Nance
Occurring in Savannas

Byrsonima crassifolia

Parque Nacional Yaxha, Nakum and Naranjo (PNYNN)
Reserva de la Biosfera Maya (RBM),
Petén, Guatemala

Nicholas Hellmuth & Mariana Rivas
October. 2023

FLAAR MESOAMÉRICA

FLAAR

FOR COOPERATION, HOSPITALITY, AND ASSISTANCE AT PARQUE NACIONAL YAXHA, NAKUM AND NARANJO

(August 2018 through July 2019)

- **Lic. Jorge Mario Vázquez** (CONAP, Santa Elena, Petén)
- **Arq. José Leonel Ziesse** (IDAEH, Santa Elena, Petén)
- **Biolg. Lorena Lobos** (CONAP)

INITIATION AND COORDINATION OF THE PROJECT OF COOPERATION FOR

2021–2025

- **Licda. Merle Fernández,** CONAP
- **Marla Mercedes Bolvito Jerónimo,** Unidad de Cooperación Nacional e Internacional de la Secretaría Ejecutiva de CONAP
- **Licda. Ana Luisa De León N.,** Directora de Educación para el Desarrollo Sostenible, CONAP
- **Lic. Apolinario Córdova,** CONAP Petén

ASSISTANCE FOR KNOWLEDGE OF PLANTS AND ANIMALS OF PNYNN

- Moisés Daniel Pérez Díaz, "Teco", park ranger, PNYNN

Plus, all the helpful and knowledgeable park rangers of IDAEH CONAP at PNYNN who accompanied us each day. It is essential to have either an IDAEH and/or CONAP "guardabosque" or comparable when doing flora and fauna research in a national park. We appreciate the assistance of park ranger Teco (Moisés Daniel Pérez Díaz), Ricardo Herrera and every park ranger that accompanied us on other field trips.

- **FRONT COVER PHOTOGRAPH**

Photo by: Sofía Monzón,
FLAAR Mesoamerica. Feb. 19, 2014.
Camera: Canon 6D. Settings: 1/50; sec; f/16; ISO 2,000.

CREDITS

AUTHOR
- Nicholas Hellmuth
- Mariana Rivas Gálvez

EDITORS
- Vivian Hurtado
- Mariana Rivas Gálvez

PHOTOGRAPHERS
- Nicholas Hellmuth
- Edwin Solares

ASSISTANCE FOR LOCAL KNOWLEDGE OF PLANTS AND ANIMALS OF PNYNN
- Moises Daniel Pérez Díaz (Yaxha and Nakum sectors)
- Horacio Palacios (Naranjo sector)

MANAGER OF DESIGN AND LAYOUT
- Andrea Sánchez Díaz

LAYOUT OF THIS ENGLISH EDITION
- Jaqueline González

CONTENTS

CONTENTS

Introduction to Savanna vegetation

Our interest on the "nance" tree, is due to its incidence in the savanna´s ecosystems. In most Belize´s and Peten´s savannas, there are six plants mentioned in almost every list, including the "nance" tree:

- *Byrsonima crassifolia*, "nance"
- *Crescentia cujete*, "jícara"
- *Acoelorrhaphe wrightii*, "tasiste"
- *Curatella americana*, "chaparro"
- *Pinus caribaea*, "pino"
- *Quercus oleoides*, "oak"

The several impressive savannas of "Parque Nacional Yaxha Nakum Naranjo" have:

- *Byrsonima crassifolia*, "nance"
- *Crescentia cujete*, "jícara"
- *Acoelorrhaphe wrightii*, "tasiste"

Definitely never have:

- *Pinus caribaea*, "pino"
- *Quercus oleoides*, "oak"

We haven't yet found the "chaparro" bush (*Curatela americana*) in PNYNN. However, we know this plant very well, since we have photographed and documented lots of "Chaparro" and stunted "nance" trees in an awesome savanna located at the north of Rabinal, Baja Verapaz, Guatemala. This Baja Verapaz savanna is memorable, because instead of being flat it's very hilly with a lot of small ravines. Would be interesting to determine if the lack of "Chaparro" in Parque Nacional Yaxha Nakum Naranjo, is due to the lack of pine and oak trees; or, if "Chaparro" is actually part of this ecosystem, but since it's a bush, finding it might be difficult, being unnoticed among the other hundreds of bushes found in this forest.. In contrast, trees in a savanna ecosystem are easier to be noticed, since they stand out from the rest of the vegetation due to its height and dosel.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica. May. 4, 2019. Parque Nacional Yaxha Nakum y Naranjo Camera: iPhone XS.

Ximenia americana, pepenance red fruits of a relative of nance.

Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica. Mar. 28, 2019. Savanna East of Nakum.
Camera: Canon 1D X Mark II. Settings: 1/30; sec; f/10; ISO 400.

My experience with Nance trees
by Nicholas Hellmuth

My first experience with "nance" trees, was during the years that I was doing ethnohistorical research on the Cholti- Lacandon (of Chiapas) and Quejache, Peten Itza and other Mayan groups of 16th-17th century Peten. I read about the Spanish crossing savannas, where they commented that the local Mayan people told them that the leaves of nance trees were used to wrap tobacco cigars of the local Maya.

During the past decade, while studying and photographing plants in diverse areas around Guatemala, we have found nance trees in many of these ecosystems (normally planted around a house as part of its kitchen garden). During 2018-2019 we noticed isolated nance trees in areas adjacent to Lake Yaxha, where people had their houses in the past decades. So, these nance trees are the result of human habitation. However, we began to find more nance trees in the savannas of the Parque Nacional Yaxha Nakum Naranjo, specially in the seasonally inundated Savanna East of Nakum. Since this savanna has no published data, studies, or/and no photographic material prior to our visit, we would like to document the vegetation and increase the research efforts for this place, so that botanists, ecologists or any other scientist get to know the new data of this place based on our documentation and research.

The PNYNN savannas have a different "mini-ecosystem" every 50 or 100 meters (depending on the amount of water and elevation, including differences of a few centimeters on the elevation). In this way, we have found, so far, lots of different plants in the three "savanna-like" areas. However, the plants we started with are the three primary indicators: nance, tasiste, and jícara.

Photo by: Sofía Monzón, FLAAR Mesoamerica. Feb, 19. 2014.
Camera: Canon 6D. Settings: 1/50; sec; f/16; ISO 2,000.

Plant Family Name
for *Byrsonima crassifolia*

Plant family name is: Malpighiaceae

Full Botanical Name
for *Byrsonima crassifolia*

Byrsonima crassifolia (L.); Knuth

Local and common names
for *Byrsonima crassifolia*

"Nance de monte"
"Chi' (Mayan)"

Note to consider: These names are mostly used for another species of nance Byrsonima bucidifolia Standl. However, they can also be used to commonly name *B. crassifolia*.

Photo by: Sofía Monzón, FLAAR Mesoamerica. Feb, 19. 2014.
Camera: Canon 6D. Settings: 1/80; sec; f/16; ISO 800.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica. Jan. 22, 2019. Río Ixtinto, Yaxha park. Camera: iPhone XS.

