



Strangler Fig Trees

Topoxte Island,

Lake Yaxha

Nicholas Hellmuth

December, 2022.





Strangler fig at Topoxte Island. Photo by Edwin Solares,
Oc. 11, 2022. Sony A1.

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We appreciate a donation during November 2021 and a subsequent donation in early June 2022 to help cover the costs of FLAAR research projects specifically to assist and support the current FLAAR project of flora and fauna in the Reserva de la Biosfera Maya (RBM). This continuing donation also assisted the FLAAR (USA) and FLAAR Mesoamerica (Guatemala) research project searching for wild edible plants in the wetlands of the Municipio de Livingston area of the departamento of Izabal, Guatemala. These donations are from a family in Chicago in honor of the decades of botanical field work of botanist Dr John D. Dwyer, who worked in many areas of Mesoamerica, including in the Yaxha area in the 1970's while the site was being mapped by FLAAR. This donation

is also in recognition of the urgency and need for conservation of both wildlife and rare plants in the bio-diverse ecosystems of the Reserva de la Biosfera Maya (RBM) of Guatemala. Parque Nacional Yaxha, Nakum and Naranjo (PNYNN), Parque Nacional Laguna de Tigre (PNLT), and wetlands of Municipio San Jose are three areas that we are focusing on within the over 5 million acres of the RBM.

We thank the large lonas (tarps) from Lonas Segovia, kindly donated by Juna Manuel Segovia, are helpful when we camp in remote areas on the field trips and to cover the equipment on the back of our pickup truck.

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Front cover photograph:

Strangler fig, Topoxte Island
Nicholas Hellmuth Oct. 11, 2022.
iPhone 13 Pro Max.

Strangler Fig Trees are especially common in the Maya Lowlands

Driving from San Julian (Alta Verapaz) east to El Estor (Izabal) you see giant strangler fig trees occasionally. Several are remarkable. We have also photographed strangler figs near Purulha (Aug 14- 2016), Rio Ixbolay (Oct. 2016) and in the Costa Sur area of Guatemala: Hacienda La Esperanza, San Juan El Idolo, in June 2017 (here is also a plant nursery of Regina de Riojas and a giant photogenic *Ceiba pentandra* out in a field). So, strangler fig trees can be found in most areas of this very biodiverse country, Guatemala.

The FLAAR Report today is to show that the island of Topoxte (Lake Yaxha, Parque Nacional Yaxhá, Nakum y Naranjo) is literally filled with the most awesome strangler fig trees of Guatemala. Yes, of course there are amazing fig trees along rivers and elsewhere in Central America, but if you want to see fig after fig after fig, each one more bizarre than the other, then hop on a boat for the 30-minute ride across Lake Yaxha to reach Topoxte Island.

Where have *Ficus* species been found in the PNYNN?

Strangler figs are very common in PNYNN and elsewhere in the Reserva de la Biósfera Maya (RBM). The best place to see strangler figs are when you take a boat to Topoxte Island and hike through the ruins. Here is the largest most impressive root structure of a strangler fig that I have seen in the park.

At the visitor's center, at the entrance to the Yaxha area of the park, you can ask if a boat and lancharo are available.

If you are staying at the Ecolodge El Sombrero there is a boat and experienced lancharo available.

Always helps to make a reservation in advance.

Plant Family

Moraceae

Local names for *Ficus* species

Mata palo is the most common name in local Spanish. Strangler fig is the most common name in English.

Practical Uses of *Ficus* trees

In pre-Hispanic times, amate paper was made with trees belonging to the family of the Ficus. The word amate is derived from the Nahuatl word amatl, it refers both the *Ficus* tree –or fig tree– as well as the paper made from its bark. Currently, these are used occasionally as they are slow to grow and have a restricted distribution. As the demand for amate paper increases, Otomi artisans are looking for alternate species. Among others, they have discovered jonote trees, so called in the upper part of the Sierra Norte de Puebla, its scientific name is *Trema micrantha*. These trees have an average height of 20 meters, grow quickly and fit abundant, particularly in deforested and disturbed areas.

(López et al. 2005: 33). (Original text in Spanish).

Are there Medicinal uses for *Ficus* Trees (fruits, etc.)?

There are over 600 medicinal plants in the Mayan-speaking areas and with so many species of *Ficus* you could do a separate research project on the potential medicinal uses. Balick, Nee and Atha list medicinal use for all five species in Belize (2000: 67). Yet for one area of the Lacandon Maya of Chiapas, so far have found no uses for the fruits of this tree (Duran 1999; Cook 2016: 132).

Botanical aspects

The genus *Ficus* has a great diversity of species and is very important due to the relationship it maintains with pollinating wasps and frugivorous animals. Because this report does not focus on a single *Ficus* species, but to highlight its characteristic as a strangler tree.

Ibarra et al (2012) make a description of the genus in Mexico and provide keys for the identification of species, which can be a reference to study the genus in Guatemala. However, you can look for more information in other sources.

Get more info about Botanical aspects of *Ficus* [HERE](#)

Here the general description of the genus:

Ficus L. Sp. Pl. 2: 1059. 1753. TIPO: *Ficus carica* L. LINN1240.1.

Galglychia Gasp. Nov. Gen. Fic. 10. 1844.

Pharmacosycea Miq. London J. Bot. 6: 525. 1847.

Sycomorus Gasp. Recherche Caprif. 86. 1845.

Urostigma Gasp. Nov. Gen. Fic. 7. 1844.

Monoecious trees, smooth barks, with prominent lenticels, with milky or translucent exudate; alternate leaves, blades with entire margins, pinnate or palmate venation, petiolate, with a wax gland toward the base of the lower costa, or glands in pairs, lateral to the costa, toward the base of the lower blade, stipules paired, enveloping the buds, generally deciduous and leaving ring-shaped scars around the stem; axillary inflorescences (sycones), solitary or in pairs, pedunculated or sessile, spherical, obloid or ellipsoidal, pubescent or glabrous and with a small apical opening (ostiole), which is normally closed by bracts that overlap each other, in addition to presenting two or three bracts at the base; unisexual, small, numerous flowers, arranged on the internal walls of the receptacle, which are separated by bracts, the pistillate flowers present two to four free or connate tepals, unilocular ovary, with solitary ovules and styles of variable length, lateral or subapical, while the staminate flowers have two to six tepals, free or connate, one or two stamens, with indehiscent or dehiscent anthers; green syconiums, which when mature become succulent and yellow-green, yellow, red or black; the fruits (“seeds”) are small achenes located on the walls of the syconus, with various shapes, which may or may not be covered by mucilage, flattened cotyledons and endosperm; all species from America are monoecious (Ibarra-Manríquez, 1991; Ibarra-Manríquez and Wendt, 1992; Berg, 2006, 2009).



As you will see on the following page, all these thin “poles” are aerial roots. Others are the “strangler arms” that wrap themselves around the host tree. You can see the host tree on the next page.

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



Birds eat the tasty fruits of the figs. Then the bird flies to another tree (where it likes to rest and relax). On this other tree the bird eventually poops out the seeds of the *Ficus* fruit. These seeds are wrapped in fertilizer (the poop). These seeds have evolved to germinate up on top of the branches where they have been “deposited.”

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.

