



GOALS FOR THE 5-YEAR PROJECT OF COORDINATION

AND COOPERATION OF FLAAR (USA) AND FLAAR MESOAMERICA (GUATEMALA) WITH CONAP WITHIN THE RESERVA DE LA BIOSFERA MAYA







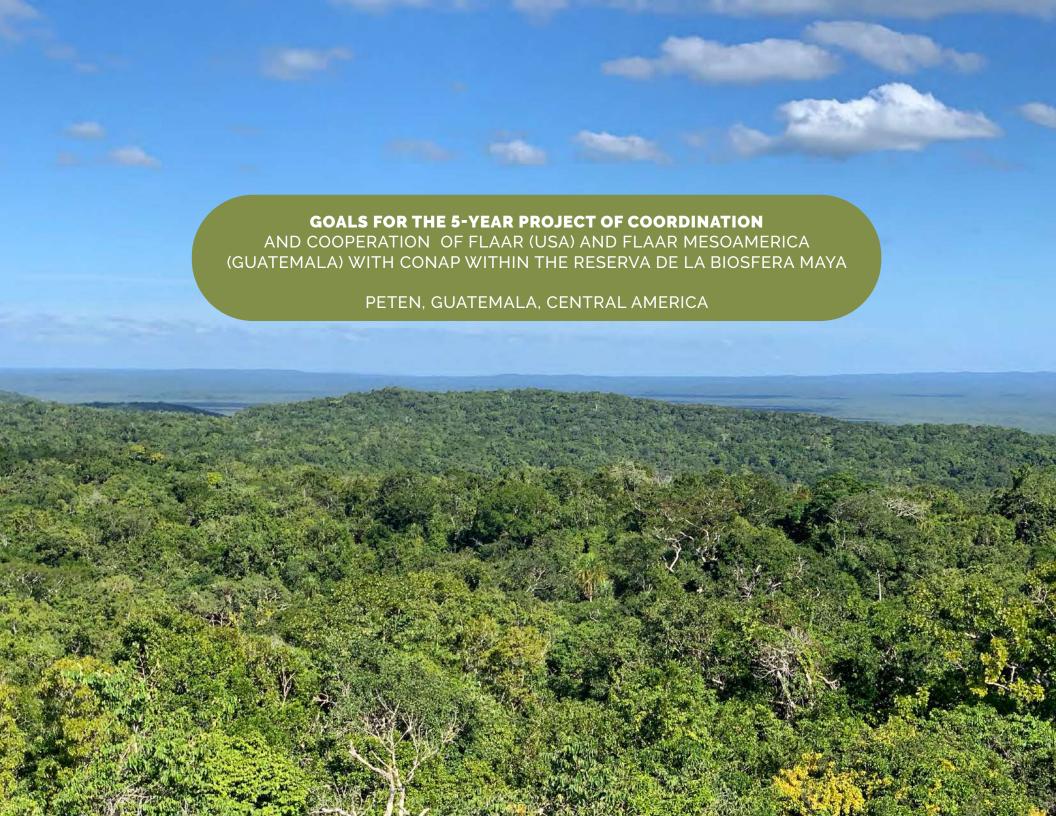
















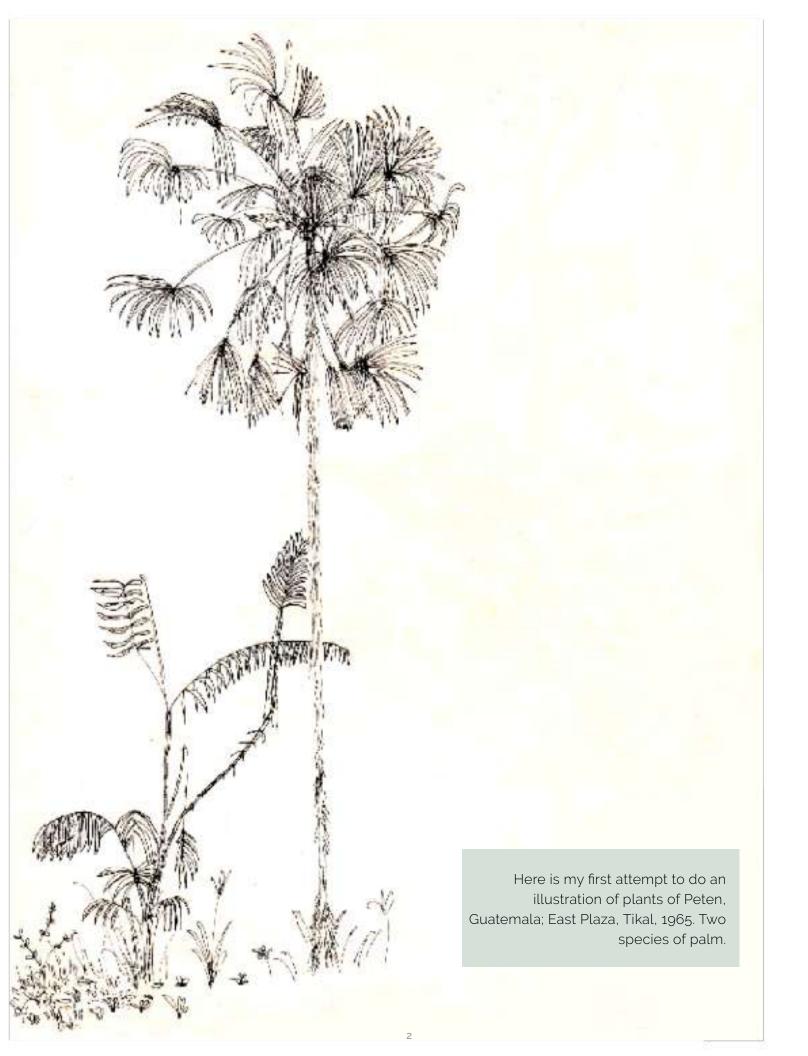
INTRODUCTION TO FIELD WORK IN REMOTE, REMARKABLY BIO-DIVERSE ECOSYSTEMS OF THE WETLANDS AND SEASONAL RAIN FORESTS OF THE RBM, PETEN, GUATEMALA

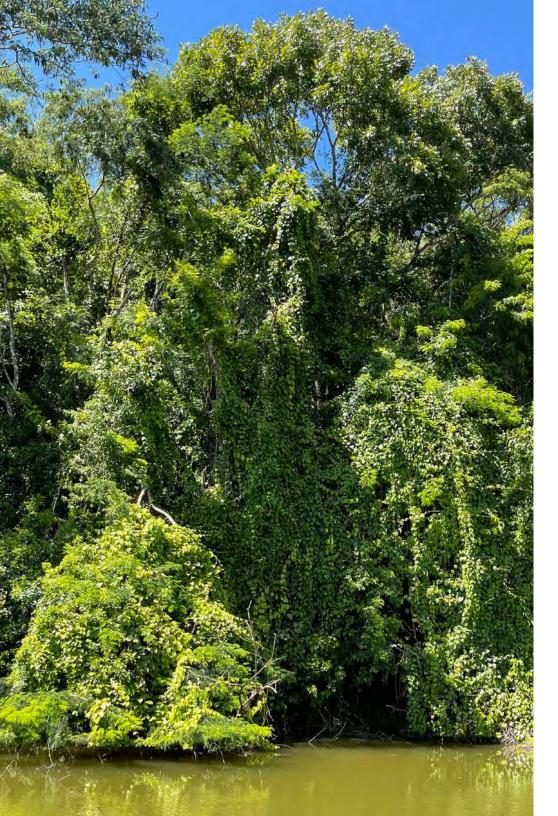
The year 2021-2025 project is a concept of cooperation and cooperation together with CONAP and with local administrators of parks, nature reserves, biotopes, and areas that request or need assistance to study flora, fauna, and fragile bio-diverse ecosystems especially areas that need conservation.

I first saw plants of the rain forests of the Maya Lowlands outside Teapa, Tabasco, Mexico, at age 15 in 1961. At age 16 was accepted as a volunteer for the Bonampak mural restoration team (when I overheard them mentioning Bonampak in a restaurant in Tenosique, Tabasco in 1962 and I asked if I could help them set up camp; they kindly flew me into the Lacandon rain forest and I helped carry supplies many kilometers from that Lacandon airstrip to far away Bonampak; no airfield nearby in 1962).

At age 17 and at age 18 I spent one week at Tikal each year (1963 and 1964) and the local archaeologists noticed that I was a photographer (with a Leica camera) and that I was student majoring in architectural sciences (at Harvard). So the University of Pennsylvania museum team at Tikalasked if I could return in 1965 for an entire year to help them with recording architecture at Tikal.

While at Tikal I also learned about the local plants, especially the palms.





I learned about corozo palm ecosystems when hiking between Yaxha and Nakum in the 1970's to improve the Harvard Peabody Museum Tozzer map and subsequent CIW map of Nakum.

During the 1970's into 1990's, FLAAR organized and led people from around the world down the Rio Usumacinta (starting at Rio la Pasion, Sayaxche and ending at Tenosique, Tabasco, Mexico). Also organized field trips hiking to Calakmul decades before it had a highway, and hiking to El Mirador decades before that became common. So I got to see tintal bajo vegetation as I hiked hundreds of kilometers during these years. From year 2000 onward I did research on plants in literally 75% of the territory of Guatemala, from the Pacific Ocean, to areas of *Theobroma bicolor*, pataxte near Chiapas, Mexico, and to the Sierra de los Cuchumatanes at altitudes so high there are no more trees (but have amazing plants). I prefer to learn about botany and ethnobotany by standing in front of the plant and studying it (and then going back to my substantial library to learning even more).

During our 12 month project in Peten from August 2018 through July 2019 I learned much more about the plants and ecosystems of Parque Nacional Yaxha, Nakum and Naranjo.

During our February-March 2020 (then delayed due to COVID) then September 2020 through 2021 I learned significantly more about wetlands ecosystems in the Rio Dulce, El Golfete, Amatique Bay areas of the Municipio of Livingston, Izabal, Guatemala (a project requested by the Municipio de Livingston, to finish in December 2021).

In Spring 2021, FLAAR Mesoamerica (Guatemala) was awarded a 5 year permit for cooperation and cooperation with CONAP (Concejo Nacional de Áreas Protegidas; flora, fauna, ecosystems entity of Guatemala). We were requested to undertake research focused on Parque Nacional Yaxha, Nakum and Naranjo but including the entire Reserva de la Biosfera Maya RBM (so north half of Peten, Guatemala (from Peten border with Chiapas and Tabasco to the west; border of Campeche to the north, and Peten border with Belize to the east).





During the initial month we were requested if we could add focus coordinating with a cooperation group of nature reserves that border on each other the first year:

- Bio Itza
- Biotopo San Miguel la Palotada
- Cerro Cahui
- Parque Nacional Tikal
- Parque Nacional Yaxha, Nakum and Naranjo

We accepted to add work in these areas and started with four of them.

Plus the first two years we wish to visit one-by-one every park, every reserve, every biotope, every area of ecological, flora, and fauna interest in the entire RBM so we can plan the field trips for the coming years: where do we have to hike in because there are no roads? Where do we find helpful local guides and assistants? What months are best to visit each area? In which months is there so much rain that access roads are impassable even to high-axel 4WD? We learn what kinds of 4WD vehicles can enter each area by speaking with local administrators and organizers of conservation projects



Our team has found wild vanilla orchid vines throughout the Yaxha, Nakum and Naranjo national park forests. They especially like to grow in seasonally inundated bajo forests. Since they bloom only 3 hours, once a year, it would help if an orchid enthusiast could donate funds so we can provide a motorcycle to local guides so they can monitor when the orchid is about to bloom and provide the guide with a good camera to record the flower (with the flower we can identify the species).



There are many capable research organizations in Guatemala (CONAP, CECON, FUNDAECO, Defensores de la Naturaleza and lots more). Our advantages include

1. Our half-century of experience with highresolution photography

- Leica starting in 1961 in Tabasco and Chiapas
- Better Leica in 1965 for Tikal field work
- Three Hasselblad medium format cameras by 1970's (and three Leica cameras)
- 5x7 large format Linhof and 8x10 large format Linhof in the 1990's (to accomplish 18 months of photography in Mexico, Honduras, Belize, for a Japanese coffee table book publisher on Mesoamerica)
- Our complete set of Nikon lenses of every size and shape from wide angle to macro to prime telephoto (400mm, 600mm and 800mm) for our Nikon D810 and Nikon D5.
- Our arsenal of four different of the latest
 Sony mirrorless digital cameras and diversity of Sony macro and telephoto lenses with in-lens stabilization.





2. Based on our accumulated experience from years of recent field work in Izabal and Peten, we have organized a list of flora and fauna and ecosystems to focus on for 2021-2025. Until outside funding comes our way, we have to be realistic. This PDF is a list of the aspects of flora, fauna, biodiversity, and conservation starting with documentation of endangered ecosystems (tough to protect and conserve an area unless you visit it, study it, photograph it, publish it and document what deserves to be conserved protected).

Our team is dedicated, inspired, and focused on the following topics (we are also open to adding additional aspects requested by parks and reserves within RBM, etc. and aspects requested by other conservation organizations).





- 3. That we already know local people:
- Our guides in Arroyo Petexbatun area have guided us since the 1970's
- We know Tikal since 1960's and Yaxha since 1970's
- 4. We have a dedication to reach remote biodiverse areas no matter how uncomfortable and hard it is to get there
- 5. We are capable of overnighting in rustic, remote, camp areas in tents if necessary (most intelligent professors work out of comfortable hotels and study what's near the hotel). Most researchers go to comfy Costa Rica or the Smithsonian tropical research station in Panama, Barro Colorado Island, Bocas del Toro, etc. (where they can study flora and fauna from the terrace of their hotel/base camp).
- 6. We share our photographs and our biological information

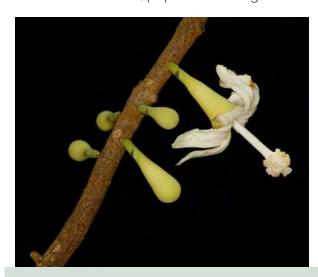


Here are ten of the field work team, July 9, 2019, on bank of the Rio Holmul, far north of the Naranjo sector of PNYNN. In this area the river is in the Arbol Verde area; outside the park.

Below is a list of flora, fauna and ecosystems that we are inspired to dedicate focus on:

Bombacaceae (changed to sub-family Bombacoideae: now family Malvaceae). There are other species elsewhere in the deserts and mountains: our focus are species in the biodiverse rainforests:

- Bernoullia flammea, uacut, mapola, red mapola.
- Ceiba pentandra, kapok, silk-cotton tree (national tree of Guatemala; sacred tree of the Maya, Zapotec, Mixtec, and Aztec). Edible seeds.
- Ochroma pyramidale, balsa wood tree.
- Pachira aquatica, zapoton, a cacao replacement drink can be made from the seeds.
- Pseudobombax ellipticum, clavellina, shaving brush tree; edible seeds.
- Quararibea funebris, molinillo, flor de cacao, cacahuaxochitl, funeral tree, rosita de cacao; popular flavoring.



Quararibea funebris provides a tasty flavoring for Maya cacao drinks and twigs of this tree are used as stirring swizzle sticks to raise froth. The Maya and Aztec preferred their cacao with froth across the top (just like I preferred to have in my beer in past years).

We would like to do an entire report on the giant Ceiba pentandra trees of Peten. Use 800mm super telephoto lenses to show visitors the orchids, bromeliads, cacti, ferns on the branches. On Google images of *Ceiba* about 75% simply show the tree (no close-up details). Perhaps 15% or more show the buttress roots; and only 10% show the top (but always with a point-and-shoot camera and not with good lighting). We suggest to do the photography of the orchids, bromeliads, ferns, and mosses on the branches at an hour of the day when the sun is illuminating at least part of the treetops. And, do this with highresolution lens. Plus, do a photo of the entire tree at an angle that is not as distorting.

There are also lots of monumental *Ceiba pentandra* trees in the Reserva de la Biosfera Maya.

Flavorings for Cacao

Although *Theobroma cacao* grows only in house gardens (or in an area where a local Mayan house existed in a past decade), tourists would be amazed to learn how many and which trees in the national parks and biotopes of RBM were used as flavorings for cacao recipes 2000 years ago. *Quararibea funebris* was used several ways: the branch as a molinillo to froth cacao and flowers as flavoring. So we at FLAAR Mesoamerica would make an Infografia (to post in Visitors' Center) to list all the plants at each park that flavored cacao for the Maya for thousands of years.



Zapote seeds (black), zapote fruit (in the middle) on top of cacao seeds; with background of leaves from wild native zapote trees of remote areas of Guatemala. We have dedicated years of field trips in past years to finding all the plants that the Maya and Aztecs and Zapotecs (of Oaxaca) used to flavor their cacao drinks. Your donation can move this cacao (chocolate of Mesoamerica) research project to completion.



