



Multi-Colored Masses of large berry-sized Fruits of *Gaussia maya* Palms

Parque Nacional Tikal (PANAT)
Reserva de la Biosfera Maya (RBM)
Petén, Guatemala. Aug. 2022.

Nicholas Hellmuth



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Fruits of *Gaussia maya* close up.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Jul. 20, 2022.
Camera: iPhone 13 Pro Max, RAW format



Appreciation

INITIATION AND COORDINATION OF THE PROJECT OF COOPERATION FOR 2021-2025

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COMMUNICATIONS WITH PANAT DURING MID-2022

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DISCUSSION ON ASPECTS OF PANAT THAT CAN ASSIST THE TIKAL PARK ADMINISTRATORS

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ASSISTANCE FOR KNOWLEDGE OF PLANTS AND ANIMALS OF PANAT

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GUIDES AND EQUIPMENT PORTERS FROM EL REMATE AND UAXACTÚN

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Roberto García
Leonel Barillas Núñez

We appreciate a donation during November 2021 and a follow-up donation in June 2022 to help cover the costs of FLAAR research projects, specifically to assist and support the current FLAAR project of exploring remote areas to find and document flora and fauna in the Reserva de la Biosfera Maya (RBM), Petén, Guatemala.

This donation is from a family in Chicago in honor of the decades of botanical field work of botanist Dr John D. Dwyer, who worked in many areas of Mesoamerica, including Petén.

This donation is also in recognition of the urgency and need for conservation of both wildlife and rare plants in the bio-diverse ecosystems of the Reserva de la Biosfera Maya (RBM) of Guatemala. Parque Nacional Yaxha, Nakum and Naranjo (PNYNN) and Parque Nacional Laguna del Tigre are the first two parts of the over 5 million acres of the RBM where we have initiated field work in 2021 and 2022. In July 2022, we initiated field work in cooperation and coordination with the biologists of PANAT at Tikal to study epiphytic plants (orchids, bromeliads, cacti, ferns that grow high up in trees), plus other biology topics of mutual interest and importance to document. Photographs are donated to the park administrators. Contact sheets are being prepared to also donate to CONAP.

- **Front cover photograph:**
Gaussia maya, taken by Edwing Solares, FLAAR Mesoamerica. July 20, 2022.
- **Title page photograph:**
Nicholas Hellmuth, FLAAR Mesoamerica, Jul. 20, 2022.



Credits

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Introduction to *Gaussia maya* of Guatemala

Every different species of palm is important to learn about. Each species has its own characteristics of size, shape, leaves, inflorescences and color of maturing fruits. Corozo palm are notable because the trunks collect leaf litter that allow thousands of ferns and Aroids to grow on the trunk. All the spiny palms have their impressive (and painful) defense system of needle-like or lance-shaped spines. The roots-above-ground are also notable, especially for escobo broom palms but also others. However one of my favorite palms is *Gaussia maya*, perhaps because it is rarely found en masse. For tasiste palms we first found close to one-million (literally) while doing field work along the Arroyo Petexbatun, far upstream from Sayaxche. Then we found even more millions of tasiste palms in kilometer-long tasistal savannas of the far southeastern part of Parque Nacional Laguna de Tigre, PNLT.

In July 2020 we were invited to have a meeting with the ecologists of Parque Nacional Tikal (PANAT) to learn what aspects of flora, fauna and ecosystems our team of FLAAR Mesoamerica could assist with high-resolution photography. After the meeting we spent three days with the park biologists to explore different parts of the park to initiate photography of one of their goals: epiphytic plants (orchids, bromeliads, ferns, cacti that grow high up in the tree tops). We have telephoto lenses for high-resolution Nikon, Sony, and Canon cameras to document epiphytic plants.

While doing photography of epiphytic plants in the area of Mundo Perdido, I decided to hike another hundred meters and as I was getting ready to turn around and rejoin the

rest of the team my eyes caught the bright orange color of maturing fruits of a palm. I immediately recognized it was a *Gaussia maya* and that the colors were impressive. So I called for the team to bring the 3-meter high ladder so I would be able to photograph the mass of large berry-sized fruits. The present FLAAR Report is based on subsequent library research on *Gaussia maya* palms.

Obviously most visitors come to Tikal to see the temple-pyramids, palaces, and acropolises, plus the view of the rain forest from the top of the pyramids. But we learned at Yaxha that visitors also appreciate learning about the different species of plants. So we always recommend having a local licensed Peten guide with you, as they know the local vegetation. The present report is to provide documentation for the guides to show visitors on their cell phones.

Second, students often do their MS thesis or PhD dissertation on a single plant or plant family. So it helps students to learn where each tree or palm is situated so they can plan their field work in advance.

Third, we wish to document all palms at Tikal to show the biodiversity. We have a long way to go, and for *Gaussia maya* we need to find it when the inflorescences are flowering.

It is also worth noting that the first specimen of this palm found anywhere in the Americas appears to have been at Tikal (Cook 1923). So clearly it is worthwhile finding and photographing more of this palm in the Tikal park.

My Personal Experience with *Gaussia maya*

During our August 2018–July 2019 project of cooperation and coordination with the co-administrators of PNYNN I noticed a beautiful palm on a Naranjo pyramid that was fruiting in June 2019. Once I had the photographs I initiated library research and learned it was a *Gaussia maya* palm.

Once my botanical scanning eyes “memorized” the size and shape and position of the leaves of this palm, I was able to recognize it elsewhere.

We found it along the limestone cliff surrounding one of the lakeside cenotes of Lake Yaxha in August 10, 2021.

Usually *Gaussia maya* is widely scattered, so not en masse in one area. However in a recent year we did find one part of the Maya Lowlands where this palm was so common it was unexpected. We will publish that finding in future FLAAR Reports; for now we are focused on flora and fauna of PANAT.



Photo by: Edwin Solares, FLAAR Mesoamerica, Jul. 20, 2022.

Camera: Sony A1. with FE 90mm F2.8 Macro G OSS lens.



Photo # 1.

Gaussia maya palm with fruits. Found in Naranjo park (PNYNN). Jul. 9, 2019.
Photo by Nicholas Hellmuth.

Photos #2, 3, 5

Gaussia maya leaves, at Yaxha lake, south shore, cenote area. Jan. 22, 2019.
Photo by Maria Alejandra Gutierrez.

Photos #4, 8

Gaussia maya palm with fruits. Found in Naranjo park (PNYNN). Jul. 9, 2019.
Photos by David Arrivillaga.

Photos # 6, 7, 9

Gaussia maya fruits. From the road to Nakum. May. 6, 2019.
Taken by Nicholas Hellmuth.

Images included in a Contact sheet of *Gaussia maya* photographed in PNYNN by FLAAR field work projects. These will be published at full-page size in upcoming report on *Gaussia maya* at PNYNN. The current FLAAR Report is on *Gaussia maya* at PANAT.

1.



Full Botanical Name

Gaussia maya (O.F. Cook) H.J. Quero & Read is the accepted name. Due to its excessive length we simply call it *Gaussia maya* in the rest of this report. Cook is the first botanist to recognize this palm (ironically at Tikal). Then Quero and Reed were able to classify it better in 1986, based on a half-century more of knowledge of palms of the Maya Lowlands.

Only one synonym for *Gaussia maya*

Rare that any plant has only one synonym:
Opsiantra maya O.F.Cook

(<http://www.theplantlist.org/tpl/record/kew-88907>)

Local names for *Gaussia maya*

Palma silvestre cambó (Lara et al. 2013: Cuadro 1, page 103).

Palma, palmasito
(Balick, Nee and Atha 2000: 195).

Mayan names for *Gaussia maya*

Aj k'änb'oo' (Lara et al. 2013: Cuadro 1, page 103). This is the name provided for Peten Itza Maya language by Atran, Lois and Ucan (2004: 11 and more detail on 133).

Habit for *Gaussia maya*

Palm.



***Gaussia maya* palm with fruits.**

Found in Naranjo park (PNYNN). Jul. 9, 2019.
Photo by David Arrivillaga.

In what Ecosystem(s) can you find native *Gaussia maya*?

Gaussia maya grows in karst geology of the Maya Lowlands. So far most of the areas where we have found it are within partially cleared national park areas of monumental architecture. But at PNYNN we found it in thick wild vegetation in karst areas around the sides of cenotes that are part of the western area of Lake Yaxha.

Botanist and ethnobotanist Cyrus Lundell provides helpful information (1937: 36) on where to find *Opsiandra maya* (the original name in his epoch).

Ramonal-The distribution of certain species in Northern Peten possibly is due more to man's influence than to edaphic differences, for the rendzina soils appear much the same throughout the uplands. I am personally convinced that the groves of the ramon, *Brosimum alicastrum*, on old Maya sites, are there largely because the Maya Indians planted the tree, thus giving the species an advantage which it has been able to maintain against all competition (see p. 10).

Although transect counts have not been made, I estimate that there are as many as one hundred trees of this species per acre in some groves (see Plate 3).

The ramonales are virtually forests of one species, yet trees of the caobal and zapotal are not excluded. *Brosimum alicastrum* is comparatively fast growing; I conjecture from information obtained concerning ages of trees planted in present villages that it reaches a height of 20 meters in about 50 years.

As in all the rain-forest, there are a number of tiers, the uppermost of which towers as much as 15 meters above the general mass. The caoba, *Swietenia macrophylla*, and species of *Sideroxylon* and *Ficus* have been observed as among the outstanding of what may be termed the forest sentinels.