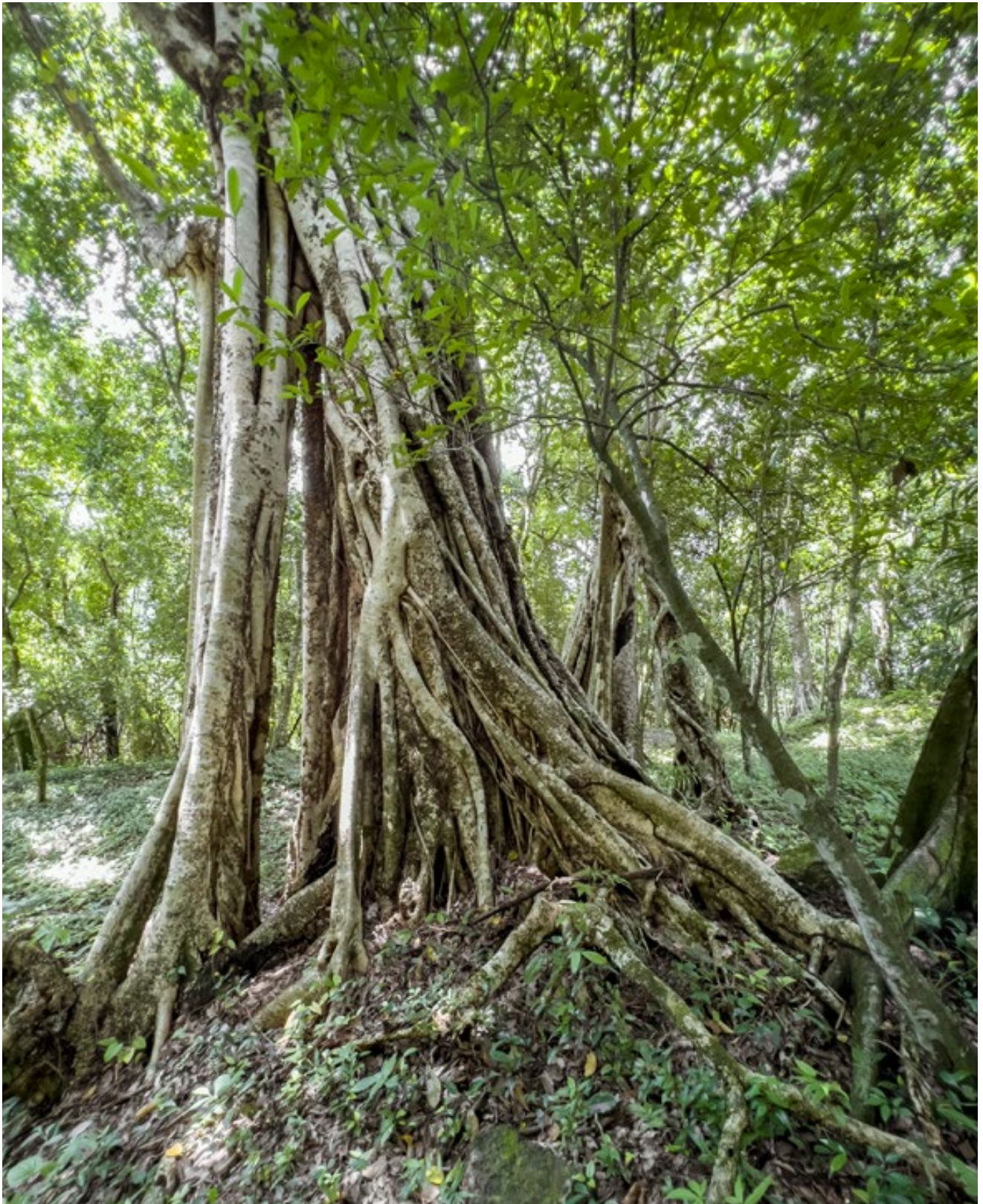


Once the seed sprouts, it spends most of its energy sending aerial roots downward. The sprout wants to have roots in the ground so it can become a real tree.



So, most of the *Ficus* tree are its two-story high roots that run downwards. Some grab onto the trunk of the host tree. But other roots go straight down to the ground.

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



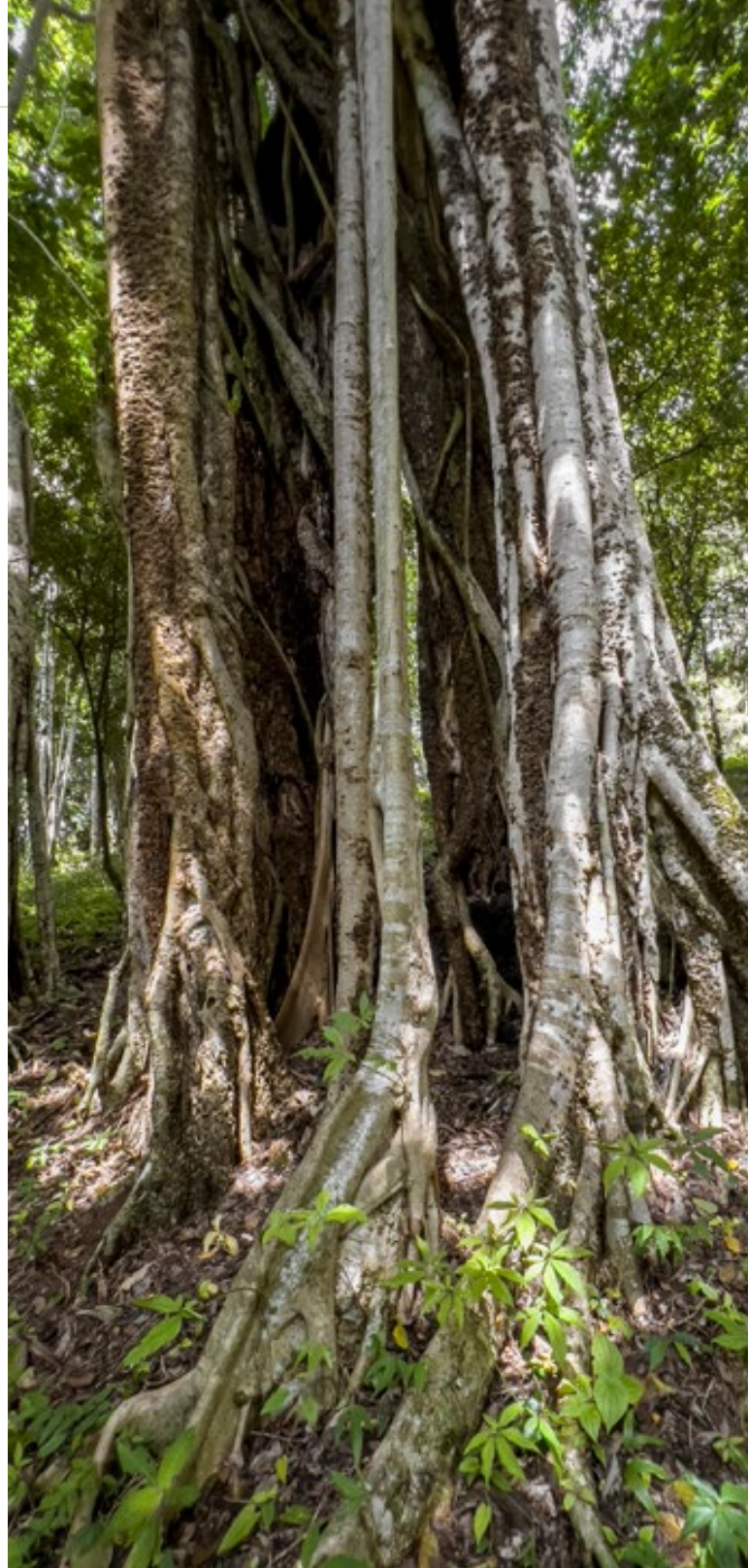
I estimate that most of these fig trees are “growing downward” rather than growing up.

All photos are Topoxte Island, Parque Nacional Yaxhá Nakum y Naranjo (PNYNN), Reserva de la Biósfera Maya (RBM), Peten. Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