Bernoullia flammea, uacut, mapola, red mapola, flowering in April 18, 2018, the week we were invited to Yaxha to discuss the possible future project of August 2018-July 2019.

This tree also grows happily around the Main Plaza and Central Acropolis of Tikal, so from any pyramid or palace of Tikal you can see whole areas of the tree tops in bright red during flowering season.

Many botanists list the tree as producing edible food (the seeds). Ethnobotanists say local people smoke the leaves to get a high. It is true that each different part of a plant will have very different chemicals: so the seeds may be regular food and not give you a high while the leaves have different chemicals. However we ourselves do not "taste test" the plants.

Photograph by Nicholas Hellmuth, Nikon. Lake Yaxha is in the background, Parque Nacional Yaxha, Nakum and Naranjo.

Araceae (Aroids) in general

Vines with leaves of photogenic size and shape; inflorescences of remarkable shapes, several of which are edible *Anthurium*, several species have edible parts *Philodendron*, several species are edible: *Monstera deliciosa* is edible but this is a Highland plant more than a Lowland plant *Spathiphyllum*, popular for Mayan people to eat Xanthosoma, edible; we grow them in our FLAAR research garden.

Lemna, Wolffia and others that grow not on trees but across the surface of aguadas and the edges of lagoons.

Most of these seldom mentioned plants are edible.



The leaves of *Philodendron radiatum* Schott are the same size, same color, and similar shape as the equally giant leaves of *Monstera deliciosa* Liebm. But the *Monstera* is native to the Maya Highlands and *Philodendron radiatum* is found more often in the adjacent Maya Lowlands, especially in Izabal and Peten and adjacent areas: Belize, etc.

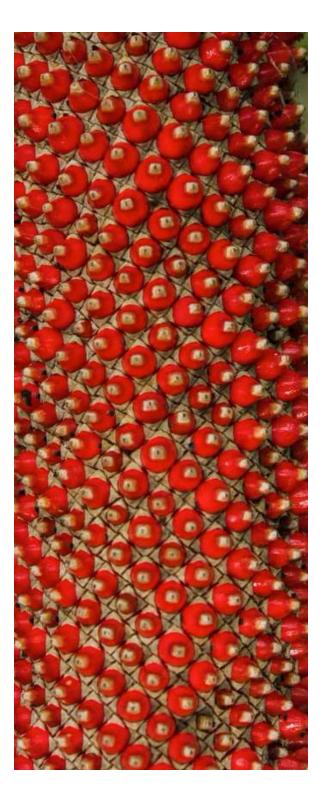
So this large leaf Araceae at Yaxha is *Philodendron radiatum.*

Photograph by Nicholas Hellmuth, Nikon D5, f/13, 1/100th, ISO 640 since there was plenty of natural sunlight shining on the leaf.

This is edible for people. I have also seen local wild foxes eating it.

Local name is hoja de piedra; botanical name is *Anthurium schlechtendalii Kunth*, plant family Araceae.





This plant is wild in many parts of the Reserva de la Biosfera Maya but an easy place to see it is in front of the Hotel Ecolodge El Sombrero.

Photographs by Nicholas Hellmuth, July 5, 2019.



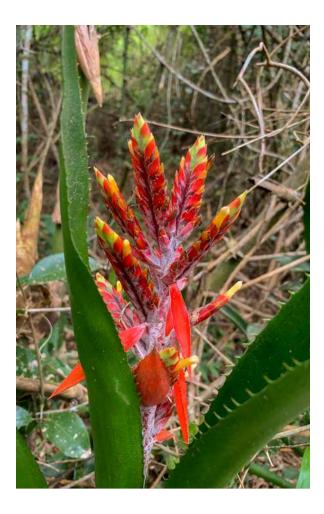
BROMELIADS IN GENERAL

Aechmea tillandsioide Aechmea bractata

Research to determine which bromeliads are edible and how many are in each Parque Nacional and in each Biotopo:

- Aechmea magdalenae, pita, pital ecosystem
- Bromelia alsodes
- Bromelia karatas
- Bromelia pinguin

And lots of other bromeliads: terrestrial and epiphytic.







Aechmea bracteata we have found in Parque Nacional Yaxha, Nakum and Naranjo in 2018-2019 project and now are finding it in many other parts of RBM during our new year 2021-2025 project.

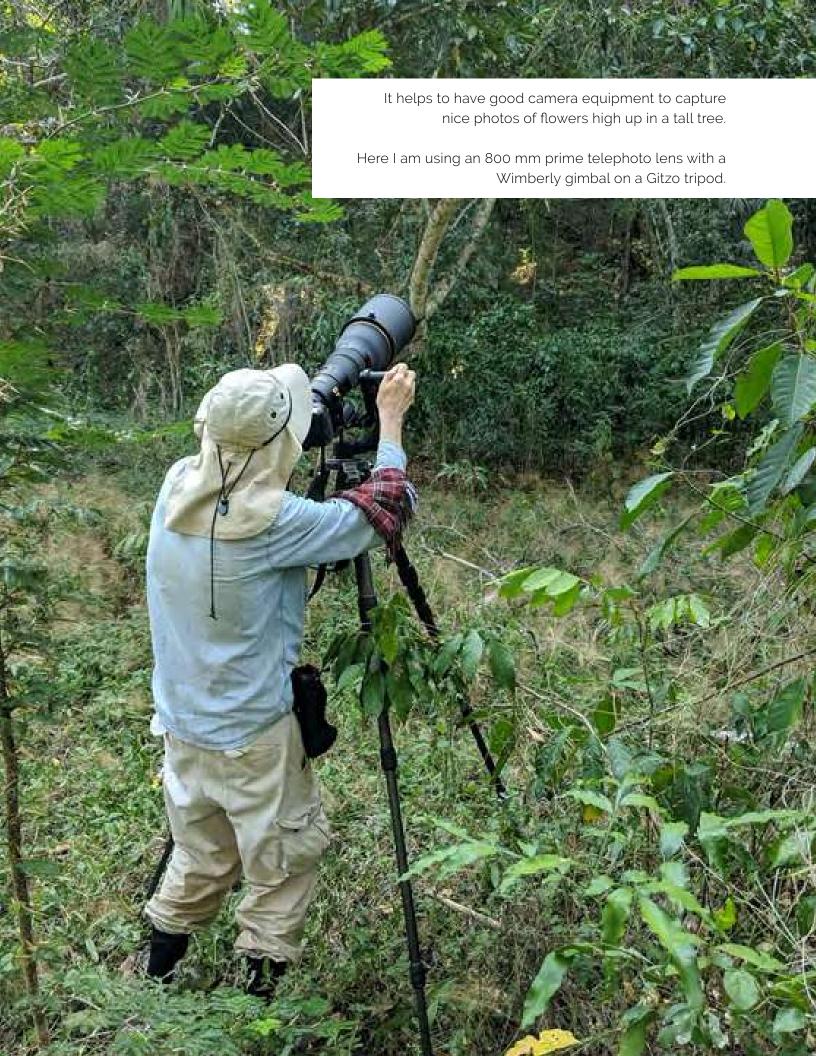


It can grow high up on a tree branch, or in a tree fork, and if the branch breaks off during a tropical rain storm the *Aechmea bracteata* still continues to grow after falling to the ground.

Reserva de la Biosfera Maya, August 8, 2021, photo by Nicholas Hellmuth, iPhone 12 Pro Max.



January 23, 2019, iPhone Xs. Photography by Nicholas Hellmuth.





ORCHIDS IN GENERAL

Tourists love to see orchids in flower; wild vanilla orchid vines should be findable in many areas of Peten (we have found "hundreds" in PNYNN during the August 2018-July 2019 field work)



Encyclia radiata orchid that you can see while visiting the Grupo Maler area, northwest part of Yaxha.

With funding we can find and photograph more orchids and then prepare a coffee table book on *Wild Native Orchids of Parque Nacional Yaxha, Nakum and Naranjo.* We are also working towards photographing all the flowering orchids that we find elsewhere in the Reserva de la Biosfera Maya.

Photograph by Nicholas Hellmuth, Nikon, f/8, 1/40th of a second (so clearly was using a tripod), ISO 400.







In this one single photograph there are enough plants for lots of research. The orchid is obvious. But what you see here is the habitat: the aguada whose water level will rise and fall depending on rainfall (or lack thereof) by month and year.

And the surface of the water is covered by leaves of "miniature plants" only a few millimeters in size (actually two different species).

This is an aguada that required a 6x6 pickup truck to get us even close; it got stuck in mud so deep that even with a winch it could not continue. So we hiked to the aguada and then hiked all the way back to where

we parked our own 4WD pickup truck many kilometers away.

Finca Tulan is outside the Tikal park, part of the long-term project of Sebastian de la Hoz and Juan Carlo de la Hoz to buy up fincas and haciendas and then reforest them to create a corridor for the howler monkeys, spider monkeys, jaguars and other felines from Parque Nacional Tikal down to the Cerro Cahui biotope alongside Lake Peten Itza.

We know the helpful and hospitable de la Hoz family for many decades. We prefer to do field work in areas where we know the local families.



WATER-ASSOCIATED ORCHIDS

Bletia purpurea (we found common in PNYNN; should also be at elsewhere in RBM) Habenaria repens (we found in PNYNN; should also be in other aguadas and marshes) Wetlands associated orchids not yet found: so look for these:

- Catasetum integerrimum Hook.
- Chysis bractescens Lindl.
- Laelia tibicinsis (Bateman) L.O. Williams
- Notylia tridachne Lindl. & Paxton
- Oncidium adsendens Lindl.







We found hundreds of *Bletia purpurea* orchids flowering literally all around the edges of Lake Yaxha and Laguneta Julequito (an inlet at far west end of the lake en route to the Southwest Cenote).

They flower in late November. These were photographed on November 26, 2018 with a Nikon D810 camera and macro lens. f/10, 1/250th, ISO 3200.

99% of the orchidologists with whom we spoke told me "Nicholas, it is impossible for an orchid to grow out on the water; what you probably found was an orchid that had fallen from a tree growing on the shore of the lake..." So we went back to Yaxha three more times (1,000 kilometers round trip each time) in order to find more. We found that these Bletia purpurea orchids rest on floating reeds: the roots of the orchids reach down through the floating roots of the reeds to also reach the water. But the Bletia purpurea orchids need a support; they do not float by themselves independently. But 100% are between one and three meters away from the shore, out over the shallow edge of the lake.

No *Bletia purpurea* orchid is epiphytic whatsoever. And they never grow along the shore itself.

Once we learned all this in-person out in the lake, we invited one of the orchidologists to come with us to see this. While out in the lake, I showed him the orchids happily growing on the reeds, several meters from the shore, with the roots of the orchids growing 5 to 10 centimeters down so they could reach the water under the floating reeds (the reeds don't always grow in the ground, they often float). The orchid specialist was so upset that I had proven the reality (that these are aquatic orchids) he refused to get up and look over the side of the boat to see the actuality.

The only 1% of orchid specialists who realized that I had indeed found what I was finding was experienced Guatemalan orchid botanist Fredy Archila. He has known our field work for many years.

We would obviously like to publish these photogenic aquatic orchids, but first we would like to study the dozen other lakes and riverside marshes and find five MORE different species of riverside and lakeside orchids. Your donation can make this possible and you are welcome to join us on our field trips.



Senaida Ba, Q'eqchi' Mayan plant finder specialist of our team, noticed another water-related orchid: *Habenaria repens*. This orchid grows adjacent to water and survives being inundated as the water level rises in the rainy season.

Not many people are willing to hike as many kilometers as it took us to even get close to this bio-diverse swamp. And most intelligent people would not wade into such a swamp just to see and photograph a rare orchid.

Southeast part of Savanna of 3 Fern Species. Most savannas and sawgrass cibal savannas have a ring of water around their edge.

We spent four hours studying what was in this marsh. We returned in autumn 2021 to do aerial photos with our drone. We will return in 2022 to make a list of more of the wetlands plants of this area of Parque Nacional Yaxha, Nakum and Naranjo.

You can join us in-person, or join us via ZOOM and video, to share our adventure in flora, fauna, and ecological field trips.

WATER PLANTS OF WETLANDS: AGUADAS, BOGS, MARSHES, EDGE OF SWAMPS

Acrostichum danaeifolium
Chrysobalanus icaco
Lemna species, Landoltia species, Spirodela species, Wolffia, etc.
Ludwigia species, plant family Onagraceae
Pontederia cordata, edible
Sagittaria species, edible
Typha latifolia, edible
Typha domingensis, edible

And lots more (we have over a year's experience in the swamps and marshes of the Municipio de Livingston)

"edible" means that some part of the plant is eaten either in Mexico, Costa Rica, Panama, or Brazil, etc. Most of these wild native edible plants are no longer eaten locally because sugarand-chemical foods provide taste treats that sadly end with Diabetes 2. Our goal is to document which local wild healthy edible plants native to Peten can be raised and eaten outside the parks and nature reserves (since obviously no plants should be harvested from inside a national park).

Eco-tourism has lots of potential. Lots of people around the world love to learn about new Super-Foods. Ramon is the best known so far; let's find even more so that local village cooperatives can process health foods to sell locally (and hopefully eventually earn more money for Peten people by exporting to Whole Foods or to Trader Joe's in the USA (these are the stores with the most health foods, such as Bob's Red Milland other brands).







What if both these plants' miniature leaves are edible? This is why we are enthusiastic to study remarkable plants of the wetlands of Peten, Guatemala. And their biodiverse ecosystem.

Natural aguada, in corridor being created by Sebastian de la Hoz and Juan Carlo de la Hoz to help animals be able to wander from the south end of Tikal park all the way down to Cerro Cahui nature preserve.

August 8, 2021, photo by Nicholas Hellmuth, iPhone 12 Pro Max.







These flower much of the year and are found in many wetland areas of Parque Nacional Yaxha, Nakum and Naranjo.

The most common flowers that decorate Late Classic Maya vases, bowls, and plates are 4-petalled flowers. We have found several dozen different species of wild native plants of Guatemala with four petals. We have a fully-illustrated PowerPoint presentation that we can give via ZOOM to you, your family and friends, or to the university of botanical garden that you know in your home city.





In the Izabal area of Guatemala 90% of the *Costus* species have red flowers. And many have ants wandering around the flowers suggesting a symbiotic or other relationship. But in Peten, most of the *Costus* species that we have found are yellow (with brown-red ends). And we have not yet noticed ants on them.

Costus pictus D. Don, plant family Costaceae, in corazera (an area of "thousands" of corozo palms thickly growing together) along the west edge of the ruins of Naranjo. Bajo la Pita is to the west.

Naranjo part of PNYNN, July 9, 2019, 3:12 pm. Photo by Nicholas Hellmuth, Phone Xs.

FERNS IN GENERAL



We have found an unexpected diversity of tree ferns throughout the eastern half of Izabal, Guatemala. I had expected tree ferns mainly in the cloud forests of Alta Verapaz; but in the Municipio de Livingston you get them at only a few meters above sea level.

Giant mangrove ferns are also found along the rivers of brackish water near the mangrove swamps of the east part of Izabal (facing Amatique Bay, the Caribbean part of Guatemala).

In the rain forests of the Reserva de la Biosfera Maya ferns come in many sizes and shapes but so far we have not yet found "tree ferns." But some ferns grow "as high as a sapling" albeit without the tree-trunk base. Now we are finding giant leather ferns in several areas of Peten; plus a "Savanna of 3 Fern Species" northwest of the west end of Lake Yaxha.

I show here ferns that are two to three meters high that encircle Aguada Maya, north of Yaxha (en route to Nakum). We have also found tall ferns around the outside of the Cibal Savanna in the southeastern part of Parque Nacional Laguna de Tigre (PNLT).



So even though ferns do not have flowers, we still photograph them whenever we find them. Funding would allow us to produce a photo album and research report on all the different sizes, shapes, and colors of ferns that we have found across the Yaxha, Nakum and Yaxha park (PNYNN) and other parks and nature reserves within the Reserva de la Biosfera Maya.







The underside of most ferns shows the structure of each individual leaf.

We find ferns throughout the park; these were at the west end of Lake Yaxha, August 15, 2018. Photo by Nicholas Hellmuth, Nikon D810, f/14 (to get depth of field), 1/400th of a second (since no tripod and neither the Nikon nor lenses had image stabilization in

those years). ISO 12,800 in order to allow the speed and f/stop that I felt was helpful.

This is why funding would be appreciated so all our team can have the newer improved technology of mirror-less Sony a1, 50 megapixel resolution and in-camera stabilization and in-lens stabilization also.

