

Introduction to Flora and Fauna of Biotopo Protegido San Miguel la Palotada (El Zotz) and Potential for Further Research

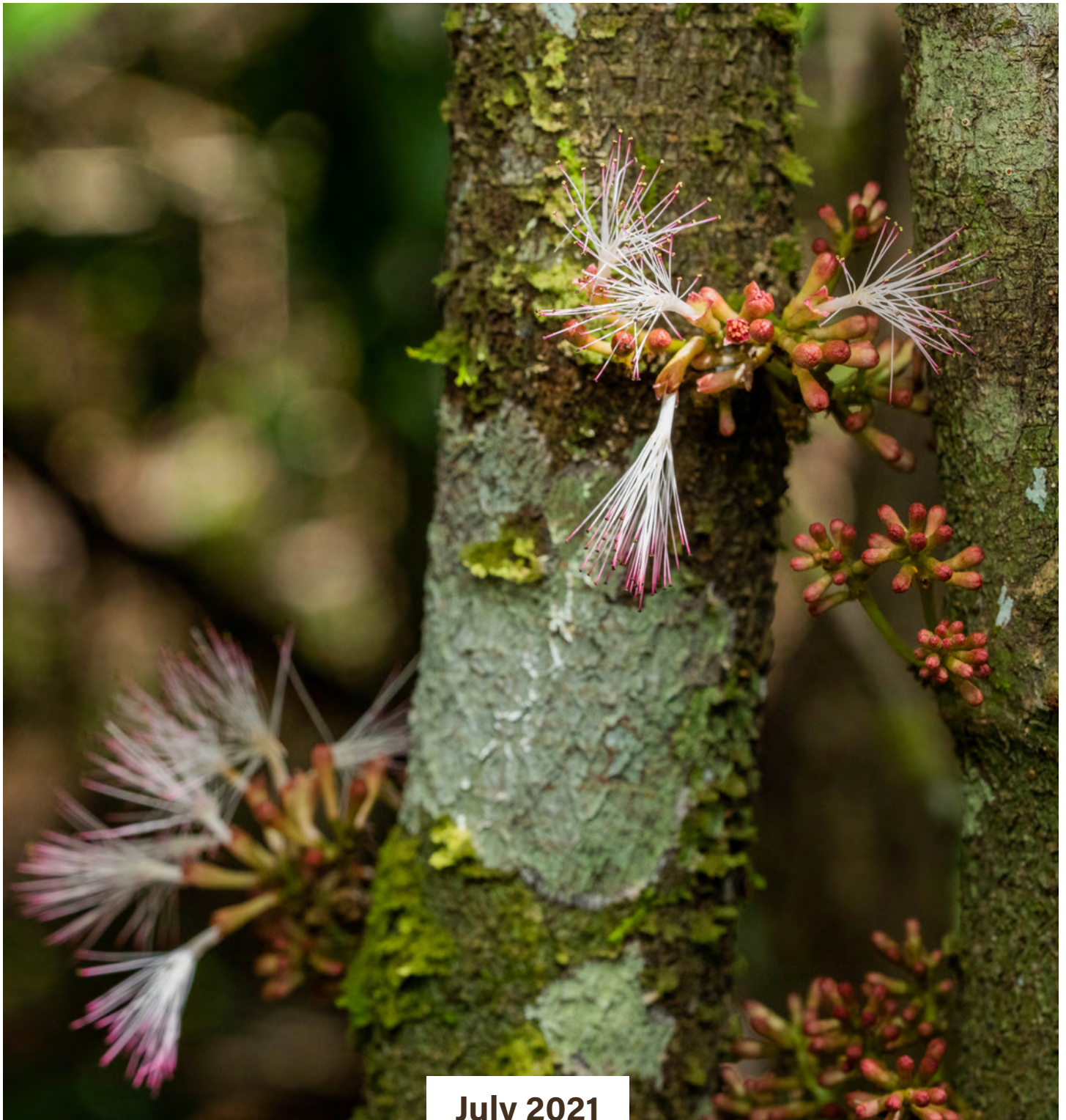


Reserva de la Biosfera Maya (RBM)
Petén, Guatemala



FLAAR
MESOAMÉRICA

Introduction to Flora and Fauna of Biotopo Protegido San Miguel la Palotada (El Zotz) and Potential for Further Research



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Camera: Sony Alpha A9 II. Lens: Sony FE 90mm Macro G OSS. Settings: 1/250 sec; f/10; ISO 1,600.

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Introduction to Biotopo San Miguel la Palotada of Peten, Guatemala

The flora and fauna of this biotopo are very diverse because of the size of this nature reserve. This biotope also has hills, cliffs, aguadas, lagoons and lots more. It is helpful to have different professors and different entities cooperating and coordinating their research since each professor is a specialist in certain aspects. Each biologist will have their own experience and will look at a plant from a different perspective. By sharing information among specialists, there can be complete results.

Since this Biotopo adjoins Tikal, it provides a corridor for the flora and fauna to move around and not stay stuck in just one area. Sebastian de la Hoz (member of the family that owns Ecolodge El Sombrero) is working on securing a property that encompasses an area on the south of Tikal all the way to Cerro Cahui to protect an even larger biological corridor for felines, monkeys and all other species. Also, trees and other plants benefit from areas that are not chopped down or bulldozed down for cattle or commercial (non-native) plants.

We carried out a field trip to Biotopo San Miguel la Palotada (Peten) since the co-administrator of Parque Nacional Yaxha, Nakum and Naranjo -PNYNN-, Ing. Mario Vazquez from CONAP, asked us to initiate our 5-year coordination and cooperation project regarding flora and fauna. The initial process consisted of contacting the members of a recent alliance among Tikal, PNYNN, Cerro Cahui, Bio Itza, and Biotopo San Miguel la Palotada. In late June we drove to each of these five areas; we already know PNYNN so we dedicated several days here. For the other reserves the first step was to have a meeting with the directors or administrators of each area, and learn how our team could assist them and their areas. Thus, we spent a day visiting Biotopo San Miguel la Palotada and meeting with its director.

Full Name of the nature reserve and its main website

The legal name of the area is Biotopo Protegido San Miguel la Palotada. However, the common name by which this area is referred to is "El Zotz". Since we are focused on the flora and fauna, rather than its impressive ruins, I will tend to refer to it informally as Biotopo El Zotz. El Zotz means bat in maya language therefore the bats are the logo of this reserve (in addition to the remarkable bats, this reserve is so biodiverse that is also a great place for research regarding trees, other plants, birds and insects).

As soon as we know their own website or Facebook page, we will list it.



Visitors center

Photo by: Nicholas Hellmuth, FLAAR Mesoamérica, Jun. 26, 2021. Biotopo El Zotz, Petén, Guatemala.

My personal experience with Biotopo El Zotz

While organizing tours for people from the USA, Canada, and EU to encourage them to visit Guatemala, many decades ago, I visited Biotopo San Miguel la Palotada once in the 1980's. This, in order to decide whether this place should be included in our yearly tours of Guatemala. However, there was no way to get a tour bus to the area, so our tours continued to focus on el Ceibal, Tikal, Yaxha, Zaculeu, Mixco Viejo, and the museums. Thus, currently, my limited initial knowledge of the Biotopo San Miguel la Palotada is about the bats. The "millions" of bats that fly up in the area most evenings is known all over the Internet.

Now (June 2021), I have learned that Biotopo San Miguel la Palotada also has plants that deserve being recorded. All the nature reserves to be visited have plant lists or at least tree lists, so we can help them by updating these lists (showing which names are botanical synonyms today and which names are accepted as of today). Plus we can add the plants that we notice while hiking through the rain forests. Most importantly, our full-color, high-resolution photographs are available to CONAP, CECON and any entity associated with Biotopo Protegido San Miguel la Palotada that wishes access to use them on their websites or reports.



How to reach this nature reserve

During the dry season it is helpful to have a 4WD pickup truck, although most 4WD SUV type vehicles would scrape off their bottoms unless the road is bone dry. Even then, the ruts are very deep, but this is part of the adventure.

The local administrators use specially equipped 4WD vehicles to access the area during the rainy season as even a 4WD normal pickup truck would be severely damaged. For example, not only do you need to have your entire 4WD pickup truck raised up (everyone in Peten has recommended SYMS, a taller in Coban, Alta Verapaz) but you also need Yokohama tires with treads on the top side (in the deep ruts your tires are touching not only the bottom of the rut but also the sides).

Paco Austurias came to meet with us in our El Remate base camp and showed us the kind of tire that is essential for the off-road, and which you should not drive on paved roads at high speeds.