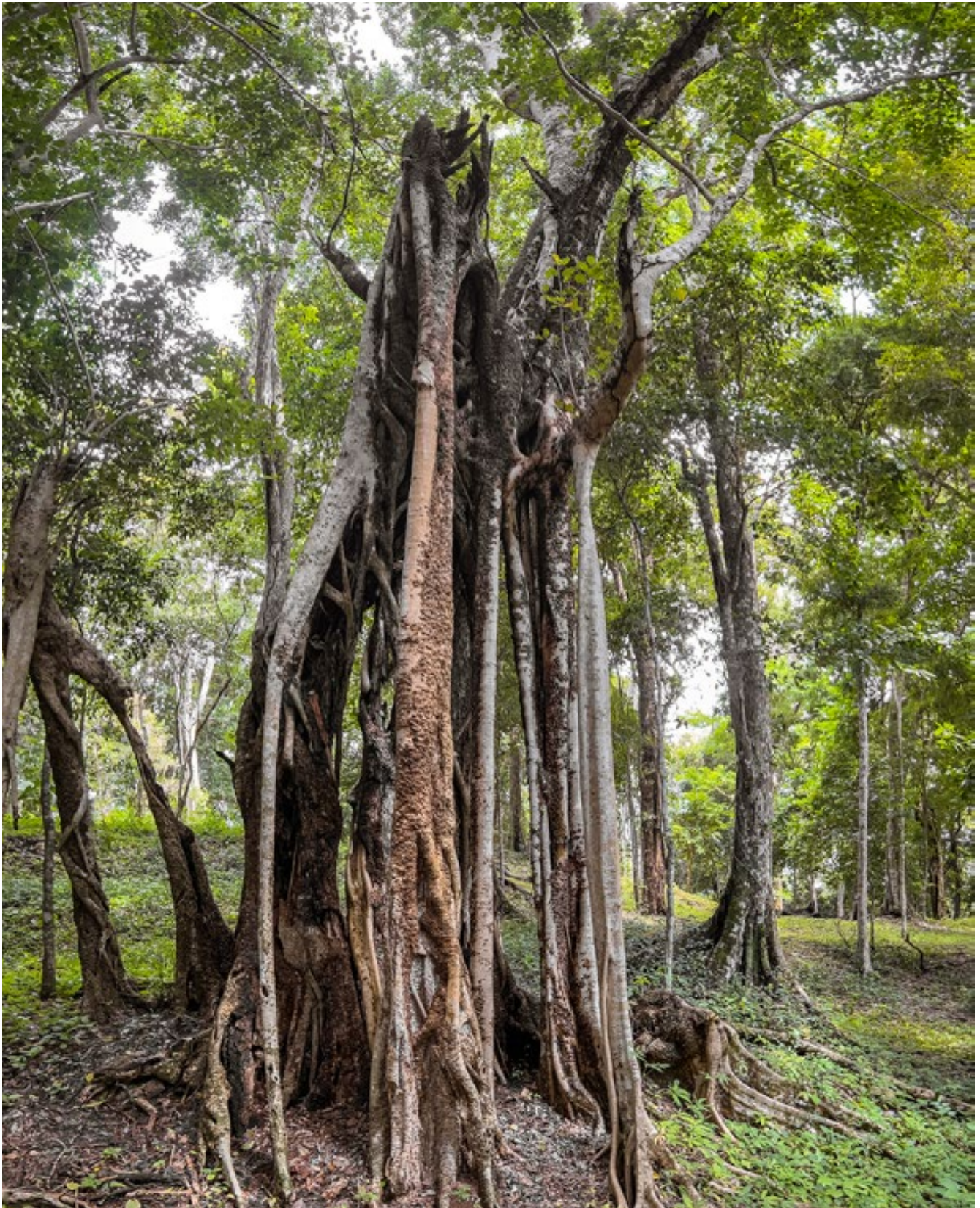
Looks like a tree trunk but most (I estimate) are aerial roots that have grown down and then “turn into trees” and “grow back up” (and wrap themselves around the host tree for security).

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



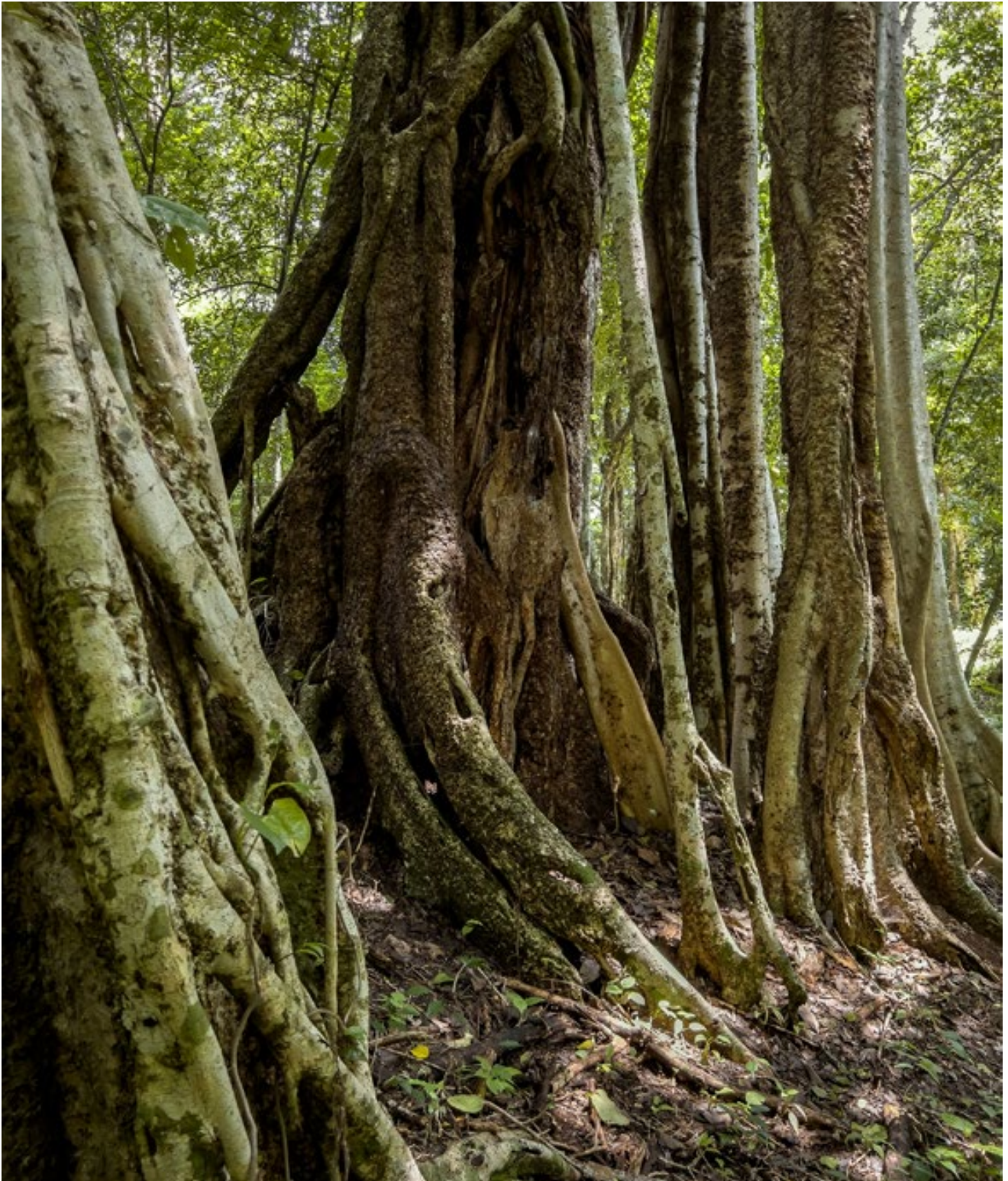
Root after root after root reaches the ground. Then the root grows along the surface of the ground.

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



Closer view: lots of the roots still survive even when the host tree is rotted and its top blew over in a heavy rain and wind storm.

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



If you visit Topoxte Island in-person, you can learn so much more. It's worth the visit (I have visited Topoxte Island perhaps 80 times).

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



a.



b.

a. Most of the surface of Topoxte Island consists of plazas and house mounds plus remains of low structures that collapsed a thousand years ago. Several nice temple pyramids are preserved. If you have visited Chichen Itza in Yucatan, you can recognize that the Post Classic Maya of Peten shared some “serpent balustrades” for stairway sides.

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.

b. Once the aerial roots reach the ground they turn into a “tree trunk” and look a bit like a normal tree (unless you are standing in front of them in the rain forest and can see that they came down before they “turned into a tree trunk.”

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



There are single host trees encircled by strangler fig dedicated just to that host tree. But here we see that the *Ficus* is “wandering around (as you can see about 15 meters up; the diagonal “trunk” with aerial roots going down (which allow the diagonal limb or trunk not to collapse under its own weight).

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



I estimate that the two aerial roots at the left were cut with a machete several years ago; they have resprouted several extra “rescue roots” and are still sprouting fresh thin roots as well.

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



Surely some of the seeds which are pooped out by the birds, land on the ground, but 90% or more of what I see seem to have grown from above, sending roots down and only then growing up. Since there are an estimated 180 to 220 different species of trees in any national park of the Reserva de la Biósfera Maya, our goal is to publish photo albums first and encourage students to do MA thesis or PhD dissertation on a genera or species (I spent multiple months on my MA thesis: *Teotihuacan influence continuing in Classic Maya art even after the collapse of the imperial capital* and I spent more years than I can count doing research for my PhD dissertation on the *Surface of the Underwaterworld: iconography and cosmology of rivers, and marine areas of the Mayan areas*). Unfortunately, with hundreds of trees I don't have hundreds of months to handle each tree in depth. But what we can achieve is photographic documentation, in full color, at good resolution, and produced at full-page size.

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.

Here it looks like a normal tree... but the slender pole at the front center left is an aerial root that has recently reached the ground.