SEASONALLY INUNDATED BAJOS (ARE NOT ALWAYS A TINTAL)

Bajos occupy substantial areas of the RBM. The ones around Tikal, Yaxha, Nakum, and Naranjo have been studied by capable biologists, ecologists, and archaeologists. But with modern digital technology it will be possible to document the biodiversity of these areas and to show there is a lot more than just palo de tinte (logwood) in bajos of Peten. There are lots of *Pithecellobium lanceolatum* and many other trees.

Cyrus Lundell lists most bajo trees (dozens more than just palo de tinto) But needed are high resolution photographs, especially when each plant is flowering, and then return to photograph the fruits.

Bamboo (in wet areas, especially parallel to Rio Holmul, etc.)

Guadua longifolia, wild native to Peten, Izabal, etc. This plant is usable and has edible parts. It helps to promote native bamboo of Guatemala instead of foreign bamboo from China or South America.





Vines

- Water vines
- Bauhinia species, Monkey ladder vines
- Cuculmeca, Smilax (medicinal and edible parts)
- Aristolochia (one of the largest flowers in the entire country)
- Passiflora (many many species have edible fruits and the flowers are awesome)
- Morning glory vine
- Other vines

Several trees have aerial roots that hang down from above trying to get down to the ground (such as strangler fig, Ficus species).

Some vines also have aerial roots that hang down, trying to keep growing until they can get all the way down to the ground. This is what we are showing here (they have another 2 meters before they reach their destination).





Twisted vines are literally everywhere, both in karst hillside and hilltops, and endless in lowland bajos and along the transition zones into savannas or cibal areas.



Although these are relatives of "morning glory" vines, these flowers were still fully open at 2 pm, November 24, 2018. You can find morning glory relatives all around Lake Yaxha and Rio Ixtinto.

We would like to find more species of different colors and put them together in a publication so that botanists as well as flower lovers know where they can find these and in which dates they are flowering. Your donation can make this possible.

Many of us grew up with morning glory vines running around the walls of our garden.

When you drive through most of Guatemala, you see morning glory vines along most highways.

Out in the national parks there are also lots of these flowers; the edges of Topoxte Island, Paxte Island, Cante Island and the shores of Rio Ixtinto are covered with thousands of vines, many of which are relatives of morning glories.

Here is one of the common flowering vines along the Rio Ixtinto. It was flowering in May and again on June 29, 2021.





"Morning glory" relatives of plant family Convolvulaceae, wild out in the swamps, riversides, and lakeside areas of the rain forests come in lots of different colors. Here are deep blue-pink-purple.Parque Nacional Yaxha, Nakum and Naranjo (PNYNN), and all nearby parks, biotopes, and nature preserves are a place worth visiting to see the diversity of color of Neotropical flowers.

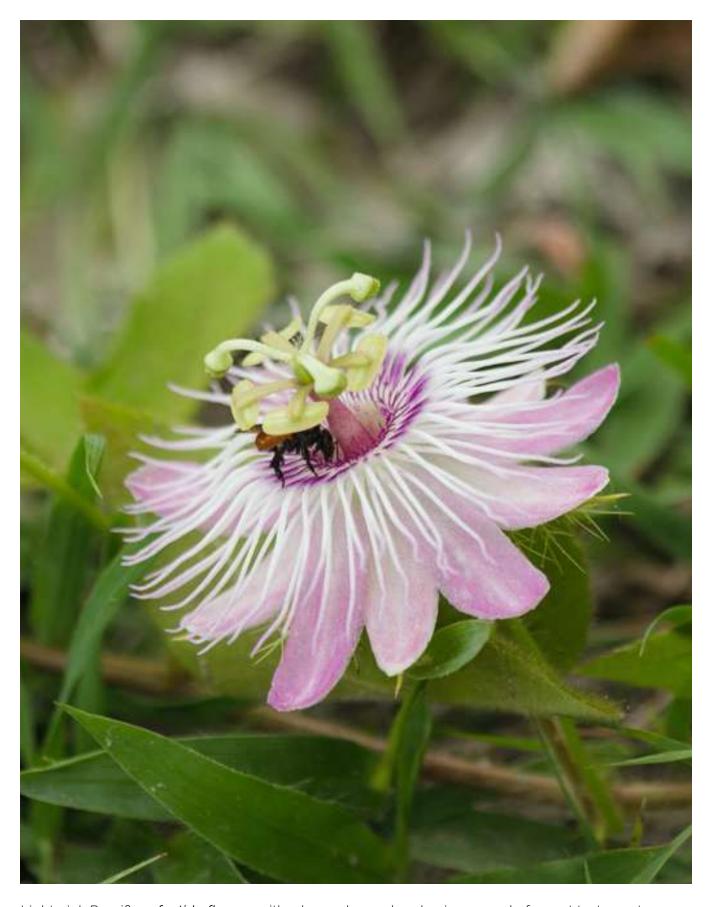
Lots of flowering trees can be seen surrounding the Late Classic pyramids, temples, and palaces at Nakum.



Would be great to produce a coffee table book on "Neotropical Flowers of Parque Nacional Yaxha, Nakum and Naranjo – Size, Shape, & Color Spectrum."

Your name, your family business, a foundation name can be featured in the front pages of such a glamorous coffee table book with photos from 2018-2019 and 2021 onward. We will have enough photographs of flowers by year 2022 to produce such an impressive book.





Light pink Passiflora *foetida flowers* with a happy honey bee having a meal of sweet tasty nectar.

PARASITIC TREES AND PARASITIC VINES

Mata palo, strangler fig, *Ficus* species *Cuscuta mimic*, *Cassytha filiformis*, we have found in PNYNN and elsewhere, so should be in other Parque Nacional areas Lots more; often *Psittacanthus* species parasitic vines

have beautiful flowers (near Grupo Maler, Yaxha, PNYNN for example) Mata palo ("kill the tree"), *Ficus*, fig genus, is the largest parasitic plant; it is a giant tree.



This is one of the several photogenic strangler figs on Topoxte Island.

These trees deserve to have their own chapter in a book TREES of Parque Nacional Yaxha, Nakum and Naranjo.

Gaby and her daughter Shaila show you the mass of all these roots. Gaby is from Senahu, Alta Verapaz, and has worked for us about 9 years.



A coffee table book is the best way to show these to the world.

Your donation can get this started (since we also need to hike through the adjacent Paxte Island and Cante Island to see what strangler figs are there).

Then have a meeting with local people and the park rangers so they can tell us where other monumental strangler figs can be photographed. Then we need to hike there.

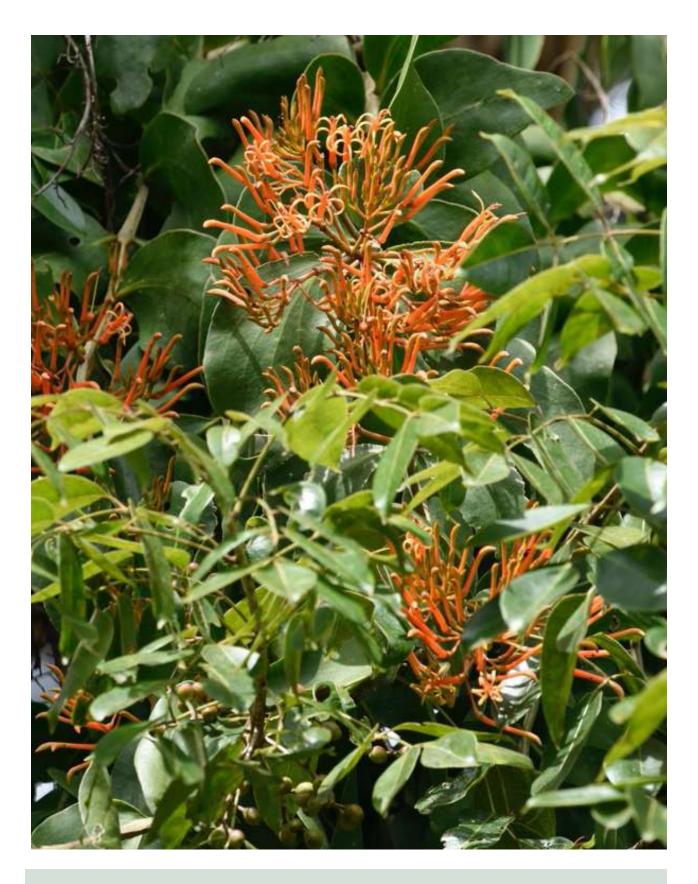
These costs are where you can help.



Psittacanthus species, probably calyculatus, plant family Loranthaceae.

These parasitic vines grow throughout the treetops around Grupo Maler of the ruins of Yaxha.

Photographed by Nicholas Hellmuth, November 25, 2018. The flowers began to bloom in early October and continue through late November.



Slightly closer view, 1:27 pm, October 28, 2018, Nikon with prime telephoto lens. F.13, 1/125th, ISO 400. Probably photographed with a Gitzo tripod.



We prefer to do "botanical photo style" where you can see the leaves and the other plants nearby.

In the following photo you will see fine art giclee style: with black background so you can see more of the helter skelter growth of this flower of genus Psittacanthus.

November 26, 2018, iPhone Xs.

After the Xs when the iPhone 11 Pro Max came out, we got that: much better photographs. Then we got the iPhone 12 Pro Max; a tad better. Since we have many photographers it helps to have several good iPhones.

We have now ordered the iPhone 13 Pro Max since it will have more advanced digital features.



One of several reasons why we can capture great images is because we are a complete team, so while I am in front of the flower to photograph it Senaida is behind the flower with a black background. This way we can show the flower in coffee table book format.



This energetic parasite does not have to be green since it gets all its food by sucking nutrients out of plants that it wraps around.

This particular parasite wanders along the ground until it finds the kind of plant it prefers to attach itself to. We have found entire "savannas" of this on the south shore of Lake Yaxha (but only when water level is low; when the lake rises this area is flooded). You can also find this *Cassytha filiformis* as a vine along the west shore of Rio Ixtinto.

This parasite is 95% identical to genus *Cuscuta* (that is common in Highland Maya areas). But here in the Maya Lowlands, *Cassytha filiformis*, the "twin," is totally unrelated (albeit identical in appearance and how it survives).

Here (on the south shore of Lake Yaxha, along the south edge of this national park) we found an entire "savanna" of orange spaghetti-sized parasitic vines.

Parasitic vines and parasitic trees (such as the energetic Strangler Fig) deserve

- Video documentation,
- Infographic posters (for schools and for visitors to Yaxha),
- Deserve better understanding: these are not plants that need to be removed!

Your donation can help document these misunderstood parts of Mother Nature of the tropics.



TREE ROOTS SIZE AND SHAPE

Buttress roots, stilt-roots, etc. Help students and eco-friendly tourists learn the classifications by making Infografic posters.

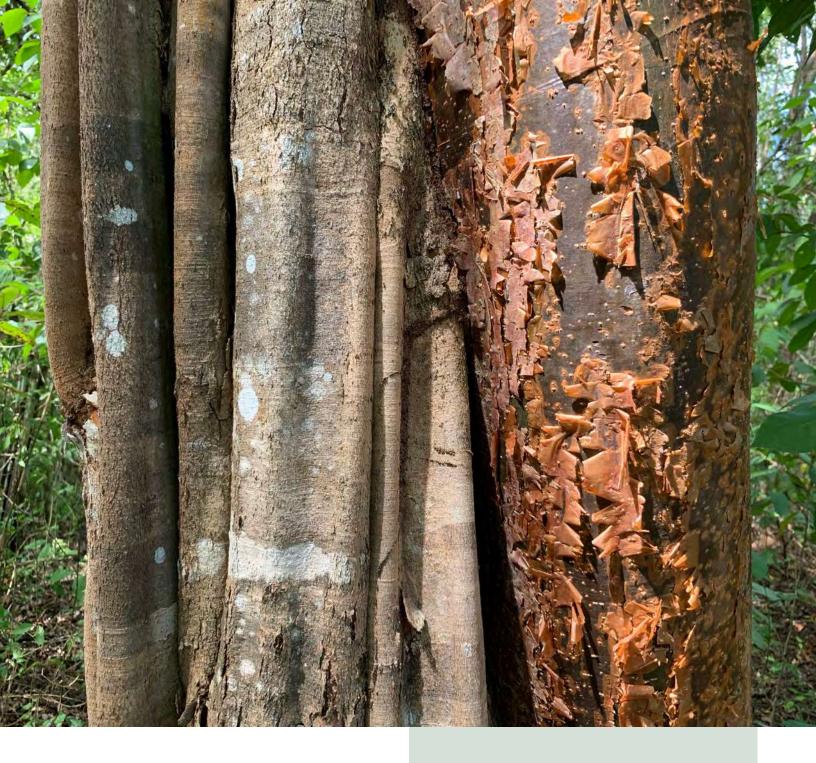


I love to see tree roots of size and shape that I have not noticed before.

This tree is near the IDAEH camp at Yaxha. The lower part of this trunk is a shape I have not often noticed elsewhere.

Tree trunk size and shape

- Tree trunk structure (smooth or fissured or channeled, like Palo de Tinto or roble)
- All trees with spines, thorns, or prickles on the trunk
- Bark patterns
 - Tree trunk bark that peels off (jiote, pimiento gorda; wish to find more species)
 - All the plants that grow on tree trunks: mosses, liverworts, ferns, vines, lianas, etc.



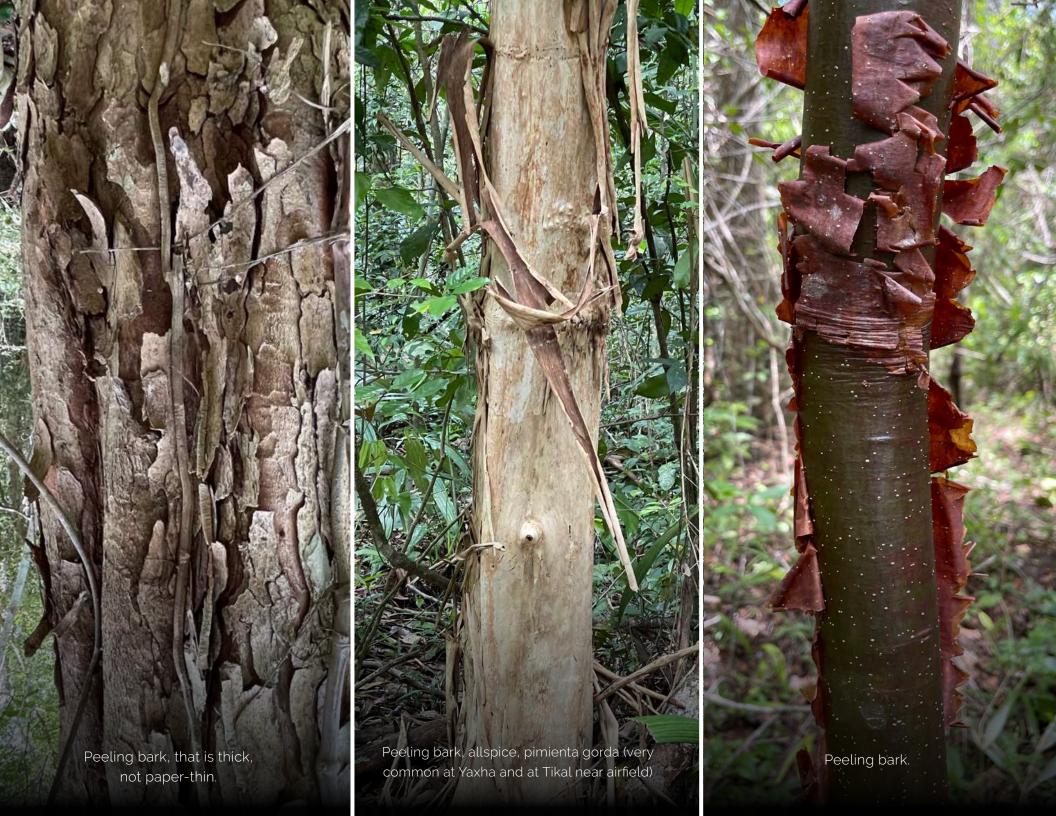
What are the statistical chances of finding a logwood tree (*Haematoxylum campechianum*) growing physically adjacent to a palo de jiote tree (*Bursera simaruba*)?

But we find these unexpected and unprecedented coincidences of Mother Nature because month after month, year after year, we are hiking into the tintal bajos and into the hillside forests of Parque Nacional Yaxha, Nakum and Naranjo and neighboring parks and nature reserves and biotopes.

Only when the water level of Rio Ixtinto is high can you reach this tintal bajo by lancha, as we did in January 22, 2019.

Notice the ridged fissured trunk of the logwood tree and the smooth bark with the outside layer deliberately peeling off of the palo de jiote tree.