To the middle tree tier, which forms the mass of the forest canopy, belong the dominant ramón, the zapote (*Achras zapota*), the guayo (*Talisia olivaeformis*), and many other species not yet collected.

The lower tier consists of smaller trees including *Celtis trinervia* (Lundell 4806), *Ocotea lundellii* (4359), and several palms among which *Opsiandra maya* is notable because of the fact that it is generally encountered on Maya ruins in ramonales. It occurs elsewhere, however, on bluffs and along water courses.

We also found *Gaussia maya* on bluffs (the edges of open cenotes along the edge of Lake Yaxha).

Later in his *The Vegetation of Peten* Lundell says (page 53):

Opsiandra maya Cook. Cambo. Uaxactun, Bartlett 121,25. Unarmed palm 3 to 8 meters high; common on sites of Maya ruins and along stream banks.

Again, this is where we found *Gaussia maya* at Naranjo: on the slopes of a pyramid; and our first example at Tikal: on a plaza near collapsed pyramid. Lundell also found this palm "on the pyramid at Polol." (page 161).

Soil scientists and ecologists now have the question to study: pyramids are the collapsed remains that have all the fallen stones and construction fill material, plus the leaf litter of over a thousand years. We will need to compare the *Gaussia maya* growing on pyramids with the only area (so far) where we have found dozens, scores, and probably hundreds of this tree elsewhere in the Reserva de la Biosfera Maya. We need to return to that area to see whether it is a bajo, or a bajo worked by the Maya thousands of years ago, or on a low hilltop with house mounds. We undertake no excavations, but with our eyes we can estimate whether the area has construction below the *Gaussia maya* palms.

(Cyrus Lundell (1937: 36)

Where has *Gaussia maya* been found in the Parque Nacional Tikal (PANAT)?

We found one *Gaussia maya* palm in the Mundo Perdido area. This particular palm was loaded with inflorescences filled with fruits: two with fruits bright red, orange, yellow, yellow green. The other fruits were young and still green (identical in color to a green grape and almost same size).

These palms would be expected in many other areas of Tikal. Two years ago we found one fruiting as we climbed a pyramid at Nakum (in the nearby PNYNN).

Same for Yaxha, Nakum and Naranjo, is *Gaussia maya* present or missing from earlier lists?

Gaussia maya and all the *Chamaedorea xate* palms and *Desmoncus* palm vines are all missing from the Dix and Dix 1992 list which was used in past Plan Maestro reports for PNYNN (most recent edition is CONAP- DGPCN/MICUDE- 2015). So we have added lots of palms for this area.

Botanical Description of *Gaussia maya* for Guatemala by Standley and Steyermark (1958)

We show the entire botanical description by Cook (1923) in our Appendix A, at the end of this FLAAR Report, before the References Cited. The description in 1958 by Standley and Steyermark is much shorter. And surprisingly does not contain mention of edible or usable parts (that we cite later).

The genus consists of a single species. It is related to *Synechanthus* but differs in the much greater size of the plant, the pinnae regularly arranged but in different planes from the rachis, the stout rather than slender spadix branches, and the valvate rather than imbricate petals of the pistillate flowers. Some of the West Indian species of *Gaussia* are somewhat similar in habit.

Opsiandra maya O. F. Cook, Journ. Wash. Acad. Sci. 13: 182. 1923. Palma cimarrona; Cambo.

Known only from the forests of northern Peten, at 150 meters or lower, and in adjacent British Honduras; type from Laguna Colorada, Tikal District, Cook & Martin 94.

Trunk 20 meters tall or more, about 15 cm. in diameter near the base, the Internodes 12-15 cm. long, becoming shorter above; leaves 2-3 meters long, the sheathing portion 30 cm. long, the petiole 65 cm. long, 3 cm. thick above; pinnae about 88 pairs, the lowest 41 cm. long and 2.2 cm. wide, the largest ones, somewhat below the middle, 61 cm. long and 3.8 cm. wide, one nerve on each side of the costa more prominent than the others; inflorescence 75 cm. long, the branched portion 34 cm. long, the branches 17-18, 30 cm. long or less, 4-5 mm. thick; spathes 4, the lowest 9.5 cm. long, 5.5 cm. wide, distinctly carinate on each side, the uppermost 19 cm. long and 2 cm. wide; sepals 1 mm. long, the pistillate petals in anthesis 2 mm. long, slightly accrescent; fruit 1-1.5 cm. in diameter, with a soft, red, fleshy pericarp, the flesh mucilaginous and very sticky; seeds about 1 cm. in diameter.

(Standley and Steyermark 1958: 273-274).



Gaussia maya. Photos by Nicholas Hellmuth. Jul. 20, 2022.

In which States of Mexico is *Gaussia maya* listed by Villaseñor

Gaussia maya (O.F. Cook) H.J. Quero & Read CAM, CHIS, OAX, QROO, TAB, VER

(Villaseñor 2016: 59).

Gaussia maya in Belize

Gaussia maya (O.F. Cook) Quero & Read — Syn: *Opsiandra maya* O.F. Cook — Loc Use: CNST, POIS. — Reg Use: CNST. — Nv: la palma, palmasito. — Habit: Palm.

(Balick, Nee and Atha 2000: 195).



Here are the leaves of *Gaussia maya*. Since the tree has no spines on the trunk it is easy to distinguish from other palms. It is taller than most xate palms.

Photo by Nicholas Hellmuth, iPhone 13 Pro Max, RAW format, .DNG, converted to .JPG for the report, 12:13 pm, July 20, 2022.

Practical uses of *Gaussia maya* for the Lacandon Maya of Chiapas

So far, much to my surprise, I have not found *Gaussia maya* palms listed for Lacandon areas of Chiapas. This is a notable point. So neither in Cook 2016 nor in the focused palm studies by Contreras, Mariaca and Pérez 2018.

Are any parts of *Gaussia maya* edible?

Kermath, Bennett, & Pulsipher suggest it is possibly eaten in Peten (2018: 465).

Gaussia maya (O.F.Cook) H.J.Quero & Read [syn. *Opsiandra maya* O.F.Cook]

FAMILY: Arecaceae or Palmae (palm)

ENGLISH: palmasito

SPANISH: cambo, pacaya, palma cimarrona, palmasito

USES/NOTES: Reportedly eaten in the Petén, Guatemala.

NATURAL RANGE: Quintana Roo, Mexico, Belize, and Petén, Guatemala

REFERENCES: Henderson et al. 1995, Mutchnick and McCarthy 1997, Sousa and Cabrera 1983, Standley and Steyermark 1958.

Would need to check his four references to see where this suggestion comes from. No edibility reported for *Gaussia maya* in Belize (Balick, Nee and Atha 2000: 195). But Atran, Lois and Ucan do mention edible aspect in the Peten Itza area of central Peten (2004: 152):

AJ K'ANB'oo' [k'lin-b'oo' = amarillo-espata de palma/hoja grande, por la inflorescencia amarilla]. Cambo. *Gaussia maya*. (che'imb'il o no afiliado; tronco: 10-20m x 10-15cm; hoja: 2-3m). noj k'aa.x, kab'al k'aa.x.

Se come el cogollo aunque es de inferior calidad. La hoja se usa en techos y en adornos navideños.

Is there potential medicinal usage of *Gaussia maya* by local people?

So far we do not have list of medicinal use by local Maya but this we will eventually find.

Concluding Discussion and Summary on *Gaussia maya*

One long-term goal at PANAT is to find, photograph, document, prepare list of suggested reading, and publish a FLAAR Report on each and every palm that is native to Parque Nacional Tikal. We start with *Gaussia maya* since by pure luck I found a tree with four inflorescences with fruits while hiking into the Mundo Maya area during our exploratory field trip in late July 2022.

This palm is found in most of the Maya Lowlands but otherwise not widespread even in the Americas. Will be interesting to communicate with botanical, soil scientist and ecological colleagues in other parts of the Maya Lowlands to learn whether *Gaussia maya* prefers to grow on ruins in those other areas or whether this palm is perfectly happy in any karst area. Since ruins occupy most karst hilltops it is not much surprise that these palms will be on pyramids. What about other palms? Is *Gaussia maya* the primary palm on pyramids? So far the only plant that I have noticed likes pyramids are ground plants.

Half the photos on the Internet are taken in botanical gardens nowhere near Mesoamerica so we definitely will be looking for this palm when its inflorescences are filled with flowers. We will also look for the fruits when they are all tomato red.

The single most important item for botanical photography is a 3-meter high ladder. This ladder makes it possible for me to climb up and have the inflorescences directly in front of my camera.

In today's digital world, it is 100% more realistic to use an iPhone camera to accomplish nice resolution and perfect color. We have tested each generation of iPhone and the 13 Pro Max has the best qualities.

This palm definitely deserves more information on more web pages. We are accumulating our documentation into a PDF since here we can show the photographs at full page width and/or full page height. Will also be helpful to have a page that shows the stems (trunks) of each tree-sized palm of PANAT everyone can more easily recognize each species.

Appendix A

“Discovery” of *Opsiandra maya* (*Gaussia maya*) at Tikal by Cook

The new palm would not be classified ecologically with the undergrowth species, but as a true forest type, growing to the same height as many other trees. It has a rather slender trunk, about 6 inches in diameter, supported on a solid conical mass of thick and attaining a height of 60 feet or more. The leaves are large and pinnate, but few in number, usually only 5 or 6, with a total length of 8 or 9 feet, and about 90 pinnae, but on each side of the midrib. The inflorescences are several joints below the leaves, with the branches robust and mostly simple, and ripening into large clusters of red cherry-like fruits, like those of *Synechanthus*.