There are also local people in nearby towns that can get you to the Biotopo if you book their services in advance (**if you are going to trek from biotope El Zotz to Tikal it is helpful to get to the base camp at El Zotz by vehicle**, though many of the treks start at the community at the turnoff to Dos Lagunas. You don't need a 4WD pickup as you can hike the entire way from start to finish).

I enjoyed the drive here in a 4WD VW Amarok although it did not have a raised chassis nor the off-road Yokohama tires (that are needed). We use a VW Amarok since it is the most comfortable for the long round-trip drive from our office in Guatemala City up to Reserva de Biosfera Maya -RBM-. This car brand has a more comfortable back seat and a more powerful motor than most Mazda or Mitsubishi pickup trucks.

We evaluated each brand during every field trip over several years and we interviewed dozens of owners of different 4WD pickup brands in Guatemala before we made our decision. For example, Ford F250 and Dodge are too large to travel through the mountain roads in Alta Verapaz. Besides, neither Ford 150 nor Ford F250 are sold in Guatemala.

Overall, to get to Bio Itza, El Zotz, Nakum, and other similar areas to study flora and fauna, a retrofitted Toyota Land Cruiser is, 100%, the most recommended brand. The downside is that it can't fit four people in the back seat and can't take as much photography equipment, supplies and food as the VW Amarok.

Geology, elevation and other characteristics of Biotopo Protegido San Miguel la Palotada

The reports on the biotope already provide lists of the karstic geology, elevations and others (Ixcot 2005 and ParksWatch) and each of these reports are easy downloads (the Ixcot 2005 report took a while to open as the online version is locked. Fortunately the capable Guatemalan university students who assist us were able to access it).

From a web page, this is a helpful summary:

Tiene además lagos, lagunas, aguadas y áreas inundables. Las lagunas son:

El Guineo al Sureste, Palmar al este. Las aguadas son: La Cumbre al este y El Pucté al Noreste.

[\(https://www.sicultura.gob.gt/directory-directorio_c/listing/san-miguel-la-palotada-el-zotz/\)](https://www.sicultura.gob.gt/directory-directorio_c/listing/san-miguel-la-palotada-el-zotz/)



Photo by: Nicholas Hellmuth, FLAAR Mesoamérica, Jun. 26, 2021. Biotopo El Zotz, Petén, Guatemala.



Tree with thorns

Photo by: Roxanna Leal, FLAAR Mesoamérica, Jun. 26, 2021. Biotopo El Zotz, Petén, Guatemala.

Camera: Google Pixel 3 XL. Settings: 1/451 sec; f/1.8; ISO 52.

What Ecosystem(s) can you expect to find at Biotopo El Zotz?

I would rate the diversity of habitats of El Zotz as higher than nearby areas (there are abundant water holes or aguadas and a lagoon of healthy size). As for the PNYNN, it has two large lagoons (I call them Lake Yaxha and Lake Sacnab due to their size), a row of small lagoons to the west, Rio Ixtinto (wetlands along the south and especially southwest of Yaxha lake) and Rio Holmul. We have documented a seasonally inundated large savanna (East of Nakum) and a remarkably biodiverse savanna with 3 Fern species. No savannas of these sizes nor biodiversity have yet been studied and published about nearby areas (except in Belize where "savannas are everywhere"). The difference is there is no pine or oak at PNYNN or most of the RBM, only the famous pines northeast of the border of Tikal. We will be exploring the savannas of the western part of RBM where oak has been documented and our plant contacts tell us there is also pine.

At Biotopo Protegido San Miguel la Palotada, it would be helpful to carry out pollen analysis from core samples. However, this is best accomplished by geologists and our project is only on flora and fauna growing here today.

In some cases the larger a biotope or park is, the more diverse ecosystems you will see. For example, Bio Itza has notable biodiverse habitats despite its medium size and El Zotz has, in biodiversity, what you could expect from it being 10-times larger than Bio Itza.

Name	Hectares	Square kilometers	Square miles	Acres	Access Road	Notes
Tikal	55,005 ha	550 km ²	212 square miles	135,920 acres	paved	
Biotopo Naachtún Dos Lagunas	49,500 ha	495 km ²	191 square miles	122,317 acres	4WD	
PNYNN	37,160 ha	371 km ²	143 square miles	91,824 acres	Dirt, but passable all year	Nakum and Naranjo, best with high-axle 4WD
El Zotz	34,934 ha	349 km ²	134.88 square miles	86,323 acres	4WD	
Bio Itzá	3,600 ha	36 km ²	13.89 square miles	8,895 acres	4WD	
Cerro Cahuí	650 ha	6.5 km ²	2.51 square miles	1,606 acres	4WD	

Are the trees found in Biotopo El Zotz also registered for Parque Nacional Tikal?

Since Biotopo Protegido San Miguel la Palotada is adjacent to Tikal park, it would be expected to have the same trees as the park. Also, as the Biotopo has more wetlands, overall, it will have more species of plants than some surrounding areas.

Will Biotopo El Zotz have similar plants than Yaxha, Nakum and Naranjo Park?

The Biotopo Protegido San Miguel la Palotada will have in common more plants with PNYNN because there are more wetlands in PNYNN. However, we have documented a seasonally inundated large savanna east of Nakum and that the bajo (that comes up to west side of the acropolises of Naranjo) has a savanna between the end of the bajo and the beginning of the cibal or sibal (that comes before the jimbai at the north end). At the west there are biodiverse seasonally inundated forests and then a remarkable corozera (more moist than the two corozeras between Yaxha and Nakum).

For Tikal, Bio Itza or Biotopo Protegido San Miguel la Palotada no savannas have been documented. Notice the word "documented" as the savanna East of Nakum was known to all archaeologists who did field work either studying bajos or studying house mounds on hilltops, but none (that I have found so far) describe its remarkable biodiversity. The other savanna of PNYNN that I found, using aerial photos, is the "Savanna of 3 Fern Species" which was even less visited (the park rangers recounted they cried when they saw the plant diversity of this area). During our field trip the park rangers kindly hiked beforehand to find the best trail for our team so we would not have to test different trails). The "Savanna of 3 Fern Species" is a combination of a bog, a seasonally inundated area and a diversity of other habitats (it changes every 50 to 80 meters).

What tree species of Biotopo El Zotz did Cyrus Lundell find in Peten?

Cyrus Lundell worked primarily in other areas of Peten so will need to check whether he explored what is now Biotopo Protegido San Miguel la Palotada. In the 1930's this area would have had a different name.



Palo de jiote or Gringo quemado are some of the names for this tree. *Bursera simaruba*, it's scientific name.

Photo by: Nicholas Hellmuth, FLAAR Mesoamérica,
Jun. 26, 2021. Biotopo El Zotz, Petén, Guatemala.

Camera: Google Pixel 3 XL. Settings: 1/60 sec; f/1.73; ISO 85.

Brief tree list of Biotopo El Zotz from our initial visit on June 26th, 2021

To summarize the information we skipped the last names of each species. Our goal is to find and identify plants; once the botanist's names information is tabulated on a thousand websites, any botanist or student who needs the rest of the information can easily find it on-line. To keep track of which camera photographed each plant we mark them as:

- iPhone 12pro in green
- Google Pixel 4a in brown

As it takes an hour or so to drive from our base camp in El Remate to San Jose, and then some more to reach San Andres for the turnoff to the north (then additional roads from there), by the time we reached the biotopo it was well into the day. Upon arrival Juan José Romero, the hospitable administrator, gave us a presentation of the area and then we had almuerzo before we began hiking to the aguada. Since I am deeply interested in trees that flower from their trunks, once I began seeing the slender *Zygia* trees with their fluffy flowers, we stopped every time to take lots of photos (in another month there would be no more of these flowers on the trunks). Then, we offered to give a ride to the park administrator as he needed to return to the Lake Peten Itza area; we left in time to drop him off.

Photo by: David Arrivillaga, FLAAR Mesoamérica, Jun. 26, 2021. Biotopo El Zotz, Petén, Guatemala.

Camera: Sony Alpha A9 II. Lens: Sony FE 90mm Macro G OSS. Settings: 1/80 sec; f/8; 400 ISO 1,000.



