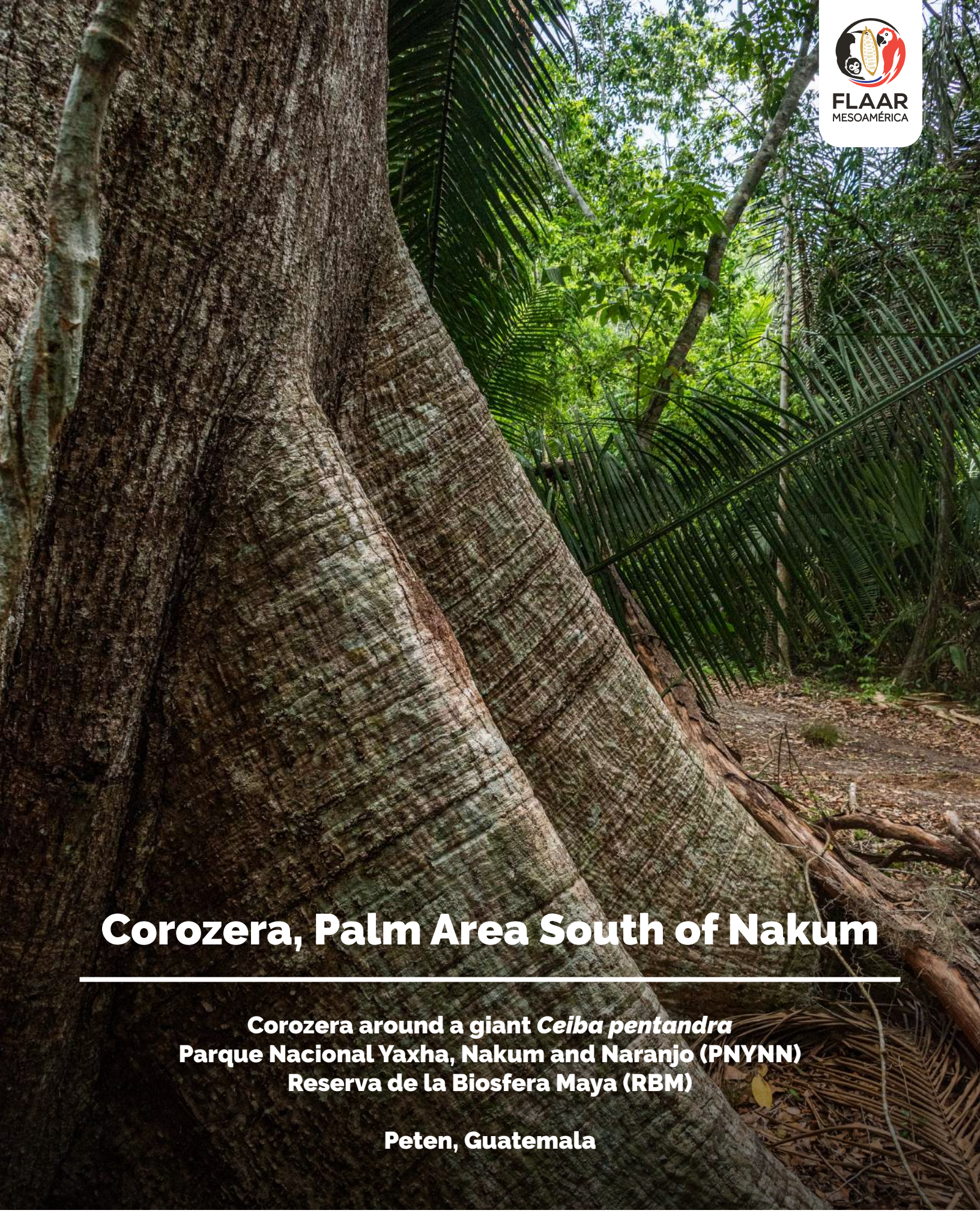
FLAAR MESOAMÉRICA

Corozera, Palm Area South of Nakum

Corozera around a giant *Ceiba pentandra*
Parque Nacional Yaxha, Nakum and Naranjo (PNYNN)
Reserva de la Biosfera Maya (RBM)

Peten, Guatemala

Nicholas Hellmuth



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FOR COOPERATION, HOSPITALITY, AND ASSISTANCE AT PARQUE NACIONAL YAXHA, WE THANK
all the helpful and knowledgeable guides 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.

ASSISTANCE FOR KNOWLEDGE OF PLANTS AND ANIMALS OF PNYNN
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We appreciate

a donation during November 2021 and a subsequent donation in early June 2022 to help cover the costs of FLAAR research projects specifically to assist and support the current FLAAR project of flora and fauna in the Reserva de la Biosfera Maya (RBM). This continuing donation also assisted the FLAAR (USA) and FLAAR Mesoamerica (Guatemala) research project searching for wild edible plants in the wetlands of the Municipio de Livingston area of the departamento of Izabal, Guatemala.

These donations are 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 in the Yaxha area in the 1970's while the site was being mapped by FLAAR.

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), Parque Nacional Laguna de Tigre (PNLT), and wetlands of Municipio San Jose are three areas that we are focusing on within the over 5 million acres of the RBM.

FLAAR MESOAMÉRICA

FLAAR

FLAAR was formed in 1969 to map Yaxha (and nearby Topoxte Island and Nakum). When the president of Guatemala visited Yaxha in the 1970's we mentioned that it was urgent to create a national park to protect both the Mayan heritage and also the original forests. We also spoke with the head of FYDEP to initiate protection of this area as a national park. A few months later the president of Guatemala asked me to accompany him to Tikal, so I had additional time to encourage him to declare Yaxha and Sacnab areas as a national park. The last day of our field work, I found a painted sign placed by FYDEP reading Parque Nacional Laguna Yaxha Laguna Sacnab. It then took over 15 years to formalize the paperwork. Other NGO's and other individuals focused on conservation nudged the government to finish the paperwork plus these other entities intelligently added the Naranjo area to Yaxha and Nakum areas. I had not worked at Naranjo; only at Yaxha, Topoxte Island, and Nakum. I feel proud that FLAAR initiated what today is Parque Nacional Yaxha, Nakum and Naranjo. The ruins of Naranjo-Sa'al were a helpful addition by the individuals and NGO's in the late 1970's and 1980's.

Recently we were asked to return for flora, fauna, and biosphere field work from August 2018 to July 2019. This project found and documented with high-resolution photography enough plant, bird, and insect species, plus ecosystems, that as a result we were asked by CONAP to return for five years, 2021-2025 of coordination and cooperation with them, both in the Yaxha, Nakum and Naranjo national park plus all the rest of the Reserva de la Biosfera Maya.

CONTENTS

Introduction to Corozera South of Nakum
(Corozal surrounding giant Ceiba)

There are two areas of "solid corozo palms" between Yaxha and Nakum that you see as you drive from one ancient Maya city to another:

1. Corozera North of Yaxha (Corozal-Botanal)
2. Corozera South of Nakum (Corozal surrounding giant Ceiba)

We are preparing a FLAAR Report on each of these photogenic biodiverse ecosystems. In the present report on Corozera South of Nakum (Corozal surrounding giant Ceiba) we discuss the botany and ethnobotany of corozo palms. In the parallel report on the Corozera North of Yaxha (Corozera Botanal North of Yaxha) we provide botanical and ethnobotanical discussion of Sabal palms. This way we don't repeat these botanical documentations. The two corozeras are relatively similar to each other but we estimate that the Corozera North of Yaxha has more botan palm (Sabal species).

Photo by Nicholas Hellmuth with FLAAR Iphone 13 Pro Max, May 11, 2022.

Photo by Nicholas Hellmuth with FLAAR Iphone 13 Pro Max, May 11, 2022.

Parque Nacional Yaxhá, Nakum y Naranjo (PNYNN)
Reserva de la Biósfera Maya (RBM).

Corozeras, Pitales and Aguadas of Parque Nacional Yaxhá, Nakum y Naranjo

Route traveled on Wednesday, May 11th, 2022.

- Lodging (Starting/ending point)
- 30 minutes mark
- 60 minutes mark
- 30 minutes mark (return)
- 60 minutes mark (return)
- R Return point
- * Ecosystems, with provisional names, that were visited on May 11th (in black letters)
- Road PET-04
- Roads inside the Park

Source: Elaboration via GPS recording with our Garmin GPS 66sr and then time put on the map by Sergio D. Jerez. Photographic background generated from CalTopo.com CALTOPO and reproduced with permission, which contains layers from CalTopo, MapBox, Maxar, USDA Farm Service Agency, EOX IT, and modified Copernicus data (2019).

FLAAR MESOAMÉRICA FLAAR

GPS MAP with Garmin 66sr by Sergio Jerez and designer Andrea Bracamonte, FLAAR Mesoamerica.

In the future it would help to map each corozera and make a list of all the other corozo areas within Parque Nacional Yaxha, Nakum and Naranjo (PNYNN). We discuss this in the conclusion.

My Personal Experience with the Corozera South of Nakum
(Corozal surrounding giant Ceiba)

When you drive from Yaxha to Nakum you first pass through a corozo palm botan palm "jungle" several kilometers north of Yaxha. Then a half hour later you pass through another very similar corozera-botanal ecosystem south of Nakum. This second corozera has a giant *Ceiba pentandra* tree on the west side of the road. So you get the national tree of Guatemala surrounded by "pristine rain forest". Definitely worth the experience.

I first saw these two incredible palm jungle areas in the 1970's while hiking to Nakum to document the looting. This documentation was needed to tell the world that looting was destroying the pyramids of Nakum (and the looting was encouraging more looting because nothing was done to stop it or even slow it down in these years). In subsequent decades I visited this area at least once every decade leading tour groups who wanted to see "untouristed areas".

Then, a permit for a 1-year project of cooperation and coordination with the park administrators for August 2018 to July 2019 was provided so we returned with a full photography team. Based on all the results we produced (reports and tons of high-resolution photographs), we were then asked to return for five more years (2021-2025). With this new project of cooperation and coordination with CONAP we realized that a drone was the single most significant and helpful item. So we found an excellent drone pilot, Haniel Lopez and began doing aerial photography of each eco-system with a DJI Mavic 2 Pro. For two months he was working on his own project elsewhere, so he recommended another experienced drone pilot and aerial photographer, Emanuel Cohcooj. So in May 2022 we accomplished even more aerial and ground level panorama photography.

Corozal areas are well known to botanists, ethnobotanists, and archaeologists, but I am not yet aware of any PhD dissertation or long-term field work research Project on the corozera areas of the Reserva de la Biosfera Maya. That is why the FLAAR Mesoamerica team is now focused not only on corozeras, but also in other inexplored ecosystems (most of which are seasonally inundated) throughout PNLT, PNYNN, and elsewhere in the RBM. These include:

- Corozeras
- Swamps
- Marshes
- Grassland savannas
- Cibales, sawgrass savannas
- Tasiste palm savannas
- Bajos, low, seasonally inundated forests (tintales, corozeras, etc.)

Full Botanical Name of
Corozo Palm

Attalea cohune Mart. is the accepted name.

The word Cohune is also used (in Belize) for *Bactris* mexicana Mart. and *Astrocaryum mexicanum* Liebm. ex Mart. (Standley and Williams 1958: 206; Balick, Nee and Atha 2000: 196). Keep in mind that plant genus and species names of past decades are now considered synonyms as botanists today can analyze more specimens and their DNA, so new botanical designations evolve. Nonetheless, the earlier botanical research and publications still have helpful information.

> En Guatemala y en el departamento de Petén, existen otras palmas muy similares a ésta, las cuales toman los mismos nombres vulgares de corozo, coquito, manaca, Cantutz, este último en maya, son *Scheelea lundellii* Bartley y *Scheelea preussii* Burret; se distinguen de *Orbygnia* por sus flores que sólo tienen 6 estambres.
>
> (Aguilar and Aguilar 1992: 185).
>
> Family name: Arecaceae.

Photo by Nicholas Hellmuth with FLAAR Iphone 13 Pro Max, May 11, 2022.

How many different species of *Attalea* palms are in Peten, Belize, etc.?

