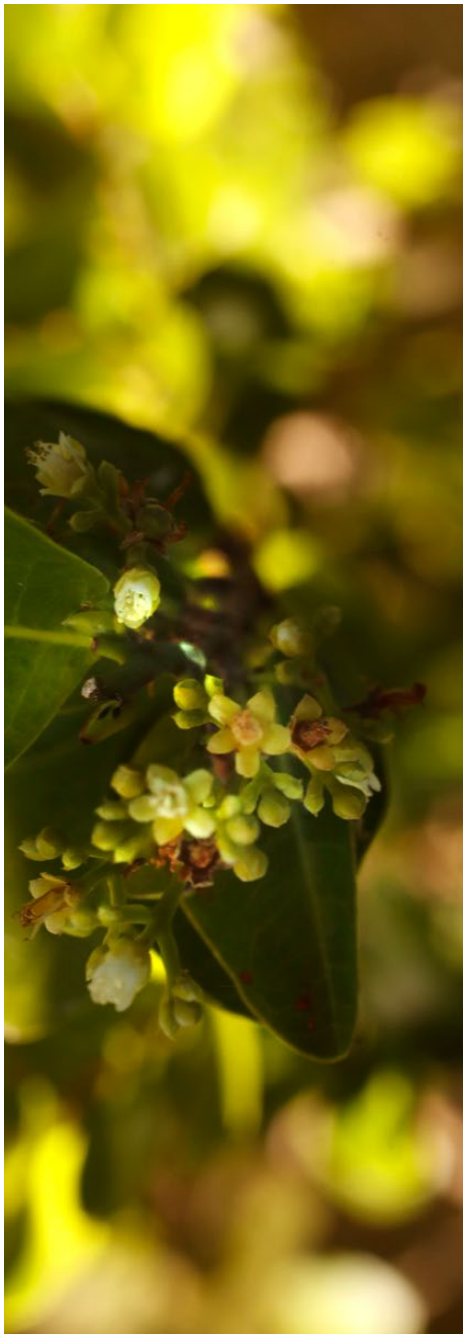
Chrysobalanus icaco L. is the accepted name.

ROSACEAE. Rose Family (in past century); currently CHRYSOBALANACEAE.

HERE ARE SYNONYMS **FOR *CHRYSOBALANUS ICACO***

- *Chrysobalanus ellipticus* Sol. ex Sabine
- *Chrysobalanus guianensis* Klotzsch [Invalid]
- *Chrysobalanus icaco* f. albus G.Klotz
- *Chrysobalanus icaco* subsp. *ellipticus* (Sol. ex Sabine) Souza
- *Chrysobalanus icaco* var. *ellipticus* (Sol. ex Sabine) Hook.f.
- *Chrysobalanus icaco* subsp. *icaco*
- *Chrysobalanus icaco* var. *icaco*
- *Chrysobalanus icaco* var. *luteus* (Sabine) Souza
- *Chrysobalanus icaco* subsp. *orbicularis* (Schumach.) Souza
- *Chrysobalanus icaco* var. *pellocarpus* (G.Mey.) Hook.f.
- *Chrysobalanus icaco* subsp. *pellocarpus* (G.Mey.) .E.Murra
- *Chrysobalanus icaco* var. *pellocarpus* (G. Mey.) Souza
- *Chrysobalanus interior* Small
- *Chrysobalanus luteus* Sabine
- *Chrysobalanus orbicularis* Schumach.
- *Chrysobalanus pellocarpus* G.Mey.
- *Chrysobalanus purpureus* Mill.
- *Chrysobalanus savannarum* Britton
- *Chrysobalanus stuhlmannii* Engl.

(www.theplantlist.org/tpl1.1/record/kew-367588)



***Chrysobalanus icaco* L.**

Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica, Mar. 22, 2021. Livingston, Izabal.

Camera: Canon 1D X Mark II. Lens: Canon EF 300mm IS II USM. Settings: 1/3200 sec; f/3,5; ISO 1,250.

MAYAN NAMES FOR ***CHRYSOBALANUS ICACO***

Not found, icaco is a name of Taino origin.

LOCAL NAMES FOR ***CHRYSOBALANUS ICACO***

Icaco, coco-plum, pigeon plum

(Williams 1981: 278)

coco plum shrub, Paradise Plum
Icaco, nuez (Arboles de Calakmul, Ochoa et al. 2018: 83).

"Icaco," "hicaco." or "jicaco" (Chiapas, Veracruz, Yucatan, Oaxaca, Guerrero, Tamaulipas, Guatemala, Honduras, Porto Rico; the name of Antillean origin); "xicaco" (Oaxaca, Seler). The English names are "cocoa-plum" and "pigeon-plum"

(Standley 1922: 344).

I estimate that Standley back almost an entire century (1922) misspelled the word as cocoa. Most ethnobotanists write it as coco plum (one word or two words).

HABIT FOR ***CHRYSOBALANUS ICACO***

Shrub or tree.

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

Hirtella paniculate is called "icaco de montaña" (FUNDAECO 2007).

Chrysobalanus icaco

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Apr. 27, 2015. Monterrico, Berger House.
Camera: Nikon D810. Lens: Nikon AF-S Micro 60mm G. Settings: 1/25 sec; f/10; ISO 640.

Chrysobalanus icaco

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Apr. 27, 2015. Monterrico, Berger House, Guatemala. Camera: Nikon D810. Lens: Nikon AF-S Micro 60mm G. Settings: 1/25 sec; f/10; ISO 640.

Chrysobalanus icaco
Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Apr. 27, 2015. Monterrico, Berger House.
Camera: Nikon D810. Lens: Nikon AF-S Micro 60mm G. Settings: 1/25 sec; f/7,1; ISO 640.

