



Tasistal Arroyo Petexbatun

Part I: Notes on
Tasiste Palm and Tasistal Biome
from Ground Level

Acoelorrhaphe wrightii

Nicholas Hellmuth



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PHOTOGRAPHY CREDITS

FRONT COVER PHOTOGRAPH

Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth.
FLAAR Mesoamerica. December 4,
2019. Tasistal Arroyo Petexbatun, Petén,
Guatemala. Camera: iPhone Xs.

TITTLE PAGE PHOTOGRAPH

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Guatemala. Camera: iPhone Xs.

BACKCOVER PHOTOGRAPH

Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth.
FLAAR Mesoamerica. December 4,
2019. Tasistal Arroyo Petexbatun, Petén,
Guatemala. Camera: iPhone Xs.

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Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth. FLAAR
Mesoamerica. April 16, 2020. Tasistal Arroyo
Petexbatun, Petén, Guatemala. Camera: iPhone Xs.

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Introduction:

Tasiste palm in savannas compared and contrasted with tasiste palm in a tasistal

In local (Peten, Guatemalan) Spanish, any savanna with masses of tasiste palms is called a tasistal. Most savannas of Yaxha, Nakum, Naranjo, and Arroyo Petexbatun areas are all seasonally inundated in wet years. All three savannas in the Parque Nacional Yaxha Nakum Naranjo have tasiste palm clusters, but they are widely scattered. So there is no tasistal in that park, and none yet documented for Tikal either. There are probably tasistal ecosystems in western Peten, eastern Peten, north-central and northwestern Peten, and northern Verapaz. Two of our plant scouts are taking notes in those areas.

For Izabal we have found scattered small clusters of *Acoelorrhaphe wrightii* trees. They are mostly physically along the shore of rivers, lagoons, or lakes. No tasistal exists within the parts of the Municipio de Livingston that we have explored so far (edges of El Golfete and mouth of Rio Sarstun and adjacent creeks. However we have not yet traversed the entire Rio Sarstún all the way to Puerto Mendez.



***Acoelorrhaphe wrightii* at Reserva Natural Tapon Creek**

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica.
March 12, 2020. Amatique Bay, Livingston, Izabal, Guatemala.
Camera: NIKON D810. Lens: Sigma 50mm Dg. Settings:
1/200, f/14, ISO 800.

Acoelorrhaphe wrightii trees were blooming in February and March along the shores of the lagunas, inlets, creeks and rivers around El Golfete area of Rio Dulce.

In Izabal the word *tasiste* is not known; local people call these *Acoelorrhaphe wrightii* palms *pimiento* or *pimientillo* or spelled with an a, *pimientilla*.



***Acoelorrhaphe wrightii* Izabal's shore**

Photography by: David Arrivillaga. FLAAR Mesoamerica. March 14, 2020. Izabal, Guatemala. Camera: NIKON D5. Lens: AF-S VR Micro-Nikkor 105mm G IF-ED. Settings: 1/250, f/9, ISO 800.

I use the spelling as *tasiste*; there are many reports that spell the local name *taciste*. *Te'* (so often with an accent) means tree; *che'* means tree in other Mayan languages. Would be interesting how local Maya differentiate between a palm and a tree, since in botanical science, a palm is not a tree. However in most botanists's lists of "trees of a particular area" palms are included. And in normal English you say "look at the nice palm trees over there." I follow the Mayan generic concept (*te'*= tree) though it would be helpful to learn the nuances of Mayan linguistic aspects. I could not find *taxis* or *tacis* in the several thousand page Yucatec Maya dictionary on my desk.

Hopefully from a Maya Itza speaker or Lacandon Maya speaker it could be possible to learn the literal translation of the *tasis* portion of *tasiste* palm tree word. David Bolles kindly sent me an impressive documentation of the correct translation: we will include his linguistic information in an appendix to our FLAAR botany report on *Acoelorrhaphe wrightii* palms of the Municipio de Livingston.



Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 12, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs.

Entire tasistal discovered; potentially never before documented

In October while visiting friends in the Sayaxche area of Peten we were taken to an area that they told us no botanist or ecologist (that they are aware of) has seen or knew about in the recent 40 years. So we first learned about and visited this remarkable ecosystem in October. Then in early December we spent 3 days studying this unexpected ecosystem up-close. Every Christmas I select a different part of Guatemala to visit:

- several times in past years in the comfortable Las Guacamayas Biological Research Station along the Rio San Pedro, with the helpful local guides showing us different ecosystems.
- several times in Monterrico to do field trips with Axel René Cuellar and the helpful CECON personnel
- several times to the ecosystems around Hotel Ecologico Posada Caribe to visit the family of Julian Mariona (who provided boats and services on our excursions to Arroyo Pucte and Rio la Pasion in the 1970's, 1980's, and 1990's, plus in recent years. Several Mayanists were along on one of these many excursions in the 1980's to learn about the *Nymphaea ampla* water lily flowers of Arroyo Pucte
- and Christmas trips other years to diverse other parts of Guatemala.