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



These trees are their own structural engineers. Evolution allows the “winning solution” to reproduce.

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



Here you see a huge row of strangler fig trees, and another diagonal mass behind at the left. That is why I call this “the Island of Strangler Figs.”

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



Looks simply like a bunch of trees at the left and then a diagonal row across the right. But I bet all of these are aerial roots that took years to grow DOWNWARDS from far above; then took root, and now “are trees of themselves.”



Since there is not much depth of soil in a karst limestone area, most of the roots wander around on the surface. Since there are heavy wind and rainstorms in the rainy season, this mass of fig roots seems to have been “uprooted” but it has enough support not to fall over completely.

The trail for visitors is in the background; you can see the wooden steps and rail. So, to see every row and mass of these trees, take time to go off the trail to experience every strangler fig area. This is why we recommend you stay overnight at Yaxha so you have time to see and experience everything (Rio Ixtinto and obviously Yaxha itself, and the famous [sunset](#)). But rather than having to be driven many hours that night, stay in a comfy hammock in the early evening looking out over the shore of Lake Yaxha, have a tasty dinner, and then sleep in the bungalow with howler monkeys howling every several hours.



When you walk around a clustered “row” of root like this you see a tree structure you have never seen at home across most of USA, Canada or Europe. But there are other species of fig trees around the world. But if you come to Guatemala and come to Topoxte Island, you can walk around each cluster and learn see yourself their stages of growth. Topoxte Island is like an introductory “Strangler Fig 101” course for you and your family and friends.



Survival of the fittest “or the lucky ones.”

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.

Every 20 Meters, More Strangler Fig Trees on Topoxte Island



Strangler fig “trees” are best known for their roots. Since the roots hang DOWN from the tree limbs (on which the seeds sprouted after a bird poops them out) you see more roots than “trees.”

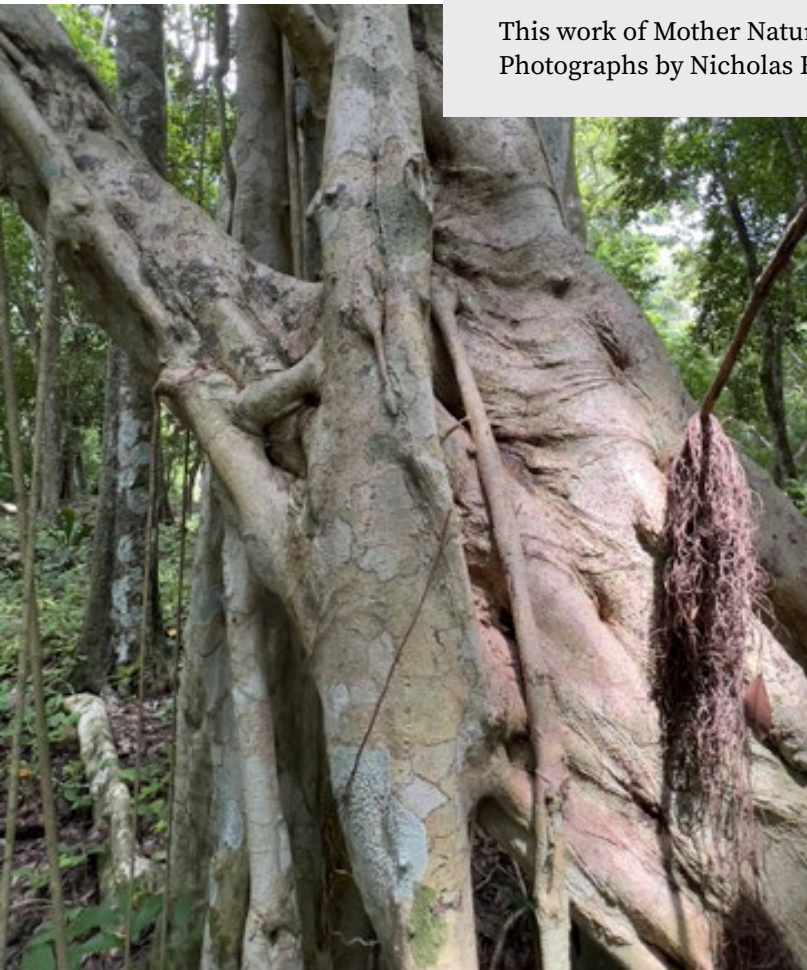


Here is the rotting trunk of a large tree being taken over by young cascading roots from a strangler fig far up in the tree canopy.



Here you can see how far up above the roots start their journey downwards. At the left and right other roots are grabbing the host trunks. This is what “strangles” the host tree.

This work of Mother Nature would make a nice fine art giclee print for your wall.
Photographs by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022





Roots, roots everywhere! The roots grab onto each other as much as they do the trunk. But the roots seem capable of “growing into and out of” each other. Really needs a PhD dissertation with a “time lapse” series of 3-D renderings of the sequence of growth.

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



Helter-skelter. But if you “send out roots everywhere, at every angle” you can be sure to be protected against heavy winds.

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



The trunk of the host tree is the dark material inside. I estimate this tree has been dead for several years. The *Ficus* is not a parasite: it does not suck nutrients from the host tree (to my knowledge; please correct me if I am wrong). The host tree is merely the support and “interior backbone” of the strangler fig. But yes, the *Ficus* does eventually usually kill the host tree (when the *Ficus* is so rooted itself that it does not need the host tree anymore).



Here the host tree is still alive and will probably continue for several more decades. This strangler's aerial roots took root on this side so now they are happy with life and so probably don't need to “strangle” the host tree anymore.

Photos by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



Leaning to the right seriously but has enough roots at the left to keep it from toppling over completely.



In many parts of PNYNN you can see fresh young aerial roots hanging down from above, yearning to find ground to root. This Hellmuth photographed on Topoxte Island, Oct. 11, 2022. iPhone 13 Pro Max. You can also see even more at the turnoff to hotel Ecolodge El Sombrero (before the entrance to Yaxha part of the park). There are more at the turnoff to Nakum (as you drive towards the Yaxha parking lot near the ruins).

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



Here the “roots” of the fig are embracing the host tree from all sides. The “roots” join like people using their hands to hang on to each other.

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.



Since the ground here is karstic there is not much soil. And most of the surface was plastered by the Classic and Post Classic Maya. So not much soil for the roots to go down, thus the roots wander around the surface of the ground.

Photograph by Nicholas Hellmuth, iPhone 13 Pro Max, Oct. 11, 2022.

Last by not Least, The “Cathedral of Strangler Fig Trees”



The stairway takes you down from the area of Topoxte temples so you can “walk through” the amazing encircling “walls” of this giant set of strangler figs. Would be helpful for a student to map all this in 3-dimensions (map every strangler fig tree on the island). And work out whether all are from “one tree” or here there are lots of “trees” that simply happen to be close to each other.

Photograph by Nicholas Hellmuth, August 21, 2018, Nikon camera, RAW format (NEF).



The “open area” in the middle is a few meters off the main trail, so not many people walk through it. A 3D image would be great.

Photograph by Nicholas Hellmuth, August 21, 2018, Nikon camera, RAW format (NEF).



Previous page photo: Abigail Cabnal was one of the several Q'eqchi' individuals from Senahu, Alta Verapaz, who have worked for many years at FLAAR Mesoamérica. Her daughter, Shaila, was welcome on all field trips from age 2 years onward. While we were photographing Shaila would be given a place to play with twigs and gravel, building piles of one or the other (or both). In this photo Shaila is about 4 years old (today she is about 7 years old, so at school in Senahu). Gaby helped in the office and on field trips she was photography assistant.

This view is at the bottom of the hill, looking up. You hike through the open “door” of the roots and climb up the wooden stairway that the park cleverly put through this “cathedral” without having to cut away any part of the roots or trunks.



Topoxte Island, July 19, 2022. Photograph by Nichlas Hellmuth, iPhone 13 Pro Max

Concluding Discussion on work-in-progress on Fig Trees of Topoxte Island and PNYNN

The present FLAAR Report is to introduce the strangler fig aspect of the fig trees of Topoxte Island and the rest of Guatemala. By showing the incredible structure we can raise interest in people doing additional reading (so we provide an ample bibliography). But the present report is a photo album on the strangler aspect and the cascading aerial roots aspect, plus brief mention of the edible, medicinal, and religious/magical aspects.

We obviously need to identify the species, a challenge since flowers are almost never visible.