Synonyms for *Byrsonima crassifolia*

This is the first time I have found another web site that had synonyms not in www.ThePlantList.org

Web platforms with a record of synonyms for Byrsonima crassifolia	
www.CatalogueOfLife.org	**www.theplantlist.org/tpl1.1/record/kew-2688172**
Byrsonima biacuminata Rusby	
Byrsonima cinerea DC.	
Byrsonima coriacea (Sw.) DC	*Byrsonima coriacea* (Sw.) DC.
Byrsonima coriacea (Sw.) DC.	*Byrsonima cotinifolia* Kunth
Byrsonima crassifolia Lunan ex Griseb	
Byrsonima crassifolia f. cubensis (A. Juss.) *Nied.*	*Byrsonima crassifolia f. cubensis* (A. Juss.) Nied.
	Byrsonima crassifolia f. ferruginea (Kunth) Griseb.
Byrsonima crassifolia subsp. insulata *Cuatrec*	*Byrsonima crassifolia* subsp. insulata *Cuatrec*
Byrsonima crassifolia var. jamaicensis Urb. & Nied.	*Byrsonima crassifolia var. jamaicensis* (Urb. & Nied.) Urb. & Nied. (sic is my comment)
Byrsonima crassifolia f. kunthiana Nied	*Byrsonima crassifolia f. kunthiana* Nied
Byrsonima crassifolia var. lanceolata Cuatrec.	*Byrsonima crassifolia var. lanceolata* Cuatrec.
	Byrsonima crassifolia var. moureila (Aubl.) DC
Byrsonima crassifolia var. peruviana Nied	*Byrsonima crassifolia var. peruviana* Nied
	Byrsonima crassifolia var. spruceana Nied
Byrsonima cubensis A. Juss	*Byrsonima cubensis* A. Juss
	Byrsonima cubensis var. brachypoda Turcz.
Byrsonima cumingiana A. Juss	*Byrsonima cumingiana* A. Juss
Byrsonima fagifolia Nied	*Byrsonima fagifolia* Nied
Byrsonima ferruginea Kunth	*Byrsonima ferruginea* Kunth
	Byrsonima ferruginea var. moureila Benth
	Byrsonima jamaicensis Urb. & Nied.
Byrsonima karwinskiana A. Juss.	*Byrsonima karwinskiana* A. Juss.

Web platforms with a record of synonyms for Byrsonima crassifolia	
www.CatalogueOfLife.org	**www.theplantlist.org/tpl1.1/record/kew-2688172**
Byrsonima lanceolata DC.	*Byrsonima lanceolata* DC.
Byrsonima laurifolia Kunth	*Byrsonima laurifolia* Kunth
	Byrsonima laurifolia var. guatemalensis Nied
Byrsonima montana Kunth	*Byrsonima montana* Kunth
Byrsonima moritziana Turcz	*Byrsonima moritziana* Turcz
Byrsonima moureila Loudon	*Byrsonima moureila (Aubl.)* Loudon
Byrsonima panamensis Beurling	*Byrsonima panamensis* Beurl.
Byrsonima pulchra DC.	*Byrsonima pulchra* DC.
Byrsonima rhopalifolia Kunth	*Byrsonima rhopalifolia* Kunth
Byrsonima rufescens Bertol	*Byrsonima rufescens* Bertol
Byrsonima spruceana Nied.	*Byrsonima spruceana* Nied.
Malpighia cinerea Poir	
Malpighia coriacea Sw.	*Malpighia coriacea* Sw.
Malpighia cotinifolia Spreng	*Malpighia cotinifolia* Spreng
Malpighia crassifolia L.	*Malpighia crassifolia* L.
Malpighia lanceolata Poir	
Malpighia laurifolia Spreng.	*Malpighia laurifolia* Spreng.
Malpighia moureila Aubl.	*Malpighia moureila* Aubl.
Malpighia pulchra (Moc. & Sesse)	*Malpighia pulchra* Sesse & Moc
Malpighia rhopalifolia Spreng	
	Malpighia rufa Poir

Colubrina arborescens, yellow green flowers nance relative.

Photo by: Juan Pablo, FLAAR Mesoamerica. Jan, 22. 2019. Yaxha Lake.
Camera: Google Pixel 3xl.

Botanical descriptions of *Byrsonima crassifolia* and *Byrsonima bucidifolia*

***Byrsonima* spp. Rich description:**

Shrubs or trees; leaves opposite, without glands, short-stalked, entire; flowers yellow, in terminal racemes or panicles; fruit an ovoid or globose drupe. Leaves acute or acuminate, usually abundantly tomentose beneath, even in age: *B. crassifolia.* Leaves rounded at the apex, glabrate beneath: *B. bucidifolia.*

***Byrsonima bucidifolia* Standl. Craboo. Honey Camp region; Yucatan; description:**

A shrub or small tree; leaves obovate or wedge-shaped, often emarginate, paler beneath; fruit yellow, about 12 mm. in diameter. The fruit is edible, and Herbario CICY, 2010 a reports that it is sometimes sold in the markets.

***Byrsonima crassifolia* (L.) DC. Craboo, Crapoo, Wild Craboo. Zacpah (Maya). Nanche (Yucatan); description:**

Common in pine forest and thickets; widely distributed in tropical America. A large shrub or small tree, as much as 9 meters high, with trunk diameter of 12 cm. ; leaves oblong to obovate, densely grayish- or rusty-tomentose beneath, thick; petals large, bright yellow, turning reddish in age; fruit globose, yellow, 1 cm. or more in diameter.

The fruit has a flavor somewhat suggestive of green apples, and it is much eaten in Central America generally, at least by children. The tree is a highly ornamental one when in blossom, bearing its golden flowers in the greatest profusion. Wood dull reddish or pinkish brown, rather hard and heavy, strong but brittle, rather coarse-textured, roe-grained, fairly easy to work, but does not finish very smoothly, is only moderately durable; suitable for general construction.(For further description of wood see T. of T. A., pp. 363-365.)

(Standley and Record 1936: 205-206). *Byrsonima crassifolia* (L.) HBK. Nov. Gen. & Sp. 5: 149. 1822. *Malpighia crassifolia* L. Sp. Pl. 126. 1753. *B. cotinifolia* HBK. Nov. Gen. & Sp. 5: 152. pi. 447. 1822. *B. pulchra* DC. Prodr. 1: 580. 1824. *B. rufescens* Bertol. Fl. Guat. 418. 1840 (type from Escuintla, Velasquez). *B. Karwinskiana* Juss. Ann. Sci. Nat. II. Bot. 13: 333. 1840. *B. laurifolia* HBK. var. guatemalensis Niedenzu, Pflanzen- reich IV. 141: 724. 1928 (type from San Antonio de las Flores, Rojas 362). nance; Chi (Quecchi); Tapal (Cachiquel, Poconchi).

Where to find *Byrsonima crassifolia* in the Yaxha Nakum Naranjo Park

28 mar 2019	Sabana inundable de Nakum	*Byrsonima crassifolia* (L.) Kunth.
4 may 2019	Sabana inundable de Nakum	*Byrsonima crassifolia* (L.) Kunth.
5 may 2019	Sabana inundable de Nakum	*Byrsonima crassifolia* (L.) Kunth.