HABITAT, IN WHAT ECOSYSTEM(S) CAN YOU **FIND NATIVE *CHRYSOBALANUS ICACO*?**

> Ecology.—Coco-plum is a coastal species. It commonly grows as single plants or thickets on dunes and rocky headlands. It may also be found on shallow soils in moist areas up to a 450-m elevation in Puerto Rico (Little and others 1974). Although the species can survive a great deal of stress from storms, salt spray, and flooding, it is low in stature, relatively intolerant of shade, and only persists where competing vegetation is short.

(Francis 2004: 199).

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

- *Pachira aquatica* (edible)
- *Pterocarpus officinalis*
- *Symphonia globulifera* (edible)
- *Manicaria saccifera* (edible)

> 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)

> Along the Atlantic beaches is the usual type of tropical Vegetation so widely dispersed in America and even on shores of Old World tropics. The sand is carpeted with mats of rope- like stems of goatfoot morning glory (*Ipomoea Pes-caprae*) and *Canavalia maritima*. In salt flats shallowly flooded at high tide are sparse colonies of halophilous grasses and sedges, with *Cakile, Sesuvium, Batis, Philoxerus*, and other plants. Just back of the strand, in places seldom reached by the waves, are compact thickets of shrubs and small trees, their outer edges usually banked with low shrubs of *Caesalpinia Crista, Coccoloba Uvifera*, and Chrysobalanus Icaco. Behind the shrubs, or frequently at the very edge of the water and projecting far into it, are often large areas of mangrove swamp, with their customary association of *Rhizophora, Avicennia, Conocarpus*, and *Laguncularia*. Usually the coast is fringed with graceful coconut palms, which add the necessary touch of picturesqueness to every tropical shore. Beyond the coastal thickets and mangrove swamps stretch miles of unbroken forest, uniform in appearance to the casual observer, but to the botanist observing its elements infinitely varied.

(Standley 1937: 11-12)

Tropical evergreen seasonal broadleaf lowland swamp forest: Low variant.
UNESCO Code: IA2g(1)(a)L
Description: Swampy stands of low, thin stemmed trees and shrubs without emergents.

> Frequently encountered trees include *Acacia* sp., *Acoelorraphe wrightii* (usually occurring in dense clumps), *Bucida buceras, Calliandra* sp., *Calyptranthes* sp., *Cameraria latifolia, Chrysobalanus icaco, Clidemia* sp., *Crescentia cujete, Erythroxylum guatemalense, Haematoxylon campechianum, Hampea trilobata, Helicteres guazumifolia, Hirtella racemosa, Hymenocalis littoralis, Licania hypoleuca, Miconia* spp., *Mimosa hemendieta, Mouriri exilis, Rinorea* sp., *Xylopia frutescens* and *Zygia* sp.

(Meerman et al. 2015: 30)

Lots of other edible plants are in the wetlands; here is the fruit of Pachira aquatica, zapotón. Seeds inside can be made into a cacao-like drink. We have a separate FLAAR report on this tree and its edible uses.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Feb. 25, 2021. Río Sarstún, Izabal.
Camera: Sony Alpha A7R IV. Lens: Sony FE 200-600mm G OSS. Settings: 1/600 sec; f/6,3; ISO 2,500.

Other edible plants you can find on the wetlands. *Symphonia globulifera,* commonly known as boarwood.

Photo by: Victor Mendoza, FLAAR Mesoamerica, Feb. 24, 2021. Laguna Grande, Sarstún, Livingston. Camera: Sony RX10 IV. Lens: Sony FE 28-60mm. Settings: 1/400 sec; f/4; ISO 320.

BOTANICAL DESCRIPTION OF *CHRYSOBALANUS ICACO* IN STANDLEY AND CO-AUTHORS CHICAGO BOTANICAL MONOGRAPHS

Chrysobalanus Icaco L. Sp. Pl. 513. 1753. Icaco. In coastal swamps or in thickets along sea beaches, at sea level; Izabal; San Marcos, and probably in all the Pacific coast departments; often planted inland in fincas or along hedges. Mexico to British Honduras and Panama; Florida; West Indies; northern South America.

A shrub or small tree, often 5-6 meters high in cultivation, along seashores usually lower and often only 1-2 meters high, the bark thin, brownish, the branches glabrous or nearly so, reddish brown; leaves coriaceous, on very short petioles, elliptic to obovate or suborbicular, mostly 3-8 cm. long, rounded to obtuse or emarginate at the apex, broadly cuneate to acute at the base, dark green and lustrous above, dull beneath, glabrous or nearly so; cymes pedunculate, with few or many flowers, shorter than the leaves; calyx densely sericeous, the lobes triangular-ovate, acute, 2.5 mm. long; petals white, cuneate-obovate, twice as long as the sepals; fruit globose or oval, 2-4 cm. long, white to pink or dark purple.

Cultivated frequently in the lowlands of the Pacific slope, whence the fruit is sent to the Guatemala market. The fruit is edible, but no one seems to esteem it highly. The flesh is somewhat spongy, white, very juicy, and insipid in flavor. The English names are "coco-plum" and "pigeon-plum." The leaves and fruit are reported to yield a black dye. The large seeds are rich in oil, and it is stated that the Caribs of the Antilles strung them on sticks and burned them like candles. The name "icaco" (sometimes written "jicaco" or "hicaco") is believed to be of Antillean origin. In Florida, jelly is sometimes made from the ripe fruits. The shrub often forms a large part of the beach thickets of Central American shores.

(Standley and Steyermark 1946: 442).