Botanists and ethnobotanists have studied *Ficus* species of Mesoamerica for over a century. Most are focused on the use of some *Ficus* species

to make bark paper. This is focused primarily on Mexico. It is sad that there is no project in Guatemala to encourage local Mayan people to make bark paper so they can earn a living selling handicrafts to tourists.

Although the fruits of most (but not all) wild *Ficus* trees are edible and are stated to be so in many informative ethnobotanical monographs (such as Balick, Nee and Atha 2000), I would bet that 99% of general books on the Classic Maya make no mention of edible fig fruits. Fortunately, there is enough botanical, ethnobotanical, and ethnographic documentation to rescue knowledge of the uses of the fig tree:

Amate, Ch'orti': jun (*Ficus* sp., a wild relative of the fig tree)

The amate tree is strongly associated with magical powers, probably because of its apparent lack of flowers: the tiny flowers are enclosed in a structure appearing to be a "fruit that grows by itself." Local people believe it produces a red flower, lasting only for a single night, on extremely rare occasions. Its finder will be lucky and successful for the rest of his life. In pre-contact Mesoamerica, strangler figs were the source of bark paper (amatl), an important utensil for ritual blood offerings. The sacred amate tree has been demonized rather than allocated to a Catholic Saint: In local stories, the power of the amate tree is often associated with the devil (see for example, Dary 1986:390–394)

(Kufer and Heinrich 2006: page 387, Table 19.1)

This, to me, immediately raises the question of whether there is a hieroglyph for the fig tree or fruit or the "Fig Devil"?

I had no idea about the role of the fig tree in Mayan Worldview. This information needs to be included in more books on the Classic Maya. And it would help to make more "books" out of fig paper (bark paper).



You too can come to Topoxte Island. Be sure to have a local guide with you to show you all the strangler fig trees (and all the other amazing plants) in addition to the Post Classic temples of Topoxte Island, at the southwest part of Lake Yaxha, Parque Nacional Yaxhá-Nakum-Naranjo, PNYNN.

Appendix A

Tabulation of which *Ficus* species (that are mostly strangler figs) are in areas adjacent to Peten, therefore are probably also findable in Peten

Chiapas, Tabasco, Campeche and Belize are on the west, northwest, north, and east sides of Peten. So, most of the *Ficus* species in any of these areas is surely also findable in Peten.

Quintana Roo is adjacent to Campeche and Belize.

So every time I notice that the lists for Peten are incomplete, I tabulate all the surrounding areas.

Next step is to find the Plan Maestro for each national park and biotope of the Reserva de la Biósfera Maya and see which species they list (keeping in mind it is not easy to find the flowers to identify each species).

Genus species botanists associated with the original identification	Belize Balick, Nee and Atha 2000: 57-58	Mexico (Villasenor 2016: 803-804)	Found by FLAAR	References
<i>Ficus americana</i> Aubl. Hoffmannia	p. 57 Food, medicinal	CAM, CHIS, HGO, PUE, QRO, QROO, SLP, TAB, VER	6. 7	Balick and Arvigo 2015 Balick et al. 2000,
<i>Ficus aurea</i> Nutt. — Syn: <i>Ficus jimenezii</i> Standl.; <i>Ficus lundellii</i> Standl.; <i>Ficus tecolutensis</i> (Liebm.) Miq.; <i>Ficus tuerckheimii</i> Standl.	p. 57 Food, medicinal.	CAM, CHIS, COL, GRO, HGO, JAL, MEX, MICH, MOR, NAY, OAX, PUE, QRO, QROO, SLP, TAB, TAMS, VER, YUC, ZAC	7	Balick et al. 2000,
<i>Ficus cotinifolia</i> Kunth	Not listed for Belize, yet it is in Quintana Roo (adjacent to Belize) and in Chiapas, Tabasco and Campeche (adjacent to Peten which is adjacent to Belize)	CAM, CHIS, CHIH, COL, DGO, GTO, GRO, HGO, JAL, MEX, MICH, MOR, NAY, OAX, PUE, QRO, QROO, SLP, SIN, SON, TAB, TAMS, VER, YUC, ZAC	17	Lundell 1938
<i>Ficus crassinervia</i> Desf. Ex Willd.	Not listed yet it is in Quintana Roo (adjacent to Belize)	CAM, CHIS, OAX, QROO, TAB, VER, YUC	6	Balick and Arvigo 2015

<p><i>Ficus insipida</i> Willd., synonym is <i>Ficus glabrata</i> Kunth, has one of the larger fruits</p> <p>Non-climbing</p>	<p>Medicinal use; not mentioned as edible by people; but we need to check other ethnobotanical sources.</p>	<p>CAM, CHIS, CHIH, COL, DGO, GRO, HGO, JAL, MEX, MICH, MOR, NAY, OAX, PUE, QRO, SLP, SIN, SON, TAB, TAMS, VER, ZAC</p>	<p>6 23 28</p>	<p>Balick and Arvigo 2015 Standley and Record 1936, 24 Williams 1981</p>
<p><i>Ficus lapathifolia</i> (Liebm.) Miq.</p>	<p>Not listed</p>	<p>CHIS, GRO, JAL, MEX, NAY, OAX, PUE, TAB, VER</p>	<p>17</p>	<p>Lundell 1938</p>
<p><i>Ficus obtusifolia</i> Kunth</p>	<p>Listed but not as edible or even medicinal</p>	<p>CAM, CHIS, COL, GRO, HGO, JAL, MEX, MICH, MOR, NAY, OAX, PUE, QRO, QROO, SLP, SIN, TAB, TAMS, VER, YUC</p>	<p>2</p>	<p>Arellano Rodríguez et al. 20003</p>

Balick, Nee and Atha 2000 is source for Belize

[Go to the Neotropical Plant Portal](#)

Genus species	Belize	Does Neotropical Flora (Neotropical Plant Portal) list this species for Belize?	Mexico (Villasenor 2016: 803-804)	Does Biodiversidad.gt/portal List this species for Guatemala? Where?
<i>Ficus americana</i> Aubl. Hoffmannia	p. 57	Yes	CAM, CHIS, HGO, PUE, QRO, QROO, SLP, TAB, VER	Peten, Izabal, Escuintla https://biodiversidad.gt/portal/collections/list.php?usethes=1&taxa=17035
<i>Ficus aurea</i> Nutt. — Syn: <i>Ficus jimenezii</i> Standl.; <i>Ficus lundellii</i> Standl.; <i>Ficus tecolutensis</i> (Liebm.) Miq.; <i>Ficus tuerckheimii</i> Standl.	p. 57	No	CAM, CHIS, COL, GRO, HGO, JAL, MEX, MICH, MOR, NAY, OAX, PUE, QRO, QROO, SLP, TAB, TAMS, VER, YUC, ZAC	Jutiapa, Huehuetenango, Zacapa, Peten, Izabal, El Progreso, Escuintla, Alta Verapaz, Baja Verapaz https://biodiversidad.gt/portal/collections/list.php?usethes=1&taxa=8186
<i>Ficus cotinifolia</i> Kunth	Not listed in 2000	No	CAM, CHIS, CHIH, COL, DGO, GTO, GRO, HGO, JAL, MEX, MICH, MOR, NAY, OAX, PUE, QRO, QROO, SLP, SIN, SON, TAB, TAMS, VER, YUC, ZAC	Baja Verapaz, Peten, San Marcos https://biodiversidad.gt/portal/collections/list.php?usethes=1&taxa=17041
<i>Ficus crassinervia</i> Desf. Ex Willd.	Not listed in 2000	Yes	CAM, CHIS, OAX, QROO, TAB, VER, YUC	Huehuetenango, Peten, Izabal, Jalapa, Santa Rosa, Quezaltenango, Escuintla, El Progreso https://biodiversidad.gt/portal/collections/list.php?usethes=1&taxa=8195
<i>Ficus insipida</i> Willd., synonym is <i>Ficus glabrata</i> Kunth, has one of the larger fruits Non-climbing		Yes	CAM, CHIS, CHIH, COL, DGO, GRO, HGO, JAL, MEX, MICH, MOR, NAY, OAX, PUE, QRO, SLP, SIN, SON, TAB, TAMS, VER, ZAC	Huehuetenango, Baja Verapaz, Izabal, Peten, Retalhuleu, El Progreso, Santa Rosa, Chimaltenango, Zacapa, Escuintla, Amatitlán https://biodiversidad.gt/portal/collections/list.php?usethes=1&taxa=8189
<i>Ficus lapathifolia</i> (Liebm.) Miq.	Not listed in 2000	No	CHIS, GRO, JAL, MEX, NAY, OAX, PUE, TAB, VER	Peten, Baja Verapaz, Zacapa https://biodiversidad.gt/portal/collections/list.php?usethes=1&taxa=17053
<i>Ficus obtusifolia</i> Kunth		Yes	CAM, CHIS, COL, GRO, HGO, JAL, MEX, MICH, MOR, NAY, OAX, PUE, QRO, QROO, SLP, SIN, TAB, TAMS, VER, YUC	Peten, Izabal, Escuintla, Huehuetenango, Zacapa, Quiche, Sacatepéquez https://biodiversidad.gt/portal/collections/list.php?usethes=1&taxa=13614
<i>Ficus velutina</i> Humb. & Bonpl. ex Willd. http://tropical.theferns.info/viewtropical.php?id=Ficus+velutina	Not in Balick et al.	No	CAM, CHIS, COL, DGO, GRO, HGO, JAL, MEX, MICH, MOR, NAY, OAX, PUE, SLP, SIN, VER, ZAC	Huehuetenango, Peten, El Progreso, Alta Verapaz https://biodiversidad.gt/portal/collections/list.php?usethes=1&taxa=17063