Genus species	Common name	Where	Photo
<i>Bursera simaruba</i>	Palo de jiote	This tree is found throughout areas of karst geology in Peten.	<p>Biotopoto-El-Zotz-RBM-Bursera-simaruba-iPhone-12pro-1221pm-and-other-times-Jun-26-2021-NH</p> <p>Biotopoto-El-Zotz-Bursera-simaruba-Palo-de-jiote-Peten-RBM-Google-Pixel-4a-114pm-Jun-26-2021-NH</p>
<i>Ficus sp.</i>	Amate		Biotopoto-El-Zotz-RBM-Amate-Ficus-species-trunk-surface-nodules-Peten-RBM-iPhone-12pro-109pm-Jun-26-2021-NH
<i>Guettarda combsii</i> Familia Rubiaceae	Texpac, taxtop, testap		Biotopoto-El-Zotz-RBM-Guettarda-combsii-Texpac-taxtop-testap-peeling-bark-107am-iPhone-12pro-Jun-26-2021-NH
<i>Zygia species</i>			<p>Biotopoto-El-Zotz-Zygia-species-Peten-RBM-Google-Pixel-4a-122pm-136pm-and-236pm-Jun-26-2021-NH</p> <p>Biotopo-El-Zotz-NEEDS-ID-Zygia-species-flowers-seed-pods-Biotopo-El-Zotz-NikonD810-126pm-Jun-26-2021-NH</p> <p>Biotopoto-El-Zotz-Zygia-species-Peten-RBM-Google-Pixel-4a-122pm-136pm-and-236pm-Jun-26-2021-NH</p> <p>Biotopo-El-Zotz-NEEDS-ID-Zygia-species-flowers-seed-pods-NikonD810-158pm-225pm-Jun-26-2021-NH</p>

Plus one aguada: Biotopoto-El-Zotz-RBM-Aguada-iPhone-12pro-146pm-Jun-26-2021-NH

This is very very different from aguadas at PNYNN, which tend to be a pital (thousands of pita bromeliads *Aechmea magdalenae*). Other aguadas near Nakum are filled with flowering vines, so I am curious why the aguada here at Biotopo Protegido San Miguel la Palotada is so different (few plants in the water or around the forest edge).

Our project goes beyond just biology, botany, zoology, and ecology, a parallel goal is to assist CONAP to offer opportunities for the social-economic development of local people. All this by encouraging eco-tourism, avi-tourism and the sustainable use of biodiversity being protected by CONAP, CECON, IDAEH and associated entities.

Eco-tourism is encouraged by atypical, unusual, and photogenic native local flora and fauna. I estimate that 90% of the people visiting any country in Mesoamerica would absolutely love to see, stand in front of, and photograph the cauliflorous flowers of the *Zygia* trees. When a visitor takes a selfie in front of a *Zygia*, they send it to their friends and relatives and post it on Facebook, Instagram or Pinterest. Thus, people around the world can see the flora and fauna of Biotopo Protegido San Miguel la Palotada, attracting more visitors. However, it is essential that visitors know which trees are flowering in which month, and in which part of the Biotopo can be found by the local guide.

Estos visitantes proporcionan ingresos a las

These visitors provide income for local families and the more people visit a biotope, the more chance local people will realize they should not burn down, chop down, or otherwise destroy the forest around the edges of the biotope. Therefore, we have a lot to accomplish here at Reserva de la Biosfera Maya; Roxana Leal is our social media manager who posts every day during each field trip (under the name FLAAR Mesoamerica).

So far, the best tree and plant list for Biotopo Protegido San Miguel la Palotada is Anexo 2, "Listado de Plantas del Biotopo de El Zotz" (Ixcot 2005). This is a well documented list by qualified botanists. They found 129 plants and also collected samples (insects, bats, etc.). We are not collecting samples because our focus is to find, photograph (at high resolution) and then document thoroughly the major species, so in the future we will have a full report on the bright and colorful *Zygia* flowers. The 2005 monograph by Ixcot and team lists *Zygia* for Dos Lagunas but not for Biotopo El Zotz. This can be explained by the fact that you can see the *Zygia* tree flowering if you hike a particular trail during a specific month. However, if you are not in the reserve that same month, or if you are hiking other trails, then understandably you would not notice the *Zygia* (they are not a very large tree). For example, we never noted a *Zygia* in PNYNN but Teco (Moises Daniel Perez Diaz) found *Zygia* with flower buds in June. **This is why it helps to have several teams doing research in an area in different months.**

So far we have not seen *Heliconia* while hiking during the first visit, however, surely *Heliconia* can be found in the future. Historically, *Heliconia* leaves of some species were used as thatch for houses; we have found and documented many Q'eqchi' Mayan houses near Cahabon with *Heliconia* leaves as thatch. Obviously, most rural houses are thatched with palm (or with a plant that looks identical but is not even a relative: kala or junco, *Carludovica palmata*). In Peten there is usually plenty of palm and not as much kala. Also, the stems of kala are edible. When we visited a friendly Q'eqchi' family area near Tucuru, Alta Verapaz, the kids picked kala stems to offer us to eat.



Photo by: David Arrivillaga, FLAAR Mesoamérica, Jun.
26, 2021. Biotopo El Zotz, Petén, Guatemala.

Camera: Sony Alpha A9 II. Lens: Sony FE 90mm Macro
G OSS. Settings: 1/160 sec; f/9; 400 ISO 1,000.

Zygia species





Photo by: David Arrivillaga, FLAAR Mesoamérica, Jun. 26, 2021. Biotopo El Zotz, Petén, Guatemala.

Camera: Sony Alpha A9 II. Lens: Sony FE 90mm Macro G OSS. Settings: 1/160 sec; f/9; 400 ISO 1,000.

Photo by: David Arrivillaga, FLAAR Mesoamérica, Jun. 26, 2021. Biotopo El Zotz, Petén, Guatemala.

Camera: Sony Alpha A9 II. Lens: Sony FE 90mm Macro G OSS. Settings: 1/80 sec; f/8; 400 ISO 1,000.



We are interested in these insects

I admit that I enjoy finding and photographing wasp nests. As a former student of architecture, I am curious about the architectural aspects of wasp nests. Also there is at least one case of either mutualistic or symbiotic relationship between wasps that build their nests in subin bushes or small trees (family Acaceae). The bullhorn acacia spines are filled with fierce Azteca ants which protect the plant (and the spines keep people and animals away as well). In an intriguing percent of these bullhorn acacia plants there are wasp nests; in an even more intriguing percent of these there is a species of bird nests. During our drive from El Remate towards San Jose (then towards San Andres to the turnoff north to reach Biotopo El Zotz), I noticed a subin with both wasp nest and bird nest so I pulled over and we all got out to do photography. The plant was deep down in a space far below the road level so we could not photograph the wasps or bird nest from any other angle.

Is there potential medicinal usage of plants of Biotopo El Zotz by local people

The book by Atran et al. lists hundreds of local medicinal plants of the area around Lake Peten Itza. The Biotopo is north of this Lake, but should have most of the same plants.



Concluding Discussion and Summary on Biotopo Protegido San Miguel La Palotada

The primary goal of the coordination and cooperation project with CONAP is to find, photograph and share information on flora, fauna, and ecosystems with local entities.

Our photos of fauna are usually from insects and lizards, since mammals (other than monkeys) are best photographed by camera traps, which are capably handled by other local projects. For Biotopo Protegido San Miguel La Palotada it has been requested that we return to do photography of the bats because the photos available to the reserve are over 10 years old. We have Sony mirrorless full-frame cameras that can use high ISO to accomplish better photography in dark conditions and we also have Canon mirrorless R5 with both, 600mm and an 800mm prime lenses. Both of these cameras have image stabilization, so you don't need a tripod (though to photograph the bats we have tripods and gimbal tripod heads available) and have animal-eye recognition firmware built into the camera. Simply point the camera at any animal and the camera itself automatically focuses on the eye of the animal.

Also, each of these two models (Canon R5 and Sony a1) have "bird eye focus mode". Thus, it will be necessary to test whether the camera recognizes a flying bat as a bird or as an animal.

The benefit of the high resolution of these cameras is that you can crop onto a single bat, and enlarge the image so that capable bat specialists in Guatemala can identify each bat. Jose Cajas is an example of a proficient bat specialist

The other aspect of the bats of this Biotopo Protegido San Miguel La Palotada to be photographed, is where they "hang out" (where they live). I had always assumed that "bats live in caves" and that some caves have small entrances (that a bat can navigate but that a person can't). However, as I do more research I see that these bats live inside the vertical fissures of the karst geology. There may also be tiny entrances to hidden caves or cenotes that the bats are flying out of, but it's the cliff that is pictured most often.

www.researchgate.net/profile/Jose-Octavio-Cajas-Castillo

<https://gt.linkedin.com/in/jose-octavio-cajas-castillo-28b2473b>

In addition to identifying how many genera and species of bats are in this nature reserve it is crucial to tabulate which are the insects and fruits they eat. I doubt there are "vampire" bats within these masses but obviously we will check this out. We have studied the carnivorous Slicer Bat of the Popol Vuh for several years which is one of the two False Vampire bats; these are unlikely to fly en masse. We also have bibliographies and tons of information and notes on these bats (one of which prefers to live inside the rotten hollows of trees; so is not always a cave bat).