CHRYSOBALANUS ICACO TREES IN BELIZE: **STANDLEY AND RECORD**

> **Chrysobalanus Icaco** L. Coco Plum. Icaco (Central America generally). Frequent on sea beaches; widely distributed in tropical America; western Africa. An almost glabrous shrub, 1.5 meters high or less; leaves small, rounded; flowers small, white, sweet-scented, in axillary cymes; fruit 2-4 cm. in diameter, globose or nearly so, white, pink, purple, or black. A characteristic shrub of sandy beaches, often prostrate. The sweet, white, juicy flesh of the fruit is eaten, but the flavor is not attractive. The bark and leaves are astringent, the seeds rich in oil.
>
> (Standley and Record 1936: 148)

CHRYSOBALANUS ICACO IN BELIZE **(BALICK, NEE AND ATHA 2000)**

> **Chrysobalanus Icaco** L. — **Loc Use:** FOOD, MED, FORG. — **Reg Use:** FOOD, PRD, FUEL, DYE, MED. — **Nv:** caye caulker plum, cocoplum, coco plum, coco-plum, hicaco plum, icaco, jicaco plum, ka-ka-tà, kocho-rhum. — **Habit:** Shrub or tree.
>
> (Balick, Nee and Atha 2000)

CHRYSOBALANUS ICACO MENTIONED **IN FLORA OF YUCATAN, STANDLEY**

> **Chrysobalanus Icaco** L.
> Sp. Icaco. Coco-plum (B. H.). Probably common along the coast. Coco-plum or pigeon-plum. A shrub with small thick leaves; flowers small, white; fruit a drupe 2-4 cm. long, white or purple. The edible but insipid fruit is eaten fresh or made into dulces. The seeds are said to have an agreeable flavor and to be rich in oil.
>
> (Standley 1930: 274).

***Chrysobalanus icaco* L.**

Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica, Mar. 22, 2021. Livingston, Izabal.
Camera: Canon 1D X Mark II. Lens: Canon 50mm Macro. Settings: 1/800 sec; f/8; ISO 800.

Chrysobalanus icaco L.

***Chrysobalanus icaco* L.**

Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica, Mar. 22, 2021. Livingston, Izabal.
Camera: Canon 1D X Mark II. Lens: Canon EF 300mm IS II USM. Settings: 1/3200 sec; f/3,5; ISO 1,250.

BOTANICAL DESCRIPTION OF THE *CHRYSOBALANUS ICACO* **BY STANDLEY IN TREES AND SHRUBS OF MEXICO**

6. CHRYSOBALANUS L. Sp. Pl. 513. 1753.

1. Chrysobalanus icaco L. Sp. Pl. 513. 1753.
Along the coast, Tamaulipas to Yucatan; Guerrero to Oaxaca. Widely distributed in tropical America and western Africa; type from Jamaica. Low shrub, 1 to 1.5 meters high, or said sometimes to be a tree 9 meters high, with a trunk 30 cm. in diameter; bark thin, scaly, brownish gray; leaves persistent, broadly elliptic to orbicular, 5 to 7 cm. long, nearly sessile, leathery; flowers cymose, small, whitish ; fruit globose or nearly so, 2 to 4 cm. in diameter, creamy white, pink, purple, or blue-black, the flesh white, sweet, juicy; wood hard, strong, close-grained, light brown, its specific gravity about 0.77. "Icaco," "hicaco." or "jicaco" (Chiapas, Veracruz, Yucatan, Oaxaca, Guerrero, Tamaulipas, Guatemala, Honduras, Porto
Rico; the name of Antillean origin); "xicaco" (Oaxaca, Seler).

The English names are "cocoa-plum" and "pigeon-plum" The bark, leaves, and root are astringent and have been used for dysentery, etc. The leaves and fruit furnish a black dye. The seeds contain a large amount of oil, and by the Caribs they were strung on sticks and burnt like candles. The seeds are edible also. The fruit is highly valued in some parts of Mexico and elsewhere in tropical America and was a favorite food of the Caribs. It is astringent until perfectly ripe, when it is sweet and insipid. It is eaten raw but more often made into preserves, which are sold in Mexican markets. For an illustration of a fruiting branch see Contr. U. S. Nat. Herb. 8: pi. 26.

The "hicaco" is well described by Oviedo (Lib. VIII, Cap. IX). "The skin of the fruit," he writes, "has some resemblance to that on a monkey's face; for no matter how young a monkey is, it seems old because of its wrinkles, and likewise the hicaco fruit, no matter how fresh it may be, is always full of wrinkles."

(Standley 1922: 344)

Chrysobalanus icaco L. CAM, CHIS, GRO, MICH, OAX, QROO, TAB, TAMS, VER, YUC

(Villaseñor 2016: 162).

WHERE HAS *CHRYSOBALANUS ICACO* BEEN **FOUND IN THE MUNICIPIO OF LIVINGSTON?**

Is *Chrysobalanus icaco* listed for Biotopo Protegido Chocón Machacas, CECON/USAC?

In some riparian places, there are well-established shrub formations of *Chrysobalanus icaco*, which are as tall as or slightly shorter than the mangrove (Parks Watch 2013).

Chrysobalanus icaco is the second most abundant species in the biotope with 176 individuals counted (PEREZ-Consuegra 2001).

Is *Chrysobalanus icaco* listed for Tapon Creek Nature Reserve (including Taponcito Creek), FUNDAECO?

Not mentioned

Is *Chrysobalanus icaco* listed for Buena Vista Tapon Creek Nature Reserve?

Not mentioned

Is *Chrysobalanus icaco* listed for Cerro San Gil (south side of Rio Dulce)?

Yes, it is one of the most abundant species in flooded forests (Ruíz 2006).

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

Yes, in facultative wetland species (FUNDAECO 2007).

Credits for page 15
***Chrysobalanus icaco* L.**

Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica, Mar. 22, 2021. Livingston, Izabal. Camera: Canon 1D X Mark II. Lens: Canon 50mm Macro. Settings: 1/800 sec; f/8; ISO 800..

IS *CHRYSOBALANUS ICACO* LISTED FOR SARSTOON-TEMASH **NATIONAL PARK (NORTHERN SIDE OF RÍO SARSTÚN)**

Yes, in facultative wetland species (Meerman, J. C., Herrera, P. and A. Howe 2003).

IS *CHRYSOBALANUS ICACO* LISTED FOR EL REFUGIO DE VIDA **SILVESTRE PUNTA DE MANABIQUE?**

The beach and river mouth system includes the plant communities of icaco (*Chrysobalanus icaco*) and provides critical habitat for birds migratory and rodents, reptiles, crabs and other organisms that are only found in this area (Fundary 2001).