Palo de Jiote, *Bursera simaruba*, is the most common tree of all Peten with peeling back. Pimienta gorda, allspice is common in some areas (Tikal and Yaxha) but not common elsewhere. Other species are present but nowhere near as common as jiote or allspice.

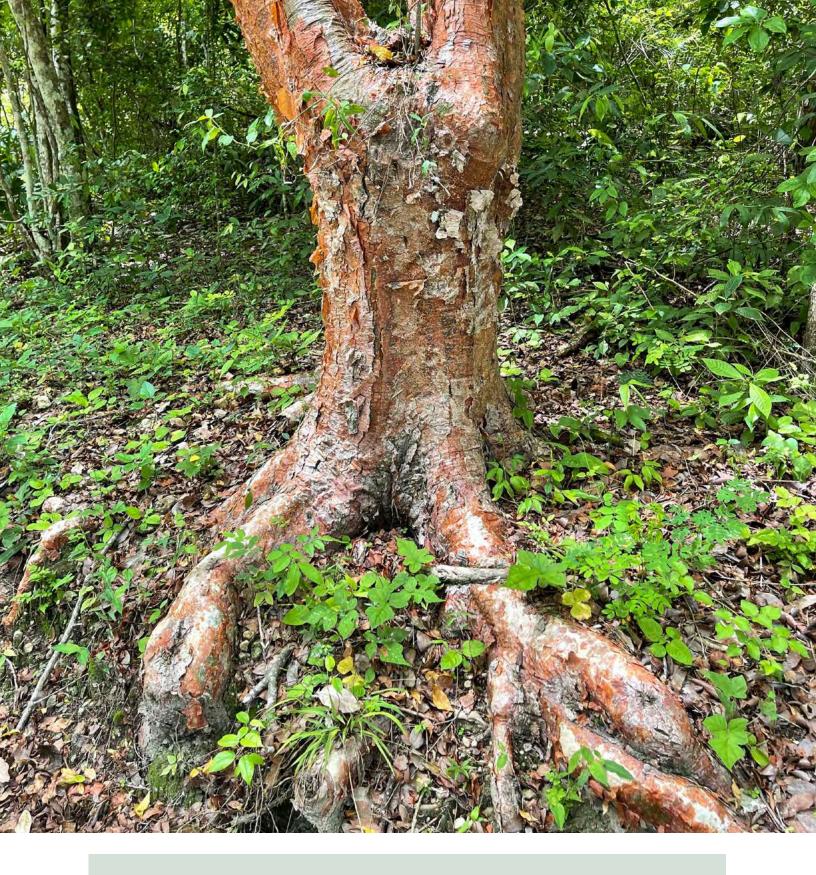


At the base of this tree you can see the amount of bark that has been shed by this tree in order to get rid of vines.





Pimenta dioica, Pimienta gorda, allspice. Photograph by Nicholas Hellmuth, iPhone 12 Pro Max, June 30, 2021. Yaxha to Nakum road.



Yaxha is paradise for trees with peeling bark. This shows the trunk and roots of another palo de jiote.

There is now a huge opportunity to find-and-photograph lots more examples throughout the RBM of trees working hard to get rid of vines and lichen by shedding their back.

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This tree species here did not evolve that protection and is suffering the results.



PALMS

All palms of all sizes

Edible palms

- Acrocomia aculeata (Jacq.) Lodd. ex Mart.,
- Astrocaryum mexicanum Liebm.,
- Attalea cohune Mart.,
- Bactris major Jacq.,
- Bactris species
- Calyptrogyne ghiesbreghtiana
 (Linden & Wendl.) H. Wendl.
- Chamaedorea pinnatifrons (Jacq.) Oerst.,
- Chamaedorea tepejilote Liem. ex Mart.
- We estimate three more edible species will be findable
- Plus other rare palms that we will research to see if also at Parque Nacional areas
 of RBM



Palm flowers are a challenge to find but it helps when you are one-week-per-month, every month, year-after-year able to hike into the rain forests. Here is the inflorescence coming out long before it turns into green or red berries (seed pods).

Escoba (in Spanish); broom palm in English; botanical name is *Chamaedorea tepejilote* Liebm., family Arecaceae.

Yaxha to Nakum road, October 29, 2018.

Often it helps to have a backdrop (background cloth or photo studio backdrop paper) so you can see the size, shape, structure and color more easily. We do this out in the rain forest; we do not need to cut anything; our team simply holds the material behind the subject.

This xate palm was along the trail to Pochiteca, October 10, 2018, photographed by Nicholas Hellmuth, Nikon D810, f/8, 1/100th of a second, ISO only needed 500 because we are using portable lighting. We have an entire portable studio with us.





Bayal is a very common palm. Thousands of bayal palms grow along the edges of creeks and rivers that feed into El Golfete, Municipio de Livingston, Izabal. Most of these must survive seasonally high river levels that flood the base of everything growing anywhere near the edge of the river.

Bayal is common in Peten, but there are not as many rivers or creeks here, so it had to evolve to grow with less water.

Bayal is a vine; not a tree whatsoever. But bayal is nonetheless still a palm, of the same family Arecaceae as all other palm trees. It climbs high up into trees. Shoots of bayal are edible.

There are several species of this vine but we estimate this is *Desmoncus orthacanthos* although there is a very similar appearing *Desmoncus chinantlensis*. We photographed this along the road from Yaxha to Nakum, June 28, 2021.



This is one of the largest masses of fruits from a single palm that we have yet found. We would like to do an entire chapter on the color and mass of the seeds of each of the dozen species of palms in the Reserva de la Biosfera Maya. The fruits here are of *Gaussia maya*.

Photo by David Arrivillaga, Naranjo sector of PNYNN, June 9, 2019.





This is one of the three most common palms in the rain forests of Peten. These are called guano when at this height and called boton when they rise above the treetops around them. These leaves of this genus Sabal are used to thatch the houses of local Mayan people.

Yaxha to Nakum, May 6, 2019, photo by Nicholas Hellmuth, iPhone Xs.



Corozo, named cohune palm in nearby Belize, is one of the three most common palms of Peten. Although this can be used as roof thatch, guano lasts longer.

Yaxha to Nakum, May 6, 2019, photo by Nicholas Hellmuth, iPhone Xs.



CACTI

There are no terrestrial *Opuntia* cacti native to most areas of Peten; so any prickly pear cactus has been planted in a home garden. Instead you see lots of arboreal cacti high up on tree limbs; one nice example is *Selenicereus testudo*; we wish to document other species with edible fruits.

Twice we have photographed hour after hour to record in stop-motion sequence the opening of flowers of Selenicereus testudo. It was fully open by 8:24 pm and we kept photographing for another hour; we started over 4 hours before that. September 5, 2021.







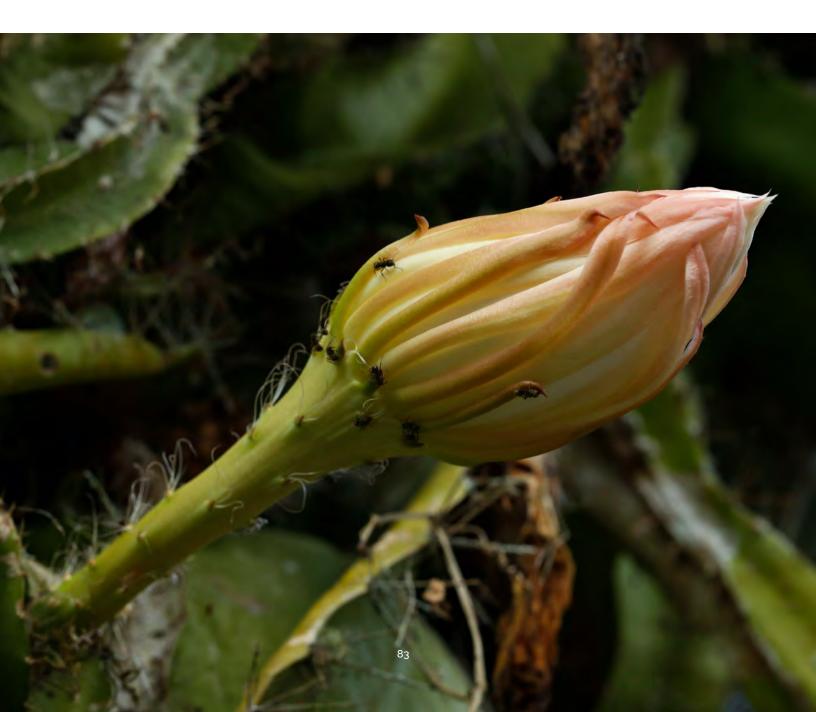




I had two separate cameras, each on a separate tripod, so I could take one sequence from the front and a second simultaneous sequence from the side. Erick Flores was also taking photos.

Here is a view at 7:51 pm, September 5, 2021 by Erick Flores. Local people kindly brought us dinner so we could eat while we were photographing (since we were four hours in

front of this tree that the cactus was attached to). Fortunately we have tripods two meters high so it was possible to have our cameras closer to the position of the flower. To do stop motion (photos every minute for many hours) you need a sturdy tripod and an electronic cable release. FLAAR has all this equipment which is why local entities request that we do a cooperative project with them.





5. testudo. Cactus de tortuga at the moment the flower opens. Photo by: Nicholas Hellmuth, FLAAR Mesoamérica. Location: in front of Temple 216. Camera: NIKON D5. Lens: 200 mm, f/11, 1/100, 12800 ISO.



5. testudo. Cactus de tortuga at the moment the flower opens. Photo by: Nicholas Hellmuth, FLAAR Mesoamérica. Location: in front of Temple 216. Camera: NIKON D5. Lens: 200 mm, f/11, 1/100, 12800 ISO.



5. testudo. Cactus de tortuga as the flower opens further. Photo by: Nicholas Hellmuth, FLAAR Mesoamérica. Location: in front of Temple 216. Camera: NIKON D5. Lens: 200 mm, f/11, 1/100, 12800 ISO.



S. testudo. Cactus de tortuga as the flower opens completely. Photo by: Nicholas Hellmuth, FLAAR Mesoamérica. Location: in front of Temple 216. Camera: NIKON D5. Lens: 200 mm, f/11, 1/100, 12800 ISO.

WILD RELATIVES OF EDIBLE PLANTS

- Wild relatives of papaya, *Jacaratia mexicana* and others
- 2. Wild relatives of camote,
- 3. *Cucurbita lundelliana*, wild relative of squash

The projects of Dr Cesar Azurdia have advanced knowledge of wild relatives of edible plants especially in the Maya Highlands and other areas of Guatemala.





Wild native *Cucurbita lundelli* is an obvious relative of domesticated squash and gourds. This wild relative is found along the seasonally inundated shores of both rivers and lakes in Parque Nacional Yaxha, Nakum and Naranjo.

This one was flowering on January 22, 2019, and wide open at 10:03 in the morning on that day.

When possible we photograph flowers front and back. You will not see these full original color details in a dried herbaria specimen in the great botanical research gardens.

Plus, in a digital photo you can see a stingless bee flying away (at the right). Inside the flower of the left there is another stingless bee still inside



CAULIFLOROUS TREES

(trees that bloom and fruit from trunk)

- Crescentia cujete, jicarro (we have found in savannas in PNYNN)
- Grias cauliflora (very common along riversides feeding into El Golfete and Rio Dulce)
- 3. *Parmentiera aculeata*, Cuajilote (we have found wild in PNYNN)
- 4. Zygia species, Paterna de montaña (wild in PNYNN and elsewhere in Peten; common in Izaba)







TREES WITH SPINES

(more than just *Ceiba pentandra*)

- 1 *Cochlospermum vitifolium*, pochote Erythrina species
- 2. Zanthoxylum, several species should be present (Palo de Lagarto, tree with crocodile scales





HELICONIA

Heliconia, Platanillo, all species (not many species in Peten; most are in Alta Verapaz and Izabal, but worth finding more species in RBM Peten).



Heliconia is rare in the RBM part of Guatemala; we have explored and photographed remote areas of the Municipio de Livingston that had, literally, over a million heliconia in one single hillside area (80% one species; 15% another species; 5% a third species). With our Q'eqchi' plant research assistant, Senaida Ba, we have also studied Heliconia in the cloud forests around her home in a remote area of Alta Verapaz.

The horizontal part of the inflorescence are the bracts; the flowers (and subsequent seed pods) are in the open trough of the bracts. The column of trident-shaped vine is actually a palm; bayal. This palm is a vine, not a tree; but otherwise is member of the palm family *Arecaceae*.

Photograph by Nicholas Hellmuth on the road from El Caoba to Nakum, August 18, 2018, Nikon D810, f/13, 1/80th of a second, ISO 5000.





OTHER PLANTS WHOSE LARGE LEAVES ARE USED TO WRAP TAMALES

Although tortillas were potentially known and made in parts of Mexico at least by the Post Classic, most of us archaeologists estimate that the tortilla was not the primary way for the Preclassic and Classic Maya to consume maize: they had many maize drinks and dozens of maize tamales.

When I had a Christmas dinner in the mudfloored Q'eqchi' Maya home in the high cloud forests of Alta Verapaz, dinner was maize tamale with no meat inside: pure "corn bread." This is how I learn what the Mayan people eat. We have Kaqchiquel, Q'eqchi', and Pokomchi Mayan students working for us and when I visit their parents and grandparents I learn what they really eat.

These large leaves have many names: hoja de sal is one. Mashan is more for another different species of *Calathea*. The ones in the photo are *Calathea lutea*. We have also found lots of this plant in the Savanna of 3 Fern Species in the northwestern part of PNYNN.

The *Calathea lutea* in this photograph is inside the corozera immediately west of the ruins of Naranjo; to the east of the Bajo la Pita.

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



LATEX TO MAKE HULE (RUBBER)

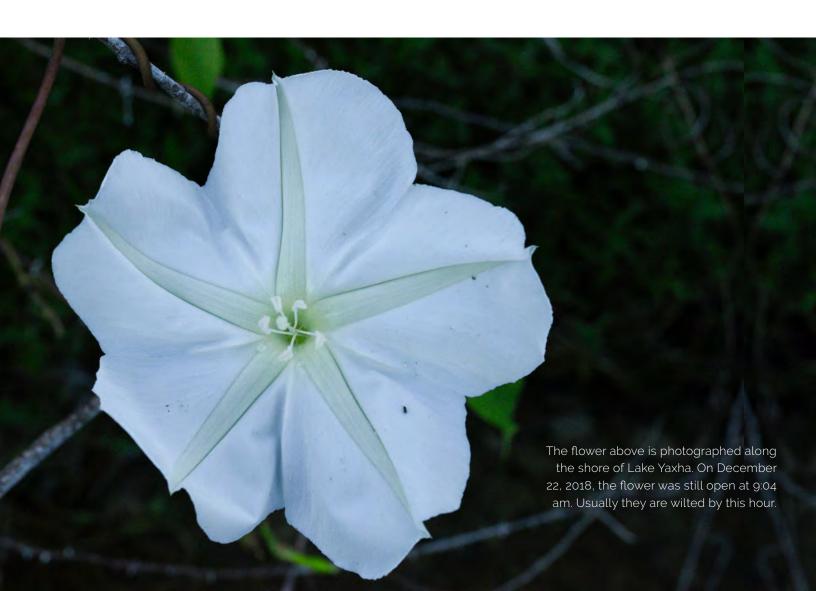
Castilla elastica, native wild rubber tree (not the commercial Brazil rubber tree)

Tanaecium nocturnum, (hutkih in Lacandon Maya language) of the Bignonia Family Other wild native plants also can produce "rubber"

All three plants whose juice (when the stem is squashed) can coagulate latex of Castilla elastica are found in PNYNN. Merremia tuberosa and Merremia umbellata are found on the hills overlooking Julequito Inlet. Ipomoea alba is common around the moist shores of Laguna Yaxha and along Rio Ixtinto.

This "morning glory" relative is called Moon Flower because it opens at night. We raise this in our FLAAR ethnobotanical research garden so we can do stop-motion photography as it starts to open between 6:30 and 8 pm (depends on the weather and the moon). It's amazing how it unfurls.

We can send you our FLAAR report on the opening sequence; hundreds of sequential photos: from 5:52 to 9:30 pm. This is why we have a research garden surrounding our office building in Guatemala, so we can do this type of photography.







This national park has so many species of plants that you can find all three of the sources of chemicals that when you add them to latex of *Castilla elastica* the rubber will bounce. Thomas Goodyear used totally different chemicals; the Olmec, Maya, Aztec used chemicals in vines.

The *Merremia tuberosa* were blooming at Christmas time on a hillside, far west part of Lake Yaxha, as you enter towards Laguneta Julequito, which is an inlet that you cross to reach the Southwest Cenote.