We had to check for the mixed adjacent ecosystems a hundred or so meters west of "Naranjo" ruins. We believe that nance trees are there. This area, at the west of the ruins, has jimbal area (no nance there); then cibal (nothing would surprise me here); then savanna-like (with *Crescentia cujete* and palmetto palm (tasiste). This is where we expect to find the nance trees, near the "Naranjo" ruins. I also expect that nance trees could be found in the savanna of three (3) fern species, especially in the rectangular area, adjacent to the boggy oval area.

Since sectors are swampy, it takes time to figure out where you will sink less than a meter. This makes the hike last more than six hours round trip to the campsite. I The journey also took more than those estimated six hours as we dedicated time to photograph and document the photogenic plants along the path.

The nance outside the savanna was down by the shore of the lake. We photographed this on August 19, 2018. Ironically we list it as "nance agrio", which is not necessarily correct.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica. May, 5. 2019. Parque Nacional Yaxha Nakum y Naranjo. Camera: Nikon D5. Settings: 1/320; sec; f/13; ISO 1,000.

Colubrina arborescens, yellow green flowers nance relative.

FLAAR Photo Archive. Mar, 28. 2019.
Camera: Canon 1D X Mark II. Settings: 1/400; sec; f/10; ISO 320.

In which ecosystems can Nance be found?

You can find nance around houses (In a typical Mayan kitchen garden), or you can find nance where there was a Mayan kitchen garden in past decades (But the house is no longer standing). These trees are introduced; (not wild).

However, in the wild you get nance primarily in seasonally inundated savannas. But I would not be surprised if nance were also present in hillside and hilltop forests. Whether nance also occurs in "bajo" ecosystems, it needs to be documented for PNYNN.

Uses of *Byrsonima Crassifolia:* Potential to make fiber

The bark can be used to make a strong fiber (Morton 1987). However, there are so many other sources of fiber that this aspect is not often discussed.

Potential as a Tannin

"The bark is a main material for tanning skins"

(Standley and Steyermark 1946: 479).

The Classic Maya would have tanned deer, jaguar, puma, margay, ocelot, jaguarundi and other animal hides. You can see scenes with Mayan hunters, wearing deer hides, and Mayan kings wearing jaguar hides or sitting on thrones with a jaguar hide.

Photo by: Sofía Monzón, FLAAR Mesoamerica.
Feb, 19. 2014. Camera: Canon 6D. Settings: 1/18; sec; f/16; ISO 800.

Photo by: Sofía Monzón,
FLAAR Mesoamerica. Feb, 19. 2014.
Camera: Canon 6D. Settings: 1/18; sec; f/16;
ISO 800.

Potential as a colorant

To people studying dye colorants in Mesoamerica, *Byrsonima crassifolia* is a known source of colorant:

"The rind gives a light-brown dye much, used in Guatemala for cotton textiles"

(Standley and Steyermark 1946: 479).

Nance branches provide chemicals that can help you catch fish

It is a lot easier to catch fish by having them turn belly-up on the surface (than using a hook and bait or using a fishing net). Because of that, in different countries the local people have found chemicals in the nance leaves, branches or/and flowers, which can immobilize the fish. Keep in mind that each part of a plant has different chemicals. Acording to Morton, 1978 "Fresh branches are cut into small pieces and thrown into streams to stupefy fish; or they are crushed at the edge of shallow waters so that the juice spills into the water, for the same effect."

(www.sabelotodo.org/agricultura/frutales/
but this is pretty much a word-forword copy of https://hort.purdue.edu/newcrop/morton/nance

Medicinal use

There are an estimated 500 to 600 local plants in the Mayan areas that have been used as medicine. Nance produces many chemicals with a variety of properties (Known as "Secondary Metabolites") in different parts of the plant, which is why the plant has been used as a medicine in Mayan villages.

Nutritional value of *Byrsonima crassifolia*

The nance has an edible fruit that possesses favorable nutritional values for humans, which is why it is a commonly consumed food among the local people. Next, the following table presents the nutritional values of the nance fruit.

Nutritional value per 100 g (3.5 oz)	
Energy	306 KJ (73 Kcal)
Carbohydrates	16.97 g
Sugars	8.31 g
Dietary fiber	7.5 g
Fat	1.16 g
Protein	0.66 g
Vitamins	Quantity%DV
Vitamin A equiv.	1%
Lutein zeaxanthin	5 mg
Thiamine (B1)	1%
Riboflavin (B2)	2%
Niacin (B3)	2%
Pantothenic acid (B5)	4%
Vitamin B6	2%
Folate (B9)	2%
Vitamin C	111%
Vitamin E	8%
Magnesium	6%
Manganese	12%
Phosphorus	1%
Potassium	5%
Sodium	0%
Zinc	1%
Nutritional value per 100 g (3.5 oz)	
Energy	306 KJ (73 Kcal)
USDA, U.S. Department of Agriculture	

Nance definitely has potential to be reintroduced today

With all these useful attributes we should all do more to rescue nance. A botanist in Mexico says very clearly: "Both the cultivation and processing of the fruit contribute significant economic income to the local population" (Aviles 2015: 157).

Nance is featured in the mythical tales of the Popol Vuh

So far all major translations of the Popol Vuh into English say that the composite bird deity "Seven Macaw," alights in a nance tree: This is the great tree of Seven Macaw, which has as its fruit the nance, being the main source of food for Seven Macaw. In order to eat the fruit of the nance, he goes up the tree every day. Since Hunahpu and Xbalanque have seen where he feeds, they are now hiding beneath the tree of Seven Macaw; and when Seven Macaw arrived, perching over his meal, the nance, it was then that he was shot by Hunahpu. (Tedlock translation; online, page 44-45). The essentially same text is in Christenson's translation (these are the best two versions in English)

If you look at scenes of this bird in Classic Maya art, the tree is usually a calabash tree, not a nance tree. Where you may get nance is on the sides of the sarcophagus of Pacal's burial chamber in Palenque, Chiapas, Mexico. However you need to check the Izapa stelae (Chiapas), San Bartolo murals, and all the scenes with the Principal Bird Deity to check whether occasionally this bird is on a nance tree or a calabash tree. The bird itself is usually a snake-eating hawk (not a macaw). The macaw features are mainly at Copan, where the macaw was a logo of the rulers.

Nance makes an attractive Cerco Vivo (Living Fence)

There are dozens of trees used in Guatemala to make living fences, and nance is one of these. The benefit of having living fences is that they can play an ecological role in the environment. In the case of the nance trees, they provide flowers for bees, wasps and lots of pollinators.These living fences also provide fruits which are a source of food for many animals like birds. Furthermore, another advantage is that making these fences doesn't involve cutting hundreds of trees, which makes it sustainable and eco-friendly when these fences are made for private properties.

PART II:
Byrsonima bucidifolia

The group of plants to which *Byrsonima bucidifolia* belongs is the plant family "Malpighiaceae". This family also includes *Byrsonima crassifolia* or the plants known as "Barbados Cherry".

Its full botanical and scientific name is *Byrsonima bucidifolia* Standl.. At the time in 1946, Standley and Steyermark spell it "*Byrsonima bucidaefolia*". The local names for *Byrsonima bucidifolia* Local names in the Yucatan peninsula in spanish include "Grosella", "Nance agrío", "Nance blanco", "Nance de monte" ; on the other hand, in maya the plant is known as "Chi', sak paj.