As the Tikal district is now entirely uninhabited, no uses of the palm were learned, and the only name to be learned was *Palma cimorrana*, or “wild palm”. At El Cayo, in British Honduras, one informant gave *cambo*, or *kambo*, as the Maya equivalent of *Palma cimorrana*. But the palm was not noticed in the vicinity of El Cayo, nor along the Belize River, though it was seen at several places on the road between Flores and Benque Viejo, as well as in the forests to the northward.

Since the fruit and floral characters are those of the Synechanthaceae, the new palm may be assigned to this family, which includes only three other genera, *Synechanthus* in Guatemala, *Gaussia* in Cuba, and *Aeria* in Puerto Rico. The tall trunk would associate *Opsiandra* with the West Indian genera, but there is no such swelling of the lower part of the trunk as in *Aeria*. Also, *Opsiandra* has 4 spathes, instead of 7 as in *Aeria*, or 2 as in *Gaussia*. Between *Opsiandra* and *Synechanthu* there is little external resemblance, the latter being a short-trunked undergrowth palm with clustered pinnae and slender, fastigate inflorescence-branches.

Diagnostic features of *Opsiandra* are the tall, columnar trunk, the infrafoliar inflorescences, the 4 short, narrow spathes, the thick simple branches of the spadix, the flowers only 2 or 3 in each cluster, the petals thick and valvate in both sexes, the persistent staminate buds, and the transversely reniform seeds, with uniform albumen and a central cavity. The most striking peculiarity is that the inflorescence branches are robust and simple, while in the other genera the branches have numerous slender divisions and the flowers more definitely in rows.

The technical characters of the new genus may be summarized as follows:

Opsiandra Cook, gen. nov.

Trunk solitary, erect, ascending or flexuous, columnar below, slightly and gradually tapering above, scarcely enlarged at the base, supported by a conical mass of very thick roots.

Leaves few, usually 5 or 6, ascending, 2 to 3 meters long, with a cylindrical sheathing base; petiole distinct, deeply channelled below and with strongly incurved margins above; pinnae numerous (88 pairs), lanceolate, not clustered or grouped, attaining a length of about 60 cm. and a width of nearly 4 cm.

Inflorescences distinctly infrafoliar, slender, with numerous (15 to 30) rather robust, simple, tapering branches, or a few of the lower branches forked near the base.

Spathes 4, slender, incomplete; 3 upper joints of the peduncle without spathes. Lowest spathe short and strongly bicarinate; third and fourth spathes longest, but not attaining the base of the branches of the matured inflorescence.

Flowers of one form externally, in longitudinal rows of 2 or 3, the lowest flower of each group pistillate, somewhat smaller than the staminate flowers, also a few solitary staminate flowers near the ends of the branches; sepals rounded, broadly imbricate; petals broadly triangular, valvate, somewhat longer than broad, thick, fleshy, persistent, becoming leathery in the ripe fruit; stamens 6, on broad short filaments; pistillodes columnar or variously compressed, sharply apiculate, nearly as long as the anthers; pistillate flowers with rudimentary staminodes, the pistil sharply trigonal, on each face a distinct median groove, the mature stigmas divaricate, persistent at the base of the ripe fruit; also some of the staminate buds persistent through the fruiting period.

Fruits globose-reniform, with a distinct groove on the median face above the stigma, color light green, turning to deep red when ripe, with a smooth skin and a soft fleshy pericarp, enclosing a somewhat depressed or subreniform seed. Surface of seed nearly smooth, slightly impressed with 5 to 7 simple or sparingly branched or anastomosing fibers rising from the inner or median side of the hilum, passing over and around the seed and converging toward the embryo; albumen uniform, with a central cavity; embryo about intermediate between basal and lateral, on the outer side of the seed away from the stigma; embryo cavity about half as broad as long, extending more than half-way to the central cavity.

Seedling with three bladeless sheaths, followed by two leaves with simple bifurcate blades.

The generic name refers to the persistence of the staminate flowers and buds which are to be found in fresh condition on the same inflorescences with ripe fruits. This may indicate an extreme condition of proterogyny or a continued production of staminate flowers through a long period. Monoecious palms may be considered as proterogynous if the stigmas are exposed before pollen is shed from the staminate flowers of the same inflorescence.

Drude alludes to the opposite relation, of female flowers developed after the male flowers have withered. The difference usually would be only a few hours, or at most a few days, whereas several weeks must be required, or possibly months, for the fruits of *Opsiandra* to grow and ripen, while staminate buds and flowers are still present.

Opsiandra maya Cook, sp. nov.

Trunk attaining 20 meters and upward, about 15 cm. in diameter near the base, tapering slightly and gradually; internodes 12 to 15 cm., becoming shorter above, separated by distinct rings. Superficial roots 3.5 cm. thick, forming a dense conical mass supporting the trunk.

Leaves 2 to 3 meters long; sheath and petiole not distinct, the strictly sheathing portion about 30 cm. long, the petiole about 65 cm., very deeply channelled below, with thin strongly incurved margins to within about 15 cm. of the lowest pinnae, there the groove becoming shallow and the margins rounded. Sheath 1.5 cm. thick at the back, the petiole becoming thicker above and the groove more shallow; diameter of petiole above 3 cm. Rachis sharply carinate above.

Pinnae 88 on one side of the midrib; lowest pinna 41 cm. by 2.2 cm.; second pinna 47 cm. long; largest pinna somewhat below the middle, 61 cm. by 3.8 cm.; fifth pinna from the end 32 cm. by 2.7 cm.; subterminal pinna 22 cm. by 1.3 cm.; terminal pinna 16 cm. by 0.5 cm., or the two last pinnae united with total width of 1.5 cm. One vein on each side of the midrib more prominent than the others, especially underneath, also 5 or 6 less prominent veins, separated by 6 or 7 subequal veinlets; in dry specimens the spaces between the veinlets showing many short translucent longitudinal lines, not in regular rows; submarginal vein delicate, separated from the margin by 3 or 4 veinlets very close together; margin thickened and veinlike, but the edge thin.

Inflorescence 75 cm. long; from lowest branch to tip 34 cm. Branches 17 or 18, about 0.4 cm. thick, at base nearly 0.5 cm. tapering gradually to the tip, attaining 30 cm. The lowest 4 branches divided near the base; terminal portion 21 cm. Peduncle with 7 joints measuring respectively 2, 11, 7.5, 12, 11, 5, and 3 cm., the last 3 joints without spathes.

Spathes 4, the lowest 9.5 cm. by 5.5»cm., distinctly carinate on each side, deeply bidentate, the tips triangular-pointed, 3 cm. long; second spathe 13.3 cm. by 4.3 cm., slightly carinate, but sharply angled at the sides; like the others; third spathe 19.5 cm. by 2.4 cm.; fourth spathe 19 cm. by 2.1 cm., attaining within 2 to 3 cm. of lowest branch, the fruiting portion emerging from the spathes long before flowering.

Sepals about 1 mm. long; petals of female flowers at anthesis about 2 mm. long, on ripe fruits 3 mm. long, thick; anthers 1 mm. long, and pistillodes nearly the same length, staminodes rudimentary.

Fruits subglobose or transversely subreniform, somewhat flattened on one side and with a vertical groove above the stigma, 1 cm. to 1.5 cm. in diameter, with a soft fleshy red pericarp 2 mm. thick, the flesh of green fruit mucilaginous and very sticky; seed 0.9 cm. to 1.1 cm. in diameter, somewhat irregular in shape, subglobose, oblong, reniform, oval, or unsymmetrical, the surface smooth or slightly uneven, marked with a few impressed fibers; central cavity of the seed often strongly depressed, 2 to 4 mm. in diameter, surrounded by a wall of uniform rather hard albumen 2.5 to 3 mm. thick

Seedlings with the three bladeless sheaths measuring respectively, 7 cm., 2.5 cm. and 5 cm. in length, in diameter about 0.5 cm.; first two sheaths without chlorophyll, white at first but soon brown and decayed; first two leaves simple, deeply bifid, the divisions measuring 12 to 13 cm. by 1.3 to 1.9 cm.

Type in the U. S. National Herbarium, nos. 1,084,215-1,084,219, consisting of leaf parts, inflorescence, and spathes from a single individual growing at Laguna Colorada, Tikal District, Petén, Guatemala, altitude 100 to 500 meters, March 23, 1922, by O. F. Cook and R. D. Martin (no. 94), of which photographs and complete leaf measurements were obtained. Ripe fruits were collected a few days later near Uaxactun, on a larger inflorescence, with more numerous branches and the fruits more abundant and crowded. The seeds of this cluster were brought to Washington and planted in a greenhouse, where the seedlings have grown well.

Young palms were noted among the ruins of Nakum with petioles much longer and slenderer than those of the adult palm at Laguna Colorada. Also, in the young palms the pinnae are relatively broader than in the adult, 1.5 to 2 cm. wide with a length of 18 to 20 cm. An injured leaf of a young palm growing on a ruined temple at Uaxactun showed a special enlargement of the basal pulvini, so that the pinnae stood nearly at right angles to the rachis instead of the usual angle of about 50 to 60 degrees in young palms, or about 40 degrees in adults.

(Cook 1923: 181-184).

Appendix B

Trying to Find Botanical Lists of all Palm Species at Parque Nacional Tikal (PANAT)

One goal of our long-range flora, fauna and ecosystems field work and research project is to find and photograph and publish each and every species of palm tree in each area that we are working in. So finding all palm species at PANAT is an example that we explore here. The first step is to make a botanical list of what palms to expect. An aspect of the goal is to provide the park administrators and CONAP with a list of palms in order to improve the list of trees and plants that is in the Plan Maestro (Master Plan) of each park and nature reserve.