Chrysobalanus icaco is on the list of Vegetation found in the Izabal area in the Cerro San Gil and Punta de Manabique sector (AMBIENS S.A 2013)

IS *CHRYSOBALANUS ICACO* LISTED **FOR BOCAS DE POLOCHIC**

Yes, it is one of the most abundant species (Pérez 2006).

The most common species of plant gathered are the icaco (*Chrysobalanus icaco*), guamo or cuje (*Inga fissicalix*), caulote (*Guazuma ulmifolia*) and frijolillo (*Samanea* spp.). There has been no evaluation of the impact of the introduction of the tilapia (*Sarotherodon* spp.) for food and commercial exploitation in Lago de Izabal (RAMSAR 1996).

IS *CHRYSOBALANUS ICACO* FROM THE HIGHLANDS OR FROM **THE LOWLANDS (OR BOTH)?**

Lowlands, 0 a 450 msnm (Francis 2003).

***Chrysobalanus icaco* L.**

Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica, Mar. 22, 2021. Livingston, Izabal.
Camera: Canon 1D X Mark II. Lens: Canon 50mm Macro. Settings: 1/800 sec; f/8; ISO 800.

***Chrysobalanus icaco* L.**

Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica, Mar. 22, 2021. Livingston, Izabal.
Camera: Canon 1D X Mark II. Lens: Canon 50mm Macro. Settings: 1/800 sec; f/8; ISO 800.

***Chrysobalanus icaco* L.**

Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica, Mar. 22, 2021. Livingston, Izabal.
Camera: Canon 1D X Mark II. Lens: Canon 50mm f/2.5 Macro. Settings: 1/800 sec; f/8; ISO 80.

Chrysobalanus icaco tiny flowers and its edible fruit.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Aug. 11, 2013. Río Dulce, Izabal.
Camera: Nikon D810. Lens: Nikon AF-S Micro 60mm G. Settings: 1/200 sec; f/18; ISO 100.

WORLD RANGE FOR ***CHRYSOBALANUS ICACO***

The most helpful resource to learn the world range is the NYBG:

http://sweetgum.nybg.org/science/world-flora/monographs-details/?irn=4240

Their list is so comprehensive it's best to read it on their website or in the botanical monograph: Prance, Ghillean T. 1972. Chrysobalanaceae. Fl. Neotrop. Monogr. 9: 1-410. NYBG Press.

ARE *CHRYSOBALANUS ICACO* TREES REGISTERED **FOR PARQUE NACIONAL TIKAL?**

Chrysobalanus icaco is listed for Tikal (Schulze and Whitacre 1999: 227,234), surprising for two reasons: no sand dunes in central Peten; and their report is on trees, not trees and shrubs.

IS THERE POTENTIAL MEDICAL USAGE OF ***TYPHA DOMINGENSIS*** **BY LOCAL PEOPLE?**

Chrysobalanus icaco has high adaptability to environmental conditions and resistance to salinity, low humidity levels where other plants suffer from water stress, fire and moderate frosts and can be used as a soil stabilizer in dry tropic areas. Also, it can be grown in all types of gardens, small or large, and even in pots (Orellana 2014)

Much of what the Mayan people eat comes from the kitchen garden around their thatched-roofed house. Imagine if we could incorporate this kind of edible plants, no matter if we are surrounded by water.

Chrysobalanus icaco

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Aug. 11, 2013. Río Dulce, Izabal, Guatemala.
Camera: Nikon D810. Lens: Nikon AF-S Micro 60mm G. Settings: 1/200 sec; f/18; ISO 100.

USES OF ***CHRYSOBALANUS ICACO***

> **Chrysobalanus icaco** L. Sp. Pl. 513. 1753.
> Icaco, coco-plum, pigeon plum. Native from Florida, Mexico and the West Indies through Central America to South America mainly along the sea. The shrub is quite abundant in many places in Central America. I have seen fruits offered in markets in all countries except Nicaragua. The fruits are oval or globose and 2-4 cm. long, white to dark purple and in my opinion rather insipid and of little value. Cultivated forms are said to produce better fruits.The large seeds contain abundant oil and are reported to be strung on sticks and used as candles in the West Indies. A black dye is obtained from the fruits and leaves.

(Williams 1981: 278-279)

> Benefits.—The fruits are edible raw and can be made into preserves. Coco-plum seeds, which have a high oil content, are also edible. The wood is light brown, hard, and heavy (specific gravity 0.8) and is used for fuel and rustic construction (Little and others 1974). Various parts of the plant have been used in folk medicine. The species is known to have hypoglycemic effects (Costa 1977). It is a honey plant and furnishes food for wildlife.
>
> Another important benefit from the species is for dune and soil stabilization.

(Francis 2004: 200).

> Put the oil on a stick and you can burn this like a candle

(Williams 1981: 279).

Chrysobalanus icaco… Fruits with edible pulp (Lundell 1938). Cyrus Lundell's 1938 list has been helpful to me my initial years. But today, in 2021, with over 5,000 other PDFs of botanical books, peer-reviewed journal articles, theses, dissertations, and pertinent webpages, I have a lot of material of more recent years to read and learn from so I can share in this FLAAR report.

IS THERE POTENTIAL MEDICINAL **USAGE OF *CHRYSOBALANUS ICACO* BY LOCAL PEOPLE?**

Yes, parts are considered medicinal. If you are into medicinal aspects of plants of Mesoamerica, there are lots of articles on the chemicals in each part of *Chrysobalanus icaco*.