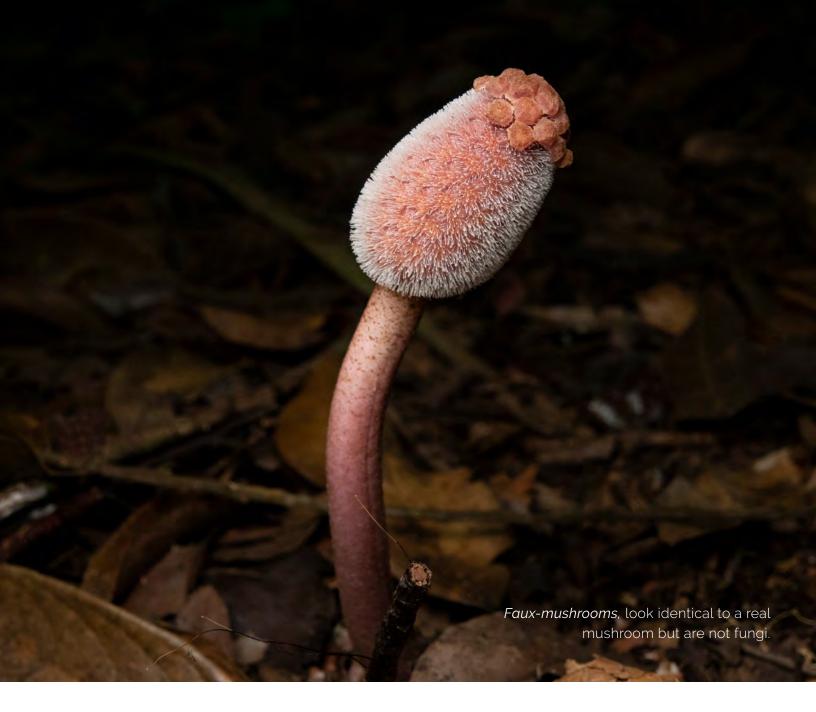
90% of botanical and ethnobotanical reports and articles on how the Olmec, Maya, Aztec and their neighbors made latex of native wild rubber tree *Castilla elastica* bounce mention only *Ipomoea alba*.



LATEX VS SAP VS GUM

Some sap is drinkable; other sap or latex is toxic; other sap or latex is a super-glue (so will glue the sides of your esophagus). Gum is used for incense (as are saps). So it is helpful to learn the differences and which trees can produce useful products for local people (if a tree produces products and/or income, then the local people learn to protect these trees and the ecosystems in which they need to grow).

- Brosimum, potentially two different species
- Calophyllum brasiliense, árbol de leche, Santa Maria
- Castilla elastica, wild native rubber tree of Mesoamerica
- Couma macrocarpa, edible (drinkable) latex
- Hymenaea courbaril, Guapinol
- Lacmellea standleyi, leche miel, edible (drinkable) latex; tree has spines like Ceiba
- Manilkara zapota, sapodilla, Chico zapote
- Pithecellobium dulce
- Protium copal, copal pom
- Stemmadenia donnell-smithii



FUNGI

- **Mushrooms** that explode; emit "smoke"
- **Mushrooms** used to make dye colorants
- **Faux-mushrooms**, look identical to a real mushroom but are not fungi.

99% of the hallucinogenic mushrooms that were used by the Aztec or Maya do not grow in the Reserva de la Biosfera Maya (Dr. Bernard Lowy, one

of the leading ethnobotanists visited us in the 1970's at Yaxha to study what species were present and which not). The hallucinogenic mushrooms of Maya mushroom stones are from the Maya Highlands (of central Guatemala and adjacent Chiapas; not from the Maya Lowlands of Peten, Guatemala).









Our photo archive of mushrooms of Peten is most likely the largest such archive of good resolution images of these fungi. We already have enough to start a coffee table book on these mushrooms.

Your donation can facilitate additional field work during the rainy season to find-and-photograph even more mushrooms.

Mushroom, not really, this is actually a parasitic look-alike *Helosis cayennensis* of plant family Balanophoraceae. that we photographed in the Naranjo sector of PNYNN, Feb. 20, 2019.







Mushrooms come in every size, shape, and color in Parque Nacional Yaxha, Nakum and Naranjo. They help decompose trees blown over in heavy tropical rain storms.

You can help by facilitating the opportunity to produce the first book on wild native fungi of Yaxha, Nakum and Naranjo national park.



LICHEN

Lichen is an amazing combination of different organisms that cooperate with each other. 80% of the flat lichen on tree trunks in the Yaxha park area of Peten are white. Here you have a rare area of yellow lichen in between the white lichen.

Would be colorful to have an educational documentary video on *Rainbow of Colors* of Flat Lichen on Tropical Tree Trunks. Plus a photo essay in .pdf format to show each different color based on fresh photography. And, macro photography to show the structure of this "flat" lichen on tree trunks.

Your donation can make all this possible.







3-D lichen is so amazing it would be super helpful to have:

- stop-motion sequential photography to show how it grows up and out
- 3-D scanning to show its structure in a digital format
- Make a photo archive of all the sizes, shapes and colors of 3-D lichen of the rain forests

There are lots of capable energetic university students available that wish to join our project; they could then utilize this material for their MS theses or PhD dissertations.

Your donation could make all this happen.

MAMMALS

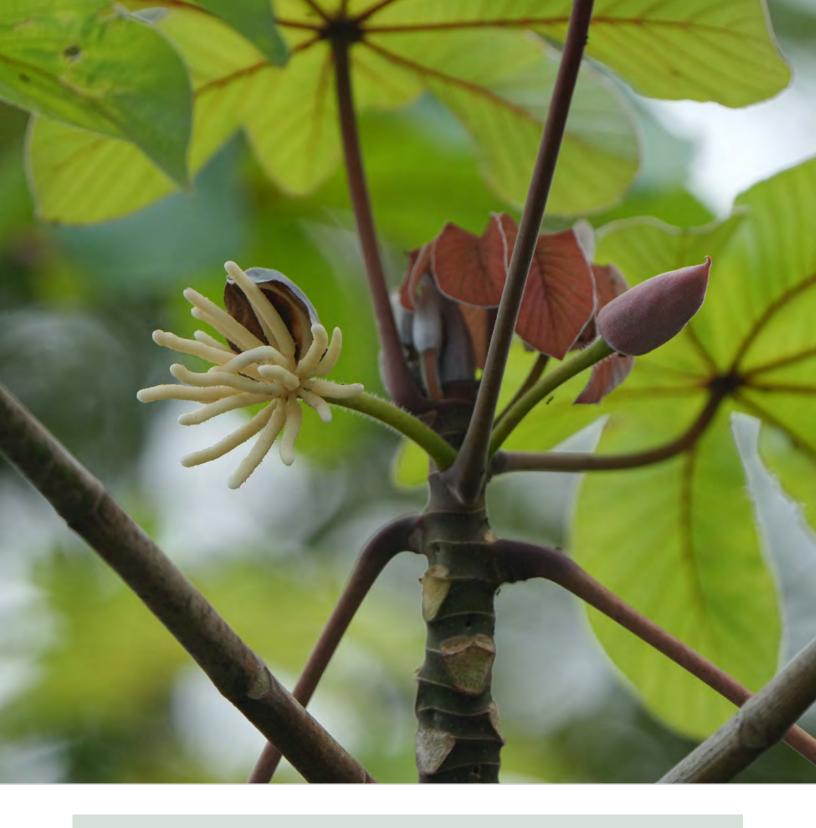
- 1. Spider monkey
- 2. Howler monkey
- 3. Agouti
- 4. Tepescuintle
- 5. Paca
- 6. Wild native foxes (very common at Tikal and Yaxha parks)

We are interested in all mammals but most are best photographed with camera traps that already exist. We are especially keen to find and photograph all plants that the monkeys and giant rodents eat. For example, when reforesting a cattle finca, to recreate a forest, it helps to plant trees that the animals and birds need to survive and reproduce.

We will have a separate FLAAR report about our interest and experience finding and photographing mammals, especially spider monkeys and howler monkeys. The other mammal that is the most commonly seen wandering around Yaxha is the gray fox.







This tree, guarumo, *Cecropia peltata*, is an important food resource for dozens, scores of birds, and for the howler monkey.

Plus this tree grows very fast, so is helpful to reforest land destroyed by cattle ranches. Plus, the guarumo has symbiotic relationship with ants inside it's hollowed trunk.

There are two sexes of *Cecropia peltata*.



BIRDS

We will have a separate FLAAR report about our interest and experience finding and photographing birds, especially water birds.

- Water birds including nocturnal Boatbilled Heron
- Laughing falcon (Snake Hawk) and other raptors
- Toucans and Relatives Parrots,
- Oropendola, Orioles & other birds that Weave photogenic Nests.

lots of photos show the colony but we suggest adding photos of individual nests with the birds clearly pictured (in other words, with 400mm, 600mm, and 800mm prime telephoto lenses). Plus, learn from local guides and guardabosques when the birds start to build new nests so we could photograph a sequence of a nest being constructed.

Millions of tourists visit Costa Rica to see flowering plants, toucans, and rain forest. So my concept is to make Tikal and PNYNN and Bio Itza and Biotopo San Miguel la Palotada, and Cerro Cahui even more popular than Costa Rica.

"Let's make history" by having, for example, the oropendola nests of Tikal, literally, the most talked-about, the most desired, and the most popular oropendola nest colony in Central America.

- Zopilotes, buzzards, vultures help clean up the forests and fields and river banks
- Potoo, there are two species, Nyctibius jamaicensis y Nyctibius grandis
- Chachalacas
- Pollinators
 - Hummingbirds and other pollinators

For avi-tourism provide infografias about each bird that is at Tikal that was featured in the Popol Vuh, and in other Maya legends; for example, snake hawk (laughing falcon), owls, etc. Owls were also a symbol of Teotihuacan warriors in the 4th century at Tikal.

Ocellated turkey, Meleagris ocellata, is the favorite bird of tourists (who are not bird specialists). The ocellated turkey is not in the Popol Vuh but its tail feather pattern is in Tepeu 2 Maya art. These birds are all over the area and definitely deserve an infografia and a photo album, plus annotated list of suggested reading.

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TOADS AND FROGS

- Water Toads (with poison glands)
- Water Frogs;
- Tree Frogs;
- Underground Uo

LIZARDS, SALAMANDERS & BASILISKS

Iguanas and all the others



INSECTS

- Butterflies and moths
 - Loxophlebia nomia, sapphire-tailed clearwing, wasp or firefly mimic
- Bee hives, size and shape
- Wasp nests, size and shape
 - Wasps that make honey
- Ants
 - Arboreal ant nests, black, high in tree tops, in colonies
 - Arboreal ant nests, off-white, 2 to 3m from ground, several per tree; small colony
- Leaf-cutting ants (also cut and use flowers), zompopos
 - Zompopos harvesting Flowers,
 - Zompopos harvesting Leaves. Queen, Workers, etc. (Castes of Zompopos)

- Army Ants & Army Ant Bivouacs
- Ant Birds (that feed on insects fleeing Army Ants)
- Ceiba borer beetle
- Lightning bugs
- Giant cave beetles
 - Eublaberus distanti,
 - Blaberus giganteus
- Click beetles (video)
- Juveniles of the giant red-winged grasshopper *Tropidacris cristata*
- Stick insects
- Preying mantis
- Damselflies
- Dragonflies

















Mosquito-like insect is a common pollinator; FLAAR Ethnobotanical Research Garden, Guatemala City, October 20, 2021, iPhone 13 Pro Max, Macro mode.

INSECTS AS POLLINATORS

Bees are obvious pollinators; butterflies are photogenic pollinators and the easiest to photograph. But by having a research botanical garden around our office in Guatemala City (and a library there plus in our office in USA) we are able to study and learn what other insects are also pollinators: we have seen grasshoppers seeking sugary nectar and getting pollen on their bodies (that gets carried to another flower and pollenates it).

We have seen ants at work inside flowers and beetles of beautiful colors.

When out in the rain forests we would need a base camp so we have a place to check each nearby flower daily. Since our current 5-year project is in Peten, it would he super helpful if a donation could allow us to buy an area for a base camp. We would turn this into a biological research station and an educational area for teaching local children how to protect the surrounding fragile rain forest and endangered species. FLAAR has an entire team (MayanToons.org) is our website for this) that has experience preparing books and animated videos to help children learn, for example, about pollinators.

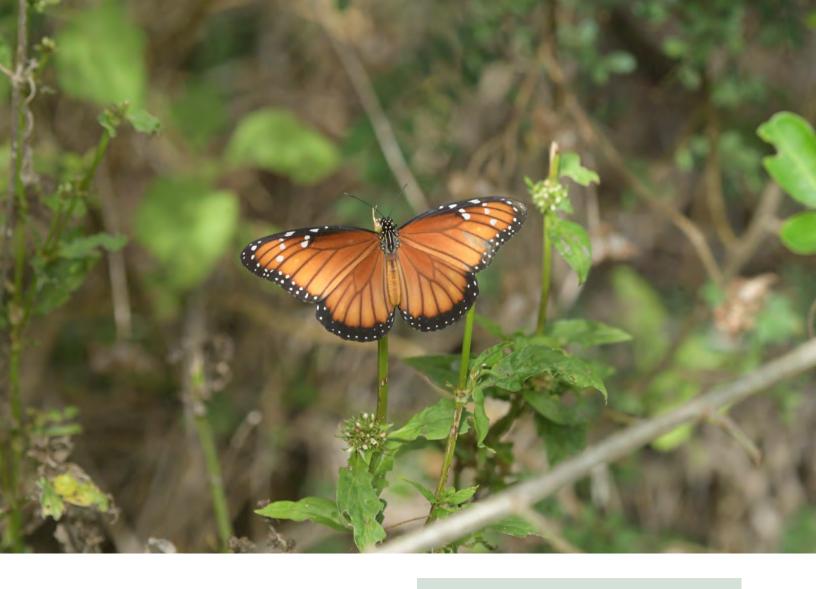






If there are no pollinators, plant species will die out. Pollinators are essential for plants to reproduce to fill the rain forests, savannas, marshes and other bio-diverse ecosystems of the national parks of northern Peten area of Guatemala, Central America.

We all know bees and butterflies and hummingbirds as pollinators.



These flowers attracted many different species of butterflies within a few minutes of each other. It is November 27th, 2018, about 10:50 am in the morning, near the shore of Lake Yaxha.

Photos by Nicholas Hellmuth with macro lens on a heavy Nikon D5 at f/14, 1/320th of a second, and ISO 4000.

It is essential to have funding so we can each have a mirrorless camera with in-camera stabilization and in-lens stabilization since it's not realistic to use a tripod when searching for pollinators. By the time you set up the tripod and put the camera on the insect has flown away before you even begin to focus the lens on it.

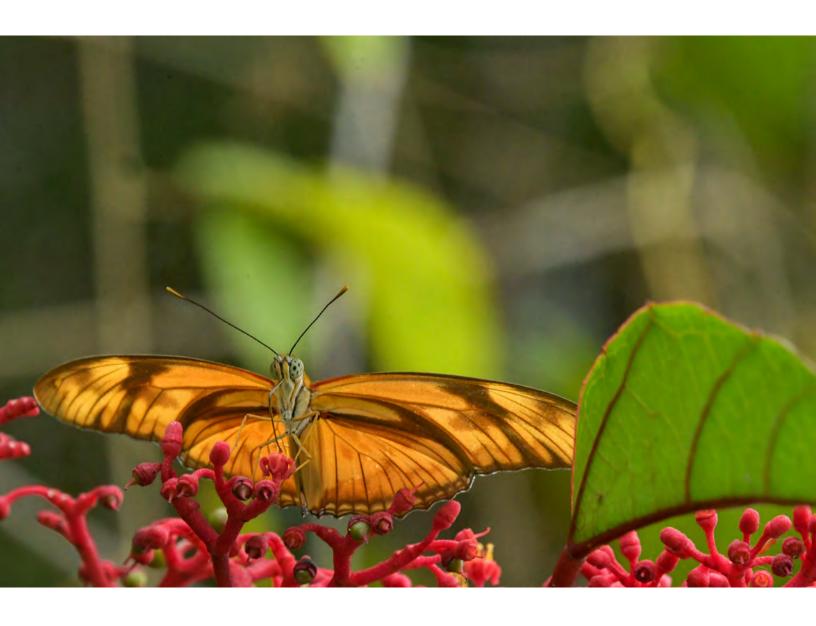
We have used Leica half a century ago but they did not do well in the digital era; Canon and Nikon had learned digital technology more quickly. And now already several years ago Sony discretely moved into mirrorless cameras; Nikon and Canon did not launch their first mirrorless attempts until at Photokina 2018 (international camera trade show in Cologne, Germany). I have attended every Photokina expo since 1998 (they are every two years). Obviously the 2020 event was cancelled due to COVID, but I still keep track of advances in digital camera technology.