During our 12-month project in nearby Parque Nacional Yaxha, Nakum and Naranjo (PNYNN, Aug. 2018–July 2019) we photographed many palm species. We found and photographed at least one palm species that is not in earlier lists for PNYNN or the entire RBM. We have now found this species at PANAT so *Gaussia maya* palm can be added to the tree and plant list in the next Plan Maestro of both the entire RBM and also PANAT.



PANAT, Mundo perdido area. Jul. 20, 2022. Photo by: Edwin Solares, FLAAR Mesoamerica. Camera: Sony A1. with FE 90mm F2.8 Macro G OSS lens.

During our 17-month project (2020–2021) in the Municipio de Livingston (eastern part of Izabal, Guatemala) we worked to find and photograph as many species of palms as possible. Izabal is not in the RBM area but it has a notable biodiversity. One impressive palm species here likes salt water (*Manicaria saccifera*, confra palm), and tasiste palm (*Acoelorrhaphe wrightii*) accepts brackish water (no savannas in eastern Izabal). Obviously, there is no brackish water in PANAT, and no large savannas. So, these two palms are on our list, but it would not be impossible to find tasiste palm in a small seasonally inundated open area. Tasiste palm in Petén has evolved to require seasonally inundated savanna areas; it does not need brackish water in Petén whatsoever. We have three more years of hiking to remote areas to document whether *Acoelorrhaphe wrightii* can be found inside PANAT or not.

Now that we are deep into a 5-year project (2021–2025) of cooperation and coordination with CONAP for FLAAR Mesoamerica to study flora, fauna and ecosystems of the entire Reserva de la Biosfera Maya, we are concentrating on PANAT, PNYNN, Municipio San José (Concession La Gloria), and PNLT (we are working in the far southeast area because no other ecologists, or biologists have hiked into this remote part of that park). We photograph every palm tree we find.

For PANAT we just had our first field trip of this project and we found fruits of two palms. It is best to photograph a palm when the inflorescences have flowers or fruits (seed pods). One of our long-range goals for palms is to sort out the botanical mish-mash for palm genera *Sabal* and *Desmoncus* classifications that change every several years, and each botanist champions what they estimate are the correct botanical names. So, we are starting with *Gaussia maya* since all studies of this gorgeous palm are consistent; all identifications and descriptions are correct. No helter-skelter with *Gaussia maya* palms. But it helps our planning team to know in advance what other palm genera and species to look for. This information we provide to the biologists of the park, and our FLAAR Reports are available to botanists, ecologists, ethnobotanists, and archaeologists around the world. Since lots of plants are in Classic Maya art, knowing which palms are wild and native from Tikal can assist epigraphers and iconographers.



***Gaussia maya* palm with fruits.** Found in Naranjo park (PNYNN). Jul. 9, 2019.
Photo by David Arrivillaga.

Early List of Palms of Tikal: Schulze and Whitacre 1999

In order to make a botanical list of all palms at Tikal it helps to start with the work of earlier botanists. Therefore, we start with Schulze and Whitacre 1999. *Orbignya cohune* is the name used in past decades; *Attalea cohune* is the accepted name today.

In coming months we will work to find additional plant lists of Tikal that include good lists of palms, so we leave these columns open at the moment.

We comment on *Bactris major* later in following chapters; it is more likely that *Bactris mexicana* is what to expect at Tikal since botanist Thomas B. Croat documents it in MOBOT herbarium for in and adjacent to PANAT (Neotropical Plant Portal).

Schulze and Whitacre 1999	eventual	Palm lists	In other	reports	What to work to find at PANAT based on CECON
					<i>Acrocomia aculeata</i>
					<i>Astrocaryum mexicanum</i>
<i>Orbignya cohune</i>					<i>Attalea cohune</i>
<i>Bactris major</i>					
					<i>Bactris mexicana</i>
<i>Chamaedorea</i> sp1					<i>Chamaedorea elegans</i>
<i>Chamaedorea</i> sp2					<i>Chamaedorea oblongata</i>
<i>Chamaedorea pacaya</i>					<i>Chamaedorea pacaya</i>
<i>Cryosophila stauracantha</i>					<i>Cryosophila stauracantha</i>
					<i>Desmoncus orthacanthos</i>
<i>Gaussia maya</i>					<i>Gaussia maya</i>
<i>Sabal mauritiiformis</i>					<i>Sabal mauritiiformis</i>
					<i>Sabal mexicana</i>

Since Schulze and Whitacre were studying “Trees” of Tikal, it is understandable that they did not list the palm that is a vine, *Desmoncus* species. But since we prefer to list all palms, we include bayal palm vines.

I doubt the faux palm, junco, is found at Tikal. We find this *Carludovica palmata* more in Alta Verapaz and rarely in Izabal (if what’s left of my memory still serves). Junco looks like a mid-sized guano palm but junco is not even in the same family whatsoever. The botanical name for junco is *Carludovica palmata*, but it’s not even a distant relative of anything in the palm family (but looks nearly identical to a common fan palm).

Palms listed by Lundell for Petén

I estimate that at least 90% of what Lundell mentions for Petén can be found at PANAT. But..., the botanical names used in the 1930’s have evolved. Plus, today a lot more is known about trees and palms of Mesoamerica. Nonetheless it is helpful to learn from Lundell’s many years of field work in Petén and surrounding areas (Campeche, Belize).

It is notable that neither Lundell (1930’s) nor Schulze and Whitacre (1990’s) list:

- *Acrocomia aculeata*, tuk, mop, coyol, vaguely similar to corozo but coyol trunk is spiny
- *Astrocaryum mexicanum*, lancetilla, easy to spot due to long flat lance-shaped spines

We will look for these two palms at PANAT (and PNYNN) but will not be surprised if they are not present (since other parts of the RBM have different eco-systems so other palms may be in those other areas but not at PANAT).

I do not consider coconut to be native to central Petén. Whether coconuts floated across the oceans and landed on the Caribbean coast or Pacific Ocean coast is an open question (they probably did but then it’s more likely that they were propagated during the Spanish conquest).

Notable that Lundell mentions three different names for *Desmoncus schippii* Burret but never once mentions *Desmoncus orthacanthos* Mart. During the recent half century, I estimate that 90% of botanists list only *Desmoncus orthacanthos* and almost never *Desmoncus schippii*.

Lundell was an experienced and capable botanist and ethnobotanist but xate and pacaya were clearly not in his top tier of interest (because he lists only one *Chamaedorea* by name). He realizes there are lots of species but tends not to name them. So today I feel similar, except that I am determined to learn them all, one by one, month by month, year by year of upcoming field work.

Notes that I have amassed from Lundell's various reports			What to work to find at PANAT based on CECON
			<i>Acrocomia aculeata</i>
			<i>Astrocaryum mexicanum</i>
	Lundell lists by old name		<i>Attalea cohune</i>
<i>Bactris</i> sp.			<i>Bactris major</i>
			<i>Bactris mexicana</i>
<i>Chamaedorea elegans</i> Mart. (?).	<i>Chamaedorea elegans</i> Mart.	Xate hembra	<i>Chamaedorea elegans</i>
<i>Chamaedorea</i>			<i>Chamaedorea oblongata</i>
<i>Chamaedorea</i>			<i>Chamaedorea pacaya</i>
<i>Chamaedorea</i>			
<i>Chamaedorea</i>			
<i>Chamaedorea</i>			
<i>Chamaedorea</i>			
<i>Cryosophila argentea</i> Bartlett	<i>Cryosophila stauracantha</i> (Heynh.) R.J.Evans	Escoba	<i>Cryosophila stauracantha</i>
<i>Desmoncus ferox</i> Bartlett	<i>Desmoncus schippii</i> Burret		
<i>Desmoncus lundellii</i> Bartlett	<i>Desmoncus schippii</i> Burret		
<i>Desmoncus uaxactunensis</i> Bartlett	<i>Desmoncus schippii</i> Burret		
		bayal	<i>Desmoncus orthacanthos</i>
<i>Opsiandra maya</i> Cook	<i>Gaussia maya</i> (O.F.Cook) H.J.Quero & Read	cambo	<i>Gaussia maya</i>
<i>Orbignya cohune</i> (Mart.) Dahlgren	<i>Attalea cohune</i> Mart.	Corozo, cohune	
<i>Sabal mexicana</i> Mart.	<i>Sabal mexicana</i> Mart.	Huano de sombrero	
<i>Sabal</i> sp. (<i>S. morrisiana</i> Bartlett, ined.)	<i>Sabal mauritiiformis</i> (H.Karst.) Griseb. & H.Wendl.	botan	<i>Sabal mauritiiformis</i>
			<i>Sabal mexicana</i>

Palms listed for the Reserva de la Biosfera Maya in Plan Maestra 2015, Vol. I

The five volumes of CONAP Plan Maestro are very helpful. I use here Tomo I because the tree list is in this volume:

Plan Maestro de la Reserva de la Biósfera Maya. Segunda Actualización, 2015. Tomo 1. Consejo Nacional de Áreas Protegidas (CONAP).

En Colaboración con:

Ministerio de Cultura y Deportes – Dirección General de Patrimonio Cultural y Natural
Centro de Estudios Conservacionistas de la Universidad de San Carlos (CECON)
Fundación Defensores de la Naturaleza, 2015

The list is: Anexo 2. Listado de Especies arbóreas presentes en La Reserva de La Biósfera Maya. Fuentes: Szejner 2005, Parker 2008, García et al. 2013, GBIF 2013.