These large bats are called "False" vampire because they don't suck blood from the neck, these slicer bats cut off the head of small creatures and eat both the blood and meat of the fresh body of their victim (besides, vampire bats don't attack the neck of humans; they tend to suck blood from your toes or feet while you are asleep).

Regarding photography, our team is comprised of five photographers and we have:

- four Sony Alpha cameras (different models, only one Sony a1),
- two Canon cameras (R5 and EOS 1D X Mark II) and
- two Nikon cameras (D810 and D5, which is the best of the two).

As for the cameras, no Nikon mirrorless camera is yet as well engineered as Sony a1 or Canon R5 (Nikon is a traditional Japanese brand with millions of fans around the world that are dedicated to using their traditional old-fashioned style of full frame cameras). Both Canon and Nikon lost the business to Sony's many years of dedication to mirrorless cameras, thus both released first-generation models during the expo Photokina 2018. I was able to inspect these cameras during this event in Cologne, Germany. Unfortunately, the Photokina 2020 did not take place due to the COVID pandemic. I have used Nikon cameras since the 1980's but from August 2021 onward I will do 80% of my photography with the Sony a1.



Photo by: David Arrivillaga, FLAAR Mesoamérica, Jun. 26, 2021.
Biotopo El Zotz, Petén, Guatemala.

Camera: Google Pixel 3 XL. Settings: 1/60 sec; f/1.73; ISO 85.

Maya Trek, community tourism

Physical exercise is very helpful for your health, so a hike with Maya Trek from the main highway to the entrance of El Zotz, then to the bat cliff and finally, the next day to Tikal is a good choice for backpackers. Your trek also helps local Peten Maya families by providing an income to support themselves: the guides, cooks, and the team all appreciate your visit.

MayaTrek personnel can be contacted in the Comunidad Cruce Dos Aguadas

More on MayaTrek in:

www.youtube.com/watch?v=EpmHnUEVxHk



Live the "El Zotz" experience with Maya Trek!

What we will be looking for to document in future field trips

We will be documenting any flora or fauna that CONAP or the local entities of Tikal, PNYNN, Bio Itza, Cerro Cahui, Biotopo El Zotz request through the administrators. We will also document flora or fauna that is useful for the Maya Trek personnel, or any other local project, to show and explain to visitors about the biodiversity or ecosystems of the area. For example, this time the administrator asked us to carry out a field trip to photograph the bats. This is best accomplished during a month when there is no rain pouring down.

In the meantime, our interests include finding, photographing and publishing:

Cauliflory, trees with flowers on the main trunk and branches (*Zygia* and other genera).

Ramiflorus, trees with flowers on the main limbs and branches.

Peeling bark, trees that throw off their bark to get rid of lichen and vines.

Tree trunks to help visitors identify trees by their trunk shape and bark pattern (when a tree is not flowering and the leaves are above the canopy, it is helpful to know this).

Tree trunks with spines prickles.

Tree trunks with pimple-like bump patterns.

Tree trunks with horizontal patterns on their surface,

Trees with “drinkable” latex (trees named lechemiel and comparable).

Aroids (Araceae)

Palms of every size and shape.

We are interested in finding all species of Annonaceae that are present in the area as many are cauliflorous. I have been doing research and photography of all species of Bombacaceae (then renamed Bombacoideae sub-family of Malvaceae). Also, there are rare trees such as the native Maya rubber latex tree: *Castilla elastica*, family Moraceae. The flowers and fruits of this tree are bizarre beyond belief. The FONDECYT 2002 report lists *Castilla elastica* so we will definitely want to find this tree in the future (when it is flowering and then fruiting).

On the subject of latex, in our ongoing 15-month project of flora and fauna in the Municipio de Livingston, we have found two different trees that produce “drinkable” latex (though I advise against drinking the latex since one of these species produces very strong latex). It would also be nice to find:

- ***Couma macrocarpa***, family Apocynaceae
- ***Lacmellea standleyi*** (has spines on the trunk comparable to *Ceiba*), family Apocynaceae

Regarding the family Apocynaceae, Ixcot lists *Plumeria rubra* (Flor de Mayo). We have found it in several remote locations of PNYNN, however, its normal habitat is “bosque seco”, literally surrounded by cactus plants.

That said, we have also found this bright white-with-yellow flower in the humid Lanquin area, growing on solid limestone outcrops and on limestone cliffs. We dedicated two years to studying all colors of Flor de Mayo, literally throughout Guatemala, driving thousands of kilometers each month through many departamentos of Guatemala to learn which colors were in the wild and which other colors were native but domesticated (Bishop Landa makes helpful comments on these flowers in Yucatan).

So lots of trees to find, photograph, document, do library research and then publish.

Xylariaceae family





Photo by: David Arrivillaga, FLAAR Mesoamérica, Jun. 26, 2021. Biotopo El Zotz, Petén, Guatemala.

Camera: Sony Alpha A9 II. Lens Sony FE 90mm Macro G OSS. Settings: 1/80 sec; f/8; 400 ISO 1,000.



Photo by: David Arrivillaga, FLAAR Mesoamérica, Jun. 26, 2021. Biotopo El Zotz, Petén, Guatemala.

Camera: Sony Alpha A9 II. Lens: Sony FE 90mm Macro G OSS. Settings: 1/80 sec; f/8; 400 ISO 1,000.

Appendix A

Species of Bats documented for Biotopo Protegido San Miguel La Palotada-El Zotz

Note these bats were located in various parts of the nature reserve. Only once we photograph the evening swarms, it is possible to document which bats comprise them.

<https://serv.biokic.asu.edu/guatemala/portal/collections/list.php?db=1&reset=1&country=Guatemala&state=Pet%C3%A9n&county=>

Carollia sowelli Baker, Solari & Hoffmann
Glossophaga E. Geoffroy
Heteromys gaumeri J. A. Allen and Chapman
Micronycteris schmidtorum Sanborn
Mimon crenulatum E. Geoffroy
Natalus stramineus Gray
Peropteryx macrotis Wagner,





Appendix B

June 26, 2021

REPORTE DE FOTOGRAFÍA EN VIAJE DE CAMPO, BIOTOPO PROTEGIDO SAN MIGUEL LA PALOTADA-EL ZOTZ, PETÉN

PHOTOGRAPHERS: NICHOLAS HELLMUTH

 iPhone 12pro in green

 Google Pixel 4a in brown

Nikon D810 (only for Zygia and Subin with wasp nest driving to El Zotz)

Hora en que se tomó la fotografía.	Nombre del Lugar en donde se tomó la fotografía	Notas de Byron	Nombre de los archivos
09:02 am 09:07 am	Área de Jobompiche	Panal de Abejas y Nido de Pájaro	RBM-NEEDS-ID-Subin-wasp-nest-bird-nest-symbiotic-road-north-edge-Lake-Peten-Itza-NikonD810-907am-Jun-26-2021-NH
12:21 pm	Sendero del Biotopo El Zotz	Palo de Jiote, tanto que no lista cada hora	Biotopoto-El-Zotz-RBM-Bursera-simaruba-iPhone-12pro-1221pm-and-other-times-Jun-26-2021-NH
01:07 pm	Sendero del Biotopo El Zotz		
01:07 pm 01:08 pm	Sendero del Biotopo El Zotz	Árbol, nombre común: Destap, Nombre científico: <i>Guettarda combsii</i>	Biotopoto-El-Zotz-RBM-Guettarda-combsii-Texpac-taxtop-testap-peeling-bark-107am-iPhone-12pro-Jun-26-2021-NH
01:09 pm 01:12 pm	Sendero del Biotopo El Zotz	Árbol Ficus Amate	Biotopoto-El-Zotz-RBM-Amate-Ficus-species-trunk-surface-nodules-Peten-RBM-iPhone-12pro-109pm-Jun-26-2021-NH
01:14 pm	Sendero del Biotopo El Zotz		Biotopoto-El-Zotz-Bursera-simaruba-Palo-de-jiote-Peten-RBM-Google-Pixel-4a-114pm-Jun-26-2021-NH
01:22 pm	Sendero del Biotopo El Zotz	Every 20 or so minutes found Zygia; all 1 folder	Biotopoto-El-Zotz-Zygia-species-Peten-RBM-Google-Pixel-4a-122pm-136pm-and-236pm-Jun-26-2021-NH
01:26 pm	Sendero del Biotopo El Zotz		Biotopo-El-Zotz-NEEDS-ID-Zygia-species-flowers-seed-pods-Biotopo-El-Zotz-NikonD810-126pm-Jun-26-2021-NH