***Acoelorrhaphe wrightii* is visible at far left and middle to the right. The other trees are *Crescentia cujete* (another indicator of a seasonally inundated savanna). 2019 was an very dry year, even in May.**

Photography by: Maria Alejandra Gutierrez. FLAAR Mesoamerica. May 5, 2019. Savanna East of Nakum, Petén, Guatemala. Camera: NIKON D810. Lens: Nikon AF-S Micro 60mm G. Settings: 1/125, f/10, ISO 28

This year the FLAAR Mesoamerica Christmas field trip was again to the Arroyo Petexbatun area, where Julian Mariona helped us find lots of interesting biodiverse plant habitats.

We took over 500 photographs: macro photos of every flower we found; panorama photographs of every ecosystem. And normal photographs of each *Crescentia cujete* tree. Plus we photographed several of the pucte (*Bucida buceras*) trees which were around the edge (pucte you can find along many riversides and lakesides in Peten; but although pucte trees can be in the transition zone between a tinal and a savanna we would not expect many pucte trees out in the middle of a tasistal. We need to accomplish further plant mapping to learn whether pucte trees are inside or around the edges of normal tasiste-nance-jicara savannas in Parque Nacional Yaxha Nakum Naranjo.



Acoelorrhaphe wrightii
Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 12, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs.

We estimate about 1 million tasiste palm stems are in this one single Petexbatun area tasistal savanna (estimated 150 to 200 meters wide by 3 to 5 km long). The reason an area of this modest size has so many palms is because this genus and species of palm grows in thick clusters. Each root mass can have between 11 and 15 or more stems that each grow into an individual palm. In a tasistal each cluster is adjacent to the next cluster, resulting in often solid tasiste palm in many areas of a tasistal. But, in other kinds of savannas of Peten, the same palm clusters are much further apart.

In distinction, I estimate less than several hundred tasiste palms are in the seasonally inundated Savanna East of Nakum (that we discovered from aerial photos and then hiked 8 hours round trip to reach twice). This grassland savanna is almost one kilometer wide by two or three kilometers long in size. This is the largest savanna discovered so far in Parque Nacional Yaxha Nakum Naranjo (PNYNN). We sincerely appreciate the cooperation of the IDAEH + CONAP co-directors of this biodiverse national park to facilitate our focus on searching for previously undocumented plant habitats. There is no savanna inside or outside the Tikal National Park of this size.

The Savanna of 3 Fern Species I discovered from aerial photos west of Yaxha. With the assistance of IDAEH+CONAP and the friendly local military park guards, we hiked long distances to reach this biodiverse area twice. This previously unlisted and undocumented moist area has only a few dozen or so clusters of tasiste palm (*Acoelorrhaphe wrightii*, called palmetto palm in Belize and Florida). This is the smallest of the three PNYNN area savannas (but because it is the wettest of the three savannas (in one of the driest of recent years) has plants not present in any of the other savannas in addition to most of the plants of the Savanna East of Nakum).



Savanna of 3 Fern Species. The really permanently wet areas have no tasiste palm; you can see the standing water in this photo, even in one of the driest recent years (2019). But 50 meters away there are tasiste in areas that are seasonally inundated.

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. March 26, 2019. Nakum area, Petén, Guatemala. Camera: iPhone Xs pano mode.

In the Savanna adjacent to the west side of the Naranjo sector of Parque Nacional Yaxha Nakum Naranjo (showed to us by Archaeologist Vilma Fialko and Architect Raul Noriega and with Horacio Palacios as guide) we found at most a dozen or so tasiste palms (if we have the opportunity to study this savanna-cibal ecosystem again perhaps we can find at most a hundred tasiste palms).

So a “savanna with tasiste” and a “tasistal savanna” are two totally different ecosystem terms: again, potentially a MILLION tasiste palm stems in the one tasistal. All three open savannas of PNYNN have probably fewer than several hundred tasiste palms; the Savanna of 3 Fern Species may have less (we need two more field trips here to document all the species, especially in the rectangular area to the east of the main oval area).



Tasiste in clusters. *Crescentia kujete* to the left.

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. May 5, 2019. Savanna East of Nakum, PNYNN, Petén, Guatemala. Camera: iPhone Xs.