GBIF is an understandable source but did not succeed in providing an adequate list of plants for anywhere in the RBM.

Parker 2008 is not much help because it is copy-and-paste of Standley and Steyermark of decades earlier. Szejner is limited to 100 species of trees; in theory there should be between 180 and 220 species of trees in any area of Guatemala that has biodiversity.

Szejner, M. 2005. Caracterización ecológica y botánica de 100 especies de árboles amenazados en Guatemala, con fines de conservación. Tesis de licenciatura. Departamento de Biología. Universidad del Valle de Guatemala, Guatemala. 205 pp.

Since I am focused on wild palms (not palms of gardens) I exclude non-native coconut palms and palma real.

Pseudophoenix sargentii is not listed in any herbaria of Neotropical Flora database, so I exclude this. *Thrinax radiata* should not be included in future lists for anywhere in Petén. This is a palm of coastal Belize.

The RBM Plan Maestro list includes 21,000 square kilometers (more ecosystems than in PANAT), so for the RBM list I excluded tasiste palm and *Thrinix* palm for the moment. The database records for *Thrinax radiata* for Tikal are incomplete, confusing, and I estimate a copy-and-paste error of year 1922 (long before computer errors). Because I do not know any “Belize Bat Station” in “Tikal district”. All *Thrinax radiata* is found along the coast of Belize. Curiously not for coastal Izabal.

Genus species in 2015 report	Local name	Name I prefer	Comments based on recent FLAAR field work
<i>Acoelorrhaphe wrightii</i>	<i>taciste, guano</i>	tasiste	Yes, in RBM, PNLT, PNYNN; not yet in PANAT
<i>Acrocomia aculeata</i>	<i>tuk, mop, coyol</i>		
<i>Astrocaryum mexicanum</i>	<i>ak-te, güiscoyol, lancetilla, pacaya</i>	Lancetilla since güiscoyol is for different species	
<i>Attalea cohune</i>	<i>tutz, corozo</i>		All over the Maya Lowlands, including PANAT
<i>Cryosophila stauracantha</i>	<i>escobo</i>		All over the Maya Lowlands, including PANAT
<i>Pseudophoenix sargentii</i>	<i>kuká</i>		Not listed in any herbaria of Neotropical Flora
<i>Sabal mauritiiformis</i>	<i>xa'an, botán</i>		All over the Maya Lowlands, including PANAT
<i>Thrinax radiata</i>	<i>palma de agua</i>		Should be gently and politely removed from list; highly unlikely anywhere in Petén.

I suggest adding xate palm for the list on page 287. There are thousands of several species of xate palm all over many parts of central Petén. Three species are mentioned on page 47 but somehow did not get put into the tabulated list on page 287.

- Xate (*Chamaedorea elegans*),
- Eljade (*Chamaedorea oblongata*),
- Cola de pescado (*Chamaedorea ernesti-augusti*)

Astrocaryum mexicanum we will look for on upcoming field trips. It was not found at PANAT by Schulze and Whitacre 1999.

Acoelorrhaphe wrightii is suggested by archaeologist Vilma Fialko for the pine area several kilometers outside PANAT. But *Acoelorrhaphe wrightii* has not yet been found inside PANAT. In Petén it will be only inside a grassland savanna or a tasistal savanna (or potentially in a sawgrass savanna, a cibal).

The field work of FLAAR (USA) and FLAAR Mesoamerica (Guatemala) found on the first field trip to Tikal (and also found on previous field trips to Nakum) *Gaussia maya* palm in the Reserva de la Biosfera Maya. This is precisely one of our goals: to provide documentation to CONAP and associated institutes to add to the next edition of Plan Maestro lists of flora and fauna. Even when a plant is already in the list, our project provides high-resolution digital photographs.

Palms of the Reserva de la Biosfera Maya (RBM) in Velasquez 2015

The complete list is from Velasquez 2015: 37. There is a list for biotopos protegidos Naachtún dos Lagunas (Lagu), San Miguel la Palotada el Zotz (Zotz) y Laguna del Tigre Río-Escondido (Tigre) on pages 49.

Genus, species in Velasquez 2012 report	Local name	Comments based on recent FLAAR field work
<i>Astrocaryum mexicanum</i>	Cocoyol	Not yet adequately documented at PANAT
<i>Attalea cohune</i>	tutz, corozo	All over the Maya Lowlands, including PANAT
<i>Brahea dulcis</i>	Palma real	Herbaria list predominantly for Quetzaltenango so unlikely to be found at PANAT but we will double-check.
<i>Chamaedorea elegans</i>	xate hembra	
<i>Chamaedorea ernesti-augusti</i>	Cola de pescado	In one place says unresolved; in another list as accepted
<i>Chamaedorea oblongata</i>	xate macho, xate jade	
<i>Chamaedorea seifriizi</i>	cambray	
<i>Chamaedorea tepejilote</i>	pacaya	So often planted in kitchen gardens and then escapes so a challenge to document if wild and native to PANAT; we will research this.
<i>Cryosophila stauracantha</i>	escobo	All over the Maya Lowlands, including PANAT
<i>Desmoncus orthacanthus</i>	bayal	
<i>Gaussia maya</i>	kuká	
<i>Sabal mexicana</i>	guano	

Velasquez uses the name *Sabal guatemalensis* for guano on page 49 but not on page 37.

Velasquez uses the name *Brahea nitida* for tasiste on page 49. But *Brahea calcarea* is the accepted name. Neither is a synonym of *Acoelorrhaphe wrightii* which is the true tasiste palm of savannas and tasistal areas of the RBM of Petén and surrounding areas. *Brahea nitida* grows in the cloud forests of Coban and Trece Aguas, Alta Verapaz. So not to be found in PANAT. *Brahea calcarean* is not listed for anywhere in Guatemala by Neotropical Flora data base (ThePlantList.org).

Palms of the Reserva de la Biósfera Maya (RBM) in another report

Since Parque Nacional Tikal is within the RBM it is logical that most palms elsewhere in the RBM could be found also in Tikal. We comment for each species of palm of RBM. The present chapter introduces the list from the following publication:

CECON, USAC, DIGI

2015 Proyecto “Dinámica de la regeneración natural de un bosque tropical como fundamento para el desarrollo de estrategias de restauración ecológica en la Reserva de Biosfera Maya”.

CECON, USAC, DIGI

2015 Proyecto “Dinámica de la regeneración natural de un bosque tropical como fundamento para el desarrollo de estrategias de restauración ecológica en la Reserva de Biosfera Maya.”

Centro de Estudios Conservacionistas (CECON)/ Fac. C.C.Q.Q y Farmacia/ USAC
Instituto de Investigaciones Químico biológicas (IIQB)/ Fac. C.C.Q.Q y Farmacia/ USAC
Dirección General de Investigación (DIGI)/ Universidad de San Carlos (USAC)
Agradecimientos a: Consejo Nacional de Áreas Protegidas (CONAP)
y Fundación para el Ecodesarrollo y la Conservación (FUNDAECO).



Gaussia maya in PNYNN, (Naranjo archaeological site). Jul. 9, 2019.
Photo by David Arrivillaga.

Genus species	Botanical History	Local names	Comments by Hellmuth
<i>Acoelorrhaphe wrightii</i>	(Griseb. & H. Wendl.) H. Wendl. ex Becc.	tasiste	We have found several million (literally) in the RBM but always in a savanna; no savannas (so far) in Tikal.
<i>Acrocomia aculeata</i>	(Jacq.) Lodd. ex Mart.	Coyol, cocoyal	Slim chance to find at Tikal
<i>Astrocaryum mexicanum</i>	Lieb. ex Mart.	Lancetilla is the name I prefer	Slim chance to find at Tikal; lots in Izabal
<i>Attalea cohune</i>	Mart.		<i>Attalea cohune</i> is the correct modern name for antiquated name <i>Orbignya cohune</i>
<i>Bactris major</i>	Jacq.		Most herbaria specimens are for Izabal; no botanical specimens for Tikal or nearby (Lundell specimens have no location listed whatsoever).
<i>Bactris mexicana</i>	Mart.		Herbaria specimens for Tikal or nearby (MOBOT, etc).
<i>Chamaedorea elegans</i>	Mart.	Xate hembra	Herbaria specimens for Tikal or nearby (MOBOT, etc).
<i>Chamaedorea oblongata</i>	Mart.	Xate macho, xate jade	Herbaria specimens for Tikal or nearby (MOBOT, etc).
<i>Chamaedorea pacaya</i>	Oerst.	pacaya	<i>Chamaedorea pinnatifrons</i> (Jacq.) Oerst. Is accepted name today; mainly Izabal and Alta Verapaz
<i>Colpothrinax cookii</i>	Read	shan	I am not familiar with this as a wild palm of Peten; it has been collected from Alta Verapaz.
<i>Cryosophila stauracantha</i>	(Heynh.) R. Evans	escobo	Common in PANAT, PNYNN and elsewhere in RBM
<i>Desmoncus orthacanthos</i>	Mart.	bayal	Notable that they list only one species and prefer <i>Desmoncus orthacanthos</i> .
<i>Gaussia maya</i>	(O.F. Cook) H.J. Quero & Read		Present but rarely en masse.
<i>Orbignya cohune</i>	(Mart.) Dahlgren ex Standl.	Corozo, manaca, cohune, tutz (maya),	This antiquated botanical name should no longer be used; long ago it was replaced by <i>Attalea cohune</i>
<i>Sabal mauritiiformis</i>	(H. Karst.) Griseb. & H. Wendl.	Botán	Very tall palms are called botan. Zilch under this name in Neotropical Flora (Neotropical Plant Portal) for Peten.
<i>Sabal mexicana</i>	Mart.	Botán, guano	Not as tall as "botan". These eye-level palms are always called primarily guano.