Reference of information: https://www.cicy.mx/sitios/flora%20digital/

Synonyms for *Byrsonima bucidifolia*

According to the official Plant List.org, there are no synonyms for this botanical name. However,there are two ways to spell the species name, these being "bucidifolia" or/and "bucidaefolia". At the moment, we have not yet found a botanical article which discusses these differences in the spelling of the names of these plants.

Reference source: www.ThePlantList.org

Nance dulce vs. Nance agrio

The plant *Byrsonima crassifolia* is considered by botanists to be "nance dulce" (Trabanino 2010:477). On the other hand, the species *Byrsonima bucidifolia* is stated by Trabanino,2010 to be "nance agrío". It's important to mention that even though *Byrsonima crassifolia* is known as the "nance dulce" (sweet nance), its fruit without added sugar is definitely not "sweet", referring that this "sweetness" is more of an acquired taste than the actual flavor of the fruit of *B. crassifolia*. However, evidently it is less tart than *Byrsonima bucidifolia*.

Photo by: Vivian Hurtado, FLAAR Mesoamerica.
Feb, 6. 2022. Biotopo Protegido San Miguel La Palotada, El Zotz, Petén, Guatemala.
Camera: iPhone 13 Pro Max.

FLAAR Photo Archive. Jun, 6. 2014
Camera: Nikon D800. Settings: 1/13; sec; f/13; ISO 400.

Comparison of where each kind of Nance is found

Byrsonima crassifolia is best known for being in savannas in house gardens (Remaining when the house is no longer present and forest has regrown around it; in other words, can be found far from any savanna). On the other hand, *Byrsonima bucidifolia* is best known for being in bajos (Trabanino 2010: 477).

Standley and Steyermark do not give any information whatsoever on in what ecosystems this tree grows. This is the unfortunate result of a botanist writing a book based on herbarium specimens. If Standley and Steyermark had hiked through Alta Verapaz, Baja Verapaz and the hundreds of other ecosystems in biodiverse Guatemala, their book would have been even better. But even though a tad incomplete and weak for Peten in general and for *Byrsonima bucidifolia* in particular, their work is a landmark and is absolutely essential (especially because it is all on-line in digital format).

Botanical descriptions Of *Byrsonima bucidifolia*

The botanical description by Parker (2008: 489), is of course taken from Standley and Steyermark: Nothing new is added whatsoever. So work by Trabanino and others in recent years is essential. But, since Standley and Steyermark knew how to describe the leaves and other parts, they are the source of my English language botanical description: *Byrsonima bucidaefolia* Standl. Field Mus. Bot. 8: 16. 1930. Northern British Honduras, and probably occurring in Peten; Yucatan.

A small tree, the branchlets densely sericeous at first, soon glabrate; petioles mostly 6 mm. long or less; leaf blades obovate or cuneate-obovate, 5-8 cm. long, 2.5-3.5 cm. wide, broadly rounded at the apex and often emarginate, cuneate or broadly cuneate at the base, thin, green above and glabrous or with a few lax deciduous hairs, paler beneath, laxly whitish-tomentose, the margins often revolute; racemes pedunculate, equaling the leaves, many-flowered, ferruginous-tomentose, the pedicels 4-8 mm. long; sepals 3-3.5 mm. long, ovate, obtuse, the glands half as long as the sepals; limb of the petals 5 mm. wide, coarsely dentate; fruit globose, yellow, 8-12 mm. in diameter, glabrous.

Called "craboo" in British Honduras; "nance" "agria" (Yucatan); "zacpah" (Yucatan, Maya). The edible fruit is said to be sold in the markets of British Honduras. (Standley and Steyermark 1946: 477).

Where to find *Byrsonima bucidifolia* in Mexico?

Byrsonima bucidifolia can be found in Campeche, Quintana Roo and Yucatan (www.cicy.mx). I also estimate that *Byrsonima bucidifolia* can be found in Chiapas and other parts of Mexico. In Campeche, Quintana Roo and Yucatan, *Byrsonima bucidifolia* is found in many different kinds of habitats: SBC, SBI, SAP, SMSC, and SMSP.

Habitats code:

SBC = Selva Baja Caducifolia
SBI = Selva Baja Inundable, ak'alche'
SAP = Selva Alta Perennifolia
SMSC = Selva Mediana Subcaducifolia
SMSP = Selva Mediana Subperennifolia

Reference source: www.cicy.mx/sitios/flora%20

This species of nance is definitely not focused on seasonally inundated savannas. To my perspective, a SBI (Selva Baja Inundable; ak'alche') is more a "tintal", a "bajo" (a forest or type of vegetation characterized by having mainly low-height trees) rather than a savanna. Most savannas in Parque Nacional Yaxha Nakum Naranjo have a bajo at one end or sometimes on several sides. The Savanna East of Nakum merges into bajo vegetation at its west and southwest sides. In Parque Nacional Yaxha Nakum Naranjo, a savannas with three species of fern and bajo vegetation on several sides have been documented. The savanna parallel to Naranjo ruins has a cibal and then jimbal at its north and northeast; then merges into a bajo at its southern end.

Photo by: Erick Flores, FLAAR Mesoamerica. Mar, 5. 2016.
Camera: Canon 6D. Settings: 1/16; sec; f/100; ISO 640.

Synonyms of *Malpighia glabra*

Malpighia glabra L. is the accepted name for this plant.

The synonyms are:

- *Bunchosia parvifolia* S.Watson
- *Malpighia biflora* Poir.
- *Malpighia dicipiens* Sessé & Moc.
- *Malpighia fallax* Salisb.
- *Malpighia glabra* var. *acuminata* A. Juss.
- *Malpighia glabra* var. *antillana* Urb. & Nied.
- *Malpighia glabra* var. *guatemalensis* Nied.
- *Malpighia glabra* var. *lancifolia* Nied.
- *Malpighia glabra* var. *typica* Nied.
- *Malpighia glabra* var. *undulata* (A. Juss.) Nied.
- *Malpighia lucida Pav. ex* A. Juss.
- *Malpighia lucida Pav. ex* Moric.
- *Malpighia myrtoides Moritz ex* Nied.
- *Malpighia neumanniana* A. Juss.
- *Malpighia nitida* Mill.
- *Malpighia oxycocca* var. *biflora* (Poir.) Nied.
- *Malpighia peruviana* Moric.
- *Malpighia punicifolia* L.
- *Malpighia semeruco* A.Juss.
- *Malpighia undulata* A. Juss.
- *Malpighia uniflora* Tussac
- *Malpighia virgata* Pav.

FLAAR Photo Archive. Nov, 18. 2013
Camera: Canon 1D X Mark II.
Settings: 1/80; sec; f/14; ISO 640.

M. glabra is known with a variety of names, called "Wild craboo" in British Honduras, Maya name "Cipche" alsoreported; "Chi," "Canibinche," "Boxuayabte" (Yucatan, Maya); "Camaroncito" (Salvador); "Escobillo" (Tabasco).