References Cited and additional Suggested Reading on Strangler Fig Trees Especially of Mexico, Guatemala, and adjacent areas of Central America

The first segment of this bibliography was prepared by Marcella Sarti in 2017, updated by María José Toralla for the present year 2022 FLAAR Report. FLAAR Mesoamérica has a university biology student each year preparing bibliographies to help other students and assist researchers. Marcella Sarti worked with FLAAR Mesoamérica for many years and when she graduated María José Toralla continued.

AGUIRRE de Riojas, Regina and Elfriede de PÖLL

2007 Trees in the Life of the Maya World. BRIT PRESS, Botanical Research Institute of Texas. 206 pages.

A very helpful book; Regina de Riojas has also researched, written, and published lots of other books on other trees of Guatemala.

ANDREU, Michael, FRIEDMAN, Melissa H., MCKENZIE, Mary, QUINTANA, Heather V. and Robert J. NORTHROP

2010 *Ficus citrifolia*, Shortleaf Fig. EDIS. 2 pages.

Available online:

<https://edis.ifas.ufl.edu/pdf/FR/FR328/FR328-Duurx4g45u.pdf>

BEACH, Timothy

1998 Soil catenas, tropical deforestation, and Ancient and Contemporary soil erosion in the Petén, Guatemala. *Physical Geography*. Vol. 19. No. 5. Pages: 378-405.

Available online:

<https://www.tandfonline.com/doi/abs/10.1080/02723646.1998.10642657>

BERG, Cornelis C.

2001 Moreae, Artocarpeae, and *Dorstenia* (Moraceae), with Introductions to the Family and *Ficus* and with Additions and Corrections to Flora Neotropica Monograph 7. *Flora Neotropica* Monograph 83: 1-346

Buy online:

<https://search.library.wisc.edu/catalog/999921223602121>

BURGER, W. C.

1977 Moraceae. *Fieldiana Botany*. Vol. 40. Pages: 94–215.

CARVAJAL, Servando

2007 Moraceae. Flora del Bajío y de Regiones Adyacentes. Fas. 147.

Available online:

www1.inecol.edu.mx/publicaciones/resumeness/FLOBA/Moraceae147.pdf

CLEARY, K. A., SANFIORENZO, A. and L. P. WAITS

2015 Chapter 25. Genetics as a Tool for Biodiversity. Conservation: Examples from Central America. *Central American Biodiversity*. 30 pages.

Available online:

https://link.springer.com/chapter/10.1007/978-1-4939-2208-6_25

CONDIT, I. J.

1947 The Fig. Chronica Botanica Co., Waltham, Mass.

CONDIT I. J. .

1955 Fig Varieties: A Monograph. *Hilgardia*: 11: 323-538.

CONRAD, Jim

2012 101 Yucatan Trees. 192 pages.

Brief mention of strangler figs; mostly in China but also in Mexico

DRUMMOND, J.

1991 Determining and processing quality parameters in geographic information systems.

EISERMANN, Knut., ARBEITER, Susanne., LÓPEZ, Gerardo, AVEDAÑO, Claudia and Josué DE LEÓN LUX.

2011 Distribution, habitat use, and implications for the conservation of the globally threatened Azure-rumped Tanager *Tangara cabanisi* in Guatemala. *Bird Conservation International*. Vol. 21. Pages: 423-437.

Available online:

<https://www.cambridge.org/core/journals/bird-conservation-international/article/distribution-habitat-use-and-implications-for-the-conservation-of-the-globally-threatened-azurerumped-tanager-tangara-cabanisi-in-guatemala/DE21A79C8CFF474D0003A19AA14D78EB>

GARBINO, Guiherme S.T. and César Augusto CORREA Piñeros

2022 First record of *Platyrrhinus albericoi* (Chiroptera: Phyllostomidae) roosting in *Ficus americana* (Moraceae). *Notas sobre Mamíferos Sudamericanos*. Vol. 4. 6 pages.

Available online:

<https://ojs.sarem.org.ar/index.php/nms/article/view/803>

GRANDTNER, M. M.

2005 Revision of the genus *Dahlia* (Compositae, Heliantheae-Coreopsidinae), *Rhodora* 71: 309-365, 367-416.

Pages 358-360 list dozens of *Ficus* species for Mesoamerica.

HELLMUTH, Nicholas

n.d. Economic Potential for Amate Trees. *Ficus* (Fig Tree) Species of Guatemala. 9 pages.

Available online:

http://www.maya-archaeology.org/FLAAR_Reports_on_Mayan_archaeology_Iconography_publications_books_articles/57_Economic-potential-for-Amate-Ficus-trees-in-Guatemala-FLAAR-Reports-Nicholas-Hellmuth.pdf

IBARRA, G., CORNEJO, G., GONZÁLEZ, N., PIEDRA, E. and A. LUNA

2012 El género *Ficus* L. (Moraceae) en México. *Botanical Sciences*. Vol. 90, No. 4. Pages 389-452.

Available online:

www.scielo.org.mx/pdf/bs/v90n4/v90n4a4.pdf

KUFER, Johanna and Michael HEINRICH

2006 Food for the Rain Gods, Cacao in Ch'orti' Ritual. Chapter 19 in *Chocolate in Mesoamerica. A Cultural History of Cacao*. Cameron L. McNeil, editor. pp 384-407. University Press of Florida.

LAMAN, Timothy G.

1995 The ecology of Strangler Fig Seedlings establishment. *Selbyana*. Vol. 16. No. 2. Pages: 223-229.

Available online:

<https://www.jstor.org/stable/41759910>

MCDERMOTT, Amy

2022 As the sport of tree climbing grows, ecologists and climbers grapple with the implications. *Science and culture*. Vol 119. No. 14. 4 pages.

Available online:

<https://www.pnas.org/doi/pdf/10.1073/pnas.2204295119>

PENNINGTON, T. D. and J. SARUKAHN

2005 Árboles tropicales de México. Manual para la identificación de las principales especies, tercera edición. Universidad Nacional Autónoma de México y Fondo de Cultura Económica, México, D. F. Pages: 42–145.

Buy online:

<http://www.libros.unam.mx/arboles-tropicales-de-mexico-manual-para-la-identificacion-de-las-principales-especies-9789703216437-libro.html>

PUTZ, Francis E. and Michele HOLBROOK

1986 Notes on the natural history of Hemiepiphytes. *Selbyana*, Vol. 9, No. 1. Pages 61-69.

Available online:

<https://www.jstor.org/stable/41888786>

PUTZ, Francis and Michele HOLBROOK

1989 Strangler Fig Rooting Habits and Nutrient Relations in the Llanos of Venezuela. *American Journal of Botany*. Vol. 76. No. 6. Pages: 781-788.

Available online:

<https://bsapubs.onlinelibrary.wiley.com/doi/abs/10.1002/j.1537-2197.1989.tb15056.x>

REBOLLAR, S., DE LA PAZ, C. and A. QUINTANAR

1996 Anatomía de la madera de ocho especies de la selva mediana subperennifolia de Quintana Roo, México. *Revista Biológica Tropical*. Vol. 44, No. 3. Pages 67-77.