ARE ANY PARTS OF *CHRYSOBALANUS ICACO* **EATEN BY MAMMALS?**

Yes (*Arboles de Calakmul*, Ochoa et al. 2018: 83). Eaten by birds (Balick and Arvigo 2015: 253)

WHAT ARE THE PRIMARY POLLINATORS **OF *CHRYSOBALANUS ICACO* FLOWERS?**

- *Xylocopa* sp.
- *Centris* sp.
- *Epicharis* sp. (Pacho 2020)

CLOSE RELATIVE(S) OF ***CHRYSOBALANUS ICACO***

- *Chrysobalanus cuspidatus*
- *Chrysobalanus icaco* L.
- *Chrysobalanus venezuelanus*

Chrysobalanus icaco

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Aug. 11, 2013. Río Dulce, Izabal. Camera: Nikon D810. Lens: Nikon AF-S Micro 60mm G. Settings: 1/200 sec; f/18; ISO 100.

CONCLUDING DISCUSSION AND SUMMARY ON *CHRYSOBALANUS ICACO* TREES

Lots of uses for this tree: **Loc Use**: FOOD, MED, FORG. — **Reg Use:** FOOD, PRD, FUEL, DYE, MED (Balick, Nee and Atha 2000). Dye colorants were used to color fibers for anything and everything. Fuel is for the kitchen to keep the fire burning. Product is to make things for the house. And medicinal is to help when sick. Forage is for animals to eat also. So for the Maya past and present and future this plant had and has potential.

Botanists know of the uses of this tree: *Chrysobalanus icaco*, Madera, comestible, aceite y tintes (INAB, IARNA-URL 2012, No. 117 in tabulation on page 172).

Let's find where these trees are today. Let's protect their eco-systems.

And let's make sure this tree is in books on Classic Maya foods available from wild, native trees of the wetlands: the fruit, kernel, seeds, nut are all edible.

***Chrysobalanus icaco* L.**

Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica, Mar. 22, 2021. Livingston, Izabal. Camera: Canon 1D X Mark II. Lens: Canon 50mm Macro. Settings: 1/800 sec; f/8; ISO 800.

Chrysobalanus icaco

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Apr. 27, 2015. Monterrico Berger House. Camera: Nikon D810. Lens: Nikon AF-S Micro 60mm G. Settings: 1/25 sec; f/10; ISO 640.

Humid environment where *C. icaco,* and many other plants grow happily.

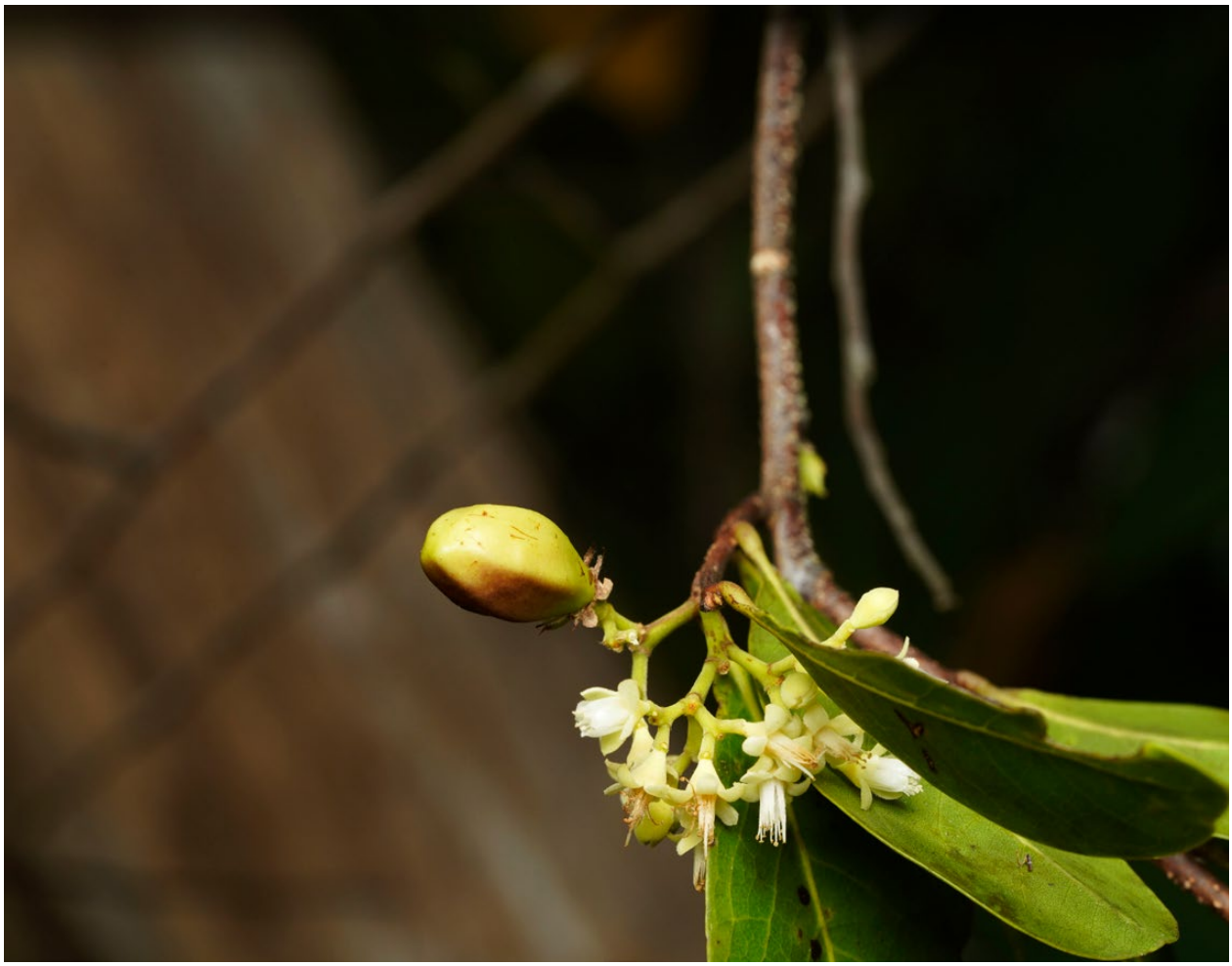
Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Mar. 22, 2021. Río Caliz, Livingston.
Camera: Nikon D810. Lens: Nikon AF-S Micro 60mm G. Settings: 1/25 sec; f/10; ISO 640.