In Belize only one single *Attalea* palm is listed. But as we will learn, there are actually other species also. However here are the comments on *Attalea cohune* from two decades ago. This book is the best on the vascular plants of any area of Mesoamerica; nothing even close exists for other areas because Balick, Nee and Atha mention the ethnobotanical uses of each plant (how they were used by local Mayan people):

> ***Attalea cohune*** Mart. — Syn: Orbignya cohune (Mart.) Dahlgren ex Standl. — Ref: FG 1: 274, fig. 46. 1958; Henderson et al., 1995: 159. — Loc Use: MED, FOOD, OIL, FUEL, BEV, CNST, PRD. — Reg Use: PRD, FOOD, FUEL, MED, CNST, BEV. —Nv: cocando boy, cohune, chunciey, corozo, tutz. — Habit: Palm, large trunk and leaves.
>
> (Balick, Nee and Atha 2000: 194).

Orbignya Cohune (Mart.) Dahlgren. *Attalea* cohune Mart. Cohune Palm. Manaca. Corozo. Tutz (Maya). The commonest palm of the region, occurring extensively from sea level to an elevation of 540 meters, on all types of soil; Mexico, and probably as far south as Costa Rica. A tall, unarmed palm with very thick trunk, usually with persisting leaf bases; leaves plumelike and graceful, sometimes as much as 10 meters long, with numerous narrow segments; flower and fruit panicles very large and heavy, pendent, 1 meter long or more, often containing 500-800 fruits, these 6 cm. long, shaped like young coconuts of corresponding size. This palm is of considerable importance locally. The leaves are much used for thatching, and the pole-like rachis of the leaf for forming the framework of huts. Oil is obtained from the kernels, and the tender "cabbages" are eaten. During the World War large quantities of the nuts were exported to England for preparing charcoal used in gas masks.

(Standley and Record 1936: 85)

Synonyms

Attalea liebmannii (Becc.) Zona is included by Villasenor (2016: 58) for Campeche, Chiapas, Tabasco, so adjacent to Peten (also in Oaxaca, Tamaulipas and Veracruz). But ThePlantList does not include *Attalea liebmannii* in list of accepted species for genus *Attalea* (http://www.theplantlist.org/1.1/browse/A/Arecaceae/Attalea/) but in more mish-mash does include it as a synonym of *Attalea rostrata* Oerst. In Neotropical Flora (NeotropicalPlantPortal) when you look for *Attalea rostrata* you get *Attalea butyracea* (for Izabal and San Marcos).

So *Attalea butyracea* has been collected in the current century from several places of Izabal but is not listed for Peten). Keep in mind that the names used in year 1902 are not realistic for tabulating today in year 2022. Nonetheless, best to show the synonyms of all species named cohune palms that are *Attalea* genus and one that is a different genus.

A. guacuyule is a synonym for *A. cohune*, so I include the synonyms for this name as well.

Photo by Nicholas Hellmuth with FLAAR Iphone 13 Pro Max, May 11, 2022.

Attalea cohune Mart.	***Attalea butyracea*** (Mutis ex L.f.) Wess. Boer	***Attalea guacuyule*** (Liebm. ex Mart.) Zona
	Attalea gomphococca Mart.	*Cocos cocoyule* Mart.
	Attalea humboldtiana Spruce	*Cocos guacuyule* Liebm.
	Attalea macrocarpa (H.Karst.) Wess.Boer	*Orbignya guacuyule* (Liebm. ex Mart.) Hern.-Xol.
Orbignya cohune (Mart.) Dahlgren ex Standl.	*Attalea macrocarpa* (H. Karst.) Burret	
Orbignya dammeriana Barb.Rodr.	*Attalea pycnocarpa* Wess.Boer	
	Attalea wallisii Huber	
	Attalea gomphococca Mart.	
	Cocos butyracea Mutis ex L.f.	
	Scheelea butyracea (Mutis ex L.f.) H.Karst. ex H.Wendl.	
	Scheelea dryanderae Burret	
	Scheelea excelsa H.Karst.	
	Scheelea gomphococca (Mart.) Burret	
	Scheelea humboldtiana (Spruce) Burret	
	Scheelea macrocarpa H.Karst.	
	Scheelea passargei Burret	
	Scheelea regia H.Karst.	
	Scheelea wallisii (Huber) Burret	

All synonyms from ThePlantList.

I am always open to improved botanical nomenclature, so I use *Attalea cohune* and not *Orbignya cohune*. Nonetheless, I also include *Attalea guacuyule* in the tabulations, which is a synonym for *A. cohune*

I spell out the states that are in the Maya Lowlands. The other states are how Villaseñor abbreviates them.

Attalea cohune Mart.	***Attalea butyracea*** (Mutis ex L.f.) Wess. Boer	***Attalea guacuyule*** (Liebm. ex Mart.) Zona
CAMPECHE	*CAMPECHE*	
CHIAPAS	*CHIAPIS*	
COL		COL
GRO		GRO
	HGO	
JAL		JAL
MICH		MICH
NAY		NAY
OAX	*OAX*	OAX
	PUE	
QUINTANA ROO	QUINTANA ROO	
SIN		
TABASCO	TABASCO	
TAMS	TAMS	
	VER	
YUCATAN	YUCATAN	

So far I did not find mention of anywhere in Mexico for *Attalea butyracea* on Neotropical Plant Portal

https://serv.biokic.asu.edu/neotrop/plantae/collections/list.php?taxa=Attalea+rostrata&usethes=1&taxontype=2&page=2

Villaseñor 2016 provides all the states where each plant is located.

In addition to the *Attalea* species, there is another species which is called cohune palm:

Astrocaryum mexicanum Liebm. ex Mart
Astrocaryum chichon Linden
Astrocaryum cohune (S.Watson) Standl.
Astrocaryum mexicanum Liebm.
Astrocaryum rostratum Hook.f.
Astrocaryum warscewiczii H. Karst.
Bactris cohune S.Watson
Hexopetion mexicanum (Liebm. ex Mart.) Burret

Photo by Nicholas Hellmuth with FLAAR Iphone 13 Pro Max, May 11, 2022.

Mayan Names for *Attalea cohune* palms

If you are a linguist. You can find even more Mayan names but here is a start.

- Mokooch, Q'eqchi' Mayan, Belize (Grandia 2006: 191)
- Tutz (Yucatec Maya) (Standley and Williams 1958: 274)

Several Palms of Peten have the common local name of Cohune or Corozo; one is *Astrocaryum mexicanum*. We show the botanical description by Standley and Williams 1958 in Appendix B.

This palm is nowhere near as large as corozo and grows in slightly different ecosystems. You can instantly identify *Astrocaryum mexicanum* because of the thousands of lance-shaped spines that stick out in horizontal rows around the stem. Also, the trunk of a corozo palm is 1000% larger, taller and has lots more leaf litter areas on the trunk.

Corozera, Corozal

Since there are 21,000 square kilometers in the Reserva de la Biosfera Maya (that is over 5-million acres), it is more productive to focus on specific areas (since obviously we don't have funding for 21,000 square kilometers). So our focus is wetlands: swamps, marshes, river and lake shore areas; and seasonally inundated areas: such as bajos, savannas, etc. Many (but not all) corozeras are in bajo areas. Plus there are at least five corozeras in PNYNN, Parque Nacional Yaxha, Nakum and Naranjo (Moises Daniel Perez Diaz, personal communication, July 2022). So the present report is on corozeras. The botanical name is corozal; the local name in Peten is both corozal and, more frequently corozera.

An unusual characteristic of cohune distribution is the palm's high-density occurrence in parts of Belize's species rich forests. It is typical for most tropical tree species, including cohune, to be scattered throughout the forest at low densities (Connell and Lowman, 1989), but the cohune also occurs in discrete monospecific groves (corozales) and at above average densities in lowland forests (cohune ridge).

Both 'corozal' and 'cohune ridge' are frequent Belizean toponyms, suggesting that the recognition of cohune dominated vegetation dates to early historic settlement. Indeed, colonial travellers such as Swett (1868) and Morris (1883) mentioned cohune's concentration in some forests. The cohune's dominance is also described in most of the early 20th century studies of the 'Maya region' (Gann, 1918; Standley, 1932; Stevenson, 1932; Bartlett, 1935; Standley and Record, 1936; Standley and Steyermark, 1958). Wright et al. (1959: 301) considered cohune-dominated areas a distinctive vegetation and denoted some 124,612 ha of land in Belize (roughly 5% of the country's land area) as potential "Cohune Forest", where cohune either was or had the potential to be "dominant or prominent in the vegetation."

(McSweeney 1993: 42, her references are in her References Cited, pp. 131ff)

So 481 square miles of corozal ecosystems exist in Belize. These observations of the landscape of Belize before cattle ranches and milpas destroyed original forests is potential documentation for my suggestion of substantial areas of corozeras along the road towards Sacpuy (west of the end of Lake Peten Itza) and along the road from Melchor de Mencos towards Naranjo-Sa'al.

We named this Corozera after the giant *Ceiba pentandra* tree in the middle

The aerial views show several large *Ceiba pentandra* trees but one is adjacent to the road that goes from Yaxha to Nakum. This Ceiba is so large, and is easy to see alongside the road, that it makes a good logo name for this Corozera.

At top right you can see thick mass of corozo trees and several botan palm that are slightly taller. You can see more of the epiphytes on the limbs and branches in a month when there are no leaves.

To study a tree it helps to see if from ground level and from above.

Aerial photo by Emanuel Chocooj with FLAAR drone DJI Mavic 2 Pro, May 11, 2022.

Since Botan palms grow taller than Corozo palms you often notice lots of Botan. Also, any tall tree will obscure the corozo growing under it. So the endless areas of Corozo are not as notable from a drone photo. This is why it helps to do panorama photos at ground level and aerial photos from above.

Ceiba pentandra trees lose their leaves each year. But in some areas I have noticed that each individual tree loses their leaves at a particular time, as if each tree made such decision individually; so not every Ceiba in the same area loses their leaves the same week. Yet in the aerial view it seems that lots of Ceibas have all lost their leaves.

Aerial photo by Emanuel Chocooj with FLAAR drone DJI Mavic 2 Pro, May 11, 2022.

All this is in a bajo forest; on the far horizon you can see lots of hills.

The bajo forest changes, to the lower right you see the corozera area; everywhere else is outside the corozera area. What I note from these aerial photos is that this is definitely not a "low" forest. Bajo means low in Spanish. But it could also mean flatland area, which this is. I doubt there are any Palo de tinto (*Haematoxylum campechanum*) trees here but you would need to hike through the whole area to know for sure. Tinto trees can grow to medium height but I estimate tend to be in areas of different soil type. The soil around a corozera is stated to be one of the absolute best places to plant maize, in some degree, because the corozo palms produce a lot of leaf litter.. Fortunately the park protects the forest from slash-and-burn agriculture.

But elsewhere between Yaxha and Nakum there are literal bajo forests, where most of the plants are bushes, vines, and low trees.

Aerial photo by Emanuel Chocooj with FLAAR drone DJI Mavic 2 Pro, May 11, 2022.

65% is the corozera with botan and trees; the diagonal right side is forest with only a few palms. In the future it would help to have a higher resolution drone camera so we could map the size and shape of the entire corozera area.

Aerial photo by Emanuel Chocooj with FLAAR drone DJI Mavic 2 Pro, May 11, 2022.

The corozera with botan and trees is diagonally across the middle; the diagonal upper left side is forest with only a few palms; probably "palms"end also at top right and bottom right (although in the bottom right palms are under the treetops).

Aerial photo by Emanuel Chocooj with FLAAR drone DJI Mavic 2 Pro, May 11, 2022.

In the left middle you get an area of solid corozo palms; in several other areas to the right you see lots of corozo but more tree tops than palms. I estimate that no bajo of PNYNN has had aerial photos of this quality available before (but would help to have notably improved quality with an even better camera).

Aerial photo by Emanuel Chocooj with FLAAR drone DJI Mavic 2 Pro, May 11, 2022.

Corozo palms, isolated but frequent tall botan palms, and lots of different tree species (tall trees; not stunted).

Corozera North of Yaxha, photo by Nicholas Hellmuth, Feb. 17, 2019, with Nikon camera.

Ceiba pentandra trees grow for so many "centuries" that their buttress roots are awesome

The buttress roots are "bigger" than the trunk.

Photo by Elena Siekavizza, January 21, 2019, iPhone 6.

You can see the size of the buttress roots of the *Ceiba pentandra* when a person is next to the roots.

Photo by Sergio Jerez, May 11, 2022.

The two species of palms are so thick that you can't even see the giant trunk of the huge ceiba in front of you.

Photo by Nicholas Hellmuth, iPhone 13 Pro Max, RAW mode (DNG format),

As you slowly move forward through the thick palms, you gradually see more of the *Ceiba pentandra.*

Photo by Nicholas Hellmuth, iPhone 13 Pro Max, RAW mode (DNG format),

Now you see even more of the trunk of the Ceiba.