01:32 pm	Área de Jobompiche	Looks like a vine but the guide said it was a tree	Biotopoto-El-Zotz-RBM-ID-dual-spine-long-woody-spines-iPhone-12pro-132pm-Jun-26-2021-NH
01:34 pm 01:36 pm	Sendero del Biotopo El Zotz	Zygia	Biotopoto-El-Zotz-Zygia-species-Peten-RBM-Google-Pixel-4a-122pm-136pm-and-236pm-Jun-26-2021-NH
01:33 pm 01:39 pm	Sendero del Biotopo El Zotz	Árbol con Espina, very long spines	Biotopoto-El-Zotz-NEEDS-ID-twin-spined-Peten-RBM-Google-Pixel-4a-133pm-Jun-26-2021-NH
01:41 pm	Sendero del Biotopo El Zotz	Several areas with this tree; different hours	Biotopoto-El-Zotz-RBM-Zygis-species-iPhone-12pro-141pm-156pm-and-236pm-Jun-26-2021-NH
01:45 pm	Sendero del Biotopo El Zotz	Palo de Jiote	Biotopoto-El-Zotz-RBM-Bursera-simaruba-iPhone-12pro-1221pm-and-other-times-Jun-26-2021-NH
01:46pm 01:49 pm	Sendero del Biotopo El Zotz	Aguada	Biotopoto-El-Zotz-RBM-Aguada-iPhone-12pro-146pm-Jun-26-2021-NH
01:50 pm	Sendero del Biotopo El Zotz		Biotopoto-El-Zotz-RBM-ID-Hongos-iPhone-12pro-150pm-Jun-26-2021-NH
01:51 pm 01:54 pm	Sendero del Biotopo El Zotz	Larva Roja-blanca, photo by Byron	Biotopoto-El-Zotz-NEEDS-ID-Larva-Peten-RBM-Google-Pixel-4a-151pm-Jun-26-2021-BP
01:56 pm	Sendero del Biotopo El Zotz	Several areas with this tree; different hours	Biotopoto-El-Zotz-RBM-Zygia-species-iPhone-12pro-141pm-156pm-and-236pm-Jun-26-2021-NH Biotopo-El-Zotz-NEEDS-ID-Zygia-species-flowers-seed-pods-NikonD810-158pm-225pm-Jun-26-2021-NH
02:04 pm	Sendero del Biotopo El Zotz	Out of focus; maybe Roxy or David have it	Biotopoto-El-Zotz-RBM-NEEDS-ID-red-berry-fruits-204pm-Jun-26-2021-NH
02:11 pm	Sendero del Biotopo El Zotz	Palo de Jiote	Biotopoto-El-Zotz-RBM-Bursera-simaruba-iPhone-12pro-1221pm-and-other-times-Jun-26-2021-NH

02:24 pm 02:25 pm	Sendero del Biotopo El Zotz	Flor de Zygia	Biotopo-El-Zotz-NEEDS-ID-Zygia-species-flowers-seed-pods-158pm-225pmpm-Jun-26-2021-NH
02:30 pm	Sendero del Biotopo El Zotz	Entwined vines	Biotopoto-El-Zotz-RBM-ID-Bejuco-iPhone-12pro-230pm-Jun-26-2021-NH
02:36 pm	Sendero del Biotopo El Zotz	Several areas with this tree; different hours	Biotopoto-El-Zotz-RBM-Zygis-species-iPhone-12pro-141pm-156pm-and-236pm-Jun-26-2021-NH Biotopoto-El-Zotz-Zygia-species-Peten-RBM-Google-Pixel-4a-122pm-136pm-and-236pm-Jun-26-2021-NH
03:01 pm	Sendero del Biotopo El Zotz	Chichara	

Photo folders with no flora or fauna:

Biotopoto-El-Zotz-RBM-Entrada-signs-Peten-RBM-iPhone-12pro-Jun-26-2021-NH

Appendix C

REPORTE DE KILOMETRAJE DE RESERVA NATURAL EL ZOTZ, PETÉN 26/06/2021

Hora	Nombre local del lugar	KM y/o Coordenadas del Lugar
08:17 am	Desde el Remate	Km 0.0
08:40 am	Aldea Jobompiche	
09:29 am	Desvio a la derecha hacia Bio-Itzá (if you want to go there)	Km 22.4
09:38 am	Centro del Pueblo San Jose	Km 06.0
09:43 am	Cruce a la derecha para el Biotopo el Zotz	Km 28.2
09:46 am	Municipio de San Andres	Km 38.3
10:34 am	Desvio a Parcelamiento	Km 43.3
10:35 am	Rotulo de Biotopo el Zotz	
10:42 am	Cruce al Zotz	Km 49.9
15:32 pm	Recorrido de regreso	Km 5.1

Bibliography Part I

Flora and Fauna aspects of Biotopo Protegido San Miguel La Palotada

by Vivian Hurtado

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CATIE, OLAFO

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CECON

- 1999 Plan Maestro 2000-2004. Biotopo Protegido San Miguel la Palotada el Zotz. Centro de Estudios Conservacionistas de la Universidad de San Carlos Facultad de Ciencias Químicas y Farmacia. Guatemala.

CEMEC, CONAP

- 2001 Mapa de elevaciones del Biotopo San Miguel la Palotada el Zotz. Centro de Monitoreo y Evaluación del Consejo Nacional de Áreas Protegidas.

GÁLVEZ, R., SOTO, M., PINEDA, C., CASTILLO, G., RODRÍGUEZ, B., AYALA, M., GONZÁLEZ, R., ARDÓN, G. and A. FUENTES

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MORALES, J.

- 1999 Establecimiento de la línea base de información de biodiversidad del bosque manejado en San Miguel La Palotada, Petén, Guatemala y su aplicación en el monitoreo. CATIE. Turrialba, Costa Rica. 113 páginas.

Downloadable online: <http://201.207.189.89/handle/11554/8998>

IXCOT, L.

- 2005 Estudios de biodiversidad en los biotopos: San Miguel la Palotada el Zotz y Naachtún - Dos Lagunas, Petén, Guatemala (p. 106). Guatemala: Fondo Nacional de Ciencia y Tecnología (FONACYT) - Centro de Datos para la Conservación (CDC-CECON).

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- 1992 Estudios semidetallado de suelos del Biotopo San Miguel La Palotada El Zotz, Petén, Guatemala. Centro de Estudios Conservacionistas, Universidad de San Carlos de Guatemala, Guatemala.

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- 2002 Guatemala: Biotopo Protegido San Miguel la Palotada (el Zotz). ParksWatch.org.

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- 2016 Caracterización Del Banco De Semillas Del Suelo En El Biotopo Protegido San Miguel La Palotada El Zotz, San José, Petén. Tesis, Universidad San Carlos de Guatemala. Facultad de Ciencias Químicas y Farmacia.

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- 1996 Valoración económica de un ecosistema bosque subtropical: estudio de caso San Miguel La Palotada, Petén, Guatemala. CATIE. Turrialba, Costa Rica 132 pages.

SISTEMA GUATEMALTECO DE ÁREAS PROTEGIDAS – SIGAP

- s.f. Circuito El Zotz – Tikal el refugio de los murciélagos. Guía informativa.

Downloadable online:

<https://docplayer.es/56051413-Peten-guatemala-biotopo-protegido-san-miguel-la-palotada-el-zotz-circuito-el-zotz-tikal-el-refugio-de-los-murcielagos.html><https://docplayer.es/56051413-Peten-guatemala-biotopo-protegido-san-miguel-la-palotada-el-zotz-circuito-el-zotz-tikal-el-refugio-de-los-murcielagos.html>

VELÁSQUEZ, María del Mar

- 2016 Evaluación del Impacto del Cambio Climático en Especies de Importancia Económica y Cultural en la Reserva de Biósfera Maya: en los Biotopos Naachtún-Dos Lagunas, San Miguel La Palotada-El Zotz y La Laguna del Tigre-Río Escondido. Proyecto FODECYT No.078-2012.

Downloadable online: <http://biblioteca.galileo.edu/tesario/handle/123456789/470>

Bibliography Part II

Suggested Reading on the Bats specifically of Biotopo Protegido San Miguel la Palotada (El Zotz)

www.youtube.com/watch?v=q9TfapRf8yg

0:30 seconds

30 seconds worth watching of zillions of bats circling around as they swarm out of their nest/rest areas to go find food.

www.mylittleadventure.es/best-things/peten-department-d5699/tours/3-day-tour-a-zotz-para-ver-los-murcielagos-tikal-bu2d7Sf0MP?currency=GBP

Even though only one photograph, it shows “thousands” of bats swarming with the sun setting behind (so the bats are backlit).