There is also *Sabal japa* and *Sabal yapa* and *Sabal* mish-mash and *Sabal* helter-skelter. We will discuss these issues when *Sabal* is flowering and fruiting at PANAT so we can photograph them at high resolution.

CECON, USAC, DIGI 2015: Anexo 7. Listado bibliográfico de la Flora de la RBM, en orden alfabético.

Note: Neotropical Flora (Neotropical Plant Portal) has no herbaria plant specimens for either *Desmoncus schippii* or *Desmoncus orthacanthos*. It is not easy to “press” a plant with as many needle-sharp spines as *Desmoncus* species. But there are thousands of these spiny palm lianas all over Peten and along the edges of most rivers of eastern Izabal.

In summary: Here is what we can expect to find at Tikal. If we find additional species, that will be helpful.

Genus species	Botanical History	Local names	Comments
<i>Attalea cohune</i>	Mart.	corozo, cohune	<i>Attalea cohune</i> is the correct modern name for antiquated name <i>Orbignya cohune</i>
<i>Bactris mexicana</i>	Mart.	güiscoyol	Herbaria specimens for Tikal or nearby (MOBOT, etc).
<i>Chamaedorea elegans</i>	Mart.	xate hembra	Herbaria specimens for Tikal or nearby (MOBOT, etc).
<i>Chamaedorea oblongata</i>	Mart.	xate macho, xate jade	Herbaria specimens for Tikal or nearby (MOBOT, etc).
<i>Chamaedorea seifrizii</i>	Burret	cambray	Added from FLAAR field work at PNYNN
<i>Cryosophila stauracantha</i>	(Heynh.) R. Evans	escobo	Common in PANAT, PNYNN and elsewhere in RBM
<i>Desmoncus orthacanthos</i>	Mart.	bayal	Notable that they list only one species and prefer <i>Desmoncus orthacanthos</i> .
<i>Gaussia maya</i>	(O.F. Cook) H.J. Quero & Read	ternera	Present but rarely en masse.
<i>Sabal mexicana</i>	Mart.	botán, guano	Not as tall as “botan”. These eye-level palms are always called primarily guano.

Discussion of acceptance or denial of *Sabal guatemalensis* is too complicated for this introduction (since our focus today is *Gaussia maya*). Graf (2022: 43-44) summarizes the mish-mash that I also noticed when studying *Sabal* species of Izabal and of PNYNN. Whether *Sabal mauritiiformis* is present today is equally contradictory. When you ask Neotropical Flora (Neotropical Plant Portal) where *Sabal mauritiiformis* has been found in Guatemala you get "Your query did not return any results" (in other words, botanists of Kew, MOBOT seemingly do not accept that plant name for being present in Guatemala; hence not in Petén). We will discuss this helter-skelter headache when we find *Sabal* species flowering and fruiting in PANAT. So for the moment, I include *Sabal mexicana* as a potential for PANAT (but I am open to changing or adding other species). The helpful map of Graf (2022: Figure 2, is based on palm expert Caballero, of UNAM, back in the 1990's). Reports based solely on Guatemala

list both species: *Sabal mauritiiformis* and *Sabal mexicana* for Petén (CECON, USAC, DIGI 2015: 68). But it's best to have feedback from a botanist focused totally on *Sabal* species, so we will revise our tabulation of what palms are most likely to be found at PANAT after we find *Sabal* palms in flower and then in fruit, and photograph everything in close-up detail. But at least now we have a first-draft of probable palms to find at PANAT (and which genera have species which are not always correctly published: *Sabal* and *Desmoncus*).

Chamaedorea tepejilote is documented for Yaxha and for Uaxactun but could have been introduced from Alta Verapaz. Need to see if *Chamaedorea tepejilote* is wild and native to PANAT.

Chamaedorea ernesti-angustii is an unresolved name:

<http://www.theplantlist.org/tpl/record/tro-2400299>



Gaussia maya. Yaxha lake south shore, cenote area, Jan. 22, 2019.
Photo by Maria Alejandra Gutierrez.

Final Comparative Tabulation: Schulze and Whitacre, 1999, with our estimates

Genus species Schulze and Whitacre 1999	Genus species suggested for PANAT, FLAAR list	Local names	Comments
<i>Orbignya cohune</i>	<i>Attalea cohune</i>	corozo, cohune	<i>Attalea cohune</i> is the correct modern name for antiquated name <i>Orbignya cohune</i>
<i>Bactris major</i>			
	<i>Bactris mexicana</i>	güiscoyol	Herbaria specimens for Tikal or nearby (MOBOT, etc).
<i>Chamaedorea</i> sp1	<i>Chamaedorea elegans</i>	xate hembra	Herbaria specimens for Tikal or nearby (MOBOT, etc).
<i>Chamaedorea</i> sp2	<i>Chamaedorea oblongata</i>	xate macho, xate jade	Herbaria specimens for Tikal or nearby (MOBOT, etc).
<i>Chamaedorea pacaya</i> today is <i>Chamaedorea pinnatifrons</i>			Izabal; mostly in mountains of Alta Verapaz, so unlikely in PANAT
<i>Chamaedorea</i> sp4			
	<i>Chamaedorea seifrizii</i>	cambray	Added from FLAAR field work at PNYNN
<i>Cryosophila stauracantha</i>	<i>Cryosophila stauracantha</i>	escobo	Common in PANAT, PNYNN and elsewhere in RBM
The 1999 list was for trees only, so no vine palm	<i>Desmoncus orthacanthos</i>	bayal	Notable that they list only one species and prefer <i>Desmoncus orthacanthos</i> .
<i>Gaussia maya</i>	<i>Gaussia maya</i>	ternera	Present but rarely en masse.
<i>Sabal mauritiiformis</i>			
	<i>Sabal mexicana</i>	botán, guano	Not as tall as “botan”. These eye-level palms are always called primarily guano.

Schulze and Whitacre suggested the *Bactris* that they found at Tikal was *Bactris major*; we estimate more likely could be *Bactris mexicana*.

Schulze and Whitacre suggested the *Chamaedorea* that they found at Tikal was *Chamaedorea pacaya* (today is accepted as *Chamaedorea pinnatifrons*); we estimate more likely could be *Chamaedorea seifrizii*.

Schulze and Whitacre suggested the *Sabal* that they found at Tikal was *Sabal mauritiiformis*; we estimate more likely could be *Sabal mexicana*. But *Sabal* identifications are not universally accepted whatsoever so lots of field work and herbaria research for our team to keep us busy.

- Schulze and Whitacre list 9 palm “trees” for PANAT.
- We list 8 palm “trees” plus have added the palm vine *Desmoncus* species.

So, we are missing one more species of *Chamaedorea*. *Chamaedorea ernesti-angustii* is “an unresolved name” so it is not present in herbaria database lists.

Schulze and Whitacre did pretty well back in the 1990’s. I will also research whether *Desmoncus* is considered a vine or a liana (“woody vine”). We have seen thousands of these along the edges of rivers and swamps during our 17-month of one-week-per-month field trips of 2020–2021 to the area of the Municipio de Livingston which is the north east half of Izabal. Lots of *Desmoncus* fruiting as you drive from the main road into the Ec lodge El Sombrero area at the entrance of the Yaxha part of PNYNN.



PANAT, Mundo Perdido area. Jul. 22, 2022.

Photo by Nicholas Hellmuth. FLAAR Mesoamerica.

References Cited and Suggested Reading on *Gaussia maya*

Most helpful monographs on this plant:

There is no monograph on *Gaussia maya* that we have yet found. These trees certainly deserve more attention in Guatemala and adjacent countries.

Most helpful articles on this plant:

COOK, Orator Fuller, 1923

QUERO, Hermilo J. and Robert W. READ, 1986

Most helpful web sites on this plant:

No webpage has a complete photo album of the tree in its native habitats nor fresh information.

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

PDF, Articles, Books on *Gaussia maya*

ATRAN, Scott, LOIS, Mimena and Edilberto UCAN Ek'

2004 Plants of the Petén Itza' Maya. Museum of Anthropology, Memoirs, Number 38, University of Michigan. 248 pages.

Very helpful and nice collaboration with local Itza' Maya people. But it would help in the future to have a single index that has all Latin, Spanish, and English plant names so that you can find plants more easily. Suzanne Cook's Lacandon ethnobotany index is significantly easier to use.

Not available as a download. To help the world learn about the Itza Maya culture and ethnobotany, would be a courtesy of the author and publisher to make as an open searchable PDF as a helpful download.

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.

CECON, USAC, DIGI

2015 Proyecto "Dinámica de la regeneración natural de un bosque tropical como fundamento para el desarrollo de estrategias de restauración ecológica en la Reserva de Biosfera Maya".

Centro de Estudios Conservacionistas (CECON)/ Fac. C.C.Q.Q y Farmacia/ USAC
Instituto de Investigaciones Químico biológicas (IIQB)/ Fac. C.C.Q.Q y Farmacia/ USAC
Dirección General de Investigación (DIGI)/ Universidad de San Carlos (USAC)
Agradecimientos a: Consejo Nacional de Áreas Protegidas (CONAP)
y Fundación para el Ecodesarrollo y la Conservación (FUNDAECO)

CONAP- DGPCN/MICUDE-

2015 Plan Maestro del Parque Nacional Yaxha, Nakum, Naranjo. Primera Actualización. (Editado y revisado por Carlos Rodríguez Olivet, Julio Rafael Morales, Oscar Quintana, Jenniffer Ortiz, Julio López Payés). CATIE-GITEC Consult GmbH y Programa para el Desarrollo de Petén para la Conservación de la Reserva de la Biosfera Maya (PDPCRBM/MARN). Guatemala. 323 pages.