Photo by Nicholas Hellmuth, iPhone 13 Pro Max, RAW mode (DNG format),

Photo by Nicholas Hellmuth, iPhone 13 Pro Max, RAW mode (DNG format),

When a *Ceiba pentandra* tree is advanced in years, most of the spines are no longer on the base of the trunk (because the tree is so large it does not need much protection from animals any more). But interesting to have a close-up view of this aged Ceiba trunk.

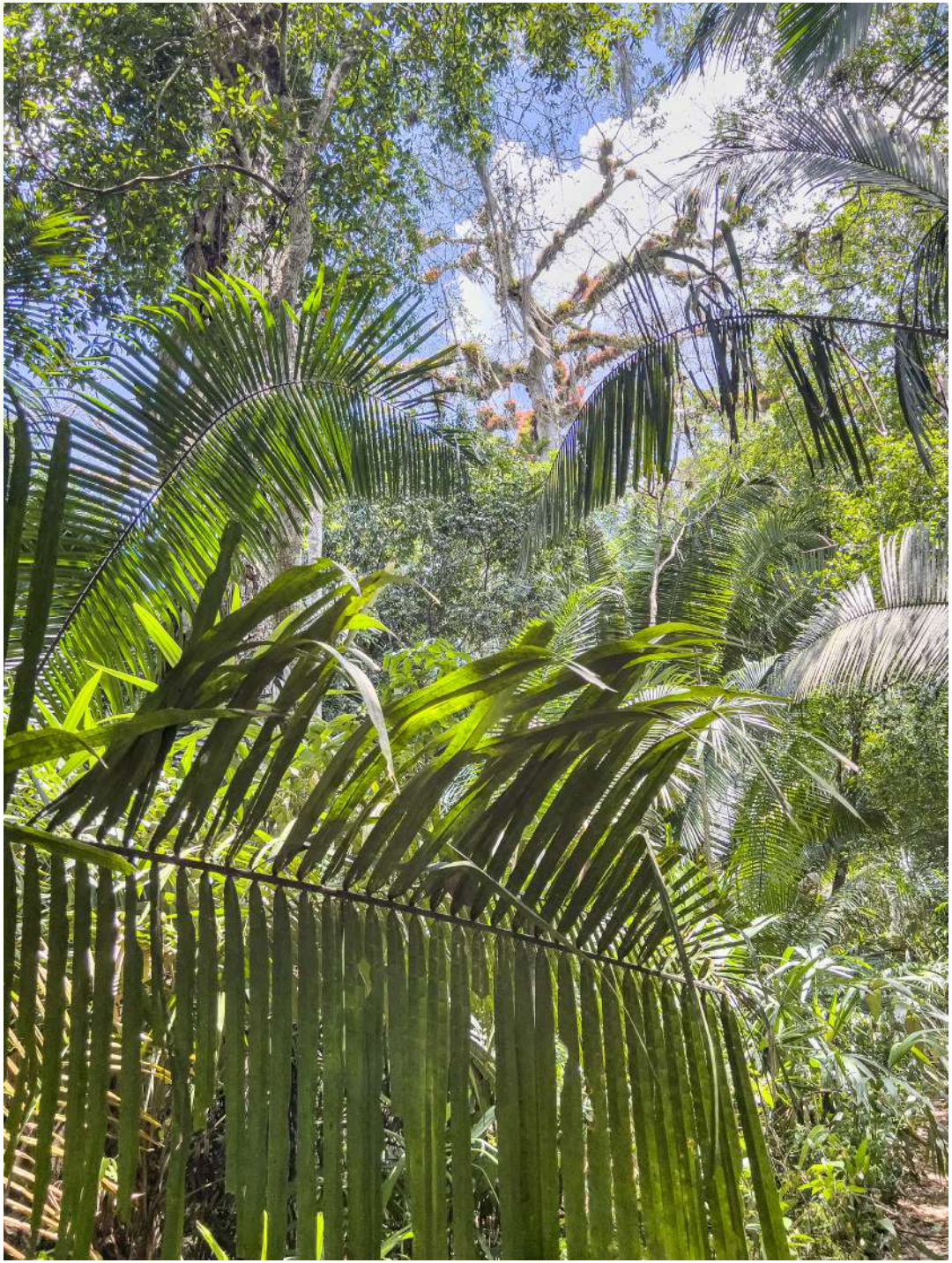
Photo by Elena Siekavizza, January 21, 2019, iPhone 6.

The giant Limbs of *Ceiba pentandra* trees are home to lots of epiphytic plants

Due to the size of *Ceiba pentandra*, these trees usually serve as a refuge for many species of flora and fauna. It is possible to find many epiphytic plants in their branches. branches, and its diversity varies according to the vertical stratification of the tree. In that sense, the greatest diversity is found in the canopy, which at the same time, contributes to the variety of birds and others vertebrates by increasing the food availability. Epiphytes are important because they contribute to processes such as nutrient cycle, since they obtain nutrients originating from outside the ecosystem and transfer them to other members of the forest. So in the *Ceiba pentandra* trees you can find lots of microecosystems.

Bright red epiphytic bromeliads on the limbs of trees within the corozera.

Photo by Nicholas Hellmuth, iPhone 13 Pro Max, RAW mode (DNG format), put into JPG so the report is not too many megapixels.



Epiphytic bromeliads and other plants on the limbs of the giant *Ceiba pentandra* within the corozera. View from the back (I hiked into the corozera to get this view).

Photo by Nicholas Hellmuth, iPhone 13 Pro Max, RAW mode (DNG format),

Epiphytic bromeliads and other plants on the limbs of the giant *Ceiba pentandra* within the corozera.

Photo by Nicholas Hellmuth, iPhone 13 Pro Max, RAW mode (DNG format), 12:44 pm, May 11, 2022,

Lots of epiphytes, especially bromeliads and Spanish moss. The large and long limbs of a *Ceiba pentandra* tree are a veritable botanical garden. Corozera South of Nakum, Parque Nacional Yaxha, Nakum and Naranjo (PNYNN), RBM, Peten.

Photo by Edwin Solares, Sony a1 mirrorless camera, Sony 200-600mm telephoto lens, 12:53 pm, May 11, 2022.

Tillandsia juncea, Tilancia

This is a closeup (with 200-600mm telephoto lens) of the most common bromeliad (*Tillandsia festucoides* Brongn. ex Mezen). on the branches of this *Ceiba pentandra.* The most photographed *Ceiba pentandra* in Guatemala is the one at Tikal (short distance from Visitors Center as you hike towards the ruins). That Ceiba at Tikal has the identical red bromeliads on all limbs and branches.

Photo by Edwin Solares Sony A1 mirrorless camera, Sony 200-600mm telephoto lens, 12:53 pm, May 11, 2022.

Close-up (with 600mm lens) of the epiphytes on the limb.

Photo by Edwin Solares, Sony A1 mirrorless camera, Sony 200-600mm telephoto lens, 12:53 pm, May 11, 2022.

Tillandsia usneoides and other bromeliads on the branches of the *Ceiba pentandra*.

Photo by Edwin Solares Sony A1 mirrorless camera, Sony 200-600mm telephoto lens, 12:53 pm, May 11, 2022.

In Peten cacti climb up trees and then spread out along the limbs. There are not terrestrial (Opuntia) cactus in the Reserva de la Biosfera Maya; those that you see are in gardens, brought from other parts of the country where there are hundreds of cacti in bosque seco areas.

The most common plant on the branches of this Ceiba pentandra is the red colored *Tillandsia festucoides*.

The oval objects hanging off the branches are seed pods of the Ceiba.

Photo by Edwin Solares, Sony A1 mirrorless camera, Sony 200-600mm telephoto lens, 12:55 pm, May 11, 2022.

The oval objects hanging off the branches are seed pods of the *Ceiba pentandra.* Cotton-like kapok fibers o seed fibers species are off-white to light brown; kapok of *Ceiba aesculifolia* is more white.

Photo by Edwin Solares, Sony A1 mirrorless camera, Sony 200-600mm telephoto lens, 12:58 pm, May 11, 2022.

Ceiba pentandra has
many edible and practical uses

Ceiba pentandra is actually one of the most useful producer trees of food and utilitarian products. Understandably, we all focus on ramon nut (*Brosimum alicastrum* Sw. as a "super food" but Ceiba offers the following:

- Ritual (it's a sacred tree)
- Products (canoes, but sadly that means cutting down the tree)
- Fuel (hopefully only after a wind storm blows it over; don't cut these trees down)
- FOOD (seeds are edible)
- Medicine
- Fiber (seed fiber)
- Construction (rare because there are hundreds of other trees and plants more realistic)
- Oil

All these are listed by Balick, Nee and Atha 2000: 68). Specific details are provided by Standley and Steyermark (1949: 392-393):

Locally the wood is used occasionally for fuel, drums, bateas, and other articles. It is considered suitable for paper pulp, corestock for veneers, packing cases and boxes, toys, and miscellaneous purposes requiring a soft, easily worked wood. It has been used at times for dugout canoes and rafts, but for the latter purpose cannot compete with the much lighter balsa wood (...)

The seeds are reported to yield an oil that has been used in some regions for illumination and soap manufacture. The leaves are said to be edible when cooked. The most important product of the tree, however, is the silk or cotton of the seed pods, known in commerce kapok fiber. It is very fine, light, and elastic, and does not become matted under pressure. Large amounts are produced in the East Indies and West Africa, and exported for use in filling pillows, life preservers, and mattresses,(…)

Balick and Arvigo provide the medicinal notes (2015: 363).

Lots more library research can reveal even more uses but the present report is on the corozera as a ecosystem. Since the Ceiba is the national tree, a sacred tree and a literally beloved tree, we tend to overlook all its usable aspects. Also notable are usable aspects of the smaller *Ceiba aesculifolia* of bosque seco areas of Guatemala and surrounding countries. Since there are thousands of *Ceiba aesculifolia* trees along the highway CA-9 halfway en route to the turn off to Peten (or straight ahead to Puerto Barrios), we have studied pochote (one of the local names C. aesculifolia and its uses.

In what Ecosystem(s) can you find native *Ceiba* tres and Corozo Palm?

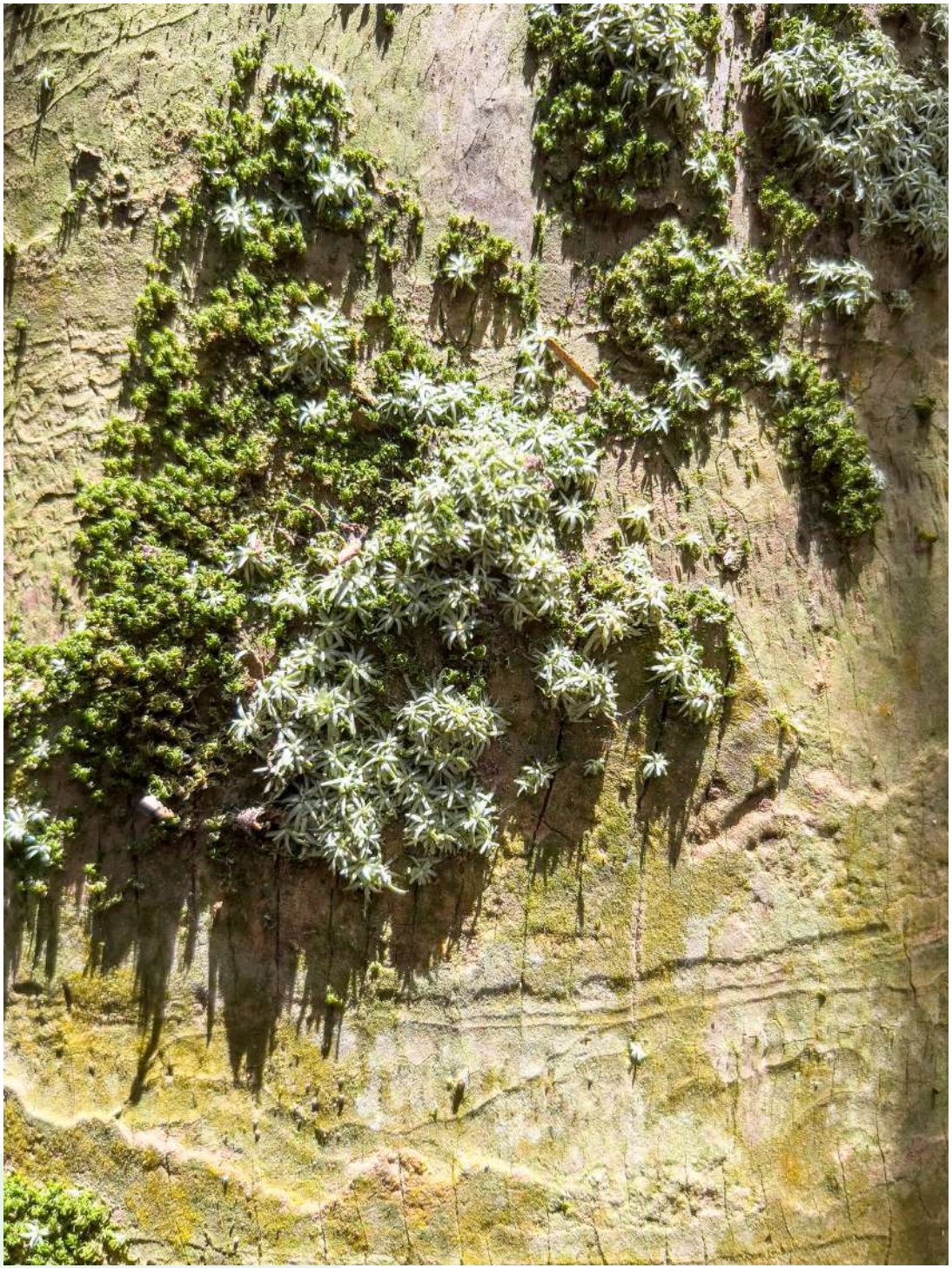
Ceiba aesculifolia prefers dry areas, often surrounded by cacti. But it can also grow elsewhere (such as in the FLAAR Ethnobotanical Research Garden at 1,500 meters above sea level in front of our office in Guatemala City).