Available online: www.ots.ac.cr/rbt/attachments/volumes/vol44-3A/10_Rebollar_Madera_mexicana.pdf

REYES Morales, Elsa María de Fátima

2009 Los Cuerpos de Agua de la Región Maya Tikal –Yaxhá: Importancia de la Vegetación Acuática Asociada, Calidad de Agua y Conservación Pro-grama Universitario de Investigación en Recursos Naturales y Ambiente - PUIRNA -. Herbario USCG - Centro de Estudios Conservacionistas - CECON - Laboratorio de Investigaciones Químicas y Ambientales - LIQA - Instituto de Investigaciones Químicas y Biológicas - IIQB -. 71 pages.

Ficus that grow near water in Peten:

Ficus elástica Roxb. (not native to Guatemala; introduced)

Ficus insipida Willd.

Ficus obtusifolia Kunth

(Reyes 2009: 61)

SANDVED, Kjell Bloch, PRANCE, Ghilleen T and Anne E. PRANCE

1992 Bark, the formation, characteristics, and uses of bark around the world. Timber Press.

SCOTT, P. E. and R. F. MARTIN

1984 Avian consumers of *Bursera*, *Ficus*, and *Ehretia* fruit in Yucatan. *Biotropica*. 16(4): 319-323.

SETTLE, D. and L. CERNUSAK

2022 Growing Strangler Figs in Coconuts. Ideation of Carbon-Negative, Living Infrastructure. In: Chaiechi, T., Wood, J. (eds) Community Empowerment, Sustainable Cities, and Transformative Economies. *Springer*.

Available online:

https://link.springer.com/chapter/10.1007/978-981-16-5260-8_11

STAECK, L.

2022 Flowering Plants in the Rainforest. In: Fascination Amazon River. *Springer*.

Available online:

https://link.springer.com/chapter/10.1007/978-3-662-64452-2_7

STANDLEY, Paul C.

1917 The Mexican and Central American Species of *Ficus*. U.S. National Herbarium Contributions 20: 1-35.

This is separate from anything by Standley on *Ficus* in Standley and Steyermark.

On-line download; no cost. But read-only, so you can't copy-and-paste into an Appendix.

STANDLEY, Paul C.

1930 Flora of Yucatan. Field Museum of Natural History Botany Series, Vol. 3, Publ. # 279.

Ficus species are discussed on pages 159-161.

STANDLEY, Paul C. and J. A. STEYERMARK

1946 Flora of Guatemala. Fieldiana Vol. 24, Part V. Chicago Natural History Museum.

Ficus trees are discussed on pages 30-48.

STEWART, S.

2006 Strangler Fig (*Ficus* sp.). 85 pages.

Available online: https://welshschoolofhomeopathy.org.uk/provings/Strangler_Fig.pdf

TITUS, Jonathan, HOLBROOK, Michele and Francis E. PUTZ

1990 Seed Germination and Seedling Distribution of *Ficus pertusa* and *F. tuerckheimii*: Are Strangler Figs Autotoxic? *Biotropica*. Vol. 22. No. 4. Pages: 425-428.

Available online:

<https://www.jstor.org/stable/2388562>

TRELEASE, William

1905 Illustrations of a “Strangling“ Fig Tree. *Missouri Botanical Garden Annual Report*. Vol. 1905. Pages: 161-165.

Available online:

https://www.jstor.org/stable/2400083#metadata_info_tab_contents

WILLIAMS, P.J., MOELLER, A.K., GRANADOS, A., BERNARD, H., ONG, R. and Jedediah F. BRODIE

2022 Food availability alters community co-occurrence patterns at fine spatiotemporal scales in a tropical masting system. *Oecologia*. Vol. 200. Pages: 169–181.

Available online:

<https://link.springer.com/article/10.1007/s00442-022-05252-2#citeas>

WINDSOR, D.M., MORRISON, D.W. , ESTRIBI, M.A. and B. DE LEON

1989 Phenology of fruit and leaf production by ‘strangler’ figs on Barro Colorado Island, Panamá. *Experiencia*. Vol. 45. Pages: 647-653.

Available online:

<https://link.springer.com/article/10.1007/BF01975681#citeas>

Suggested web pages with photos and information on *Ficus* species

<https://www.gbif.org/species/5361932>
Map location and photos of *F. bejamina*

<https://www.gbif.org/species/7835333>
Map location and photos of *F. elastic*

www.naturalista.mx/taxa/50999-Ficus
Photos and map location.

www.plantasyhongos.es/herbarium/htm/Ficus_obtusifolia.htm
Photos.

www.theplantlist.org/browse/A/Moraceae/Ficus/
Species of *Ficus*.

www.uv.mx/universo/44/vuelo/arboles.html
Information.

<http://waynesword.palomar.edu/ploct99.htm>
Always has good photographs.

Bibliography on Bark Paper from Amate

This bibliography was prepared by Nicholas Hellmuth many years ago with assistance from the FLAAR team.

AMTIH, Jonathan D.

1972 Witchcraft and Pre-Columbian Paper. Ediciones Euroamericanans Klaus Thiele, México, D.F.

BODIL, Christensen and Samuel MARTI

1977 Moraceae. Fieldiana Botany 40:94–215.

FREDERICK, Jennie

2004 Lacandon Maya Bark Cloth: Hu'un', in Hand Papermaking 19/2 (2004), pp. 23-30.

GALLINIER, J.

1979 Les Indies Otomis. (ed.). Collection Etudes Mesoamericaines II. Mision Arqueologica y Etnológica Francesa en Mexico. Mexico.

GARTNER, B.

1995 Plant stem: Physiology and functional morphology. Academic Press. 441 pages.

HUNTER, Dard

1927 Primitive papermaking. An account of a Mexican sojourn and of a voyage to the Pacific islands in search of information, implements and specimens relating to the making and decorating of bark-paper, Chillicothe.

HUNTER, Dard

1943 Papermaking: The History and Technique of an Ancient Craft. Dover Publications, Inc.

IBARRA, G., CORNEJO, G., GONZÁLEZ, N., PIEDRA, E. and A. LUNA

2012 El género *Ficus* L. (Moraceae) en México. *Botanical Sciences* 90 (4): 389-452, 2012.

Available online: <https://www.scielo.org.mx/pdf/bs/v90n4/v90n4a4.pdf>

LENZ, Hans

1949 Las fibras y las plantas del papel indígena mexicano. *Cuadernos Americanos*. Volumen 8, Mayo- Junio, Número 3. pp. 157-169.

LENZ, Hans

1984 Cosas de papel en Mesoamérica. Prólogo por José Miguel Quintana. México, D.F., 511 pages.

LOPEZ, Citlalli

2004 Amate papel de corteza mexicano (*Trema micrantha* (L.) blume): estrategias de extracción de corteza para enfrentar la demanda”, en M. Alexiades y P. Shanley (eds.), Conservación y medios de subsistencia. Diversos casos sobre productos forestales no maderables en América Latina, vol. 3, Cifor-dfid-eu. Indonesia: 387-413

LOPEZ, Citlalli

2005 Amate: presente de un papel tradicional de corteza. In La riqueza de los bosques mexicanos: más allá de la madera. Experiencias de comunidades rurales, pp. 31-35. Secretaría de Medio Ambiente y Recursos Naturales (Semarnat).

LOPEZ, Citlalli, CHAFON, Susana and Gerardo SEGURA (editors)

2005 La riqueza de los bosques mexicanos: más allá de la madera. Experiencias de comunidades rurales. Secretaría de Medio Ambiente y Recursos Naturales (Semarnat). 201 pages.

LOPEZ, Isais and M. V. MEEREN

2009 Papel amate. CONABIO, Biodiversitas 82::11-15.

MAYA Moreno, Ruben

2011 El papel amate, soporte y recurso plastico en la pintura indigena del centro de Mexico. PhD dissertation, Universidad Complutense de Madrid, Department of Painting. 461 pages.

The copious number of photographs of the step by step processing of the bark makes this one of the absolute best resources to understand how the paper is really made. It is not “bark” at the end of the process, it is boiled, steamed, mashed remains of inner bark, applied in a mud-like form to a frame. So it really is “manufactured” paper. The bark simply is what is the base material.

This dissertation is available on-line.

OETTINGER Jr., Marion.