Sony a1 (alpha 1) is high resolution, has bird-eye focus (can focus on the eye of a bird, which definitely helps to photograph a hummingbird in flight), and of course has incamera stabilization and in-lens stabilization. This Sony alpha 1 is the best mirrorless camera this year (2021-2022). The new Canon R3 is another camera that would help our field work photography in remote areas of the Neotropical rain forests.

We use 30mm macro, 50mm macro, and 90mm macro Sony lenses and comparable lenses for the Canon mirrorless R5 that we have (the newer R3 is what would help).

The flowers attracting these butterflies are of the local vine *Gouania lupuloides* (L.) Urb. of the family Rhamnaceae. The plant is named chew stick and has many uses still today. Plus is still a flavoring today so for the Classic Maya could also have been used as a flavoring thousands of years ago.



Butterfly beautifully backlit by the sun behind it on red flower buds of the vine *Cissus gossypiifolia* Standl., a popular medicinal plant. This vine grows along the edge of Lake Yaxha, especially in the trees along the north shore.

Photo by Nicholas Hellmuth with macro lens on a heavy Nikon D5 at f/14, 1/320th of a second, and ISO 4000.

I was lucky to get pretty good focus on the eye of the butterfly. I am curious whether "bird eye focus" or "animal eye focus" options on the Sony alpha cameras and on the new Canon mirrorless R-series (R5 and the newer R3) will work on an insect.

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ANT SYMBIOSIS

- Cecropia peltata (Guarumo),
- Subin, bullhorn Acacia,
- Costus species usually have ants associated with their flowers





ARACHNIDS

- Spider nest size and shape: orb web, funnel web, sheet web, etc.
- Scorpions, especially mother with babies on her back

ARTHROPODS, ARTRÓPODOS

- Centipedes, Cienpies, come in bright amazing colors
- Millipedes, milpies

BIODIVERSE ECOSYSTEMS TO FIND AND PHOTOGRAPH, STUDY AND PUBLISH

- Aguadas
- Pitales (aguadas con pita, Aechmea magdalenae)
- Lagunetas, small lagoons
- Savannas, cibales, jimbales



West half of Savanna of 3 Fern Species that I discovered from satellite photos and aerial photos in 2019. At top right is Laguneta of 3 Conjoined Cenotes that was known from satellite photos but, to our knowledge, never visited, never before photographed close up, and not previously studied (because it is a challenge to hike up and down the several very steep hills to get to this area many meters above the levels of Lake Yaxha, Lagneta El Juleque, or Laguneta Lancaja (south of this area).

Photo by drone pilot Haniel Lopez (FLAAR Mesoamerica) with DJI Mavic 2 Pro drone of our project.

Needed is a significantly higher resolution 100 Megapixel UAV-based Phase One iXM camera made for aerial photography using the DJI Matric 600 drone. High-resolution lenses are specially made for this Phase One iXM camera: best for our field work would be RSM 80mm and RSM 150mm. Your donation to enable us to have this aerial camera available on every field trip would literally change the world's understanding of wetlands bio-diverse ecosystems of the Yaxha, Nakum and Naranjo areas (plus we would make these photos available to other local conservation projects).



Rio Holmul in the dry season is a series of ponds with no flowing water. Many of these ponds have crocodiles so when I crossed the river to get to the jimba bamboo on the other side I had to be careful. The monumental Classic Maya city of Nakum is about a kilometer away.

Guadua longifolia is a wild native bamboo: not from China or from South America. You can see this bamboo at the far top right of the photo.

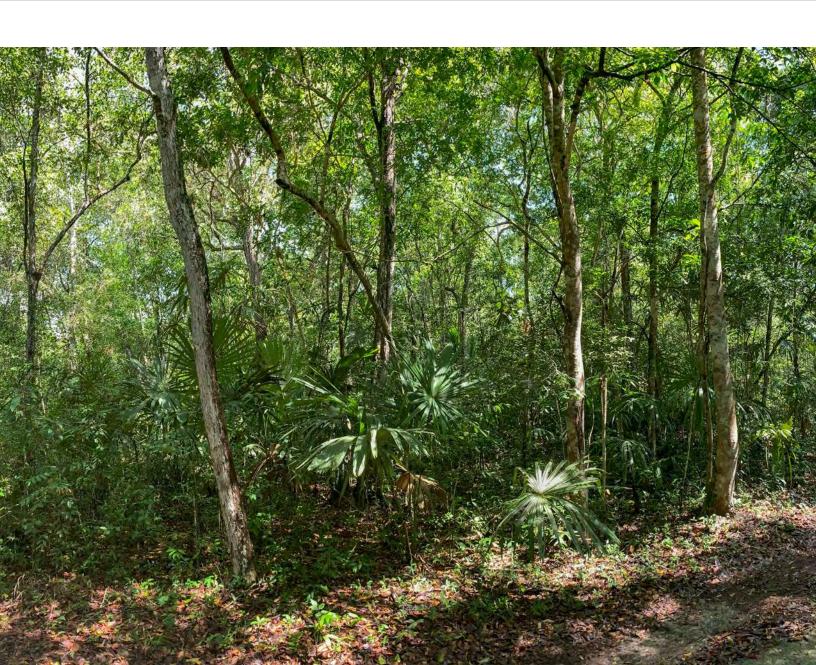
Permission was granted for us to use a drone starting in September 2021, so we will have aerial photos of the biodiversity of the wetlands of the remote areas of the national

parks, biotopes, and nature reserves this coming year, especially if a conservation-focused family or individual or foundation can provide us funding for the Phase One iXM camera and the DJI 600M drone plus two special lenses for this iXM camera.

Our current drone is a DJI Mavic 2 Pro; 20 megapixels; the Phase One is 100 megapixels and also has better lenses. Once this is available our experienced drone pilot and our photography team can literally record ecological and botanical documentation that will help conservation projects across the Peten area.

MAKE LIST OF BIO-DIVERSITY OF ECOSYSTEMS

- 1. Aguadas, bajos (tintal), corezera, escobal, guanals
- 2. See how many cibal (sibal, cival) ecosystems
- 3. See where jimbal ecosystems are found (besides along Rio Holmul)
- 4. See if there are any pital (pita, Aechmea magdalenae, bromeliad areas).
- 5. Provide a glossary of to explain names for each wetland ecosystem.
- 6. Provide an infografia poster for each kind of habitat to show the dominant plants in each kind of ecosystem in each park or biotope.





Savanna East of Nakum, known but never before photographed at high resolution and to our knowledge, never before published.





Spider Lily Savanna, far southeast area of Parque Nacional Laguna del Tigre. A video is available on all our websites. This savanna is known to local Mayan people but they told us no professor, no researcher, no student had ever visited this savanna.

There are over 100 such seasonally inundated savannas awaiting us out in the rain forests.

Your donation can allow our research teams to coordinate with local people to document the bio-diverse flora and fauna and help conservation of these fragile ecosystems.

ANIMAL SOUNDS

When possible it would be nice to record the sound of howler monkeys, birds, cicadas, and other sounds of the rain forests of the parks and nature reserves of the Reserva de la Biosfera Maya (RBM).

This project can accomplish its assignments with the help of significant donations and alliances with other NGOs with funding.

Nicholas Hellmuth does not ask for nor accept a salary; he lives from social security and modest professor retirement check each month. Our Board of Directors of FLAAR also donate their time and services; they are not paid. So donations go direct to the realistic costs of field projects.

To see our years of experience:

- www.FLAAR.org
- www.FLAAR-Mesoamerica.org
- www.FLAAR-Reports.org (digital technology and digital printing research division)
- www.Maya-ethnobotany.org
- www.Maya-ethnozoology.org
- www.digital-photography.org www.MayanToons.org
- (children's book and educational animation division)
- www.mayan-characters-value-basededucation.org

FLAAR is non-profit in USA: donations can be made by check, bank transfer, stock transfer (more tax deduction if you donate your stock rather than sell it to donate the cash).

FLAAR Mesoamerica is a non-profit in Guatemala











Inside the rain forest the sun can't illuminate all areas, so it would help to have professional photo studio flash equipment that is portable (but more powerful than the normal flash units). But to illuminate "the entire rain forest in front of us" (such as to better illuminate this remarkable strangler fig), we need professional flash equipment.

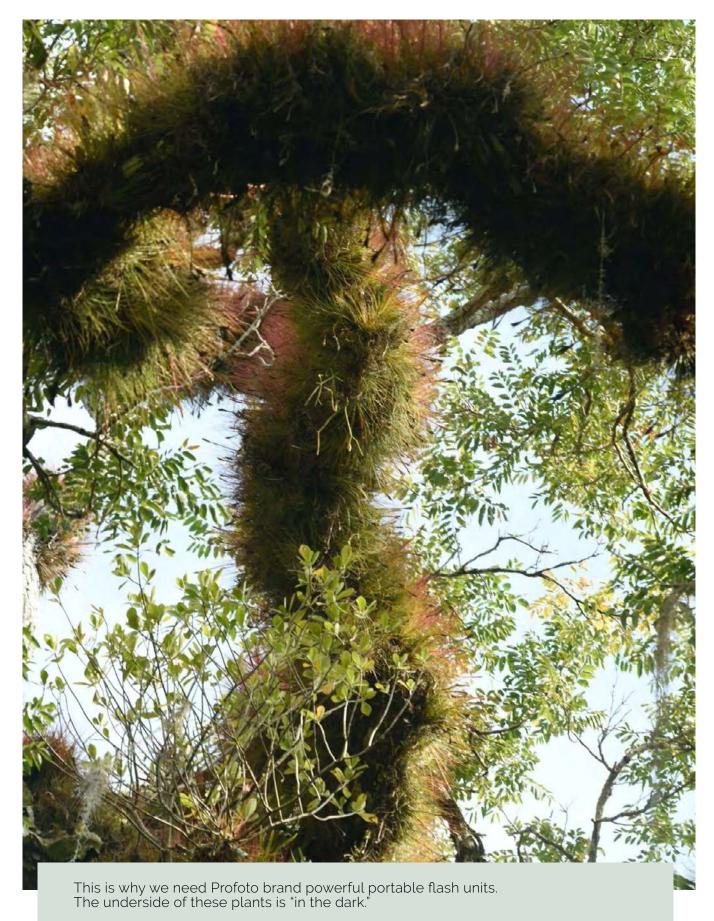
Profoto, Elinchrom, Broncolor and other brands make this equipment, \$2300 to \$4500 per individual flash. Very simple, if you want to take photos of a resolution never before accomplished, it helps to have good equipment.

Your donation can rescue digital images of inside the rain forest.

For example, to photograph something high in a tree (orchid, bromeliad, fern, 3-dimensional lichen, etc.) the sun is up above but the photographer is down on the ground. So the bottom of the plant is dark. We need powerful flash equipment. We have tested several brands; one (made in Switzerland) is too fragile to survive being driven for hours on a bumpy road. So we wish to switch to Profoto brand (Made in Sweden). Obviously

needs heavy-duty battery to power such a telescopic flash. Cheaper brands made in China don't last very long.

We have also learned that to accomplish better photographs you need light from more than one angle. So we wish to have two Profoto B2 with necessary accessories: Air Remote TTL, OCF Zoom reflector



North plaza of Nakum, February 18, 2019, Nikon camera, photo by Nicholas Hellmuth

And a Profoto B10 plus twin-head kit for plants even further away. Your iPhone can trigger these. Or, you can do the photography with your iPhone together with the Profoto B10 flash units.

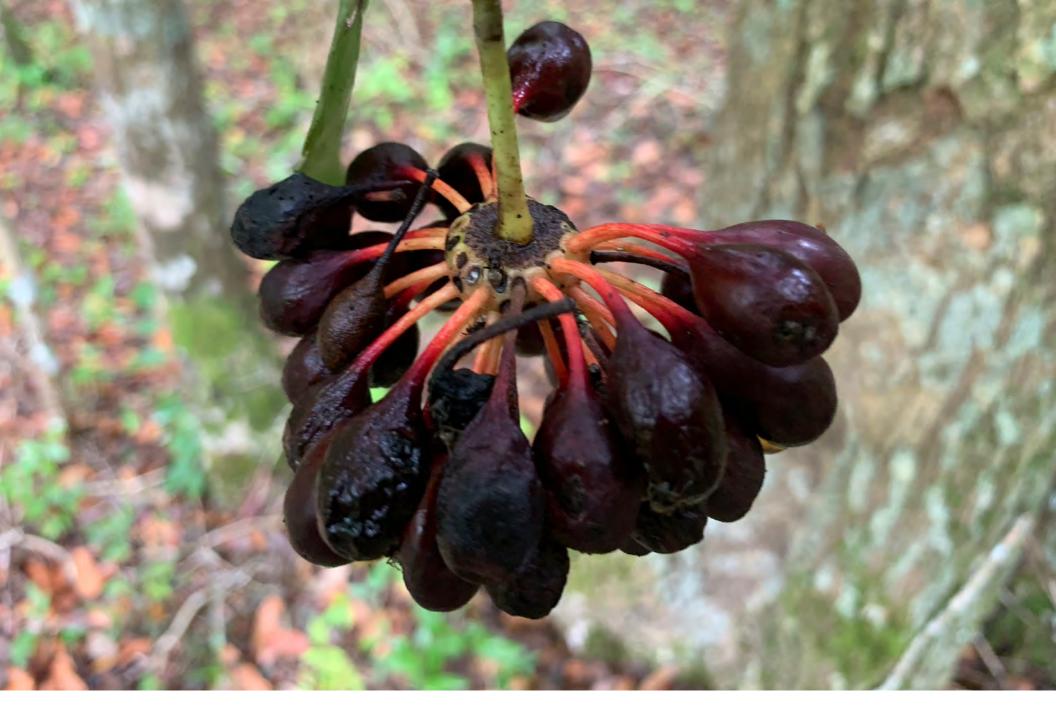
Since it takes a complete team to accomplish the field work successfully, we need a second 4WD double-cabin pickup. No van or SUV would survive even the first mile of the roads we have to drive to reach the biodiverse ecosystems. We have test-driving many brands; we have consulted with dozens of colleagues in Peten; everyone recommends the double-cabin Toyota Land Cruiser. But then it has to be uplifted (modified; there is an experienced company in Coban, Alta Verapaz that does this for everyone we have spoken with). Because it is such a specially engineered pickup, the Toyota Land Cruiser plus modification is about \$78,000. Plus, once you put on the mud terrain tires it should not be driven long distances on a highway: it's only for off-road.

So we are considering a Ford Ranger (Ford F-150 and Ford F-250 are not sold in Guatemala) or a VW Amarok V6. Mazda, Mitsubishi, etc we have test driven and the Ford and VW are significantly better. Base cost in Guatemala is about \$48K and with the all-terrain tires (so excellent on the highway and also helpful in mud out in the rain forest trails) total is about \$50K. Dodge Ram is available but they are literally too large and too heavy. Most roads in remote areas are too narrow (so no one can pass by in the other side of the road if you have a Dodge Ram).

For camera equipment, we have been testing digital cameras since 1998 (on our www. digital-photography.org website) and I was guest visiting professor of digital photography in Japan, island of Malta (as a consultant), Guatemala (at UFM circa 2000-2004), Ohio (BGSU) and at two colleges in Florida. Today, the Sony alpha 1 (Sony a1) is the best camera; Canon EOS R5 and the newer Canon EOS R3 are of comparable ability.

We need:

Sony a1, 50 megapixels. Since we have between 3 and 5 photographers on each field trip each one needs a camera the entire day. Multiple photographers are a part of our success because each individual has their own style: some focus on insects; others focus on birds. When hiking into a rain forest we are often surrounded by a literal botanical garden of Mother Nature and so many photogenic butterflies that it's awesome.



Since the tropical sun is high above, the tops of trees are nicely illuminated. But the bottom of black fruits are dark (as you can see in this photo). So it would help considerably to have telephoto flash (such as from Profoto, Elinchrom or Broncolor).

These are fruits of the *Mosannona depressa* tree.



We also need better ring-flash to photograph the details of flowers of complex shape.

These are the flowers of Annonaceae family of trees related to the black fruit in the other photo on this page. With your help we can do significantly better photographs to document the bio-diversity of these rain forests as a first step to documenting how much needs to be conserved.