Ceiba pentandra grows in the Costa Sur, Peten, Alta Verapaz and many other parts of Guatemala (listed by Standley and Steyermark 1949: 391). Also survives not far from ***Ceiba aesculifolia*** but has probably been planted there (since kapok trees prefer more rainfall).

Corozo palm is most noticeable in Peten, Belize and similar areas but is also found in many other parts of Mesoamerica. But I would not expect corozo palms in a cloud forest. But nothing would surprise me due to the popularity of this tree and its sacred aspects to the Mayan people for thousands of years.

What other Trees or Plants are often found in the same Corozera Habitat?

In the future will be essential to get tabulated lists of what trees grow in the Corozeras of nearby Belize. Depends on altitude; whether a hill slope, or flat bajo that is seasonally inundated. The Corozera areas between Yaxha and Nakum are both flat and are seasonally inundated. First step is to notice that a corozera deserves to be studied, photographed and published so that botanists can make plant inventories in these locations.



It's so wonderful to see, in front of your eyes (not on the Internet, not in a 50-year old botanical monograph) something growing as energetically as these plants on a smooth trunk of a palm.

Photo by Nicholas Hellmuth, May 11, 2022, iPhone 13 Pro Max, (RAW mode produces a DNG file quality).

Photo by Nicholas Hellmuth, May 11, 2022, iPhone 13 Pro Max, (RAW mode produces a DNG file quality).

Photo by Nicholas Hellmuth, May 11, 2022, iPhone 13 Pro Max, (RAW mode produces a DNG file quality).

Strangler Fig embraces unfortunate tree or Palm

Birds eat the fig fruits; then, they fly to another tree and poop out the seeds. These seeds land on the trunk, limb, or branch of where the bird is resting. The seed is surrounded by fresh fertilizer so it grows. Gradually the roots wind downward, to reach ground level to dig into the soil.

All the while the roots "embrace" the host tree. Eventually the roots reach the ground and "take root" so the embracing roots strangle the host tree. The host tree dies (from strangulation). The fig trees continues to live and more birds eat more fruits and it spreads around. Tayasal Island is a great place to see monumental strangler fig trees.

These trees grow all over Guatemala, so are only found on bajo habitats.

Photo by Nicholas Hellmuth with FLAAR Iphone 13 Pro Max, May 11, 2022.

The parallel horizontal bands on this tree suggest it may be a giant botan palm.

All photos by Nicholas Hellmuth, iPhone 13 Pro Max, set to RAW mode (DNG format). May 11, 2022.

Strangler fig embracing an unfortunate tree or palm. Corozera Ceiba South of Nakum, Parque Nacional Yaxha, Nakum and Naranjo (PNYNN), RBM, Peten, Guatemala.

Photo by Nicholas Hellmuth with FLAAR Iphone 13 Pro Max, May 11, 2022.

The soil must be very healthy for these roots. Closeup photo by Nicholas Hellmuth.

Photo by Nicholas Hellmuth with FLAAR Iphone 13 Pro Max, May 11, 2022.

Brief Look at the Corozera
West of Naranjo-Sa'al

The Corozera West of the edge of Naranjo-Sa'al ruins seem to have more moisture year round and thus a lot of ground plants and bushes that we have not yet noticed in either of the corozeras between Yaxha and Nakum. We show the bijao (*Calathea* sp.). and pinuela (*Aechmea magdalenae*) as samples of the biodiversity of the Corozera West of the edge of Naranjo-Sa'al ruins. Once we have time to hike around inside (off the road) into the two Yaxha-Nakum corozeras we can report on what we find.

These are the inflorescences of mashan plants inside the Corozera West of Naranjo-Sa'al Ruins. We found lots of these plants in the Savanna of 3 Fern Species, west of Lake Yaxha. Their more common name is bijao. Their leaves are used to wrap maize dough to make Mayan tamales. There is potential to utilize the leaves to wrap foods instead of plastic. They are not often used for roof thatch since guano, corozo, heliconia and other plants are larger and more popular for roof thatch in Guatemala. In other tropical parts of the Americas these leaves also have other uses.

Balick, Nee and Atha list *Calathea lutea* as being food and medicinal (2000: 178).

We have not yet found any of these *Calathea lutea* plants in either of the Corozeras along the road from Yaxha to Nakum. But, the corozera west of Naranjo already has trails and so it's easy to hike around to see what's inside the corozera in addition to corozo palms and guano palms.

Photo by Nicholas Hllmuth, iPhone Xs, July 9, 2019.

Corozera West of Naranjo-Sa'al Ruins, Parque Nacional Yaxha, Nakum and Naranjo (PNYNN), Reserva de la Biosfera Maya (RBM), Peten, Guatemala.

Photo by David Arrivillaga, 2019.

Lots of plants in a corozera are edible, especially most of the giant terrestrial bromeliads such as this piñuela.

Corozera West of Naranjo-Sa'al Ruins, photo by Nicholas Hellmuth, iPhone Xs, July 9, 2019.

FLAAR (USA) and FLAAR Mesoamerica (Guatemala) are inspired to continue to find, photograph, document, and publish additional corozeras, tasistales and do aerial photography of the not yet photographed guanal-escobal palms area west of Nakum.

Bromelia karatas, Pita

Sabal sp., Guano juven

Corozera West of Naranjo-Sa'al Ruins

Photo by Nicholas Hellmuth, iPhone Xs, July 9, 2019.

This Corozera West of Naranjo-Sa'al Ruins is an awesome rain forest botanical garden. Would be a great location for any movie that needs to have a "jungle background." Sadly most of movies go to Costa Rica or Colombia for these photogenic backgrounds.

Photo by David Arrivillaga or Nicholas Hellmuth, 2019

We also need to find all the other corozeras within PNYNN to see how similar and how different they are one from another.

Part of a corozera (with logos of guano palm) as you hike towards the jimbal. Photo by Nicholas Hellmuth, iPhone 13 Pro Max, 2:56 p, Dec. 17, 2021.

In 2019 we had the iPhone Xs. Then we got the iPhone 11 Pro, then the iPhone 12 Pro Max, and now provide three iPhone 13 Pro Max cameras to the FLAAR photography team. It is easier to get lots of good photos with an iPhone 13 Pro Max because they are light weight and easy to carry. But they have no polarizing filter. For a photo to enlarge for an exhibit, Canon or Sony mirrorless cameras are excellent. Nikon has not yet produced a mirrorless camera as advanced as Sony A1. The crucial aspect of these mirrorless cameras is in-camera stabilization and in-lens stabilization, so you don't need to carry a heavy tripod, unpack it, set it up, alight the tripod head, etc. (then undo everything and repack it to hike several more kilometers).

Are Corozeras documented for Parque Nacional Tikal (PANAT)?

In 1999, Schulze and Whitacre said that Cohune Forest were so rare at Tikal that did not give it a forest type code. Of course the immediate question is, did they hike through the entire park? Or did they explore near the roads and trails that provide easy access? PNYNN is adjacent to PANAT and there are multiple corozeras in PNYNN, so potentially more should be findable at PANAT

Edible aspects of Corozo palm

You can extract cooking oil from the nuts. Or you can eat the nuts raw. Or roast the nuts slowly and then eat the seeds (Grandia 2006: 191). As I comment in the final photographs after the concluding remarks, lots of other wild native plants inside a corozera are also edible.

Utilitarian Aspects of Corozo palm

- Construction - Thatch
- Crafts - for making ch'ixb' (smoke rack).
- Hunting - for making fish traps (yuuch) and for making fishing poles. (Grandia 2006: 191)

Utilitarian Aspects of other growing organisms in this area

In the rainy season mushrooms of every size, shape and color are sprouting from the ground or from rotting trees that were blown over in past decades. There are also 3-dimensional lichen. But these are mainly on thin twigs so you only see them when the twigs fall to the ground. Here are closeups.

3-dimensional lichen in many parts of the Americas has been used to make dye colorant. Turkey tail mushrooms can also be used to make a dye colorant.

Photo by Nicholas Hellmuth, iPhone 13 Pro Max. This telephone camera does better close-ups than earlier models of iPhone.

Concluding Discussion and Summary
on the Corozera South of Nakum (Corozal surrounding giant Ceiba)

Experienced and professional botanists Schulze and Whitacre said "One forest type, Cohune Forest, was only documented in one small area of Tikal, and has therefore been omitted from further analyses. (1999: 186). Need to see if this is same area as "El Corozal" archaeological site (Vidal, Teufel and Fialko 1996). The archaeologists list this as about 5 kilometers to the east of Tikal (so towards PNYNN).

It will help the Plan Maestro for PNYNN and the Plan Maestro for RBM to have documentation on corozeras. We need a lot more field work, especially to find even more than the two along the road from Yaxha to Nakum. Definitely need to study the corozeras in the Naranjo-Sa'al area of PNYNN. Moises Daniel Perez Diaz, "Teco", notes five corozeras for PNYNN. He has decades of flora and fauna experience in this park and elsewhere in Peten.

1. Corozera Botanal, Corozera North of Yaxha
2. Corozera Ceiba, Corozera South of Nakum
3. Corozera west of west edge of ruins of Naranjo-Sa'al
4. Corozera at entrance to Naranjo-Sa'al
5. Corozera near Maya site of La Pochitoca (a bit northeast of Aguada Maya / Poza Maya)

Studying the corozeras near the Naranjo-Sa'al part of PNYNN is in our "To Do List" as soon as a 4WD can get into Naranjo-Sa'al without getting stuck. Fortunately that road was significantly improved by putting rocks in the mud ruts in 2018-2019 and evidently a tad more after that, but there is still a kilometer or so that needs a customized (lifted) 4-wheel drive pickup during any wet month. We also are inspired to explore the corozera near Maya site of La Pochitoca (that Teco told us about).

You need a 4K monitor at 32" width to enlarge this aerial photo from IGN. But if you know what a corozera-botanal ecosystem looks like from above, you can find the Corozera Botanal La Pochiteca in this photograph. Teco told us there was a corozera near La Pochiteca; I sent this info to Sergio Jerez then half an hour later found a map and sent Sergio the location of La Pochiteca. He then dedicated another hour to searching the year 2006 aerial photos of IGN and found the corozera-botanal. Sergio said that the satellite photos to which we have access were not as good a resolution as the aerial photos from IGN.

The aerial photographs of IGN, Instituto Geográfico Nacional de Guatemala, are the best aerial photographs that we have found so far. If you are a professor or student studying ecosystems of Guatemala these photographs are essential.

If a kind soul or conservation agency could provide funding for a 100 megapixel Phase One iXM aerial camera, two interchangeable auto-focus lenses specially made for this camera, and a DJI M600 drone that is powerful enough to carry this camera and lens, then we could show you "palm by palm."