Our goal will be to photograph the bats from backlit and frontlit, and show them en masse (which is what people want to experience) but also to show the individual bats. Obviously what's notable en masse is that the bats don't crash into each other (they have obviously evolved millions of years to avoid this).

www.youtube.com/watch?v=f7s0as2V0Ws

16:54 minutes; bats are a few seconds from 15:05 onwards. He mentions a count of 39 species of bats (but there is no list of references cited in the video). The video is too dark; can't hardly see anything. This is why we are bringing special cameras with high ISO capability, without too much fuzziness. To see the bat swarm, this other 30-second video, is significantly better: www.youtube.com/watch?v=q9TfapRf8yg

Although rather long (16 minutes) and a bit disappointing, what I did learn is that there are bat falcons sitting on the bat cliff waiting to eat bats as they fly out.

Bibliography Part III

The Archaeological Site of El Zotz

Since our project in the RBM is on flora and fauna, we are not doing archaeological research. Also, there is already a capable archaeological project by Licda. Yeny Myshell Gutiérrez Castillo and Dr Thomas Garrison.

ROMÁN, E., GARRIDO, J., PIEDRASANTA, R., GARRISON, T., HOUSTON, S., NWE MAN, S., GUTIÉRREZ, Y., CARTERET, A., HERNÁNDEZ, D., PÉREZ, E., ZACEÑA, I., BEACH, T., LUZZAFER, S., DOYLE, J., CARTER, N., KINGSLEY, M., ESCOBEDO, H., ARREDONDO, E., PÉREZ, G., CZAPIEWSKA, E., SCHERER, A., NELSON, Z., GÁMEZ, L., ARROYAVE, A., MELÉNDEZ, J. C., CAMBRANES, R., MATUTE, V., HRUBY, Z., QUIROA, F., LÓPEZ, J. and J. KWOKA

2015 Diez años de investigación del Proyecto arqueológico El Zotz XXIX Simposio de Investigaciones Arqueológicas en Guatemala. Museo Nacional de Arqueología y Etnología.

This history of the initiation of the El Zotz archaeological project and it's first ten years is also available:

www.asociaciontikal.com/wp-content/uploads/2020/07/15-Rom%C3%A1n-et-al.pdf

I would rate the Proyecto Arqueológico El Zotz as remarkably capable and productive (using LiDAR, using 3D scanning inside tunnels) and producing multiple field reports.

The entire project staff is listed in their 2018 report (www.mesoweb.com/zotz/El-Zotz-2017.pdf) which is a 4-page bibliography. Thus, there is no need to repeat that here.

Additional information is in their year 2019 report: www.mesoweb.com/zotz/El-Zotz-2019.pdf

SISTEMA GUATEMALTECO DE ÁREAS PROTEGIDAS – SIGAP

s.f.

Circuito El Zotz – Tikal el refugio de los murciélagos. Guía informativa.

SIGAP (Sistema Guatemalteco de Áreas Protegidas) has a 25 page report (Guía informativa) on the Biotopo and the MayaTrek (El Zotz to Tikal). I found this on <https://docplayer.es/56051413-Peten-guatemala-biotopo-prottegido-san-miguel-la-palotada-el-zotz-circuito-el-zotz-tikal-el-refugio-de-los-murcielagos.html>

Unfortunately the website docplayer.es is 90% commercial advertisements, so I hope in the future this well designed PDF can be available as a download without all the ads (not from SIGAP). If you are clever you can turn it into a PDF from the website for an easier read .This PDF is mostly about the ruins, showing nice architectural renditions (visual reconstructions) of what each site looked like over a thousand years ago.

Bibliography Part IV

General Reading on Trees of nearby areas (trees of Guatemala in general and trees of adjacent areas of Chiapas, Tabasco, Campeche, Quintana Roo, and Belize provide good comparative documentation for studying Trees of Peten)

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

Regina de Riojas ha dedicado gran parte de su vida a estudiar los árboles de los mayas y de Guatemala. Elfriede de Pöll también ha dedicado su vida a la biología de Guatemala, en la Universidad del Valle de Guatemala.

ARELLANO Rodríguez, J. Alberto, FLORES Guido, José Salvador, TUN Garrido, Juan and **M. M. CRUZ Bojórquez**

2003 Nomenclatura, forma de vida, uso, manejo y distribución de las especies vegetales de la Península de Yucatán. Etnoflora Yucatanense Fascículo 20. Universidad Autónoma de Yucatán, UADY. 815 pages.

A challenge to find as a download.

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

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

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

Not available as a download.

BALICK, Michael J., NEE, Michael H. and **Daniel E. ATHA**

2000 Checklist of the Vascular Plants of Belize: With Common Names and Uses. Memoirs of the New York Botanical Garden Vol. 85. 246 pages.

BALICK, Michael J. and **Rosita ARVIGO**

2015 Messages from the Gods: A Guide to the Useful Plants of Belize. The New York Botanical Garden, Oxford University Press.

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

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

BUENO, Joaquín. ALVAREZ, Fernando and **Silvia SANTIAGO (editors)**

2005 Biodiversidad del Estado de Tabasco. CONABIO, UNAM, México. 370 pages.

CHIZMAR, Carla

2009 Plantas Comestibles de Centroamérica. Instituto Nacional de Biodiversidad (INBio). Santo Domingo de Heredia. Costa Rica. 360 pages.

Downloadable here:

www.museocostarica.go.cr/descargas/PlantasComestiblesCA-VE.pdf

COOK, Suzanne

2016 The forest of the Lacandon Maya: an ethnobotanical guide. Springer. 334 pages.

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

DIX, Margaret A. and M. W. DIX

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

This is one of the sources for the tree list in CONAP's Plan Maestro of Yaxha in the past decade. Unfortunately the Dix and Dix list is rather limited. The 1999 Schulze and Whitacre list for Tikal is more complete (but all these lists need more field work to improve).

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

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Download here: www.eeo.ed.ac.uk/sea-belize/outputs/Papers/goodwin.pdf

GRANDTNER, Miroslav

2005 Elsevier's Dictionary of Trees: Vol. 1: North America. ELSEVIER.

IBARRA-Manríquez, Guillermo, VILLASEÑOR, José Luis and Rafael DURÁN García

1995 Riqueza de especies y endemismo del componente arbóreo de la Península de Yucatán, México. Bol. Soco Bot. México 57: 49-77

Download here: www.researchgate.net/publication/306128522_Riqueza_de_especies_y_endemismo_del_componente_arboreo_de_la_Peninsula_de_Yucatan_Mexico

INE

2013 Nomination of Ancient Maya City and Protected Tropical Forests of Calakmul, Campeche. 55 pages.

There is no author on the fragment that is downloadable, so we put INE.

LESUR, Luis

2011 Árboles de México. Editorial Trillas. 368 pages.

LUNDELL, Cyrus L.

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

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1938 Plants Probably Utilized by the Old Empire Maya of Peten and Adjacent Lowlands. Papers of the Michigan Academy of Sciences, Arts and Letters 24, Part I:37-59.

MARTÍNEZ, Esteban and Carlos GALINDO-Leal

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Download here: www.botanicalsciences.com.mx/index.php/botanicalSciences/article/download/1660/1309/

OCHOA-Gaona, Susana, RUÍZ González, Hugo, ÁLVAREZ Montejó, Demetrio, CHAN Coba, Gabriel and Bernardus H. J. DE JONG

2018 Árboles de Calakmul. ECCOSUR, Chiapas. 245 pages.

It is amazing that there is no such book for Parque Nacional Tikal, nor El Mirador. Even though it includes only half the estimated number of "trees," it has more tree species than Schulze and Whitacre for Tikal (they estimated about 200 but list only about 156. Their lists of species and list by plant family are not identical).

The entire book is totally free to download, however, you can't copy and paste so it is difficult to add to your discussion.

In the future it would be helpful to have a photographer with high-resolution equipment available and a book producer that can put these photos at a resolution that allows you to see the details. The photos of the overall tree have almost no visible detail. Nonetheless, the authors all have botanical experience and this book is a good start. A second edition would be helpful as well as to have more than one page per photo.

http://aleph.ecosur.mx:8991/exlibris/aleph/a22_1/apache_media/74R92GMRSJSEPFDEE5NJY4SJJ2I8AK.pdf

ORDÓÑEZ, MARÍA de Jesús

2014 Las flores comestibles. Instituto nacional de investigación sobre medios bióticos

Download: www.academia.edu/12405169/LAS_FLORES_COMESTIBLES_MAR%C3%8DA_DE_JES%C3%9AS_ORD%C3%93%C3%91EZ

PARDO Tejada, Enrique

1979 Flores Comestibles. comunicado n° 36 sobre recursos hióticos potenciales del país.

PARKER, Tracey

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

Although more than half the book is copy-and-paste from Flora of Guatemala, it helps to have 99% of the trees of Guatemala in one single volume. And, since the Parker book is 2008, it has additional information for some trees.

PEÑA-Chocarro, María and Sandra KNAPP

2011 Árboles del mundo maya. Natural History Museum Publications. 263 pages.