APENDIX A

Photographs of *Chrysobalanus icaco* on sandy edge of Rio Cocoli where it flows into Amatique Bay

All these photographs were taken by David Arrivillaga, FLAAR Mesoamerica.

The purpose of putting these into an Appendix is to show what a single tree can provide to an ethnobotanical research team. Of the dozens of this same species along the edge of a mangrove swamp, this was the only one blooming the last days of April (2021).



Chrysobalanus icaco

Photo by: David Arrivillaga, FLAAR Mesoamerica, Aug. 11, 2013. Río Dulce, Izabal, Guatemala.
Camera: Sony Alpha A7R IV. Lens: Sony FE 90mm Macro G OSS. Settings: 1/250 sec; f/11; ISO 400.

Chrysobalanus icaco

Photo by: David Arrivillaga, FLAAR Mesoamerica, Aug. 11, 2013. Río Dulce, Izabal, Guatemala.
Camera: Sony Alpha A7R IV. Lens: Sony FE 90mm Macro G OSS. Settings: 1/250 sec; f/11; ISO 400.

Chrysobalanus icaco

Photo by: David Arrivillaga, FLAAR Mesoamerica, Aug. 11, 2013. Río Dulce, Izabal, Guatemala.
Camera: Sony Alpha A7R IV. Lens: Sony FE 90mm Macro G OSS. Settings: 1/250 sec; f/11; ISO 400.

Chrysobalanus icaco

Photo by: David Arrivillaga, FLAAR Mesoamerica, Aug. 11, 2013. Río Dulce, Izabal, Guatemala.
Camera: Sony Alpha A7R IV. Lens: Sony FE 90mm Macro G OSS. Settings: 1/250 sec; f/11; ISO 400.

Chrysobalanus icaco

Photo by: David Arrivillaga, FLAAR Mesoamerica, Aug. 11, 2013. Río Dulce, Izabal, Guatemala.
Camera: Sony Alpha A7R IV. Lens: Sony FE 90mm Macro G OSS. Settings: 1/250 sec; f/11; ISO 400.

Chrysobalanus icaco

Photo by: David Arrivillaga, FLAAR Mesoamerica, Aug. 11, 2013. Río Dulce, Izabal, Guatemala.
Camera: Sony Alpha A7R IV. Lens: Sony FE 90mm Macro G OSS. Settings: 1/250 sec; f/11; ISO 400.

Chrysobalanus icaco

Photo by: David Arrivillaga, FLAAR Mesoamerica, Aug. 11, 2013. Río Dulce, Izabal, Guatemala.
Camera: Sony Alpha A7R IV. Lens: Sony FE 90mm Macro G OSS. Settings: 1/250 sec; f/11; ISO 400.

REFERENCES CITED AND SUGGESTED READING ON *CHRYSOBALANUS ICACO*

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.

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

COOK, Suzanne
2016 The forest of the Lacandon Maya: an ethnobotanical guide. Springer. 334 pages.

Sold online: www.springer.com/la/book/9781461491101

ESTRADA Loreto, Feliciana
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

FRANCIS, John K. (editor)
1989 Wildland Shrubs of the United States and Its Territories: Thamnic Descriptions: Volume 1. United States Department of Agriculture. USDA.

FUNDARY-ONCA
2001 Plan Maestro 2002-2006 Área De Protección Especial Punta De Manabique. Consejo Nacional De Áreas Protegidas Fundación Mario Dary Rivera.

GOODWIN, Z. A., LÓPEZ, G. N., STUART, N., BRIDGEWATER, G. M., HANSTON, E. M., CAMERON, I. D., MICHELAKIS, D., RATTER, J. A., FURLEY, P. A., KAY, E., WHITEFOORD, C., SOLOMON, J. LLOYD, A. J. and **D. J. HARRIS**
2013 A checklist of the vascular plants of the lowland savannas of Belize, Central America. Phytotaxa 101 (1): 1–119.

Download: www.eeo.ed.ac.uk/sea-belize/outputs/Papers/goodwin.pdf

GRANDTNER, Miroslav M.
2005 Elsevier's Dictionary of Trees: Volume 1: North America. ELSEVIER. 1493 pages.

HIDALGO, Hugo and **Cristofer LOPEZ**
2007 Propuesta de Incorporación a la Convención Ramsar del Área Protegida "Reserva de Usos Múltiples Río Sarstún". FUNDAECO.

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)

INAH, IARNA-URL
2012 Primer Informe Nacional sobre el Estado de los Recursos Genéticos Forestales en Guatemala. URL-INAB, IARNA. 189 pages.

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.

LESUR, Luis
2011 Árboles de México. Editorial Trillas. 368 pages.

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.

LUNDELL, Cyrus L.
1937 The Vegetation of Peten. Carnegie Institution of Washington, Publ. 478. Washington. 244 pages.

LUNDELL, Cyrus L.
1938 Plants Probably Utilized by the Old Empire Maya of Peten and Adjacent Lowlands. Papers of the Michigan Academy of Sciences, Arts and Letters 24, Part I:37-59.

www.botanicalsciences.com.mx/index.php/botanicalSciences/article/download/1660/1309/

MEERMAN, J. C., HERRERA, P. and **A. HOWE**
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.

MEERMAN, J. C., BOOMSMA, T. and **B. AREVALO**
2015 Spanish Creek Wildlife Sanctuary Management Plan 2016-2021. Belize Key Biodiversity Areas Secretariat and the Rancho Dolores Environmental and Development Group Ltd.

OCHOA-Gaona, Susana, RUÍZ González, Hugo, ÁLVAREZ Montejo, Demetrio, CHAN Coba, Gabriel and **Bernardus H. J. DE JONG**
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

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

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.

PRANCE, Ghillean T.
1972 Chrysobalanaceae. Flora Neotropical Monograph 9: 1-410. NYBG Press.