Finding more corozeras (and more tasistal palm areas) is high on our list. I especially like tasiste palm areas of PNYNN, PANAT, and elsewhere in RBM because these are always savannas. In Izabal the same *Acoelorrhaphe wrightii* palm (Tasiste) grows along the edges of rivers and lakes but not en masse as in tasistal areas of Peten and not in savannas (which are not yet known for east half of Izabal).

There are corozo palms growing on the hills overlooking the beaches of Amatique Bay, Izabal. Need to learn whether these are *Attalea butyracea* or *Attalea cohune*? "90%" of *Attalea butyracea* are by the Neotropical Flora portal listed for Colombia; lots from Costa Rica, some from Ecuador and Panama. Only a few from Honduras (Lancetilla Valley) and then Izabal. So frankly I would leave the "identification" as *Attalea butyracea* for Livingston area as in need of serious additional collecting and macro photography of the inflorescences, flowers, seeds, and leaves to compare with *Attalea cohune*.

We have hiked through areas filled with *Attalea* palms around Plan Grande Tatin, inland from Livingston to Cueva del Tigre (west of Tatin). We are usually so eager to see the plants further into the rain forest that so far we have not done drone photography of the corozo areas between Livingston, Plan Grande Tatin, and the jaguar cave (jaguars are called "tigres" in Guatemala; cougers are called "leones").

Most needed of all, is a list of all the corozales of Peten, but on a map. Ruiz Garcia helpfully mentions corozales in the area of Rio Mopan (2017: 93):

"En las zonas inundables más septentrionales encontramos bosques de corozales, tintos y palmas, mientras que en las riberas fluviales son el bayal, el jimbal y otros los que predominan" (Ruiz 2017: 93).

Jimba bamboo *(Guadua longifolia)* is common also along Rio Holmul. Bayal palm vines *(Desmoncus orthocanthos)* love sun, so they are growing up and down trees along the edge of a river. Bajo de tinto *(Desmoncus orthocanthos)* is a tintal; common in many parts of Peten, Campeche, Quintana Roo, Belize, etc. It is notable that Ruiz correctly distinguishes corozal from tinto bajo. His "palmas" probably means a guanal or guanal + escobal. This you see to the west of Nakum in PNYNN as you drive to the west out of Nakum. Ruiz also mentions four archaeological sites with the word Corozal in their names (ibid.: 180); so perhaps lots of corozeras. Would help if the corozera ecosystem aspects could be mentioned, tabulated, and photographed.

Since so many edible and usable plants happily grow in corozeras in PNYNN, it would be helpful to have soil scientists, pollen core analysis, and studies of what is found by archaeologists in nearby middens to estimate how the soil of corozeras was used thousands of years ago by the Maya.

References Cited and additional Suggested Reading on *the palms and habitats of Mesoamerica*

Most helpful monographs on this plant:

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

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

AGUILAR, Maria and **Marco Antonio AGUILAR**

1992 Árboles de la Biosfera Maya, Peten, Guía para las especies del Parque Nacional Tikal. CECON.

We scanned this book in the FLAAR library so we have it available for instant study because it's part of our 13,000 digital reports (flora, fauna, and Maya studies).

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

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

Very helpful and nice collaboration with local Itza' Maya people. But 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.

BESTELMEYER, Brandon T. and **Leeanne E. ALONSO (editors)**

2000 A Biological Assessment of Laguna del Tigre National Park, Petén, Guatemala. RAP Bulletin of Biological Assessment 16, Conservation International, Washington, DC. 221 pages.

Helpful download:

BROKAW, Nicholas Van Liew and **Elizabeth P. MALLORY**

1993 Vegetation of the Rio Bravo Conservation and Management Area, Belize Manomet Bird Observatory, Manomei Massachusetts.

ESTRADA Loreto, Feliciana

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

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

GOODWIN, Z. A., LÓPEZ, G. N., STUART, N., BRIDGEWATER, G. M., HANSTON, E. M., CAMERON, I. D., MICHELAKIS, D., RATTER, J. A., FURLEY, P. A., KAY, E., WHITEFOORD, C., SOLOMON, J. LLOYD, A. J. and **D. J. HARRIS**

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

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

HENDERSON A., GALEANO, G. and **R. BERNAL**

1995 Palms of the Americas. Princeton University Press, 352 pages.

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.

McSWEENEY, Kendra

1993 The Palm Landscape of Belize: Human Interaction with the Cohune Palm *(Orbignya cohune)* . Master's Thesis, University of Tennessee, Knoxville. 152 pages.

Helpful download: https://trace.tennessee.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=6343&context=utk_gradthes

PINTAUD, Jean-Christophe

2008 An overview of the taxonomy of *Attalea* (Arecaceae). Rev. peru. biol. 15 (supl. 1): 055- 063 (Noviembre 2008) Las palmeras en América del Sur.

Helpful download.

RUIZ Garcia, Juan

2017 Paisaje y Urbanismo en la Región del Río Mopán (Petén, Guatemala) Durante el Período Clásico Maya: El Caso de La Blanca y su Entorno. PhD dissertation, Universitat de València. 500 pages.

I must admit I like dissertations over 200 pages; so this 500-pager is impressive.

Helpful download.

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.

Helpful download.

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.

Helpful download.

STANDLEY, Paul C. and **Julian A. STEYERMARK**

1949 Flora of Guatemala. Fieldiana: Botany, Volume 24, Part VI, Chicago Natural History Museum.

STANDLEY, Paul C. and **Louis O. WILLIAMS**

1958 Flora of Guatemala. Fieldiana: Botany, Volume 24, Part I.

Helpful download.

QUATTROCCHI, Umberto

2016 CRC World dictionary of medicinal and poisonous plants: common names, scientific names, eponyms, synonyms, and etymology. Vol. 5. 3960 pages.

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.

Helpful download: 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.

Currently, this is one of the most reliable botanical web sites to find the accepted names of the species as well as their synonyms. The data from other leading botanical institutes has been and is being transfered to this site, so it should be used instead of or in conjuction with ThePlantList helpfull web site.

https://plantidtools.fieldmuseum.org/pt/rrc/5582
SEARCH page, but only for collection of the Field Museum herbarium, Chicago.

https://fieldguides.fieldmuseum.org/guides?category=37
These field guides are very helpful. Put in the Country (Guatemala) and you get eight photo albums.

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

www.kew.org/science/tropamerica/imagedatabase/index.html
Kew gardens in the UK is one of several botanical gardens that I have visited (also New York Botanical Gardens and Missouri Botanical Gardens (MOBOT), in St Louis. Also the botanical garden in Singapore and El Jardín Botánico, the open forest botanical garden in Guatemala City).

www.ThePlantList.org
This is one of the most reliable botanical web sites to find synonyms.

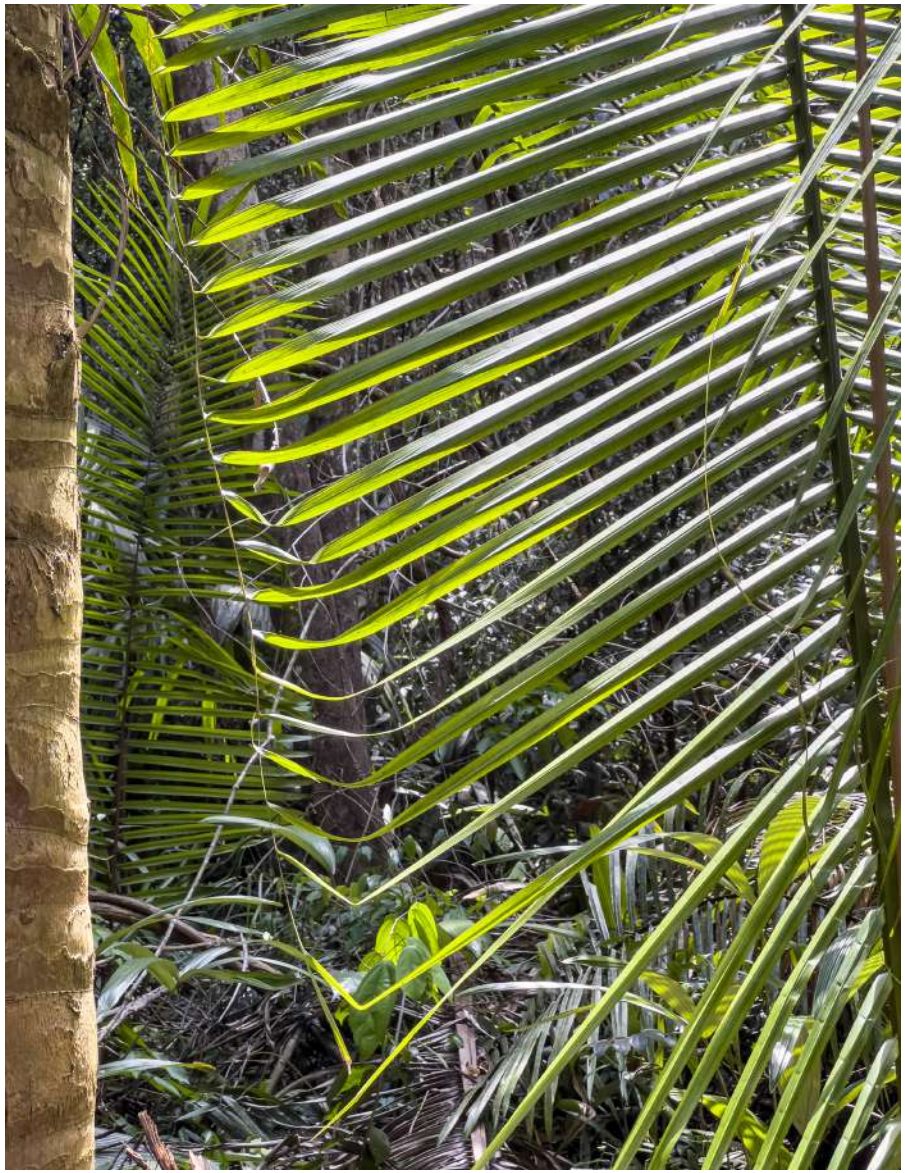
This report can be cited in your preferred style. Here is the basic information:

HELLMUTH, Nicholas

2022 Corozera, Palm Area South of Nakum, Corozera around a giant *Ceiba pentandra*. Parque Nacional Yaxha, Nakum and Naranjo, Reserva de la Biosfera Maya (RBM), Peten, Guatemala. FLAAR Reports, FLAAR (USA) and FLAAR Mesoamerica (Guatemala).