CONTRERAS Cortés, Leonardo Ernesto Ulises, MARIACA Méndez, Ramón and Miguel Ángel PÉREZ Farrera

2018 Importancia y Uso de las Palmas entre los Mayas Lacandones de Nahá, Chiapas. *Revista Etnobiología*. Vol 16, Num. 1. Abril 2018. pp: 19-30.

Can be downloaded without needing to give up personal information. This we appreciate.

COOK, Orator Fuller

1923 *Opsiandra*, a new genus of palms growing on Maya ruins in Petén, Guatemala. *Journal of the Washington Academy of Sciences*, Vol. 13, No. 9 (May 4, 1923), pp.179-184.

Cook is the botanist who first noticed what today, a century later, is known as *Gaussia maya*. In the era of Cook's field work he named it *Opsiandra maya*.

JStor requires personal information. So, I prefer BiodiversityLibrary.org to download botanical reports.

<https://www.biodiversitylibrary.org/page/12467260#page/187/mode/1up>

The JStor pdf could not be copied-and-pasted without multiple errors.

The BiodiversityLibrary.org copied-and-pasted easily and correctly (with no errors).

DIX, M. A. and M. W. DIX

1992 Recursos biológicos de Yaxhá-Nakúm-Yaloch. 54 pages.

This is the report used in all Plan Maestro reports of PNYNN. But we have not found a copy of the physical 54 pages. Would really help to have a copy.

GARCÍA, M. J., GONZÁLEZ, V. R. and P. E. YAXCAL

2013 Levantamiento y evaluación de la línea base para el monitoreo de los efectos del cambio climático en la fenología reproductiva de especies vegetales de importancia ecológica en la Reserva de Biósfera Maya. Proyecto FD 26-2011. Centro de Estudios Conservacionistas, Facultad de Ciencias Químicas y Farmacia, Universidad de San Carlos de Guatemala. Consejo Nacional de Ciencia y Tecnología. Guatemala. 35 pages.

Actually, the original thesis of Manolo Garcia V. is 116 pages long, not just 35 pages. The complete thesis is filled with helpful info but is focused on just a few trees.

Available as a helpful download:

<http://biblioteca.galileo.edu/tesario/bitstream/123456789/455/1/Informe%20final%20FD26%202011%20Fenolog%c3%ada%20RBM.pdf>

GRAF, Paul

2022 Evaluación multiperspectiva de las palmas de *Sabal* y otras plantas posiblemente utilizadas como material para techos por los antiguos mayas en las tierras bajas centrales. *Estudios de Cultura Maya* LIX: 37-83 (primavera-verano 2022).

Very informative report. Would help to be compared with Guatemalan reports on RBM and on nearby palms listed for PANAT, since this is physically adjacent to Yaxha, where Graf did his field work 27 Feb. 2018 through 9 March 2018. We arrived in April 2018 to discuss our project and returned from August 2018 onward (so were not at Yaxha while Graf was there).

Available on-line as a download.

HENDERSON, Andrew, GALEANO, Gloria and Rodrigo BERNAL

1995 Field Guide to the Palms of the Americas. Princeton University Press.

KERMATH, BRIAN M., BENNETT, BRADLEY C., and LYDIA M. PULSIPHER

2018 Food Plants in the Americas: A Survey of the Domesticated, Cultivated and Wild Plants Used for Human Food in North, Central and South America and the Caribbean. Self-published on-line.

1,791 pages, so quite helpful. And most important of all, they provide references for each and every plant they mention.

LARA Ponce, Estuardo, Caso Barrera, Laura, ALIPHAT Fernández, Mario, RAMÍREZ Valverde, Benito, GIL Muñoz, Abel, and Gerardo GARCÍA Gil

2013 Visión ecogeográfica de los mayas itzaes: estudio de la reserve Bioitzá, El Petén, Guatemala. *Investigaciones Geográficas, Boletín del Instituto de Geografía*, UNAM, Núm. 81, 2013, pp. 94-109.

LUNDELL, Cyrus L.

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

We scanned the entire book so have it as a super-helpful in-house PDF.

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.

PÉREZ-Sarabia, José E., DUNO de Stefano, Rodrigo, CETZAL-Ix, William, ALVARADO-Segura, Arturo A. and Saikat K. BASU

2020 Conservation assessment using the IUCN criterion B: A case study on palms of the Mexican portion of the Yucatán Peninsula Biotic Province. *KEW BULLETIN* (2020) 75:40. 13 pages.

Discusses several different palm species of the Yucatan peninsula. Not all of these are in Peten.

PARKER, T.

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

Essential book but no innovative information and little settling of confusion and mish-mash of conflicting plant nomenclature for genera that are not adequately worked out elsewhere.

Also, unless a book nowadays is available as an open PDF, research time is much better focused on books and articles, theses and dissertations, and reliable websites that are all digital.

Nonetheless, it helps to have all trees of Guatemala in one single volume since otherwise you have to search "ten volumes of *Flora of Guatemala of Fieldiana: Botany monographs*."

QUERO, Hermilo J. and Robert W. READ

1986 A Revision of the Palm Genus *Gaussia*. *Systematic Botany*, Vol. 11, No. 1 (Jan.- Mar., 1986), pp. 145-154. American Society of Plant Taxonomists.

This is crucial reading on *Gaussia maya* that resulted in the year 1923 name by Cook being updated to genus *Gaussia*.

SANTIZO, C., DIX, M., DIX, M. and G. URBINA

1989 *Estudios Preliminares de la Laguna De Yaxha y Áreas Circundantes*. Universidad del Valle de Guatemala 35 pages.

SCHULZE, Mark D. and David F. WHITACRE

1999 A Classification and Ordination of the Tree Community of Tikal National Park, Peten, Guatemala. *Bulletin Florida Museum of Natural History* 41(3): 169-297.

SZEJNER, M.

2005 *Caracterización ecológica y botánica de 100 especies de árboles amenazados en Guatemala, con fines de conservación*. Tesis de licenciatura. Departamento de Biología. Universidad del Valle de Guatemala, Guatemala. 205 pages.

STANDLEY, Paul C. and Samuel J. RECORD

1936 The Forests and Flora of British Honduras. Field Museum of Natural History, Botany Series 12.
432 pages

STANDLEY, Paul C. and Julian A. STEYERMARK

1958 Flora of Guatemala. Fieldiana: Botany, Volume 24, Part I. Chicago Natural
History Museum

VELASQUEZ Azurdia, Maria Del Mar

2015 Evaluación del Impacto del Cambio Climático en Especies de Importancia Económica y Cultural en la Reserva de Biósfera Maya: en los Biotopos Naachtún–Dos Lagunas, San Miguel La Palotada–El Zotz y La Laguna del Tigre–Río Escondido. PROYECTO FODECYT No. 78–2012. Informe final. CECON USAC, Herbario USCG, USAC. 96 pages.

CONSEJO NACIONAL DE CIENCIA Y TECNOLOGIA –CONCYT
SECRETARIA NACIONAL DE CIENCIA Y TECNOLOGIA –SENACYT
FONDO NACIONAL DE CIENCIA Y TECNOLOGIA –FONACYT
FACULTAD DE CIENCIAS QUIMICAS Y FARMACIA
CENTRO DE ESTUDIOS CONSERVACIONISTAS –CECON
DE LAS UNIVERSIDAD DE SAN CARLOS DE GUATEMALA

Available as a helpful download.

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>

Helpful web sites for any and all plants

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

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

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

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

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

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

This is the main SEARCH page.

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

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

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

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

<http://enciclovida.mx>

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

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

Kew gardens in the UK is one of several botanical gardens that I have visited (also New York Botanical Gardens and Missouri Botanical Gardens (MOBOT), in St Louis. 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 *Gaussia maya*

It would help if photos listed location-where-photographed so reader can know whether in a botanical garden or whether wild and native in its original homeland climate of the Americas. Would also help to have field work reports: standing in front of a wild palm in its original habitat.

<https://biodiversidad.gt/portal/taxa/index.php?taxon=9680&clid=1>

Specimens listed for several places within Peten, including Tikal. Few international botanists have collected from Nakum.

https://en.hortipedia.com/Gaussia_maya

Reliable information and five photos though unclear where photographed. No bibliography.

<https://www.monaconatureencyclopedia.com/gaussia-maya/>

Nice closeup photo of the fruits when pure tomato-red color.

https://www.cicy.mx/sitios/Flora%20Digital/ficha_virtual.php?especie=121

A page in the helpful website on the FLORA DE LA PENÍNSULA DE YUCATÁN. Has helpful calendar of when it flowers and when it fruits (in the climate of the Peninsula of Yucatan, which is Campeche, Yucatan and Quintana Roo).

<http://tropical.theferns.info/viewtropical.php?id=Gaussia+maya>

Basic information, basic photos, references each comment but no bibliography-per-se. No medicinal use listed; no edible use listed; stems (trunks) potential for construction (but need to check in Peten and Belize whether actually used for construction since so many other plants are available).

Videos on *Gaussia maya*

I estimate 99% of videos are on *Gaussia maya* of Florida. We will do videos when we are back in PANAT.