The shrub is most common on the plains of the Pacific coast, where it often is abundant in the thickets and forest. In the same region it is also planted in house gardens, but in other parts of Guatemala it is uncommon in cultivation. The cherry-like fruit is juicy and acidic, with scant flesh. The fruit is sometimes used in preparation of sweets (dulces) or alcoholic beverages.

The plant has other uses, being medicine one of the standout ones. In Yucatan a decoction of the bark is a domestic remedy for diarrhea. Also the bark, formerly at least, was employed there for tanning skins. (Standley and Steyermark 1946: 488-489).

Malpighia punicifolia L. Sp. Pl. ed. 2. 609. 1762. Pimientillo; Tocob (Peten, Maya).

M. punicifolia distribution includes Guatemala: Peten (fide Lundell), Zacapa, Chiquimula, El Progreso; Southern Mexico; British Honduras and West Indies. These plants are primarily found in dry or moist thickets, at 600 m.a.s.l or less.

The description for *M. glabra* indicates that is a shrub or small tree, the young branchlets densely whitish-sericeous; leaves on petioles 2-4 mm. long, membranaceous to subcoriaceous, elliptic-oblong or obovate-oblong, often obovate, 2-7 cm. long, 1-3 cm. wide, very obtuse or rounded at the apex, narrowed to the obtuse or subacute base, sericeous when young but in age glabrous or nearly so; umbels with 6 or fewer flowers, sessile or nearly so, the pedicels 6-15 mm. long; flowers pink or lilac, said to be sometimes white, 12 mm. Broad; sepals ovate, the glands 2 mm. long; petals, at least in part, fimbriate; drupes red, broadly ovoid or subglobose, 1-1.5 cm. long, the nutlets 3-cristate.

Maya names of Yucatan are recorded as "uzte" and "xbec-che"; "manzanillo" (Campeche). The fruits are eaten, especially by children, wherever the shrub grows. The acicular hairs are stiff and penetrate the skin easily, causing intense and prolonged itching and irritation (Standley and Steyermark 1946: 489).

Malpighia Lundellii Morton, Carnegie Inst. Wash. Publ. 461: 138. 1936.

In thickets or forest on limestone, little above sea level; Peten. Type from Betsy Croft, Belize River, British Honduras, Lundell 4083; collected alsoin Tabasco.

A tree of 6-9 meters, the trunk 12-15 cm. in diameter, the young branchlets densely yellowish-sericeous; leaves almost sessile, oval or oblong, 9 cm. long and 3.5 cm. wide or smaller, very obtuse to rounded or retuse at the apex, obtuse at the base, chartaceous, in age glabrous above, densely silvery-sericeous beneath; flowers umbellate, reddish, the umbels on peduncles 2 cm. long or longer, the pedicels 9 mm. long or less; sepals ovate-lanceolate, 3.5 mm. long, the glands oblong, 2.5 mm. long; petals 10 mm. long, erose-lacerate. Sometimes called "hicatee plum" in British Honduras (Standley and Steyermark 1946: 489).

This shrub or tree is definitely needed to be searched for in Parque Nacional Yaxha Nakum Naranjo, to learn whether or not it is present; and if it is present, in which ecosystems can be found and how this plants are associated with other plant species. Five species of *Malpighia* are documented for Tikal; so surely lots of species can be found in PNYNN.

PART III: *Clethra lanata*

Another tree called Nance (but not yet documented for PNYNN)

Clethra lanata M.Martens & Galeotti is the full botanical name; family Clethraceae. Tree is called nance macho in Costa Rica and Panama also. Called zapotillo in Guatemala (OFI-CATI).

Mary W. Farmer flickr.com photo shows an inflorescence which she identifies as *Clethra lanata*. No information on where this plant was photographed.

www.flickr.com/photos/ntsavanna/2328907221.

But on another of her pages she says the photos were taken in Panama. And turns out there are nine photos. https://m.flickr.com/photos/ntsavanna/albums/72157604102374132

Indeed, although present in Oaxaca, Mexico, this tree is best documented (so far) in Panama. Here common names are nancito, nancillo, nance macho, mameicillo

(http://ctfs.si.edu/webatlas/findinfo.phh).

This web page is very helpful by warning botanists that the leaf of Clethra lanata can easily be confused with the leaf of "true nance (*Byrsonima crassifolia*):"

Similar species: Due to the similarity of the leaves, it can be confused with *Byrsonima crassifolia*, but in *B. crassifolia* the leaves are opposite, the flowers are yellow, and the fruits are drupes.

Clethra sp is mentioned for theLacandon area of Chiapas, Mexico, by Suzanne Cook (2016: 175; photo on page 176). The word nance is not listed. No species is provided.

Curiously not one single Clethra species is in the index of Lundell for Peten (1937). This genus is missing from plant specimens collected at Tikal over the years (the list of over 9,000 specimens tabulated by the Neotropical Flora web site).

But if you have time to search endlessly you find that Clethra skutchii standl. & Steyerm. Is found in several locations in Guatemala (albeit not Tikal or Yaxha).

Photo by: Vivian Hurtado, FLAAR Mesoamerica. Feb, 6. 2022. Biotopo Protegido San Miguel La Palotada, El Zotz, Petén, Guatemala. Camera: iPhone 13 Pro Max.

Botanical information on *Clethra lanata* is rather scant

OFI-CATIE , Árboles de Centroamérica, provides not much information on Clethra occidentalis (L.) O. Kuntze (pp. 465-466).

Although *Clethra* species is named nance in lower Central America, until we find this in Parque Nacional Yaxha Nakum Naranjo, I doubt it is present, especially since it is absent from Tikal tree list and from Cyrus Lundell for plants of Peten. Will have to check all the trees of Tabasco, Campeche, Quintana Roo, and Belize. From experience I have learned that if a tree is in the Lacandon area of Chiapas or the Calakmul area of Campeche that this same species is probably also in nearby Peten.

Clethra mexicana and *Clethra occidentalis* are both listed for Belize (but no info on what location or ecosystem): Balick, Nee and Atha 2000: 77). But if you spend another hour you find: *Clethra occidentalis* which is recorded from the savannas and pine forestof Mountain Pine Ridge, but is apparently absent from the RBCMA.

Clethra mexicana and *Leucothoe mexicana* are also recorded as trees from the Mountain Pine Ridge savannas, with *C. mexicana* associated with savanna gallery forest transition boundaries (Bridgewater, et al. 2002: 13) You also find that this tree is in moist and humid river valley ecosystems (Penn, Sutton and Monro 2004: 35). Clethra skutchii is listed for Alta Verapaz, Baja Verapaz, Peten, associated with pine oak forests (but no info on which departamento) (Quezada et al. 2016: 65).

First step is to find if any *Clethra* species is in the pine-oak area 3 km east of the northeast corner of Parque Nacional Tikal. Then see if *Clethra sp* is in any of the pine savannas around Poptun or La Libertad, Peten. But in the meantime, we have plenty of other nance trees and bushes to search for around Naranjo and Yaxha; since most of the *Byrsonima crassifolia* nance found so far was in the seasonally inundated Savanna East of Nakum.