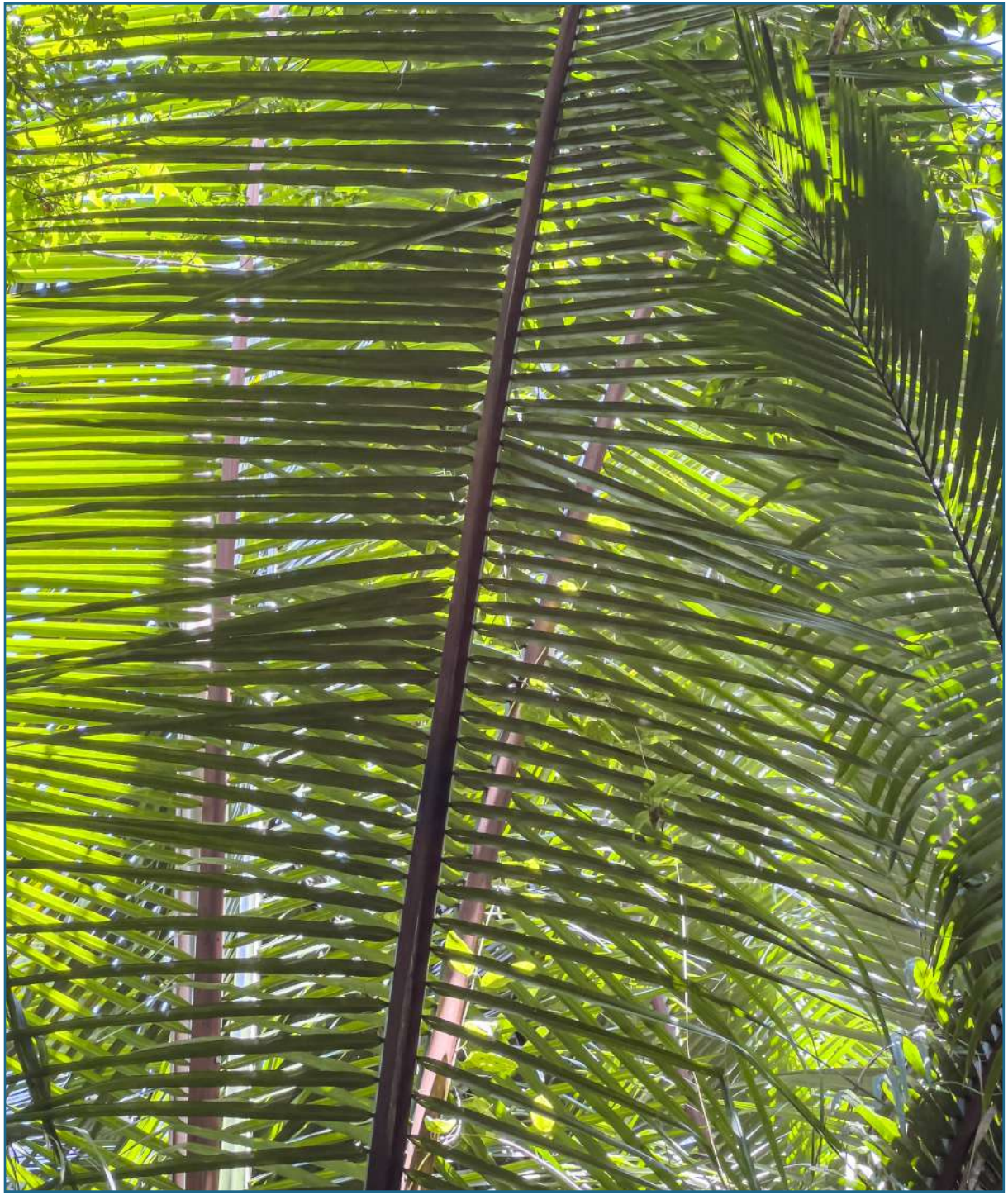
Apendix A

Would be educational to have Fine Art Giclee Photos for a "Botanical Art Exhibit"



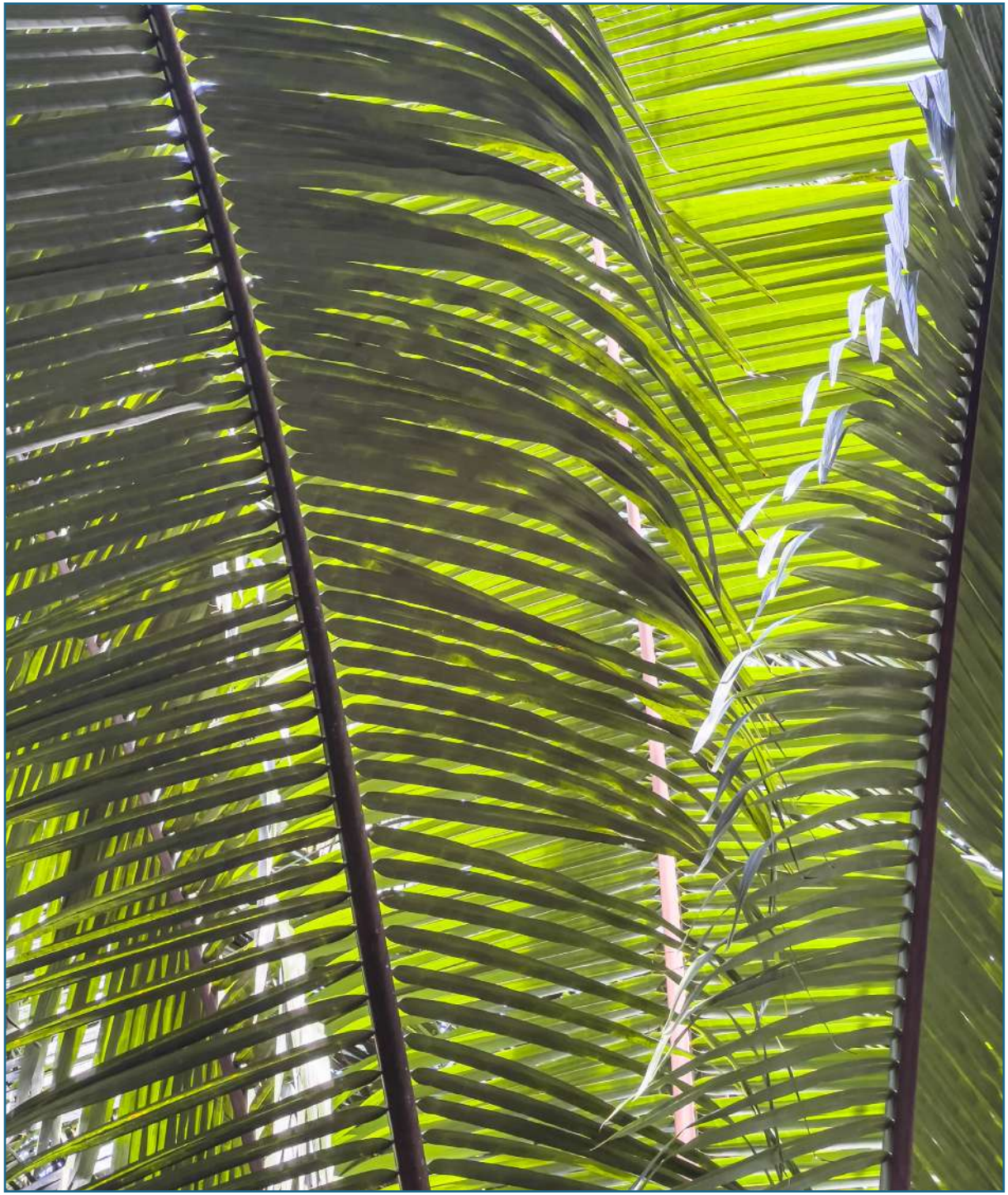
Circa 1997 a wide-format inkjet printer company donated an entire 36" printer to FLAAR so we could print our giant digital images. Earlier, Dicomed, distributor of BetterLight digital panorama and rollout camera systems, provided FLAAR with a complete tri-linear scanning digital camera system. This was large-format (used a 4x5-inch camera). So already in the late 1990's we were taking digital files of over 200 megabytes for each image. For a decade we did "fine art photography" style to print as "fine art giclee prints."

Over 20 years FLAAR Reports became one of the top three digital imaging/digital printing research centers in the world. We had digital imaging equipment and software evaluation teams at two universities simultaneously during 2000-2005. So still today, when I am in front of wild untamed original rain forests or dry cacti forests, I notice scenes that deserve to be photographed in a fine art style.



Each photographer on the team does their own style of photography when we find an interesting ecosystem that we wish to record. The drone team accomplish aerial photography; the macro team do 1:1 macro photography; the telephoto team do telephoto photography. With an iPhone 13 Pro Max I can do fine art giclee photography or macro photography. The series here show fine art giclee style. The rain forests of Parque Nacional Yaxha, Nakum and Naranjo are so gorgeous they deserve to be shown to the world.

Still today, in 2022, I occasionally like to do fine art giclee style photography when I am deep in the rain forests as I see designs from Mother Nature. I show a few here; would be great for an art exhibit.



When you hike into the corozera from the dirt road you see every size, shape, design or palm leaf. Sometimes the light is in front, other times behind. Here the sunlight calls behind the front fronds and illuminates the one behind.

Light and shadow are part of giclee photography. Here the fan-shaped leaf of a guano palm has different size and shaped leaves of corozo palm behind it.

There are two ways to photograph a tall tree or tall palm. One is just to put the camera in wide angle view and take one photo. Snag is that if you are at ground level and the tree is tall the tree may be distorted.

Another option is to take the iPhone 13 Pro Max and put it into Pano mode; I then take an upwards pano. 90% of the time there is no noticeable distortion; the camera software corrects everything automatically (how in the world it knows you want the top of the tree not to be distorted is beyond me).

You need to decide which manner to photograph the entire tree depending how far you can get away from the tree.

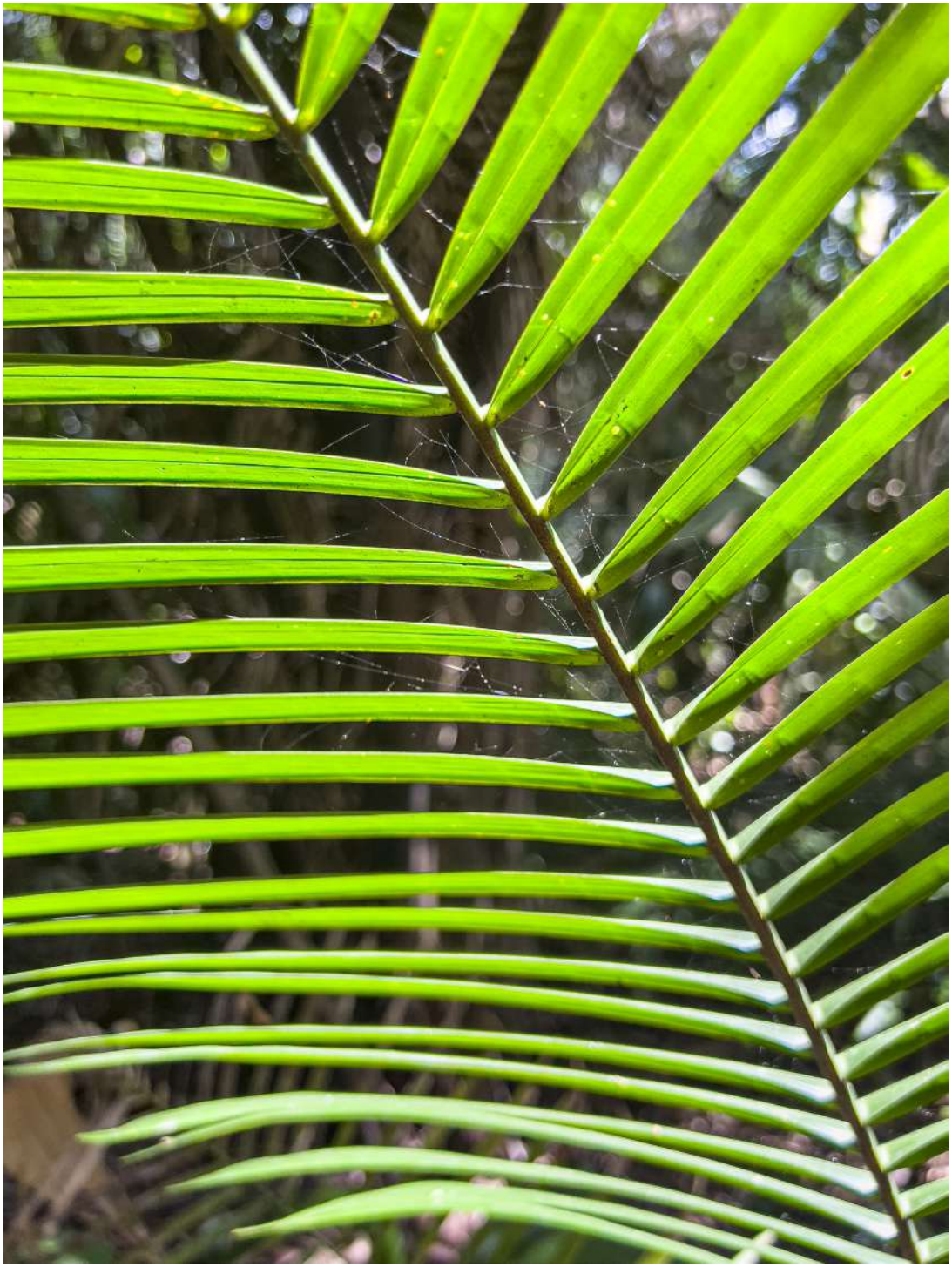
Angle of the Sunlight makes noticeable difference in how the photo turns out

Many of the students who work at FLAAR can take better photos than I do, but my style often is quite notable. I was guest visiting professor in digital imaging in Japan, Malta, Guatemala, and three colleges in the USA (Brevard Community College, then Rollins College, then Bowling Green State University). So today in 2022, when I see the sunlight shining on a shimmering palm, I stop to take a photo.

While the rest of the team is doing their style not far away, I wander off into the rain forest to see what strikes me as photogenic. Here are several samples.

Young leaves of recently sprouting corozo palm, Corozera Ceiba, south of Nakum, PNYNN. Giclee style photo by Nicholas Hellmuth, iPhone 13 Pro Max in RAW mode.