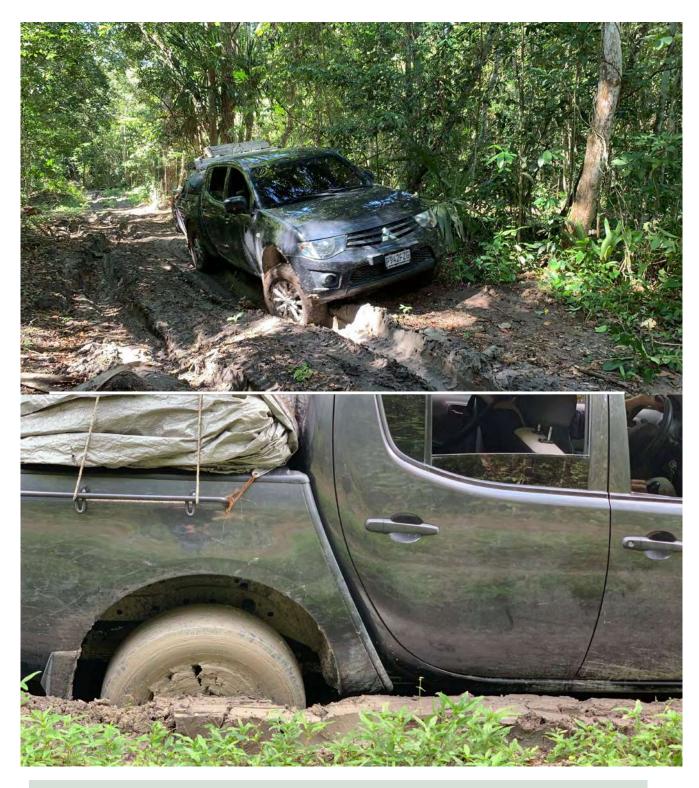
- A donation of \$43,000 would enable us to have better computer equipment, more advanced software (there are 33 people working on our projects).
 - More advanced software for all aspects (GPS, videos, etc.)
 - More advanced computers to handle high-res photos and videos
 - 5K monitors to handle the high res photos
- A donation of \$71,000 would enable us to add the DJI 600M drone (Matrice 600
 Pro Hexacopter, circa \$11K), Phase One iXM (\$40K), and two special mapping lenses
 - (\$10K each, so \$20K for the lenses). We have experienced drone pilot.
- A donation of \$50K would enable us to get the 4WD double-cabin pickup plus the special tires needed.
- The other major cost of the five years of field trips is
 - Food for the entire team
 - While going the 1,000 km back and forth (500km each way)
 - Food while at the base camp
 - Food for the local guides and porters of the camera equipment
 - Salary for the photographers,
 - The Adobe Photoshop team who prepare the images for publication
 - Salary for botanists, GPS mapper teams, etc.
 - Salary for the office managers and support team
 - Insurance

Total cost of all projects together average \$32K per month. To make the math easier, \$30K x 12 months = \$360,000 per year. So support for one year can really help.

Total 5-year project cost obviously would help every project mentioned in this series of photoillustrated topics.

FLAAR is a non-profit in USA; we can receive donation by check, or by stock (directly to stock manager; often your tax advantage is donating stock rather than cash).

FLAAR Mesoamerica is non-profit in Guatemala. We can receive donation by check or as vouchers (for example, for food, for the diesel and gasoline we need (for the electric generator for base camp).



Yaxha to Nakum road. This is why funding for better off-road tires would help; two Pirelli Scorpion tires (one imploded the other exploded) on these roads in the first 4 months. We need a second vehicle with better tires; tires alone, with strengthened sidewalls (as you see the sidewalls are rubbing against the edge of the mud track) cost an average of \$300 per tire x 4 tires + spare = \$1500.



PARALLEL PROJECTS THAT WE ARE WORKING ON

If you are interested in helping us provide school books on conservation, our MayanToons projects are also seeking funding. Both for books in Mayan languages that our in-house team has experience preparing

Click on each to go to YouTube











Children start watching videos at age 1 year on cell phones; we would like to have videos for each age group 1 to 10 years, featuring:

- Learning ABCs (in Spanish, Mayan languages, and English, since parents, teachers, and kids when we visit schools ask our help for all three languages)
- Learning numbers, colors, shapes (square, circle, etc)

Then for next age group

- Learning the different local animals of Mesoamerica
- Learning the different local plants

For next age group

- Learning how good food choice = better health
- Learning conservation
- Learning family values and ethics

For next age group

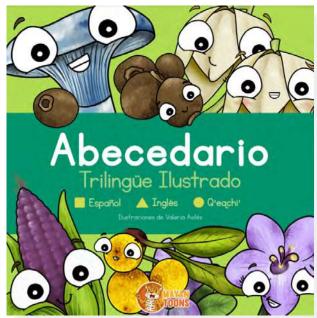
How to move forward in studies of flora, fauna, ecosystems, and conservation

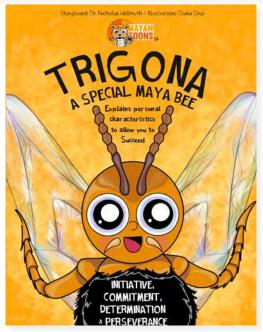


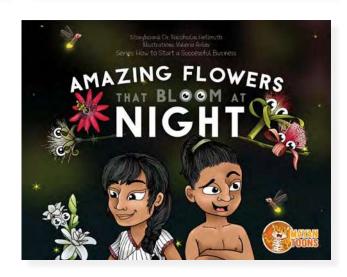
Our video animation producer is a capable individual, trained animation in Korea and Germany; Mayan heritage and language from her family, coordinates with our Kaqchiquel, Pokomchi, and Q'eqchi' Mayan team. We also wish to have in the other Mayan languages (21 Mayan languages plus two additional languages plus Spanish are spoken in Guatemala).

SOME MAYATOONS BOOKS











I finally captured my first photograph of a blue morpho butterfly; took me an hour to watch every flutter and see where it perched every 10 minutes; then I dedicated the next hour to being close-enough to capture photos (with its wings closed and with the deep blue wings open).

Photo by Nicholas Hellmuth with an iPhone 12 Pro Max; the newer iPhone 13 Pro Max will be even better.

A Sony at with 90mm macro at 50 megapixels would have been even better.

Since the blue morpho butterfly is always fluttering around, up and down and back and forth, there is no way to easily focus on it while flying. But while waiting an hour in one location I learned that the blue morpho would rest every 10 minutes and that while resting I could inch up and get a snapshot.

Finca Tulan part of the long-term project of Sebastian de la Hoz and Juan Carlo de la Hoz to buy up fincas and haciendas and then reforest them to create a corridor for the howler monkeys, spider monkeys, jaguars and other felines from Parque Nacional Tikal down to the Cerro Cahui biotope alongside Lake Peten Itza.

Nikon Zg mirrorless camera with 50mm macro and 105mm macro. No other Nikon mirrorless camera of years 2018-2021 meet our requirements; the Nikon Zg will be available early in 2022 so a donation to enable us to have this camera and the two macro lenses will be greatly appreciated.



A good example of one university student photographer; he has the initiative to get all the way down on the ground and aim up to capture this view of Planet Pandora (Avitar movie) wetland plants.

Every single swamp, marsh, aguada, pond, lagoon, or seasonally inundated savanna, cibal is a veritable botanical garden of biodiversity.

Photo by Boris Llamas, Tulan area of the new Protective corridor from Tikal all the way south to Cerro Cahui (at Lake Peten Itza), August 8, 2021. More of this good example of one university student photographer; this is a photograph from above. But to see the leaf shape, he also got way down on the ground to photograph this from below (in the other photo).

Every single swamp, marsh, aguada, pond, lagoon, or seasonally inundated savanna, cibal is a veritable botanical garden of biodiversity.



Photo by Boris Llamas, aguada in the Tulan area of the new protective corridor from Tikal all the way south to Cerro Cahui (at Lake Peten Itza), August 8, 2021.



The background is too full of "encircled" spaces between the leaves.

There is now a new 100mm lens from Sony whose technology removes the encircled spaces and makes the bokeh a better background.

These flowers are an example of the biodiversity of shape of flowers of the Neotropics.

This flower is in the forest parallel to the unpaved road that leads to the parking lot at the entrance to the ruins. June 29, 2021.



Size and shape of flowers is of remarkable biodiversity.

These *Alseis yucatanensis* flowers are definitely different than many other tree flowers. Plant family Rubiaceae. Local names for this tree in Guatemala include Tzom, Manzanillo, Tabaquillo.

Photo by Nicholas Hellmuth, while driving from Melchor de Mencos towards the Naranjo sector of PNYNN. This tree was adjacent to a molinillo tree. Nikon camera, July 6, 2019.





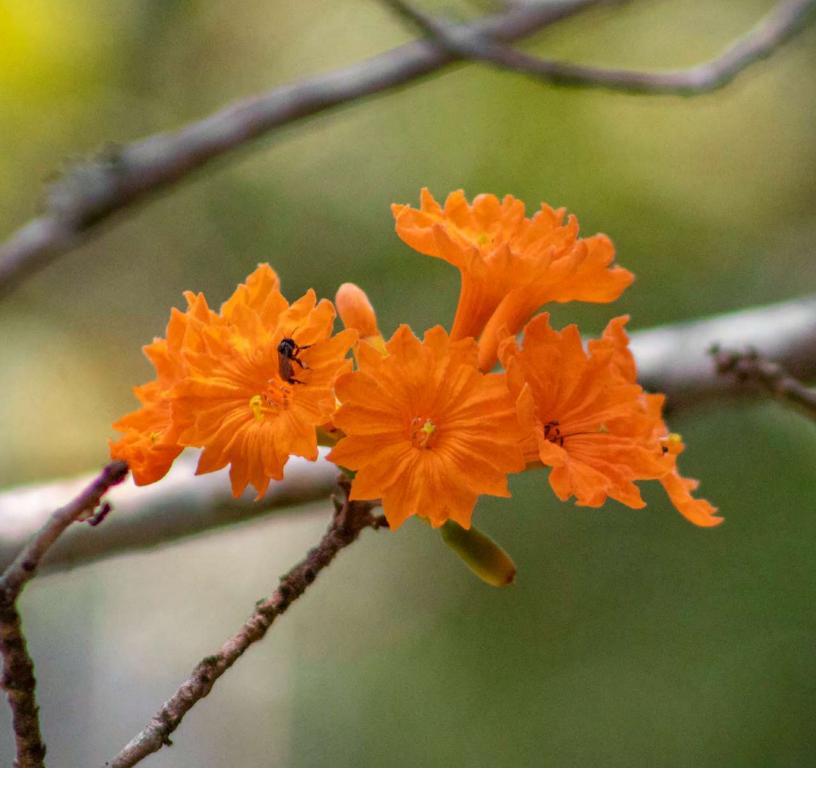


Many flowers focus on one color to attract the kind of pollinators that they need.

Flowers also develop bizarre shapes: this one reminds me of a "motor" segment for a rotating machine that is moving water.

Thevetia ahouai, huevo de chucho

Savanna of the 3 Fern Species, northwest area of PNYNN.



Ciracote, *Cordia dodecandra*, aside from being edible, is one of the most sought after hardwoods to make violins. Bees also appreciate the nectar.

The bright orange color, solid of one color, is notable. These flowers deserve conservation and protection.

Photo by Juan Pablo with Canon camera, March 28, 2019 at 10:45 am in Nakum area of PNYNN.



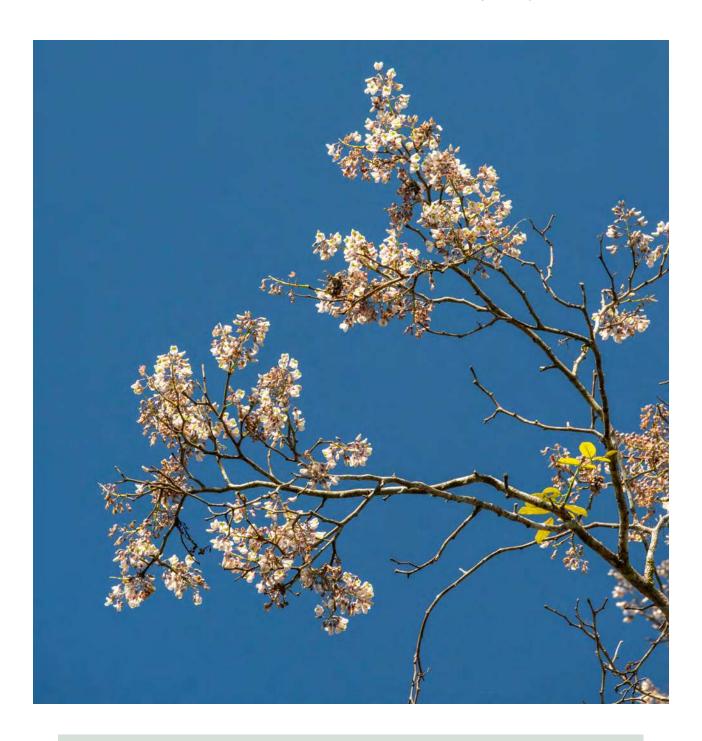


Fluffy flowers like this remind me of kapok ("silk cotton" seed pods of Ceiba or its relative *Pseudobombax ellipticum* trees). But what we show here are fluffy flowers of a totally unrelated tree.

The road from Yaxha to Nakum transferses an extensive bajo (not much palo de tinte, logwood; mainly scores of other tree species, with vines wandering around everywhere).

This tree was blooming on March 29, 2019. Photo by Nicholas Hellmuth, Nikon D5, f/13, 1/400th (because no tripod), ISO1600 (enough sun so did not need higher ISO).





Caesalpinia mexicana, the pea family Fabaceae is a Peten area relative of the Caesalpinia pulcherrima. Caesalpinia mexicana is found along the road through the bajo forest from Yaxha to Nakum.

Blooming in January, 20, 2019. Photo by Nicholas Hellmuth, Nikon D810, 2:18 pm in the early afternoon.



Looking straight down to see how the flowers of this *Bromelia pinguin* are rising up to the sun. We found a dozen of these terrestrial bromeliads in a bajo as we hiked west from the Savanna East of Nakum to search for other cibales and mini-savannas towards Naranjo sector of the park.





Each area of the park is great place to explore. This amazing mass of bright yellow flowers we found on a loooonnggg hike of many kilometers from Nakum. Good exercise to hike and great visual rewards: Tabebuia donnell-smithii, May 4, 2019.

Your donation can allow us to find and photograph lots of additional Neotropical flowering plants.

Photo by Nicholas Hellmuth, FLAAR Photo Archive.

The Androlepis skinneri bromeliad is one of the 10 most common of the large bromeliads of the lowland Maya rain forests. We find it in many bajo areas of PNYNN, here along the edge of the dirt road from Yaxha to Nakum. The one today was growing from the ground.

It was flowering on October 29, 2018.





Terrestrial bromeliads have leaves as long as 3 meters. Inflorescences come in fascinating different sizes and shapes. And the flowers that stick out vary greatly in size and color.

All this is available for you to see at Parque Nacional Yaxha, Nakum and Naranjo.







The same species of *Bromelia pinguin* bromeliads were flowering east of Nakum in early May, 2019. The fruit was photographed in the Naranjo sector of PNYNN in July 9, 2019 by Nicholas Hellmuth, iPhone Xs.

We have found this bromeliad on tree branches that have fallen to the ground; the bromeliad then survives on the ground for several years.



Topoxte Island at the west part of Lake Yaxha is paradise for strangler figs and bromeliads of diverse genera and species. Here is *Tillandsia brachycaulos* turning red to attract pollinators.

Most of what is in this photograph are the aerial roots of the strangler fig. A bird eats it's tasty fig fruits (native Guatemalan figs, so not identical to Fig Newton cookies). The bird then flies to another tree and eventually the seeds of the fig fruit are ejected out the tail end of the bird. These seeds land on the branches wrapped in fresh fertilizer. So the seed sprouts and grows up to reach the sun; but the tree also would like to get its roots into the ground. So roots grow down to the ground.

Frankly the strangler fig deserves an entire book since they come in every size and shape. Plus, they are pollinated by "the fig wasp." Why is the best video on the fig wasp from Africa? With helpful funding we could do an educational video on strangler figs of Guatemala and fig wasp's remarkable life-and-death as a successful pollinator.

You too can experience the remarkable biodiversity of this island when you spend a few days in Parque Nacional Yaxha, Nakum and Naranjo. You can get a boat at the hotel or from the park that will take you across the lake for a reasonable price.

Normally we are here every month, though since we are also doing field work in other areas of the Reserva de la Biosfera Maya, often we are hundreds of kilometers away in areas even more remote.

Photo by Maria Alejandra Gutierrez, Canon EOS 1D X Mark II, the top of the line Canon in those years (June 5, 2019). Now Canon is coming out with mirrorless cameras to attempt to catch up with Sony's many more years experience.

Just imagine how many different species of moss, ferns, bromeliads, orchids and other plants are high up on the forks, limbs, and branches of the tall trees in the rain forests of RBM area, Peten.

There are THOUSANDS of trees with different biodiverse ecosystems up in their treetops and canopy.