Next steps to document everything about "Nance" in Peten

Clethra species are not anywhere in Lundell 1937 and thus not in Lundell 1938. But I would definitely have Clethra on my "lets look for and try to find" list. *Malpighia glabra* L. Chi and *Malpighia punicifolia* L. Tocob are in Lundell 1938 list of "species of less importance have fruits with edible pulp." So we can now add these two species to the Classic Maya diet. Plus nance dulce (*Byrsonima crassifolia*) and nance agrio (*Byrsonima bucidifolia*): so there are a total of four "nance fruits" available to the Classic Maya.

The fact that *Byrsonima crassifolia* survives annual savanna fires, and that nance can also grow in other ecosystems, is one more reason to add *Byrsonima crassifolia* and its relatives to Classic Maya diet the way Dennis Puleston added the ramon plant. He noticed ramon around house mounds. On the other hand, we notice *Byrsonima crassifolia* in savannas. There were so many Classic Maya people that in addition to their kitchen gardens they also needed to harvest edible food and usable materials from the savannas and bajos around their hilltop living areas.

So, whereas Puleston looked for trees in the forests, we are looking for edible and usable plants in the savannas, since savannas have been studied in the Peten heartland less than hilltop forests and bajo ecosystems.

Parque Nacional Yaxha Nakum Naranjo has a savanna of several kilometers in length east of Nakum (documented by the FLAAR Mesoamerica project courtesy of assistance by IDAEH and CONAP park administrators and park rangers who made it possible for us to get to this remote savanna). We found nance, tasiste, and jicara in this savanna (plus more other species of edible plants than we expected). We have also found *Crescentia cujete* (Calabash trees) and *Acoelorrhaphe wrightii* (tasiste palm) in the savanna sector of the bajo-to-cibal transition a few hundred meters west of the west side of Naranjo ruins. *Byrsonima crassifolia* is surely there also. I estimate that savanna indicators can also be found in the Savanna of 3 Fern species west of the west end of Lake Yaxha.

So these three trees are useful as the defining species of a savanna in PNYNN:

- *Acoelorrhaphe wrightii,* "tasiste" palm, palmetto palm
- *Byrsonima crassifolia*, "nance"
- *Crescentia cujete,* "calabash trees", "jícara"

These are the ABC's to define a savanna that has no pine or oak trees. We are also studying tasistal ecosystems; these are savannas where there are so many tasiste palm trees that it is literally a tasiste jungle: you can barely walk into these savannas because there are so many clumps of tasiste trees. You can find *Crescentia cujete* trees scattered around these. We estimate that nance trees will also be present (tasiste are easy to notice; jicara trees are easy to notice: nance are not as distinctive so you really have to focus before you can document one (if there is no yellow fruit or their easyto-recognize orange-yellow flowers). So far there are no tasistal ecosystems yet found in PNYNN; but we found one that is several kilometers long elsewhere in Peten (no pine and no oak).

We still need to accomplish field research to learn whether *Curatella americana*, chaparro, is present in Petén savannas of Tikal and Yaxha; chaparro is present in many or possibly most Belize savannas. Chaparro has leaves used for sandpaper still today (in Rabinal, to polish the jicara and morro calabash gourds to make handicrafts for tourists). The Rabinal Achi Mayan people harvest chaparro leaves from a remarkable hillside savanna (which also has lots of stunted nance trees). We need to return to see whether pine, oak, and calabash trees are also present in this savanna with steep hills, steep ravines, and almost no "flat savanna" area.

In conclusion: the savannas of Parque Nacional Yaxha Nakum Naranjo are different than most of the savannas in Belize. The savannas of PNYNN are also different from most of the savannas around Poptun and La Libertad, Peten (notice the word "most" because in wetter areas in central Peten the savannas have no pine or oak). But irrespective of whether a savanna has pine or oak, most have nance (and almost all have *Crescentia cujete*, jicara). And every seasonally inundated savanna in these areas has tasiste palm trees. Since there is a prolonged dry season in Peten, many areas turn bone dry for months. Since there is a several-month rainy season in Peten (most years, but not every year), most flat areas have a bit of standing water on them for several weeks. Sometimes almost a meter deep (suggestions by park rangers).

The Peten area of Guatemala is a great place to study flora, fauna, and ecology. If you are interested in biodiversity, Parque Nacional Yaxha Nakum Naranjo is a nice place to do research. The park administrators recognize that flora and fauna are important to protect as it is also essential to protect the pyramids, temples, palaces, acropolises, ballcourts, causeways, and house mounds. We highly recommend PNYNN as a place for research and as a place to visit

FLAAR Photo Archive. Nov, 18. 2013.
Camera: Canon 1D X Mark II. Settings: 1/80; sec; f/14; ISO 640.

Bibliography

BROWN, M. K. and **T. W. STANDON**
2003 Ancient Mesoamerican Warfare. AltaMira Press, 384 pages.

CASTAÑEDA, C.
2006 Estudios botanicos en Cuenca Mirador: Estudio y desarrollo de vegetacion y susignificado cultural. Informe Projecto Qrqueologico cuenta Mirador Temporada 2006. Mexico.

CHRISTENSON, A.J.
2007 Popol Vuh: The sacred book of the Maya. University of Oklahoma Press. 328 pages.
CONANP2016 Estudio Previo Justificativo para la declaratoria de la Reserva de la Biosfera Caribe Mexicano, Quintana Roo. Comisión Nacional de Áreas Naturales Protegidas. 305 pages.

CONANP
2016 Estudio Previo Justificativo para la declaratoria de la Reserva de la Biosfera Caribe Mexicano, Quintana Roo. Comisión Nacional de Áreas Naturales Protegidas. 305 pages

FEDDEMA, V.L.
1993 Early Formative Subsistence and Agriculture in Southeastern Mesoamerica. MA. Thesis, University of British Columbia, Dept of Anthropology and Sociology.

FLORES J. S. and **I. ESPEJEL**
199 Tipos de Vegetación de la Península de Yucatán. Etnoflora yucatanense, Fasc. 3. Ed. Universidad Autónoma de Yucatán. 135 pages.

HOGAN, C.
2012 (Michael and World Wildlife Fund). Belizean pine forests. ed. M. McGinley. Encyclopedia of Earth. Washington DC.

JANICK, J. and **R.E. PAULI**
2008 The Encyclopedia of Fruits and Nuts. CABI. 800 pages.

KAUFMAN, T. and **J. JUSTESON**
2003 A Preliminary Mayan Etymological Dictionary. On-line. Over 1500 pages.

KRICHER, J.
1997 A Neotropical Companion: An Introduction to the Animals, Plants, and Ecosystems of the New World Tropics (2nd ed - 1999), Princeton University Press, 451 pp.

LUNDELL, C.L.
1937 The Vegetation of Peten. Carnegie Institution of Washington. Publication No. 478. 244 pages.

LUNDELL, C. 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; vol. 24, pp: 37-56. University of Michigan, Ann Arbor.

MacVEAN, L.
2003 Plantas utiles de Peten, Guatemala. Herbario UVAL, Instituto de Investigaciones Universidad del Valle de Guatemala.

MARTINEZ M.A.
1978 Don Martin Chiapas: Inferencias economico-sociales. Tesis de Licenciatura en Arqueologia, ENAH, Mexico.

MARTINEZ, E. and **C. GALINDO**
2007 La Vegetación de Calakmul, Campeche, México: clasificación, descripción y distribución. Bol. Soc. Bot. México 71:7-32.