Closer to show young leaves of recently sprouting corozo palm, Corozera Ceiba, South of Nakum, PNYNN. Giclee style photo by Nicholas Hellmuth, iPhone 13 Pro Max in RAW mode.



Close up.

Photo by Nicholas Hellmuth, Iphone 13 Pro Max

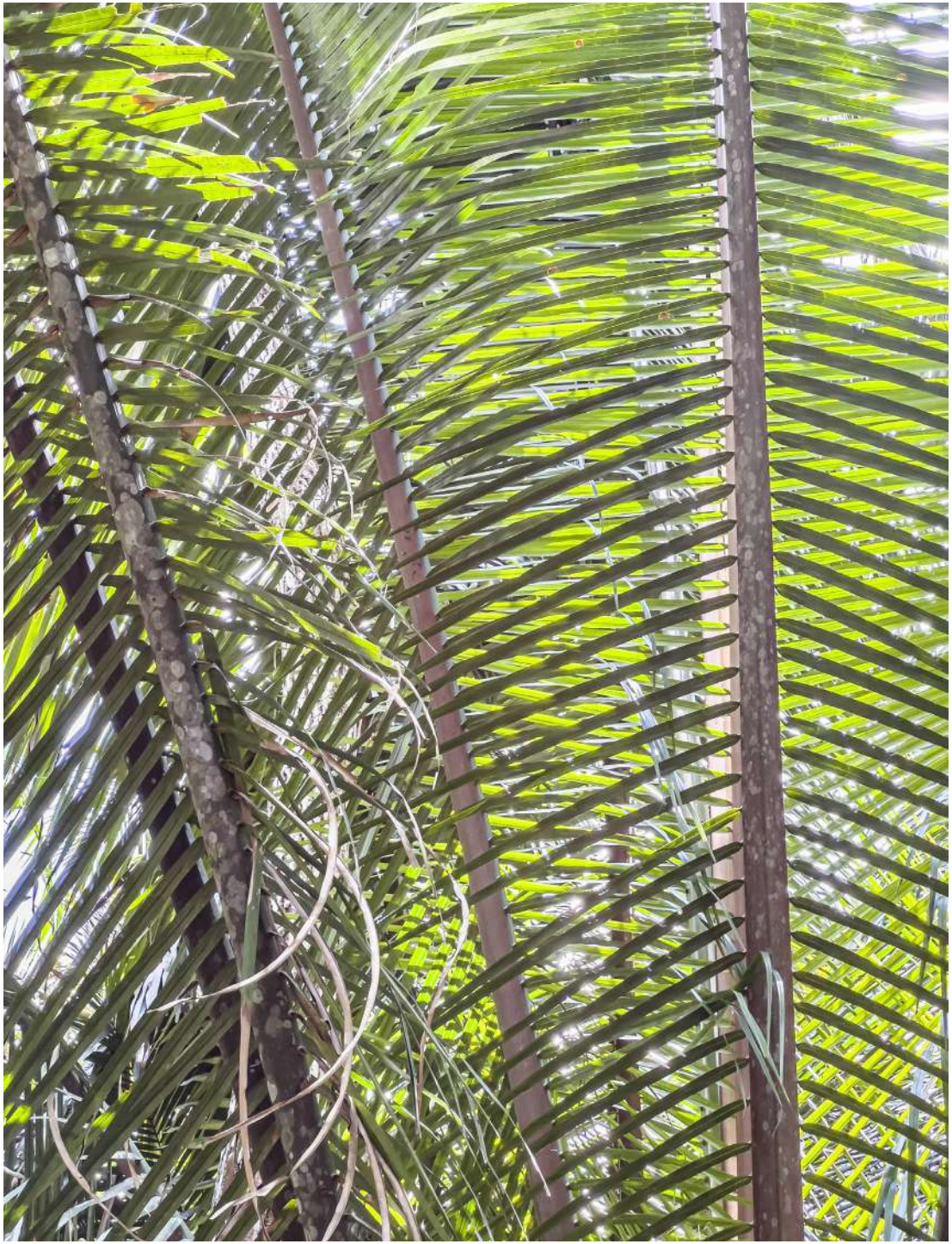


Photo by Nicholas Hellmuth, Iohone 13 Pro Max, Light from different angle. All this is natural, as found. Nothing has been moved to make these patterns.

Everywhere you look, up, down, in front, behind, you see a different “work of art by Mother Nature.” You can come to Parque Nacional Yaxha, Nakum and Naranjo and when your vehicle reaches one of the corozeras, get out of the vehicle and walk around by yourself.

But be sure to have a guide with you so you don’t get lost. There is no cell phone signal here. And be careful of snakes. Pumas and jaguars will unlikely grab you, but still, have a guide with you.

Sometimes I like a simple pattern, but other times I like a total helter-skelter mish-mash of angles of light and shadow.

Another helter-skelter mish-mash of angles of light and shadow.

Apendix B

Botanical Description of Palms named Cohune or Corozo

Astrocaryum mexicanum Liebm. Dansk. Vid. Selsk. Forh. 1845: 8. 1846 (type from Oaxaca). A. Warscewiczii Koch & Fint. Wochenschr. 1: 297. 1858. Bactris Cohune Wats. Proc. Amer. Acad. 21: 467. 1886 (type from "Chocon forests," Izabal). *A. Cohune* Standl. Trop. Woods 21: 25. 1930. *Hexopetion mexicanum* (Liebm.) Burret, Notizbl. Bot. Gart. Berlin 12: 156. 1934. Lancetilla; Guiscoyol;*Warree cohune*, Cohune (English-speaking … North Coast and British Honduras). Figure 37.

Common and often abundant in dense wet mixed lowland forest of the northern departments, usually on well-drained land, chiefly on hillsides, 400 meters or lower; Peten; Alta Verapaz; Izabal. Southern Mexico (Oaxaca, Tabasco); British Honduras; Atlantic lowlands of Honduras.

Trunk slender, 1.5-5.5 meters high, 2.5-4.5 cm. in diameter, armed with very numerous, spreading, stout spines, these compressed and 2-edged, blackish, 3-5 cm. long or longer, arranged in more or less regular whorls; leaves a meter long or larger, glaucous beneath, the petiole and rachis more or less tomentose and armed with long needle-like spines, the segments broad or narrow, very unequal, as much as a meter long, sparsely aculeolate on the margins; spathes 20-30 cm. long, caudateacuminate; staminate calyx densely lanate, the petals lanceolate, united at the base, 4 mm. long; pistillate calyx and corolla aculeolate, coriaceous, the corolla 12-16 mm. long, the calyx almost half as long; fruits very numerous in each spadix, obovoid, about 5 cm. long, 2-2.5 cm. broad, rostrate, densely covered with short slender spines; seed obovoid, acute at the base, rounded at the apex, 2.5 cm. long.

This unpleasantly armed palm often forms a dense undergrowth, especially on hillsides, in the dark forests of the Atlantic lowlands, the very numerous, sharp-tipped spines being a constant menace to any one pushing through the thickets. Watson states that the name" warree cohune" is given because of the resemblance of the spiny covering of the fruit to the bristles of the common peccary (called "warree" by the negroes of the Atlantic coast). He states also that the kernels of the fruits are edible, with a flavor similar to that of coconut. The common Spanish name "lancetilla" alludes to the lance-like spines.

(Standley and Williams 1958: 206-208).

Caution for the following text by Standley and Steyermark on corozo palm: manaca palm nowadays is considered the name for a Caribbean island palm, *Calyptronoma rivalis*, which is not found in Guatemala. Another caution: in PNYNN and in PNLT I would not expect Standley and Williams statement to be realistic whatsoever: "corozo often is associated with *Pinus caribaea*" (1958: 276) because there are no wild native pine trees in the middle of the Reserva de la Biosfera Maya except for the pine area about three kilometers northeast of the top corner of Parque Nacional Tikal (PNAT). There are millions of pine in other areas of Peten, but outside RBM.

Orbignya Cohune (Mart.) Dahlgren ex Standl. Trop. Woods 30: 3. 1932. *Attalea Cohune* Mart. Hist. Nat. Palm. 3: 300. pi. 167. 1836-50. Manaca; Corozo; Cohune; Tutz (Maya); Coros (Quecchi).

Abundant at many places in the Atlantic lowlands, growing mostly on rather well-drained land, on plains or often on mountain sides, chiefly at 300 meters or lower; Peten; Alta Verapaz; Izabal. Southern Mexico; British Honduras to Honduras, and perhaps extending as far south as Costa Rica. Figure 46.

Plants very large, often low and acaulescent or with a short trunk, the trunks of mature trees 9-15 meters tall, thick, usually bearing persistent leaf bases above; leaves numerous, plume-like and graceful in spite of their great size, sometimes 10 meters long and 2 meters wide, recurving, with numerous, elongate, very narrow segments; staminate inflorescences commonly 1-1.5 meters long, with numerous flowers; fruiting panicles very large and heavy, pendent, containing often 800-1000 fruits; fruits about 6 cm. long, resembling small coconuts.palm in Guatemala, and the term "*manaca shack*" is given commonly by the English-speaking people of the coast to the dwellings made from the leaves. A caserio of Izabal has received very appropriately the name "Manaca."

The names "corozo" and "manaca" are used commonly for this palm in Guatemala, and the term "*manaca shack*" is given commonly by the English-speaking people of the coast to the dwellings made from the leaves. A caserio of Izabal has received very appropriately the name "Manaca."

This is by far the largest and most majestic of all the palms of Central America. It is abundant in many places along and near the Atlantic coast, often forming stands of wide extent. It is naturally a forest palm, forming a dense undergrowth in primeval mountain forest, but if the shade is removed the plants seem to thrive equally well, and they are seen everywhere in their native regions in open places. Morris, who gave considerable attention to this and other palms in British Honduras, estimated one leaf he saw to have a length of 18 meters and a breadth of 2.5 meters, and lengths of 10-12 meters are not uncommon. The plant thus produces probably the largest leaves of any American plant. Brigham, who studied this and other Guatemalan plants many years ago, estimated the number of staminate flowers in an inflorescence at more than 30,000. These flowers attract many bees and wasps. He maintained that the plant was called "manaca" when acaulescent, and "corozo" when having a well-developed trunk, but this is questionable.

In Guatemala the corozo often is associated with Pinus caribaea. It is the most conspicuous palm along the railway leaving Puerto Barrios, all the way inland until the dense forest terminates shortly before the road reaches Gualan. On the North Coast of Guatemala this palm is used in constructing dwellings, a very great part of them being made almost wholly of the materials it supplies. The stout midribs of the leaves form the framework, while the leaves, placed crosswise so that their segments form a dense thatch, constitute the roofs. Such buildings are substantial and durable. The young leaves are utilized for making hats. Segments of the large leaves are used by the Indians of Alta Verapaz for making the suyacales large mats that protect their clothing and loads from the rains. During the rainy season an Indian with a rolled-up suyacal (if it is not raining) is almost as characteristic of Alta Verapaz as the Britisher with his rolled umbrella is of England.

Throughout its range, a kind of wine sometimes is made from the sap of the corozo. A cavity about 30 cm. square is cut in the cabbage, screened in various manners, and left for about a week, during which time the sap collects and ferments.

The part of the corozo having the greatest possibilities is the seeds. These are rich in oil, which is in demand for making soap and for other purposes. The only obstacle to the development of an important corozo industry is the hardness of the nuts, which are difficult to crush. In recent years an industry of considerable importance has been developed in British Honduras, in cultivating the plants and extracting oil from the seeds, and special machinery is now used for their treatment. During the first world war the seeds were used in preparation of charcoal for gas masks. The nuts are produced in great abundance, as indicated in the description above, and a single fruiting panicle sometimes weighs more than 100 pounds.

(Standley and Williams 1958: 274-277).

Apendix C

Botanical Description of *Ceiba pentandra* by Standley and Steyermark

I use the entire multi-thousands of pages of Flora of Guatemala even though most of these botanical monographs were written in the 1940's-1970's. I prefer the Flora of Guatemala over more recent monographs for several reasons:

- Standley was interested in local Mayan use of plants, so he includes these uses.
- Standley and co-authors include local indigenous names.
- 100% of these dozens of monographs can easily be downloaded in PDF format.