1986 Concarino: Mexican Folk Art. San Antonio, Texas: San Antonio Museum of Art.

PIEDRA-Malagón, Eva María, RAMIRZ Rodríguez, Rolando and Guillermo IBARRA-Manríquez

2006 El género Ficus (Moraceae) en el Estado de Morelos, México Acta Botánica Mexicana, núm. 75, 2006, pp. 45-75, Instituto de Ecología, A.C. México.

<http://www.redalyc.org/pdf/574/57407503.pdf>

QUINTANAR-Isaias, Alejandra, LOPEZ Binnquist, Citalli and Maria VANDER MEEREN

2008 El uso del floema secundario en la elaboracion de papel amate. ContactoS 69, 38-42.

Available on-line. This is an excellent technical (chemical, botanical) description of the layers of bark.

ROBERTSON, Donald.

1959 Mexican Manuscript Painting of the Early Colonial Period. University of Oklahoma Press.

ROBLES Vargas, Bertha

2011 Estado actual del conocimiento de la elaboración del Papel Amate. Thesis, Ingeniero Forestal, Universidad Autonoma Chapingo

SANDSTROM, Alan R. and Pamela E. SANDSTROM.

1986 Traditional Papermaking and Paper Cult Figures of Mexico. University of Oklahoma Press.

SANGER, Chloe.

1990 Arts and Crafts of Mexico. Chronicle Books, San Fransisco, CA.

Available on-line Also includes a list of plant species which provide colorants. Provides an abundance of snapshots of how the paper is manufactured.

It is ironic that two very lengthy PhD dissertations on bark paper came out the same year, 2011. Although the paper is called “amate paper” in fact both dissertations list all the other trees used.

SCHWEDE, Rudolf

1912 Über das Papier der Maya-Codices und einiger altmexikanischer Bilderhandschriften. Dresden.

SCHWEDE, Rudolf

1916 Ein weiterer Beitrag zur Geschichte des altmexikanischen Papiers', in *Jahresbericht der Vereinigung für angewandte Botanik* 13 (1916), pp. 4-55.

STARR, Frederick

1900 Mexican Paper, in: *American Antiquarian and Oriental Journal* 22 (1900), pp. 301-309.

TEIJGELER, Rene

2006 Amate from Cloth, Manuscript to Painting, On-line.

A good general survey of the literature, though a challenge to know whether it is based primarily or entirely on library research or whether there is first-hand research in Mexico.

A note says: "Teijgeler, R., The politics of amate and paper in Mexico. In: *IPH Congress Book 2006, vol.16*. Marburg: International Association of Paperhistorians. To be published soon."

TOLSTOY, P.

1963 Cultural Parallels Between Southeast Asia and Mesoamerica in the Manufacture of Bark Cloth. *Transactions of the New York Academy of Sciences, Series 2*, 1963 (25/1), pp. 646-662.

TSCHUDIN, W. F.

1961 Älteste Papierbereitungsverfahren in Mittelamerika. Zusammenhänge zwischen Tapa, Maya- und Otomipapier. *Textil-Rundschau* 12 (1961), pp. 3-12 and 16.

VANDER MEREEN, M.

1995 El Papel Amate: Tecnología, Composición y Alteraciones. Imprimatura, *Revista de Restauración*. pp. 3-12.

VANDER MEREEN, M.

1997 l papel amate, origen y supervivencia. *Arqueología Mexicana* 23: 70-73.

VASQUEZ, C.

1997 *Trema micrantha* (l) blume (Ulmaceae): a promising neotropical tree for Site amelioration of deforested land. *Agroforestry Systems* 40: 97-104.

RODRIGUEZ, O.

1995 Land Use conflicts and planning strategies in urban fringes: a case study of Western Caracas, Venezuela.

TOOR, Francis.

1939 Mexican Popular Arts. Francis Toor Studios, Mexico, D.F.

TROIKE, Nancy

1979 Observations on Some Material Aspects of the Codex Colombino. University of Texas at Austin: Reprinted by permission from TLALOCAN, Vol. VI, No.3, 1970.

VERDINELLI, Bocco

1990 Gully erosion analysis using remote sensing and geographic information systems: a case study in Central Mexico.

Von HAGEN, Victor

1944 The Aztec and Maya Papermakers. J.J. Augustin Publisher, New York.

Other publications of **Reserva de Biósfera Maya, Peten**



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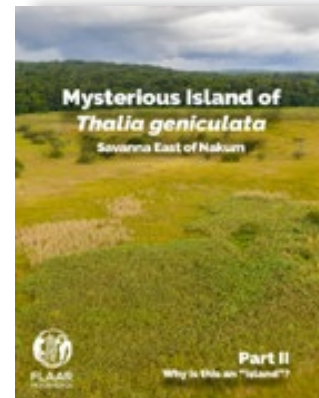
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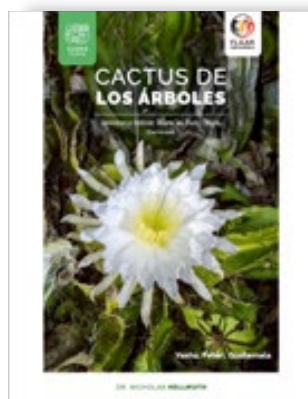
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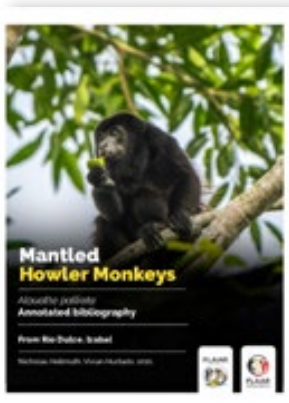
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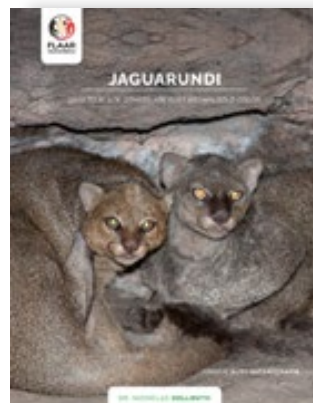
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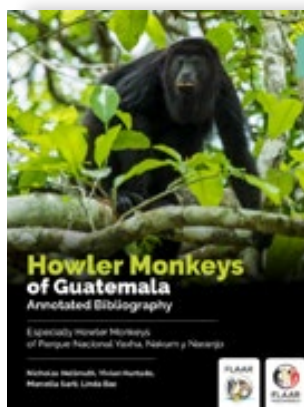
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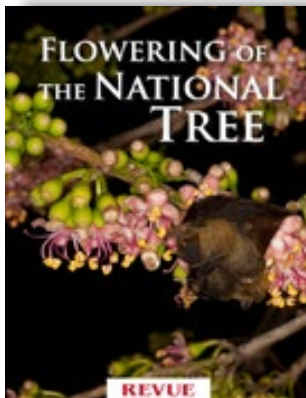
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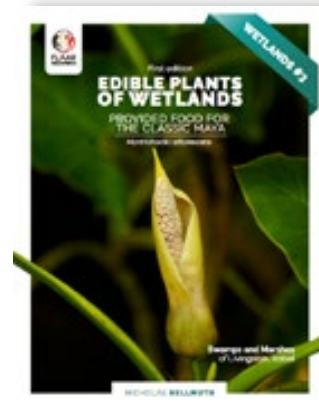
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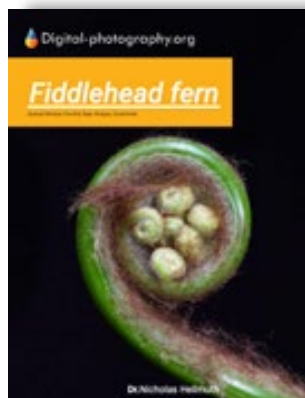
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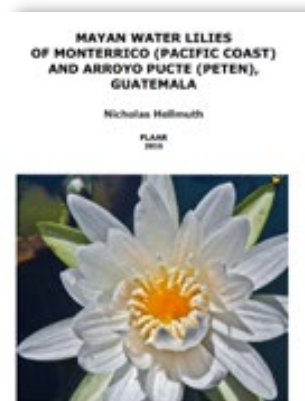
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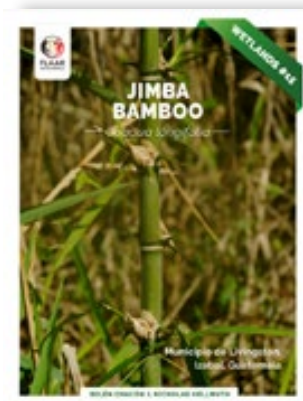
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