MEDINA, R., SALAZAR, S., and **J.R., GOMEZ**
2004 Fruit Quality Indices in eight Nance [(*Brysonima crassifolia* (L.) H.B.K.] Selections. HortSciece, vol. 39, no. 5, pp, 1070-1073. American Society for Horticultural Science.

MORTON, J.F.
1987 Fruits of warm climates. Julia F. Morton, Miami, FL.
Download: https://hort.purdue.edu/newcrop/morton/nance.html

OFICATI
2003 Árboles de Centroamérica: un Manual para Extensionistas (Trees of Central America: a Manual for Extentionists). Cordero, J. and Boshier, D. H. (eds). OFI (Oxford Forestry Institute) and CATIE (Centro Agronómico Tropical de Investigación y Enseñanza).

ORELLANA P.A. DIONEL
2014 Catálogo de frutales nativos de Guatemala. ICTA, Guatemala. 87 pages.

PENN, M. G., D.A. SUTTON and **A.MONRO**
2004 Vegetation of the Greater Maya Mountains, Belize. Systematics and Biodiversity 2 (1): 21–44.

PENNINGTON, T. D. and **J. SARUKHAN**
2005 Árboles tropicales de México. Manual para la identificación de las principales especies. 3rd edition. UNAM, Fondo de Cultura Económica. 523 pages.

QUEZADA,M. L.,L. RODAS and **MARROQUIN A.A.**
2016 Diversidad de encinos en Guatemala; una alternativa para bosques energéticos, seguridad alimentaria y mitigación al cambio climático. Fase I. Las Verapaces y Petén. Universidad de San Carlos de Guatemala. 143 pages.

REYGADAS, F.
2006 DIAGNÓSTICO AMBIENTAL Y FORESTAL DEL ESTADO DE QUINTANA ROO. Inifap, CONAFOR. 182 pages.

SABIDO, R.A
2004 ANÁLISIS ESPACIO-TEMPORAL DE LA EXPLOTACIÓN FORESTAL EN LA PENÍNSULA DE YUCATÁN. Lic. Thesis, UNAM, Mexico.

Download: http://132.248.9.34/pd2005/0601792/0601792.pdf

The download ends on p. 96 and lacks the rest of the thesis; so lacks the bibliography.

SEA Belize (Southern Environmental Association)
2015 Placencia Lagoon Management Plan, Management Plan 2015-2020. SEA Belize, Wildtracks, Belize.

SMITH, C.
1977 Ethnobotany in the Puuc, Yucatan. Economic Botany 31:93-110.

SOBRINO M.
2012 El dulce sabor del nance: préstamos lingüísticos del cholano al Yucatecano. V. Coloquio Leonardo Manrique (2012) Instituto Nacional de Antropología e Historia. Mexico.

STANDLEY, P.C. and **S.J. RECORD**
1936 The Forests and Flora of British Honduras. Publication 350, Botanical series Volume XII, Field Museum of Natural History.

STANDLEY, P. and **J. STEYERMARK**
1946 Flora of Guatemala. Fieldiana: Botany Volume 24, Part V. Chicago Natural History Museum.

TRABANINO, F.
2010 Evidencias paleoetnobotánicas del uso del nance *Byrsonima crassifolia* (L.) Kunth (*Malpighiaceae*) en la reserva de la Biosfera Maya, México. SISTEMAS BIOCOGNITIVOS TRADICIONALES Paradigmas en la conservación biológica y el fortalecimiento cultural, pages 476-480. Asociación Etnobiológica Méxicana, A. C.

VILLAR, A.L.
2005 Guatemala Arboles mágicos y notables. Artemis Edinter Editores, Guatemala.

WILLIAMS, L. O.
1981 The useful Plants of Central America. Ceiba 24 (1-2): 1-390.

Suggested Additional Reading

AGUIRRE, R. and **E. DE PÖLL**
2007 Trees in the Life of the Maya World. BRIT Press, Botanical Research Institute ofTexas.

AVILES, G.C.
2015 Rico y popular: Importancia y usos tradicionales del nance (*Byrsonima crassifolia* (L.) Kunth). Herbario CICY 7: 157–160 (15/Octubre/2015). Centro de Investigación Científica de Yucatán, A.C.

Nice summary of multiple uses noted by earlier botanists and ecologists. However does not mention use as leaf to wrap tobacco cigars, probably because not many people make their own cigars any more. Has only one terrible photo of a nance tree (p. 65). This photo is a good example of a snapshot that should not have been enlarged to attempt to decorate a page in a coffee-table book. This image was probably not good at a smaller size either.

BREEDLOVE, D. E. and **R. M. LAUGHLIN**
1993 Page 151. Mentions nance is used to treat tooth pain.

BRIDGEWATER, S., IBÁÑEZ, A., RATTER, J. and **P. FURLEY**
2002 Vegetation Classification and Floristics of the Savannas and associated Wetlands of the Rio Bravo Conservation and Management Area, Belize. Edinburgh Journal of Botany 59(3): 421-442. November 2002.

The pagination in the download is different since the pagination is before it was published by the journal.

COOK, S.
2016 The Forest of the Lacandon Maya, an Ethnobotanical Guide. Springer. 334 pages. Discusses nance on her pages 132 and 172-173. Her information is helpful but she correctly points out that if someone hands you the fruit it is not realistic to identify it as to which of the two "nance" trees it is from. So without the flower, from the fruit or leaf alone, that does not guarantee identification. We need to study nance in all savannas of Parque Nacional Yaxha Nakum Naranjo to figure out whether only B. is present; and we need to find how many other kinds of nance are present (and hence potentially which other species, or potentially other genera grow in the park and are also named nance (or nanche).Che or te means tree in most Mayan languages.

FLORESCANO, E.

2002 (Translated by Lysa HOCHROTH). The Myth of Quetzalcoatl, JHU Press. 312 pages. Suggests the tree on Izapa Stela is a nance tree. But unfortunately the fruits on this Izapa tree are of the size, shape, and location that would be typical of a morro or jicara tree, and not a nance at all. The misidentification as a nance tree is because the Popol Vuh has always been translated as the bird deity being on a nance tree. But most of the trees on which the bird is pictured as perched are really Crescentia trees, calabash trees.

STANZIONE, V. J. ,P., HARBAUGH, P. and **A. BAUER**

2003 Rituals of Sacrifice: walking the Face of the Earth on the sacred Path of the Sun. University of New Mexico Press. 360 pages Page 190 discusses the nance tree. This book is on the Tz'utujil Maya people of Santiago Atitlán. Hardcover and softcover dates are list as different by Amazon, so "p 190" may be another page in the other edition. Frankly very confusing listings for this book.

SHARER, R.obert J. and **D.avid W. SEDAT**

1987 Archaeological investigations in the northern Maya Highlands, Guatemala. University of Pennsylvania Press. 487 pages. Mentions nance tree with no further comment on page 19. This book covers archaeological research in the Salama Valley.

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/

http://legacy.tropicos.org/NameSearch.aspx?pro
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?cate
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/imagedatab-
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

- **BACK COVER PHOTOGRAPH**

  Photo by: Erick Flores, FLAAR Mesoamerica.
  Apr. 18, 2018. Hotel El Sombrero, Yaxha, Petén.
  Camera: Canon 1D X Mark II.
  Settings: 1/125; sec; f/5; ISO 500.