There is no book on trees of Guatemala or trees of the Maya areas that focus on the treetops and tree canopy.

Your donation would facilitate field work to accomplish even more treetop photography. We can use a drone plus we have rappel experts available (they can rappel up and photograph directly).

Then these remarkable photographs deserve a coffee table book with all photographs in high resolution.

Your donation can make all this possible.





This bushwillow tree deserves its own chapter in a needed book: Flower Size, Shape & Colors of Rain Forests of Parque Nacional Yaxha, Nakum and Naranjo.

Combretum fruticosum is most easily found alongside the road to the entrance of the ruins of Yaxha and along the road from Yaxha to Nakum.



These flowers are perfect for a coffee table book. Photo by Nicholas Hellmuth, Nikon camera, 2:28 pm, January 19, 2019.



Imagine what **YOU** can see and photograph if you join the FLAAR team on an exploration in 2022. You donation in 2021 and costs of the field trip can get you in front of flowers and ecosystems you have never seen in front of you.

Being here in person is better than DISCOVERY channel and better than BBC-TV documentary.

Nicholas has been exploring Guatemala since age 17 in 1963. FLAAR was formed in 1969 to start the project at Yaxha for 1970-1974. We wish to share our experience.

AN ADDITIONAL DEDICATION AND INITIATIVE IN OUR FIELD WORK & LIBRARY RESEARCH

Is to find, hike to stand in front of, photograph, study, and publish ALL edible wild plants of the Parque Nacional Yaxha, Nakum and Naranjo.

We have been doing simultaneous field work throughout Guatemala now for 12 years, to find and photograph wild edible plants: we have climbed Volcano Acatenango with an entire portable photo studio (lighting, tripods, backdrops) and a team of eight of us. We have waded through swamps and marshes at sea level on both the Pacific Ocean coast and the Caribbean coasts of Guatemala.

Amaranth is a super food of the Maya Highlands of Guatemala; yet most supermarkets in Guatemala do not sell it (fortunately it is sold by Whole Foods and by Bob's Red Mill in the USA). Ramon nut (from all over Peten) is only available in health food stores; not in supermarkets. But every supermarket has miles of junk food and "energy" beverages lining their shelves.

Yes, people have a right to eat whatever they like (I love everything on every aisle, but I prefer to eat healthy to fuel my up to 18 kilometers a day hiking through the rain forests every month). And as a courtesy it is a helpful gesture to dedicate decades to literally finding all the wild native foods available to the Classic Maya thousands of years ago.

Our 15 months flora, fauna and ecology project in the Izabal area of Guatemala has resulted in us finding more than 30 wild plants that grow in swamps or marshes that are native to this Caribbean area of Central America. Now we are finding many of these same edible plants in the Reserva de la Biosfera Maya (RBM) including in the Parque Nacional Yaxha, Nakum and Naranjo sector of the RBM.

Your donation can facilitate us finding, photographing, and researching all the hundreds of wild plants that are native to this part of the Maya Lowlands that have

- Edible flowers
- Edible roots, tubers or rhizomes
- Edible shoots or leaves
- Edible fruits or seeds
- · Other edible parts.





There are two edible species of genus *Talisia: Talisia floresii* Standl. and *Talisia oliviformis* (Kunth) Radlk. But the latter has been changed into a synonym for a new accepted name Melicoccus oliviformis Kunth.

Talisia floresii is not listed in the comprehensive monograph on all the vascular plants of Belize (Balick, Nee and Atha 2000); but they do list *Talisia oliviformis* (H.B.K.) Radlk. (2000: 116).

I photographed these edible wild native fruits with a Nikon D810 on August 14, 2018 in the Nakum sector of the PNYNN park.



Thevetia ahouai (L.) A. DC., huevo de chucho (dog's testicles) is found throughout the Maya Lowlands. We photographed these with a Nikon D810 on August 17, 2018, while going from Yaxha to Nakum.

Its bright red fruit is edible.

I estimate that 10% to 15% of the wild fruits out here in the rain forests are bright red when mature. I estimate this is to help monkeys and parrots and toucans find these edible fruits.

The fruit on the next page is Passiflora, probably P. foetida.











We are working in a "million acre botanical garden." (actual size of the Reserva de la Biosfera Maya is 5,337,970, so FIVE MILLION acres).

\$1 per acre will facilitate our team to unprecedented digital documentation of the bio-diversity of this area.

But even if you can provide half-a-dollar per acre, that two and a half million dollars can literally create botanical documentation of a digital photography quality unprecedented for anywhere in Mesoamerica (the area from Mexico to Costa Rica occupied or with trade routes by the Olmec, Maya, Teotihuacan, Toltecs, and then the Aztecs).

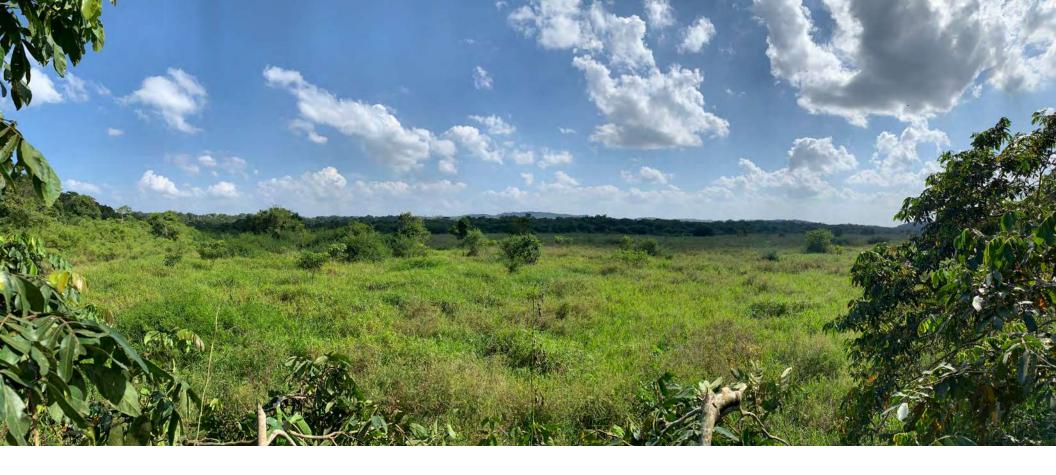


In front of you are six totally different ecosystems. We would like to introduce these to you, your family, your friends and to botanists, ecologists, geologists, and to the whole world:

- Karst hilltop seasonal rain forest
- Flatland, seasonally inundated corozal, corozo palm bajo
- Traditional multi-species Bajo forest at far left

- Savanna across the middle (with tasiste and jicara)
- Cibal, sawgrass savanna at left
- Jimbal, native bamboo ecosystem at far right

This photograph was taken from the top of a Classic Maya pyramid temple at the west side of the ruins of Naranjo, part of Parque Nacional Yaxha, Nakum and Naranjo.



When I was younger, I thought "the jungle is all jungle."

But now that I hike through these areas of the Maya Lowlands I realize there is remarkable bio-diversity: deep in the heavily forested hills, there are open areas.

Here is the open portion; this is not a cattle pasture! This is a tapir pasture! (*Tapirus bairdii*). This is a peccary pasture (two species: *Tayassu pecari* and *Tayassu tajacu*). The rain forest stops at the edge of this seasonally inundated savanna-like area (adjacent to Naranjo ruins, PNYNN).

Your donation can make it possible to produce these photographs at triple page width in monumental coffee table book (and in digital editions) so the world can see bio-diversity of the Maya Lowlands.



Join Nicholas and his team as they explore Parque Nacional Yaxha, Nakum and Naranjo.Our 5-year

project now includes lots of other nature reserves and national parks elsewhere in the Peten. So there is a lot awaiting you.



UP FRONT IMMEDIATE NEEDS, TO GET OUR TEAMS INTO THE RAIN FOREST

4WD double-cabin pickup truck, with special mud-tires for off-road, \$51,000	All other projects in the rain forests have Toyota brand Land Cruiser model double-cabin 4WD. But is \$70,000; so we prefer the Ford Ranger (Ford F-150, -250, not available in Guatemala and the Ranger model is less cost). An equally popular vehicle in Central America is the VW Amarok 4WD pickup.
100 Megapixel Phase One camera for DJI Matrix 600 drone with two high-res lenses made for this aerial camera, with mapping software, extra batteries, necessary accessories, total \$71,200 will result in photos of high resolution that no one has ever seen for the Maya Lowland forests, swamps and savannas.	Phase One iXM = \$40,000 RSM 80mm AF f/5.6 Lens=\$10,000 RSM 150mm AF f/5.6 Lens=\$10,000 DJI Matrix 600 Pro drone = \$6,599 Accessories: DJI Crystalsky; Professional software (Capture One, mapping software, other aerial photo software);t CFexpress cards, extra batteries (needed where there is no electricity out in the jungles) Total helpful accessories=\$4,600
Camera equipment for the team on the ground; Sony a1, Nikon Z9, Canon R3. This new mirror-less digital technology is definitely better than traditional digital cameras of past years.	Sony Alpha 1 camera= \$6,480; Sony 512GB Tough CEB-G Series CFexpress memory card \$569, Sony 90mm macro lens=\$998; Canon EOS R3 camera=\$5,999; ER-hE Eyecup; Sony 512GB Tough CEB-G Series CFexpress memory card \$569; Canon RF 100-500mm=\$3,599, Nikon Z9=estimated \$6,500 with NIKKOR Z MC 105mm f/2.8 VR S macro lens=\$999 with fast Sony 512GB Tough CEB-G Series CFexpress memory card \$569 totals to \$26,282 (we have multiple photographers, each one specializes in different aspects of flowers, trees, landscapes, macro, telephoto, etc.)
Camera equipment for the local Mayan people who assist as "plant scouts" in remote areas, so their cameras are more practical if small and portable: total \$4,096	Sony Cyber-Shot RX100 VII=\$1298 Sony RX10 IV=\$1699 iPhone 13 Pro Max =\$1099 has macro capabilities better than any other brand or model
Digital photography lighting equipment, especially photo studio quality telescopic flash (it's dark under the rain forest canopy of giant trees, and no electricity, so must be battery powered).	Profoto B10 or B1X or B10 PLUS=\$2,195 Godox XProC TTL Wireless Flash Trigger for Canon Cameras; Xpro-S transmitter for Sony Godox AD300 Pro Godox AD600Pro Witstro Flash with Sony Wireless Trigger for Sony Cameras Kit Godox AD1200 (Flashpoint XPLOR Power 1200 Pro R2)=\$1599; Softbox for each one. Flashpoint is identical to Godox; Flashpoint is name when sold in USA. We need one of each model (our team is of multiple photographers). Estimated total needed is \$5,300
Tripods, tripod head accessories, total \$3,008 Our tripods are over 47 years old and would help to replace the old ones and get better tripods for the photographers joining our team	Gitzo GT3543XLS Systematic Series 3=\$1,102 Gitzo Giant GT5563GS tripod=\$1,611 (when a flower is up in a tree we need a ladder and giant tripod) Six Arca-Swiss attachment plates, with traditional screw (not with Allen wrench)=\$180 Kirk Mobile Phone Mount-Ball (MPM-1B)=\$115
Better software: Capture One for each photographer and book designer; complete Adobe software for 20 of our team of 33.	Capture One Pro (for Canon, Sony and Nikon), for 10 users, \$1,619. Adobe (Acrobat, Photoshop, Lightroom, Bridge, InDesigh, Premiere, Illustrator, After Effects) Animation software:
Computer equipment to produce educational videos	27inch iMac with Retina 5K display with high-end component options = \$4,899. We have two video editors so need two = \$9,798

Computer equipment for our complete team of photographers to handle their high-res photos \$27,241 (keep in mind all the cameras are high-resolution and we are taking RAW format images to achive the best quality).	Apple 16.2" MacBook Pro with M1 Max chi and necessary components=\$2,699 Apple Mac Pro Tower Desktop - Intel Xeon W 8C 3.5GHz, 32GB DDR4, 256GB SSD, Radeon Pro 580X, 2x Thunderbolt 3, WiFi, BT, macOS Catalina, Magic Keyboard Numeric, Magic Mouse 2 = \$6,069 27inch iMac with Retina 5K display (but does not need video aspects)= \$4,299 x two = \$8,598 Apple iMac 27" = \$2,199 Each photographer also needs a second monitor, needs to be at least 4K, best 5k (Mac is now 6K): LG 27" IPS UHD \$419 each; need for all four photographers = \$1,676
Computer equipment for our designer team (who produce the photo essay reports and all FLAAR reports)	27inch iMac with Retina 5K display (but does not need video aspects)= \$4,299 x two = \$8,598
Samsung T5 1TB Portable Solid State Drive \$119 SanDisk - Extreme Portable 2TB Solid State \$249 WD Easystore 5TB Portable Hard Drive = \$79 Seagate, 8TB = \$189 WD 12 TB =\$244 Total for hard drives =\$880	Hard drives to handle the 5 TERAbytes of bird photos, monkey, jaguar, crocodile photos; plus 25 TERAbytes of flowers, trees, ferns, mushrooms, lichen, etc. Since 90% of the team work-from-home in the COVID era, each needs a hard drive with all the photos (since not even DropBox or WeTransfer can handle the quantity of high-resolution photos that our team of multiple photographers is producing every day of every field trip deep into the train forest.
Computer equipment to survive being on field trips and being used in base camp in the forest	Panasonic Toughbook 55, to survive field trips, each \$2,354; need three = \$7,062

\$219,678 will provide the field work team, support team, and production team with the crucial, pertinent equipment for the entire project.



We are ready, willing, and able to achieve our goals.

Our team has experience in remote areas.

What would help the most is one donation to cover all our up front equipment needs: this equipment will serve the entire 5-years of the current project.

6 members of the FLAAR team being helped by six park rangers. Here we are getting ready to leave the base camp at the Late Classic Maya ruins of Nakum to hike down the karst geological fault line to reach the Savanna East of Nakum. You can join us in-person; or we can share our adventures with you by ZOOM conference and video presentations to you, your family, your friends, and to others that you wish to share the results of everything that your donation makes available.

A second donation would be used to cover the monthly project costs: \$23K per month helps, so \$276,000 donation would cover everything for an entire year!



- Salaries (field trip team, organization team, managerial team, photo processing team),
- Transporting the team to the base camp each month and then to the areas even more remote
- Food for the team
- Cost for base camp (we are working each month in a different area)
- For our Mayan-speaking students who help put our finds into books for school children

- For the designers who produce the FLAAR reports for botanists, ecologists, archaeologists, students and the interested general public
- Realistic office costs for the main office that manages all the programs
- Internet, electricity, and normal office costsper-month
- We are not asking for payment for salary for Dr Nicholas Hellmuth; he lives off professor retirement + Social Security retirement check each month.

Eight park rangers came with us on this field trip because they had never been to the Laguneta of 3 Conjoined Cenotes that I had found on aerial photos. Also the park has a helpful military camp team that came along to see an area of the park that no one had been too previously. Four of the FLAAR team are in the middle.

The hike was amazing: some hills were so steep we enjoyed sliding down; the swamps were something none of us had ever dared to wade into (but of course we did anyway since from one side of the swamp we would see amazing flowers across on the other side that we had never seen before: so I would wade waist deep so that I could photograph the flowers at 1:1 macro scale).





You too can stand between the buttress roots of this *Ceiba pentandra* tree (the national tree of Guatemala today and the sacred tree of the Mayan people for thousands of years in the past).

Frugivorous bats pollenate the flowers. The flowers open at about 6:30 pm in the evening and thousands of friendly pollinating bats fly in to lap up the tasty sugary nectar.



Do you like flowers?

This is the largest wild native flower of all Guatemala. Looks like a giant carnivorous flower? But don't worry, it will not eat you (I raise them in our FLAAR Ethnobotanical Research Garden surrounding our office building in Guatemala City). The photo here, however, is in a remote area of Peten, along a river that enters the rain forest (so you can sit comfortably in a boat with the jungle on both sides of you).

We find these in Alta Verapaz and southern Peten. We would like to find them in the northern half of Peten where we are working now.

Your donation can help us find these giant flowers: these would be great for the Planet Pandora for the next AVATAR film. Would you like to stand next to a flower this large?

(They hang down because they grow on vines up in the tree tops; the picture here is with a telephoto lens).

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She mentions the *Merremia* vines as also a source of chemicals to coagulate the latex of *Castilla elastica* to make rubber bounce.

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

HELLMUTH, Nicholas

n.p. Dye Colorant Sources Trees, Vines, Bark, Lichen, Mushrooms at Parque Nacional Yaxha, Nakum and Naranjo that produce Colorants for Coloring Mayan Fibers. FLAAR (USA) and FLAAR Mesoamerica (Guatemala).

This is a work-in-progress (n.p. = not published yet)

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