There are impressive botanical series of more recent decade(s) but:

- most are strictly botanical: leaf shape, flower details: no information on local use by Mayan or other indigenous people.
- Most are not easy downloads, or you have to register your personal information

Ceiba pentandra (L.) Gaertn. Fruct. & Sem. 2: 244. 1791. Bombax pentandrum L. Sp. Pl. 511. 1753. *Ceiba casearia* Medic. Malvenfam. 16. 1787. Eriodendron anfractuosum DC. Prodr. 1: 479.1824. E. occidentale Don, Hist. Dichl. Pl. 1:513. 1831. Ceiba; Inup (Jacaltenango) ; Nuo (Poconchi); Mox, Inup (Quecchi). Common on moist or dry plains or hillsides, chiefly at less than 1,000 meters, and most plentiful on the lower plains; often planted at elevations above its natural habitat; Peten; Alta Verapaz; Baja Verapaz; Izabal; Zacapa; El Progreso; Jalapa; Jutiapa; Santa Rosa; Escuintla; Guatemala; Solola; Suchitepequez; Retalhuleu; San Marcos. Widely distributed in Mexico, south to British Honduras, and throughout the lowlands of Central America; West Indies; northern South America; also in tropical Asia and Africa, where perhaps introduced from America.

A giant tree, often 50 meters tall or larger, the trunk frequently 2 meters or more in diameter, supported by large buttresses extending widely from the base of the trunk, the crown usually broad and spreading, depressed, the bark light brown or gray, sometimes whitish, more or less densely covered with short sharp hard prickles but otherwise smooth or nearly so; young branchlets thick, unarmed; leaflets 5-7, oblanceolate to oblong or obovate-oblong, 8-20 cm. long, acute or acuminate, acute or subobtuse at the base, petiolulate, rather thick and firm, entire, glabrous or nearly so; petals white or pink, 3-3.5 cm. long; calyx campanulate, 1 cm. long or slightly larger, glabrous or nearly so, very shallowly lobate; petals densely silky-hairy outside; fruit coriaceous, elliptic-oblong, 10-12 cm. long, the large brown seeds imbedded in the silky "cotton."

The ceiba is one of the best-known trees of Central America, where it figures largely in history, legend, and romance. Much sentimental interest is associated with it, and the trees often are regarded with real affection. The tree had some religious significance among the Indian inhabitants, and it is said that even today in Guatemala the Indians never willingly cut a tree. In the ample shade of a ceiba tree the long-established markets formerly were held, and today open-air markets still are held in the shade of a ceiba, wherever the growth of the tree is possible, even at places above its natural range. The Indians of Alta Verapaz, in particular, considered the ceiba sacred, and beneath the trees they held their councils before and long after the conquest. Here public officials were chosen. The Indians often censed the trees with aromatic resins. Particularly celebrated in Guatemala is the ceiba of Palin, which shades the whole market place, and is often said to be the largest one in the country, although we believe we have seen larger ones growing naturally in the Pacific plains. Another one

extends widely over the 'picturesque market of Sacapulas, and another huge one stands in the plaza of Amatitlan. The ceiba is the largest tree of the North Coast, and perhaps of all Guatemala.

The high branches often are covered with coarse orchids and other epiphytes, which are safe from molestation. The leaves fall at the middle of the dry season or later, reappearing toward the end of the verano after the flowers have opened. While many trees are at times quite leafless, others, perhaps dependent upon the amount of moisture available, always have at least a few green leaves. The flowers are too small to be very conspicuous. When they fall to the ground, as they do in large quantities, they are eaten by deer and domestic animals. The English name is "cotton tree" or "silk cotton tree." The Maya name in Yucatan is "yaaxche" or "yaxche." The term "ceiba" is of Antillean origin. It figures in dozens of Guatemalan place names, in almost all regions except the highlands. The name "pochote" is applied in some parts of Mexico and Central America to the ceiba, and probably is the Nahuatl term for the tree. Oviedo reports "poxot" as a name given it by the Indians of Nicaragua.

The wood is pinkish white to ashy brown, the sapwood not clearly defined; light and soft but firm and tenacious, with a specific gravity of 0.44, and weight of 27 pounds per cubic foot; grain often irregular; texture coarse; easy to cut, tough and strong for its weight; not durable. Locally the wood is used occasionally for fuel, drums, bateas, and other articles. It is considered suitable for paper pulp, corestock for veneers, packing cases and boxes, toys, and miscellaneous purposes requiring a soft, easily worked wood. It has been used at times for dugout canoes and rafts, but for the latter purpose cannot compete with the much lighter balsa wood. It is stated that in 1939 some wood was shipped from Guatemala and elsewhere to Europe, presumably for crates, but its shipment became unprofitable because of a high export duty placed on the wood.

The seeds are reported to yield an oil that has been used in some regions for illumination and soap manufacture. The leaves are said to be edible when cooked. The most important product of the tree, however, is the silk or cotton of the seed pods, known in commerce as kapok. It is very fine, light, and elastic, and does not become matted under pressure. Large amounts are produced in the East Indies and West Africa, and exported for use in filling pillows, life preservers, and mattresses, and also for insulating ice-boxes and other articles. One who has slept upon kapok-stuffed pillows, so common in Central America, will be inclined to doubt some of the claims made regarding its elasticity. The fiber is reported to have been used in England for making felt hats.

(Standley and Steyermark 1949: 391-393)

Base Camp Assistance in
Parque Nacional Tikal

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 Solis family, owners of the Jaguar Inn, for providing a place to stay when park facilities had other occupants. We also thank the Solis family for food in their Jaguar Inn restaurant. Photo by David Arrivillaga, Sony A7 II

Base Camp Assistance
in PNYNN

We thank Biologist Lorena Lobos and both co-administrators of PNYNN (Arq. Jose Leonel Ziesse (IDAEH) and Lic. Jorge Mario Vazquez (CONAP) for providing a place to stay for the photographers, biologists, and assistants of the FLAAR Mesoamerica team of flora and fauna during the 1-week-a-month field trips August 2018 through July 2019.

In turn FLAAR purchased and donated a cooking stove when the original one no longer functioned, plus we have photographed and documented many tree and insect species that we found around this camp. Photo by Erick Flores, Canon EOS-1D Mark II.

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 Sebastian 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 or whatsApp VentasElSombrero@gmail.com

www.elsombreroecolodge.com/en-us

We Thank

We sincerely appreciate the storage space of Ingeniero Forestal, Sergio Balam, for Santa Elena/San Benito area of Peten to store our camping equipment when we are finished with each week-long field trip. Then all the tents and sleeping equipment, kitchen equipment, supplies, and other field trip equipment is ready-to-go on the next field trip. Thank you Sergio.

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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 POWERPOINT PRESENTATION

Dr. Nicholas (Hellmuth) has 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 field work research 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 in the Reserva de la Biosfera Maya (RBM) of Guatemala.

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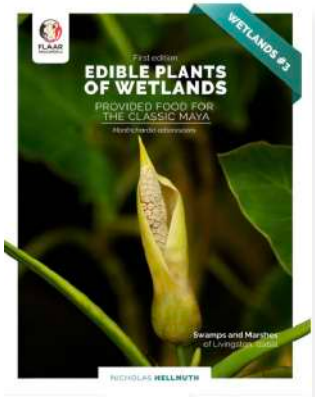

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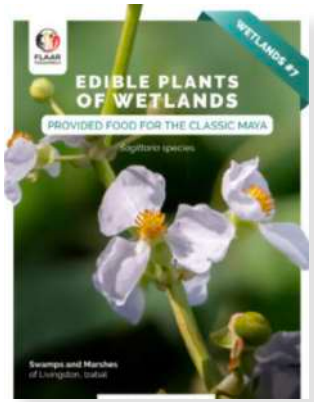

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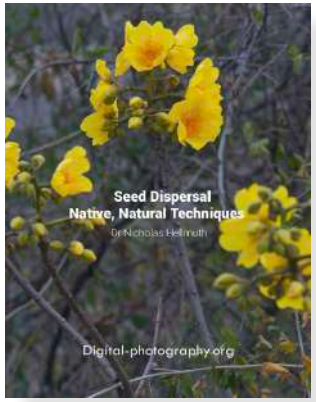

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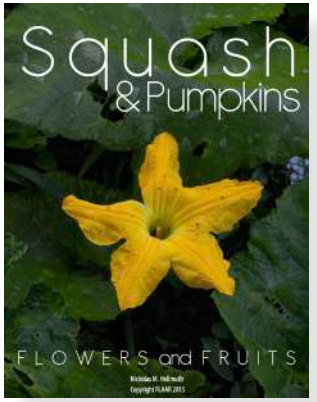

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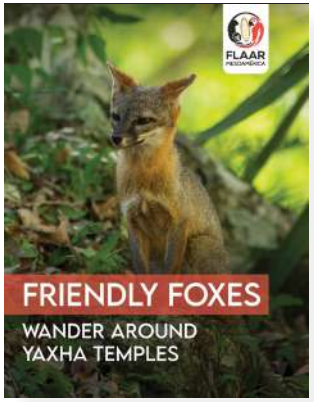

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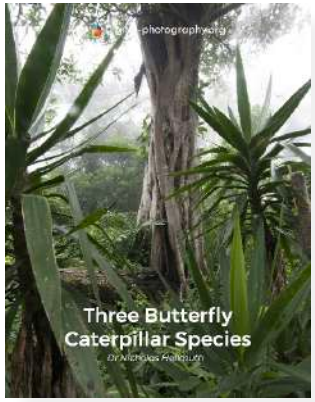

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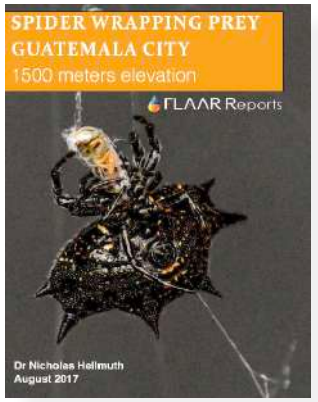

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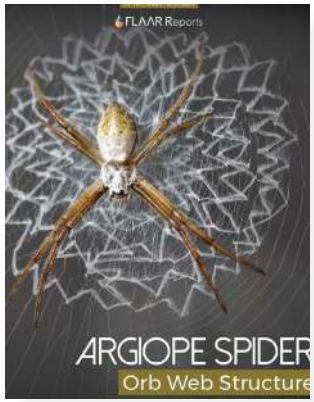

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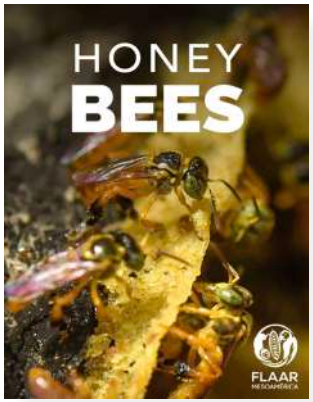

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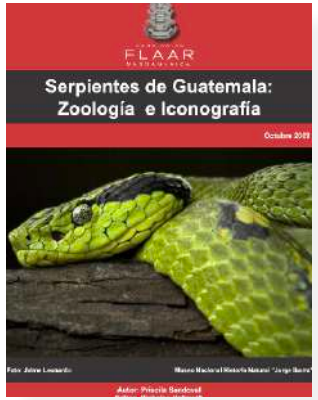

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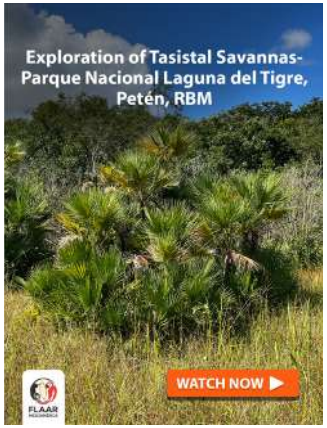

Exploration of Tasistal Savannas-Parque Nacional Laguna del Tigre,Petén,RBM
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Savanna #10 far South part of Parque Nacional Laguna del Tigre, Reserva de la Biosfera Maya
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Savannas, Unexpected Unexplained Circular Areas, Laguna del Tigre, Reserva de la Biosfera Maya
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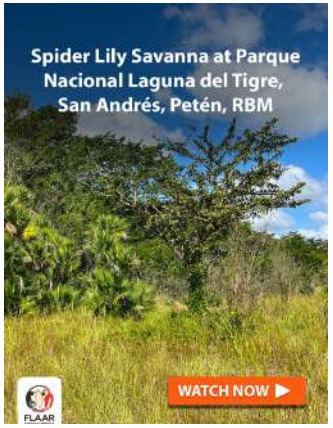

Spider Lily Savanna at Parque Nacional Laguna del Tigre, San Andrés, Petén, Reserva de la Biosfera Maya
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