Helpful book; contributing authors are experienced botanists. They cover 220 species of trees, more than virtually all other "Books on Trees of the Maya." Even include tasiste (which is missing from all other books on "Trees of the Maya" except for the recent book on Árboles de Calakmul).

However, if all this effort is going into a book, it would help if there were more and larger photos and not so much blank space at the bottom of each page. Also, it would help if the text could include personal first hand experience with these trees out in the Mundo Maya. Nonetheless, even as is, it is a helpful book.

If you are doing field work you need it, as well as Árboles de Calakmul and Árboles tropicales de México. Parker's book you need it back in your office, since out in the field is of not much help due to the lack of photographs. Back in your office the books by Regina Aguirre de Riojas are also helpful.

PENNINGTON, Terence D. and José SARUKHAN

2005 Árboles tropicales de México. Manual para la identificación de las principales especies. 3rd edition. UNAM, Fondo de Cultura Económica. 523 pages.

This book is a serious botanical monograph. The first edition was from 1968 (I still have this) and the second one from 1998. The 3rd edition is a "must have" book. Each tree has an excellent line drawing of leaves and often flowers and fruits (though to understand flowers you need them in photographs, in full color). Each tree has a map showing where it is found in Mexico (such maps are lacking in most books on Trees of Guatemala or plants of Belize). However, trying to fit a description of a tree on one single page means that a lot of potential information on flowering time is not present. Also, this is definitely not a book on ethnobotany, for that you need the Suzanne Cook.

SCHULZE, Mark D. and David F. WHITACRE

1999 A Classification and Ordination of the Tree Community of Tikal National Park, Peten, Guatemala. Bulletin of the Florida Museum of Natural History. Vol. 41, No. 3, pp. 169-297.

Even though it's from 20 years ago, it's the best tree list of Tikal that I have found. There is a website with plants of Tikal but they are not separated into trees, vines, shrubs, etc., so it is harder to use. The new monograph on Arboles de Calakmul is better than anything available so far on Tikal (and the nice, albeit short book by Felipe Lanza of decades back on trees of Tikal is neither available as a scanned PDF nor as a book on Amazon or ebay).

STANDLEY, Paul C. and Samuel J. RECORD

1936 The Forests and Flora of British Honduras. Field Museum of Natural History. Publication 350, Botanical Series Vol. XII. 432 pages plus photographs.

STANDLEY, Paul C.

1923 Trees and Shrubs of Mexico. Contributions from the United States National Herbarium, Vol. 23, Parte 3. Smithsonian Institution.

In this one monograph the species are not listed in alphabetical order, so it's a mental adventure finding the species you are looking for.

All monographs by Standley and co-authors can be easily found and downloaded. I would recommend finding the .pdf versions as they are easier to store, to copy, and to share with students and colleagues.

STANDLEY, Paul C. and Julian A. STEYERMARK

1949 Flora of Guatemala. Fieldiana: Botany, Vol. 24, Parte VI, Chicago Natural History Museum.

STANDLEY, Paul C. and Julian A. STEYERMARK

1958 Flora of Guatemala. Fieldiana: Botany, Vol. 24, Parte I Chicago Natural History Museum. 478 pages.

TETETLA Rangel, Ericka

2010 Diversidad vegetal de especies raras y su relación con la estructura del paisaje a múltiples escalas espaciales en las selvas de la Península de Yucatán. Dissertation, Centro de Investigación Científica de Yucatán.

This is one of the better dissertations that I have seen and is as good as most peer-reviewed articles in scientific journals. It even has location maps for most of the trees.

Download: file:///Users/new/Downloads/PCBP_BT_D_Tesis_2012_Tetetla_Erika.pdf

VILLASEÑOR, José Luis

2016 Checklist of the native vascular plants of Mexico. Catálogo de las plantas vasculares nativas de México. Revista Mexicana de Biodiversidad 87 (2016) 559–902.

<http://revista.ib.unam.mx/index.php/bio/article/view/1638/1296>

VILLAR Anléu, Luis

2005 Guatemala, Árboles Mágicos Y Notables. Empresa Eléctrica de Guatemala, Editorial Artemis-Edinter. 148 pages.

I always enjoy seeing an author who is really enthusiastic about what he is writing about. I have had this book in my office reference library for 15 years (since it first came out).

ZAMORA-Crescencio, Pedro, GUTIÉRREZ-Báez, Celso, FOLAN, William J., DOMÍNGUEZ-Carrasco, Ma. Del Rosario, VILLEGAS, Pascale, CABRERA-Mis, Geucilio, CASTRO-Angulo, Claudeth and Juan Carlos CARBALLO

2012 La vegetación leñosa del sitio Arqueológico de Oxpemul, Municipio de Calakmul, Campeche, México. Polibotánica, Núm. 33, pp. 131-150

Download: www.scielo.org.mx/pdf/polib/n33/n33a9.pdf

Helpful websites for each and all plants

There are several web sites that are helpful even though they don't belong to a university, botanical garden or government institute.

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

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

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

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

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

This is the main SEARCH page.

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

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

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

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

<http://enciclovida.mx>

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

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

Kew gardens in the UK is one of several botanical gardens that I have visited (as well as the New York Botanical Gardens and Missouri Botanical Gardens (MOBOT) in St Louis. Also the botanical garden in Singapore and El Jardín Botánico, the open forest botanical garden in Guatemala City).

www.ThePlantList.org

This is the most reliable botanical web site to find synonyms. In the recent year, only one plant had more synonyms on another botanical web site.

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

HELLMUTH, Nicholas

2021 Introduction to Flora and Fauna of Biotopo Protegido San Miguel la Palotada (El Zotz) and Potential Here for Further Research, Reserva de la Biosfera Maya (RBM) Peten, Guatemala. FLAAR and FLAAR Mesoamerica.

Base Camp Assistance in Parque Nacional Tikal

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

Base Camp Assistance in PNYNN

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

In turn FLAAR purchased and donated a cooking stove when the original one no longer functioned, plus we have photographed and documented many tree and insect species that we found around this camp.



Ec lodge El Sombrero

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

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

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

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

www.elsombreroecolodge.com/en-us



PERMISSIONS

Any school, college, university, botanical garden, zoological garden, botanical or zoological association (or club) may post this report on their web sites, (at no cost) as long as they link back to one of our web sites: either

www.maya-ethnobotany.org or
www.maya-ethnozooology.org or
www.maya-archaeology.org or
www.digital-photography.org or
www.FLAAR-Mesoamerica.org.

FLAAR (in USA) and FLAAR Mesoamerica (in Guatemala) are both non-profit research and educational institutes, so there is no fee. And you do not need to write and ask permission; but we do appreciate when you include a link back to one of our sites.

Any school, college, university, botanical garden, etc. can post this PDF on their school or university or institute web site for their students to download at no cost. And you do not need to write and ask permission; but we do appreciate when you include a link back to one of our web sites.

Any web site in or related to the Municipio of Livingston, is also welcome to post this PDF on their web site (no fee). This permission includes travel agencies, hotels, guide services, etc. And you do not need to write and ask permission; but we do appreciate when you include a link back to one of our web sites.

CECON, CONAP, FUNDAECO, INGUAT, ARCAS, IDAEH, Municipio de Livingston, etc. are welcome to publish our reports, at no cost.

All national parks, nature reserves, and comparable are welcome to have and use our reports at no cost.

USAC, UVG, URL, and other Guatemalan universities and high schools, and schools, are welcome to post our reports, at no cost.

IF YOU WISH OUR FLORA AND/OR FAUNA MATERIAL AS A POWERPOINT PRESENTATION

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

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

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

IF YOUR CLUB, ASSOCIATION, INSTITUTE, BOTANICAL GARDEN, ZOO, PARK, UNIVERSITY, ETC WISHES HIGH-RESOLUTION PHOTOS FOR AN EXHIBIT IN YOUR FACILITY ANYWHERE IN THE WORLD

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

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

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

TO PUBLISH PHOTOGRAPHS

Hellmuth's photographs have been published by National Geographic, by Hasselblad Magazine, and used as front covers on books on Mayan topics around the world. His photos of cacao (cocoa) are in books on chocolate of the Maya and Aztec both by Dr Michael Coe (all three of editions) and another book on chocolate by Japanese specialist in Mayan languages and culture, Dr Yasugi. We naturally appreciate a contribution to help cover the costs our office expenses for all the cataloging, processing, and organization of the photos and the field trip data.

FOR YOUR SOCIAL MEDIA

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

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

ACKNOWLEDGEMENTS TO FLAAR MESOAMÉRICA

The reports are a joint production between the field trip team and the in-house office team. So here we wish to cite the full team:

Flor de María Setina is the office manager, overseeing all the diverse projects around the world (including FLAAR-REPORTS research on advanced wide-format digital inkjet printers, a worldwide project for over 20 years). We also utilize the inkjet prints to produce educational banners to donate to schools.