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 Conservacion (FUNDAECO), The Nature Conservancy (TNC)

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.
1937 Flora of Costa Rica, Part I. Publications of Field Museum of Natural History, Botanical Series Volume XVIII, Publication 391.

STANDLEY, Paul C.
1922 Trees and Shrubs of Mexico. Contributions from the United States National Herbarium, Volume 23, Part 2. 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. and **Julian A. STEYERMARK**
1946 Flora of Guatemala. Fieldiana: Botany, Volume 24, Part IV, 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.

VÁSQUEZ Marroquín, Miguel Angel
2004 Plan de Proyecto Parque Nacional Tikal. Parque Nacional Tikal, Petén, 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.

http://revista.ib.unam.mx/index.php/bio/article/view/1638/1296

WILLIAMS, Louis O.
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/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 SPECIFICALLY ON *CHRYSOBALANUS ICACO*

www.backyardnature.net/yucatan/icaco.htm
Closeup of the flower; photo of the inside of the edible fruit.

https://www.cabi.org/isc/datasheet/13122
Good bibliography.

https://www.cicy.mx/sitios/flora%20digital/ficha_virtual.php?especie=1168
Basic info; but zilch on uses (for most other plants has data on uses).

http://www.cybertruffle.org.uk/vinales/eng/chrysobalanus_icaco.htm
Basic but still helpful photos of the leaves and flowers.

http://www.eattheweeds.com/chrysobalanus-icaco-multi-colored-fruit-2/
A few photos and humerous discussion of eating the fruits.

http://www.fao.org/pgrfa-gpa-archive/ven/web_fotos/album/slides/Frutos%20de%20Icaco%20Rosado%20(Chrysobalanus%20icaco).%20Parcela%20experimental%20del%20CENFRUZU-CORPOZULIA.%20jpg.html
Rather a log URL; I found it when simply Googling "*Chrysobalanus icaco*"
Has one single photo, but of the mature fruits, and close-up detail.

https://inaturalist.ca/taxa/160544-Chrysobalanus-icaco
Better photos of the fruits and flowers.

https://www.intagri.com/articulos/frutales/el-caco-como-cultivo-potencial
Lists food values.

https://monsterblooms.com/product/red-tip-paradise-cocoplum-plant-chrysobalanus-icaco/
Shows the fruits in their deep pink phase.

https://www.naturalista.mx/taxa/160544-Chrysobalanus-icaco
Map showing where specimens have been collected. A few nice photos of fruits and flowers.

http://tropical.theferns.info/viewtropical.php?id=Chrysobalanus+icaco
Helpful basic information; everything cited a to where the info was found. Several good photographs.

FLAAR MESOAMÉRICA

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).

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

Senaida Ba is photography assistant for many years. She knows the Canon, Nikon and is learning the two new Sony mirrorless cameras. She prepares, packs, sets-up, and helps the photographers before, during, and after each day's field trip.

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

Maria 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 sheis 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.

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.

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

Elaborado por: Andrea de la Paz; Amanda Estrada Rodas. FLAAR Mesoamerica 2020

Información de referencia:

- Limites 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.

Elaborado por: Andrea de la Paz; Amanda Estrada Rodas. FLAAR Mesoamerica 2020

FLAAR MESOAMÉRICA

WETLANDS

Edible Wetlands Plants of Municipio de Livingston, Izabal

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

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

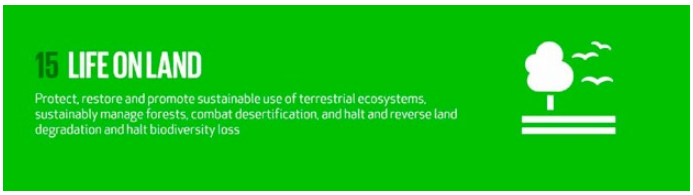
Wetland Series 2: plants that grow along the beach shore of Amatique Bay

Amphitecna latifolia Black calabash MLW#9	***Coccoloba uvifera*** Uva del mar MLW#10	***Manicaria saccifera*** Confra, Manaca MLW#11	***Chrysobalanus icaco*** Coco Plum MLW#12	***Avicennia germinans*** Black Mangrove MLW#13	***Rhizophora mangle*** Red Mangrove MLW#14

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

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

FLAAR



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

Any school, college, university, botanical garden, zoological garden, botanical or zoological association (or club) may post this report on their web sites, (at no cost) as long as they link back to one of our web sites:

www.maya-ethnobotany.org
www.maya-ethnozoology.org
www.maya-archaeology.org
www.digital-photography.org
www.FLAAR-Mesoamerica.org

This report may be cited with this information:

Hellmuth, N. (2021)
Wetland Series MLW1: Edible Plants of Municipio de Livingston from Swamps, Marshes and Seasonally Inundated Flatlands of Izabal. Wetlands Report #4, MLW1 Number 3. FLAAR (USA), FLAAR Mesoamerica (Guatemala).

BACK COVER PHOTO
Chrysobalanus icaco.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Dec. 18, 2020. Livingston, Izabal.
Camera: Sony Alpha A7C. Lens: Sony FE 90mm Macro G OSS.
Settings: 1/160 sec; f/4; ISO 1,250.

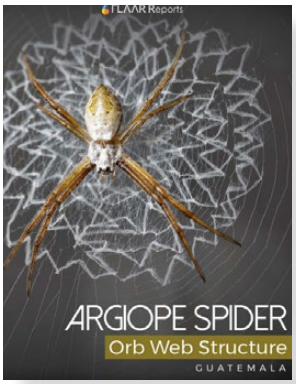
FLAAR Mesoamerica is the creator of the design and authorship of the document. When sharing information or designs on social networks, you must tag the page of FLAAR Mesoamérica, its authors and photographers. In the case of written documents, use the corresponding quote.