<https://www.youtube.com/watch?v=Z5EX9-z5F8k>

Gaussia maya – The Mayan Palm and Its Relatives.

Even though in Florida has good coverage. Shows the stem (trunk) nicely (with the inflorescences coming out of the trunk at mid-height).

This report can be cited in your preferred style. Here is the basic information:

HELLMUTH, Nicholas

Multi-Colored Masses of large berry-sized Fruits of *Gaussia maya* Palms, Parque Nacional Tikal (PANAT), Reserva de la Biosfera Maya (RBM), Peten, Guatemala. FLAAR Reports, FLAAR (USA) and FLAAR Mesoamerica (Guatemala).

Base Camp Assistance in Parque Nacional Tikal in past decade

While doing field work in the Tikal National Park about a decade ago we appreciate the house provided to us by the park administration. We also thank the Solís family, owners of the Jaguar Inn, for providing a place to stay when the park facilities had other occupants. We also thank the Solís family for food in their Jaguar Inn restaurant.

Future place to sleep while doing field work in PANAT

We thank Roxana Ortiz for offering to provide lodging for our research team at the Tikal Inn for our future field trips. Since we are not receiving payments for our field work, our budget appreciates complimentary lodging. Every workday is exhausting because we are carrying and then using very heavy cameras, super-telephoto lenses, sturdy tripods, large gimbals or ball tripod heads. Thus, it is crucial for my health to be able to rest and totally recuperate every night in order to be ready for the following day of botanical and zoological adventures in Parque Nacional Tikal.

In order to post photographs on botanical and zoological websites, you can't do this if there is either no Internet or weak Internet. Thus, it is very helpful that when we are provided rooms and meals, that functional Internet is also provided by the Hotel Tikal Inn.

Contact info:

Book by Phone: (502) 7861 2444 or (502) 7861 2445

Email: tikalinn@gmail.com

Website: <https://tikalinn.com/>

Base Camp Assistance in Parque Nacional Tikal during July 2022 field trip

We sincerely appreciate the assistance of Gelber Aldana and Esdras García to find a place for our team of five to sleep comfortably. They also kindly provided sheets and a tent for the individuals that preferred to be in a tent (less buggies that way).

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

Ecolodge El Sombrero

I thank Gabriella Moretti, owner of Ecolodge El Sombrero, for providing hotel room and meals while we have been doing field work at Parque Nacional Yaxha, Nakum and Naranjo. We also appreciate the hospitality of her sons Sebastián de la Hoz and Juan Carlo de la Hoz. Every workday is exhausting because we are carrying and then using very heavy cameras, super-telephoto lenses, sturdy tripods, large gimbals or ball tripod heads. Thus, it is crucial for my health to be able to rest and totally recuperate every night in order to be ready for the following day of botanical and zoological adventures in Parque Nacional Yaxha, Nakum and Naranjo.

Equally crucial is having a place to charge the batteries of the computers, plus all the cameras, and recharge cell phones. Solar power is great, but it lasts only an hour, or less, if you plug in multiple computers and cameras and flash batteries to charge. So, a place with enough electricity to charge the entire mass of essential field work equipment is essential and thus very much appreciated.

In order to post photographs on botanical and zoological websites, you can't do this if there is either no Internet or weak Internet. Thus, it is very helpful that when we are provided rooms and meals, that Internet is also provided by the Ecolodge El Sombrero.

We also sincerely appreciate the storage space for our camping equipment: tents, camping mattresses, cooking equipment, etc. There is no way to drive this volume of equipment back-and-forth from Guatemala City to where we may be camping in a remote area of the Reserva de la Biosfera Maya during a following month.

Contact Info: +502 5460 2934, VentasElSombrero@gmail.com or WhatsApp.

www.elsombreroecolodge.com/en-us

Permissions

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

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 web site for their students to download at no cost. And you do not need to write and ask permission; but we do appreciate when you include a link back to one of our web sites.

Any web site 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 when you include a link back to one of our web sites.

CECON, CONAP, FUNDAECO, INGUAT, ARCAS, IDAEH, Municipio de Livingston, etc. 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, and other Guatemalan universities and high schools, and schools, are welcome to post our reports, at no cost.

If you wish our flora and/or fauna material as a Power Point presentation

Dr Nicholas (Hellmuth) is flown all around the world to lecture. He has spoken in Holland, Belgium, Germany, Austria, Greece, Italy, Serbia, Croatia, Bosnia, Russia, UK, Dubai, Abu Dhabi, Thailand, Korea, China, Japan, Canada, USA, Mexico, Panama, Guatemala, etc. He can lecture in Spanish, German, or English (or simultaneously translated to your language). He has lectured at Harvard, Yale, Princeton, UCLA, Berkeley and dozens of other universities, colleges, museums, alumni clubs, etc.

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

In today's COVID era, we present via ZOOM, Google Meet or comparable platforms. This way there are no costs for airfare, airport shuttle, hotel, or meals. But it is appreciated when a donation can be provided before the lecture presentation to assist our decades of research.

If your club, association, institute, botanical garden, zoo, park, university, etc. wishes high-resolution photos for an exhibit in your facility anywhere in the world

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

discuss how to share the costs. We have material for entire exhibits on:

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

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

To publish photographs:

Hellmuth's photographs have been published by National Geographic, by Hasselblad Magazine, and used as front covers on books on Mayan

topics around the world. His photos of cacao (cocoa) are in books on chocolate of the Maya and Aztec both by Dr Michael Coe (all three of editions) and another book on chocolate by Japanese specialist in Mayan languages and culture, Dr Yasugi. We naturally appreciate a contribution to help cover the costs our office expenses for all the cataloging, processing, and organization of the photos and the field trip data.

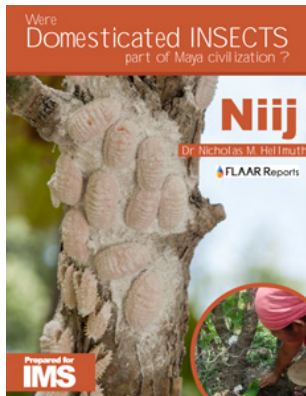
For your social media

You can post any of the FLAAR Mesoamerica PDFs about the Municipio of Livingston on your Social Media sites; you can send any of these PDFs to your friends and colleagues and family: no cost, no permission needed.

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

Back cover photo by Nicholas Hellmuth,
iPhone 13 Pro Max, RAW format, .DNG, converted
to .JPG for the report. July 20, 2022.

Other Publications of The Fauna of Guatemala



Were domesticated insects part of Maya civilization?
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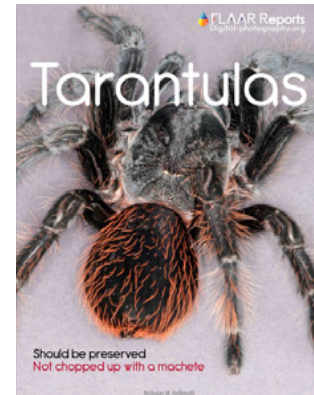
Rescate, Crianza y Reincersión de dos crías de coatis
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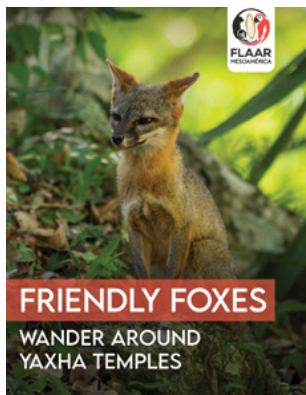
Birds in the Mayan Civilization: The Owl
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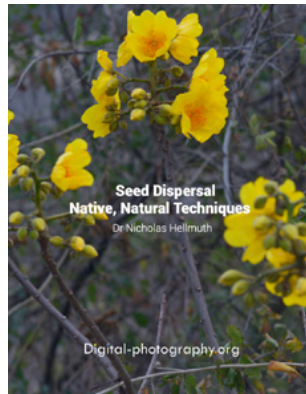
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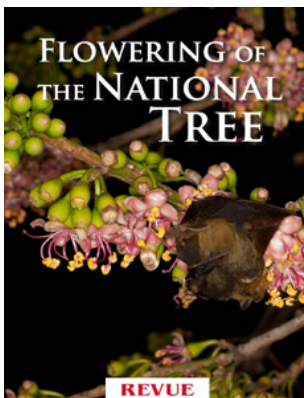
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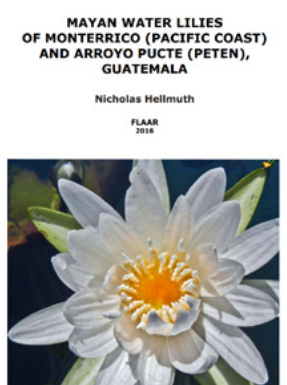
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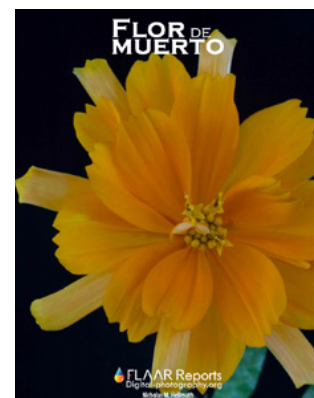
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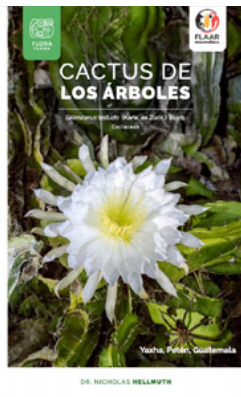
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