Vivian Díaz environmental engineer, is project manager for flora, fauna projects (field work and resulting reports at a level helpful for botanists, zoologists and ecologists, and for university students). Also coordinates activities at MayanToons, division where educational material for kids is prepared.

Victor Mendoza identifies plants, mushrooms, lichen, insects, and arachnids. When his university schedule allows, he also likes to participate in field trips on flora and fauna research.

Vivian Hurtado is part of our bibliography team. In addition, she also prepares blogs and articles for our websites with helpful information about the flora and fauna we document in our field trips and other topics we interested in.

Andrea de la Paz is a designer who helps prepare the master-plan for aspects of our publications. She is our editorial art director.

Norma Estefany Cho Cu helps with preparing the camera equipment for each field trip and helps in the office (and on field trips) as cook.

Byron Pacay handles GPS mapping of where we hike or go in the lancha (boat) each field trip day. He also lists where we stop to take photos and what each one of us is photographing and then has that tabulation ready each night.

Jaqueline González is a designer who puts together the text and photographs to create the actual report (we have several designers at work since we have multiple reports to produce).

Roxana Leal is Social Media Manager for flora and fauna research and publications, and MayanToons educational book projects.

María Alejandra Gutiérrez is an experienced photographer, especially with the Canon EOS 1D X Mark II camera and 5x macro lens for photographing tiny insects, tiny flowers, and tiny mushrooms. Work during and after a field trip also includes sorting, naming, and processing. And then preparing reports in PDF format.

David Arrivillaga is an experienced photographer and is able to handle both Nikon and the newest Sony digital cameras. Work during and after a field trip also includes sorting, naming, and processing.

Juan Carlos Hernández takes the material that we write and places it into the pertinent modern Internet software to produce our web pages (total network is read by over half a million people around the world).

Paulo Núñez is a webmaster, overlooking the multitude of web sites. Internet SEO changes every year, so we work together to evolve the format of our web sites.

Valeria Avilés is an illustrator for MayanToons, the division in charge of educational materials for schools, especially the Q'eqchi' Mayan schools in Alta Verapaz, Q'eqchi' and Petén Itzá Maya in Petén, and the Q'eqchi' Mayan and Garifuna schools in the municipality of Livingston, Izabal.

Josefina Sequen is an illustrator for MayanToons and also helps prepare illustrations for Social Media posts and for animated videos.

Rosa Sequen is also an illustrator for MayanToons and also helps prepare illustrations for Social Media posts and for animated videos.

Laura Morales is preparing animated videos in MayanToons style since animated videos are the best way to help school children how to protect the fragile ecosystems and endangered species.

Heidy Alejandra Galindo Setina joined our design team in August 2020. She likes photography, drawing, painting, and design.

Maria José Rabanales she is part of the team for editing photographic reports and educational material of Flora and Fauna since September 2020. She works together with others of the team to prepare the finished pdf editions of the material of the Yaxha, Nakum and Naranjo Project.

Alejandra Valenzuela, biology student is now part of Flora y Fauna's photographic report and educational material editing team since September 2020.

Alexander Gudiel designer who join the editorial design team on December 2020. He will combine the text, pictures and maps into the FLAAR Mesoamerica editorial criteria.

Cristina Ríos designer student who join the editorial design team on December 2020. She will combine the text, pictures and maps into the FLAAR Mesoamerica editorial criteria.

Carlos Marroquín is a USAC graphic design student who volunteered to do his professional practice with the Editorial Design Team. We are very grateful with people like him who join our team and bring his knowledge and work.

Sergio Jerez prepares the bibliography for each subject and downloads pertinent research material for our e-library on flora and fauna. All of us use both these downloads plus our in-house library on flora and fauna of Mesoamerica (Mexico through Guatemala into Costa Rica).

¿CÓMO LLEGAR A BIOTOPO SAN MIGUEL, LA PALOTADA, EL ZOTZ?



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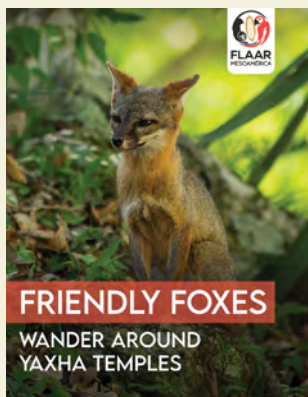
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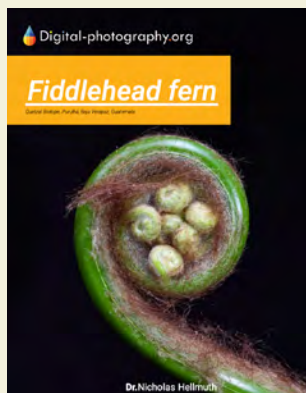
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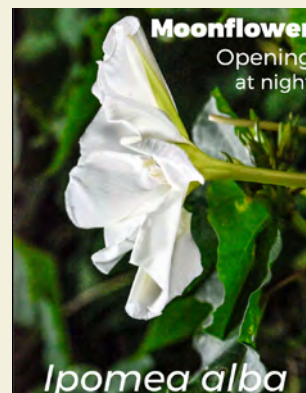
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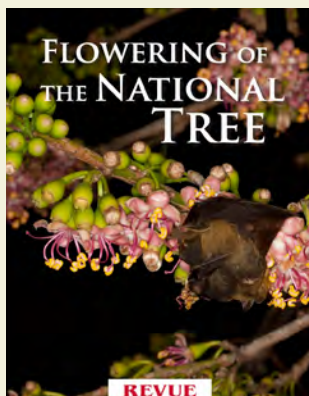
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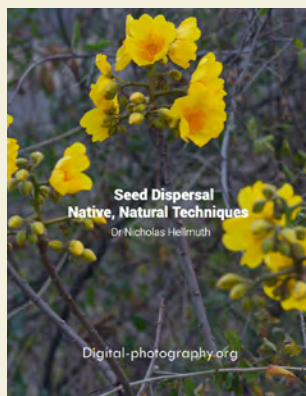
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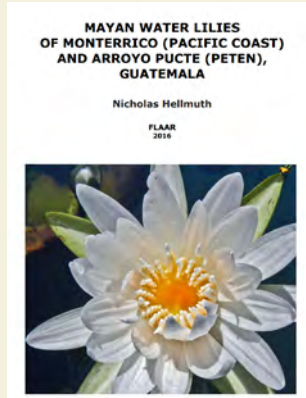
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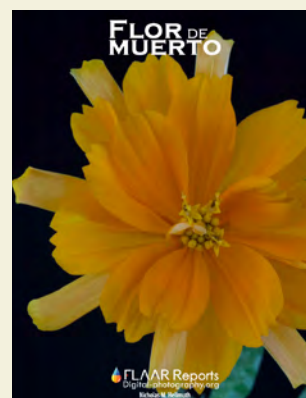
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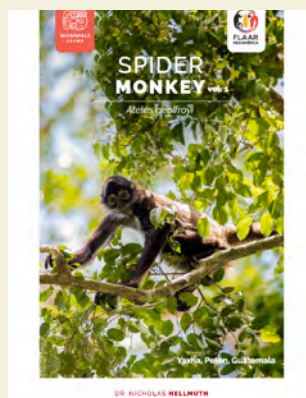
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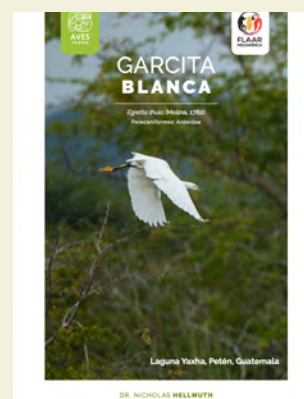
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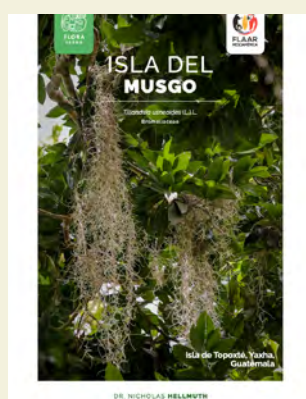
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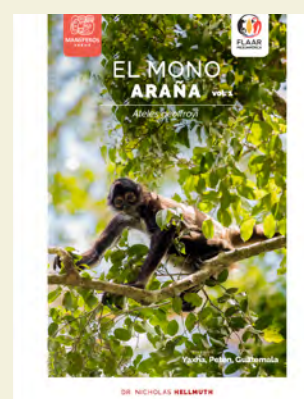
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