ACKNOWLEDGEMENTS TO FLAAR MESOAMÉRICA

Flor de María Setina is in charge of the financial administration of the institution and supports the supervision of daily activities.

Jorge Luis Arana supports the financial administration of the institution and operative activities.

Vivian Hurtado is the current project manager of the FLAAR divisions: Flora & Fauna and MayanToons. She is also an environmental engineer and a passionate researcher.

Victor Mendoza environmental engineer in charge of the photographic database and its taxonomic identification. He also helps with the coordination of research activities.

Sergio Jerez agronomy engineering student involved in the identification of plants and support in research topics.

Flor Morales is a biologist that collects information and bibliographic references to feed our electronic library of flora and fauna and support research for reports and websites.

Mariana Rivas is a biologist that edits the information of our flora and fauna reports. She also helps in other research activities.

Myrna Galindo is a biologist who manages all our social media and digital community to transfer information on biodiversity and the topics that FLAAR is interested in.

Byron Pacay is our assistant during field trips to handle GPS data. He also assists in the main office with different tasks.

Norma Cho is a helpful photography assistant during field trips. She also assists in the main office with different tasks.

Edwin Solares is a photographer and videographer during our expeditions. Later, he edits this content to be used in our different materials.

Haniel López is a drone pilot and photographer during our expeditions.

Pedro Pablo Ranero with a degree in communication is responsible for editing videos of flora and fauna to create content on our sites.

Andrea Sánchez graphic designer who helps prepare the graphic line of our publications. She is our editorial art director.

Jaqueline González graphic designer who combines text layout and photo editing to create our reports.

Heidy Galindo graphic designer who combines text layout and photo editing to create our reports.

David Arrivillaga is an experienced photographer and graphic designer. Sometimes he is a photographer during our expeditions, but he also designs our flora and fauna reports.

María Alejandra Gutiérrez is an experienced photographer who is now in charge of the preparation of photographic catalogs. She was also coordinator of the field trips for the research project in Livingston, Izabal.

Paulo Núñez is an engineer and our webmaster. He is the person in charge of the maintenance and programming of the entire network of FLAAR websites.

Juan Carlos Hernández is a graphic designer and part of the web team. Receive the material we produce to place on our sites.

María José García is a graphic designer and part of the web team. Receive the material we produce to place on our sites.

Andrés Fernández is a graphic designer and in charge of keeping our websites updated and more efficient for the user.

Karla Cho helps with general research and design assistant in the office.

Luis Molina is a professional illustrator specialized in line drawings of Maya vases, bowls, and plates.

Valeria Áviles is a graphic designer and illustrator. She is in charge of coordinating the activities of MayanToons, as well as making illustrations for the different materials that we prepare.

Laura Morales is a digital content engineer, She is in charge of directing the animation area of our MayanToons project.

Paula García is part of our MayanToons animation team. Her job is to bring our favorite characters to life.

Niza Franco is part of our MayanToons animation team. Her job is to bring our favorite characters to life.

Isabel Trejo is a graphic designer and illustrator for MayanToons and for social media posts.

Andrea Bracamonte is a graphic designer and illustrator for MayanToons and for social media posts.

Josefina Sequén is an illustrator for MayanToons.

Rosa Sequén is an illustrator for MayanToons.

Karan Arana assists in the planning and management of FLAAR USA and FLAAR Mesoamerica activities. She also provides English lessons to the Mayan-speaking team working with FLAAR Mesoamerica.

RESERVA DE LA BIÓSFERA MAYA - RBM -
DEPARTAMENTO DE PETÉN, GUATEMALA

FLAAR MESOAMÉRICA

Google Maps 2022; Asociación de Comunidades Forestales de Petén - ACOFOP - 2011; Wikimedia Commons 2019

Other publications on RBM Project

Arsenura armida
Download now

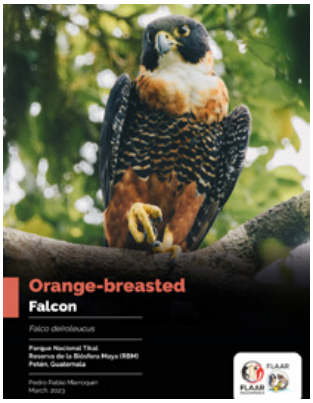
Spider Webs Photo Album}
Download now

Agalychnis callidryas/taylori,
Red-eyed treefrog
Download now

Fruits of *Gaussia maya* palms
Download now

Neotropical Flora and Fauna that you can see in 5 days in Peten
Download now

Strangler Figs, Topoxte Island
Download now



Orange-breasted, Falcon (*Falco deiroleucus*)
Download now

Nasua narica-Coatimundi
Download now

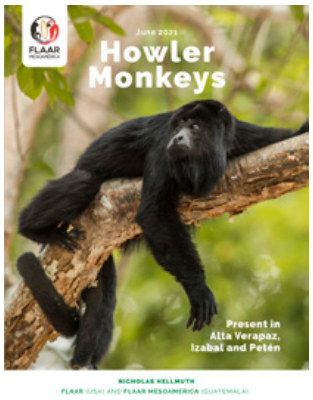
Wild Vanilla Orchid, Vanilla insignis
Download now

If you wish more FLAAR reports on RBM Project of Guatemala, visit our website:
https://flaar-mesoamerica.org/reserva-biosfera-maya-project/

Other publications of
the fauna of Guatemala

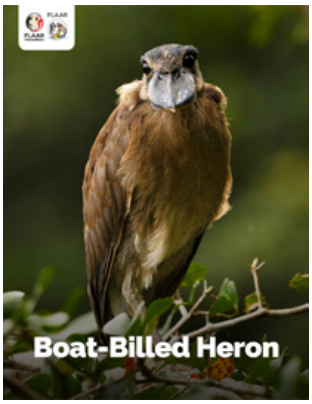
Protect Howler Monkeys
Download now

Mantled, Howler Monkeys
Download now



Howler Monkeys
Download now

Spider Diversity of Alta Verapaz
Download now



Boat-Billed Heron, *Cochlearius cochlearius*
Download now

Southern House Spiders – *Kukulcania hibernalis*
Download now

Honey Bees
Download now

Listado actualizado de los Mamíferos de Guatemala
Download now

If you wish more FLAAR reports on fauna of Guatemala, visit our website:
https://flaar-mesoamerica.org/product-category/ethnozoology/

Other publications of
the flora of Guatemala

Cacao Kuk,
Stenanona stenopetala
Download now

Pital Ecosystem
Download now

Tecomasuche, Cotton Tree.
Cochlospermum vitifolium
Download now

Bucutz, *Cassia grandis*
Download now

Pachira aquatica
Download now

Cephalanthus occidentalis
Download now

Acrostichum aureum
Download now

Cuajilote,
Pamentiera acuelata
Download now

Hoja de Piedra
Download now

If you wish more FLAAR reports on flora of Guatemala, visit our website:
https://flaar-mesoamerica.org/product-category/ethnobotany/


FLAAR
MESOAMÉRICA
FLAAR