FLAAR (in USA) and FLAAR Mesoamerica (in Guatemala) are both non-profit research and educational institutes, so there is no fee. And you do not need to write and ask permission; but we do appreciate when you include a link back to one of our sites. Any school, college, university, botanical garden, etc. can post this PDF on their school or university or institute website for their students to download at no cost. 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.

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.

OTHER PUBLICATIONS OF
THE FAUNA OF GUATEMALA



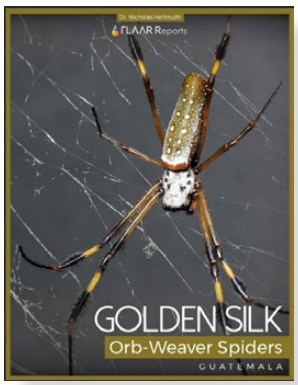
Argiope Spider
Download here

Birds in the Mayan civilization:
The Owl
Download here

Caterpillar Macrophotography
Download here

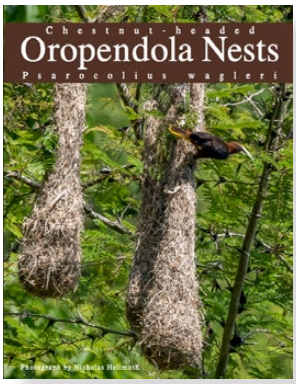
Stingless Bees of the Maya
Download here

Rescate, crianza, liberación y
Reincersión de dos crías de Coatíes
Download here

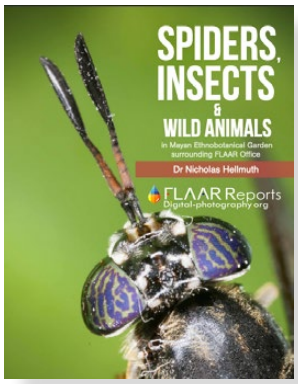


Golden Silk Orb-Weaver Spiders
Download here

Garza Tricolor
Download here



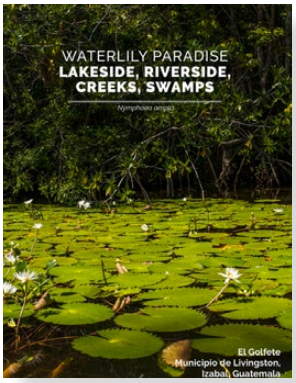
Oropendola Nests
Download here



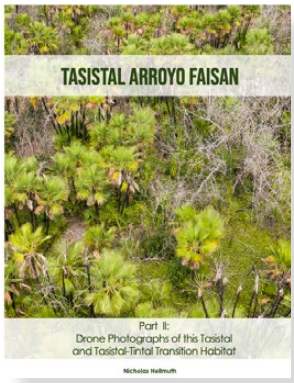
Spiders, insects and wild animals
Download here

If you wish more FLAAR reports on fauna of Guatemala,
visit our website: **www.maya-ethnozoology.org.**

OTHER PUBLICATIONS OF
THE FLORA OF GUATEMALA



Waterlily Paradise
Download here

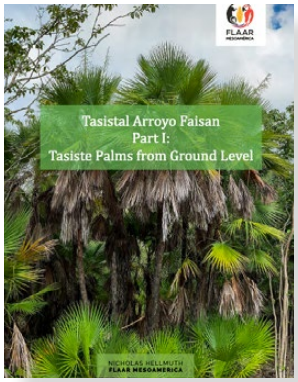


Tasistal Arroyo Faisan
Download here

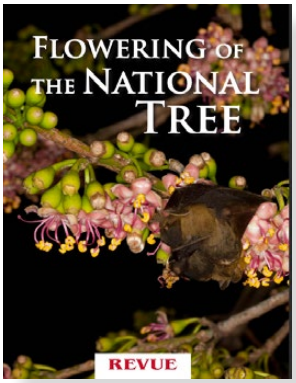
Heliconia
Platanillo, Golden Lobster Claw
Download here

Heliconia
Golden Dwarf
Download here

Pseudobombax ellipticum
Download here



Tasistal Arroyo Faisan (part 1)
Download here



Flowering of the National Tree
Download here

Heliconia
Maya Gold, Maya Blood Splash
Download here

Tecomasuche
Download here

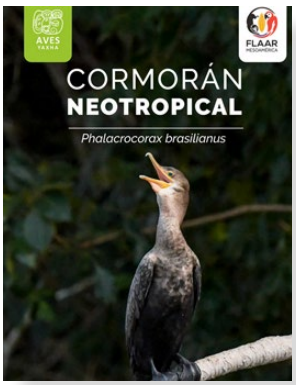
If you wish more FLAAR reports on fauna of Guatemala,
visit our website: **www.maya-ethnobotany.org.**

OTHER PUBLICATIONS FROM NATIONAL PARK **YAXHA, NAKUM AND NARANJO, GUATEMALA**

Garcita blanca
Download here

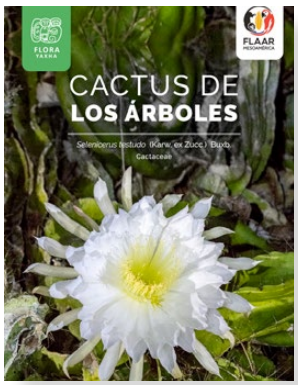
Aquatic Orchids
Download here

Garza blanca
Download here



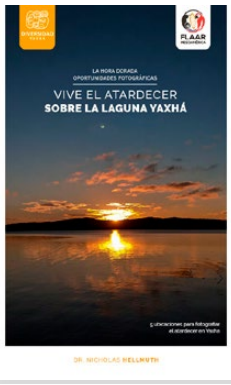
Cormorán Neotropical
Download here

El mono araña
Download here



Cáctus de los Árboles
Download here

Isla del Musgo
Download here



Vive el atardecer sobre la Laguna Yaxhá
Download here

If you wish more FLAAR reports on flora of Guatemala,
visit our website: **https://flaar-mesoamerica.org/projects-national-park-yaxha-nakum-naranjo/**

FLAAR
MESOAMÉRICA