If funds become available we would like to physically measure and physically map each savanna. Our interest is to find and document plants in areas other than hilltop vegetation, other than hillside vegetation, and other than bajo tinto vegetation (since all these well known ecosystem types of Peten have been studied for decades). Two of the three savannas in PNYNN and the newly discovered tasistal savanna, have, to our knowledge, never previously been published. The Naranjo area flatland was published as part of the larger Bajo La Pita (nicely shown on a map in a report by Vilma Fialko). Our visit to this area adjacent to the ruins of Naranjo shows that the northern 20% has the bajo vegetation merging into a grassland savanna which then merges into a (not yet botanically defined area) of cibal plus a multitude of tree species which at the north morphs into a more pure cibal area which a few dozen meters further turns into a jimbál (spiny local native bamboo, *Guadua longifolia*). In other words the northern 20% is totally different than a traditional bajo or tinto of the southern 80%.

It can help archaeologists, ecologists, and other scholars to learn about each distinct kind of ecosystems that were near ancient Maya sites. If agriculture was probably very different 2000 years ago than the slash-and-burn milpa agriculture that is used throughout Mesoamerica today, then potentially the seasonally inundated savannas of Peten surely were utilized by the Classic Maya. This is another reason we are working on making lists of every single plant that is very happy growing in these seasonally inundated flatlands: especially plants that provide food or usable material from renewable natural resources.



Acoelorrhaphe wrightii
Photography by: David Arrivillaga. FLAAR Mesoamerica. December 2, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: SONY DSC-RX10M4.

Tasistal areas are near rivers but so far never physically adjacent to a river

The solitary tasiste palm trees in Izabal are physically adjacent to the shore. Literally, most are directly on the edge of the water (in March, a rainy month this year, 2020).

But neither the Tasistal Arroyo Petexbatun, nor the Tasistal Arroyo Faisan are anywhere near the edge of the river. Tasistal #1 is about 80 to 140 meters from the edge of Arroyo Petexbatun (rough estimate). Tasistal #2 is about 140 to 200 meters from the edge of Arroyo Faisan (rough estimate).



***Acoelorrhaphe wrightii* entire inflorescence is dried out and most seeds have already fallen off.**
Photography by: David Arrivillaga. FLAAR Mesoamerica. December 2, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: SONY DSC-RX10M4.

Of course there are other tasistal areas of Belize, Peten, and potentially northern Alta Verapaz that we have not yet had funding to facilitate our visiting and documenting these other tasistal areas. But with the cooperation and assistance of the Municipio of Livingston, boat transportation and local guides were provided on two field trips (February and March, 2020) to facilitate finding and photographing lots of tasiste palms along the creeks near Rio Sarstún and along the Rio Dulce and El Golfete (and all the lagoons to the immediate north and south of the main body of water of El Golfete).



Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth.
FLAAR Mesoamerica. December 4,
2019. Tasistal Arroyo Petexbatun,
Petén, Guatemala. Camera: iPhone Xs.

Not one single solitary other palm species is inside the tasistal

Along the shores of El Golfete, Livingston, Izabal, there are occasionally escoba palms (in the canyon of Rio Dulce). You can see lots of coconut palms and corozo palms. Occasionally a thorny species of *Bactris* palm. And along seasonally inundated shore areas of the rivers and lakes you get occasional clusters of tasiste palms. But within a tasistal, of thousands of clusters of tasiste palm, you do not get a single palm of any other species.



Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth.
FLAAR Mesoamerica. December 4,
2019. Tasistal Arroyo Petexbatun,
Petén, Guatemala. Camera: iPhone Xs.

Two possible reasons:

- The tasistal is burned almost every year. *Tasiste* has evolved deep strong roots and the plants themselves often survive the fires (or even when 90% of the trees are burned down, you get plenty of shoots rising from the roots). The other palm species probably lack the ability of *tasiste* to survive fire.
- The tasistal area is seasonally inundated. Not every year because some years are dry, such as 2018-2019. But in October 2019 there had been enough rain to make the tasistal surface wet (but no standing water). If it had continued to rain the Arroyo Petexbatun would have risen and flooded much and potentially all of the tasistal. It may be that most other palm species can't survive seasonal inundation.



***Acoelorrhaphe wrightii* burned earlier in the year; some died, others resprouted.**

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs.

The transition zones (between a tasistal and adjacent forest, or between a tasistal and the tinto ecosystem closer to the river) can occasionally have other palm species. We noticed one corozo palm in the transition zone but absolutely zero in the mero tasistal.

On the subject of palms that survive seasonal inundation, huiscoyol grows in clumps along the edges of rivers. We found about four huiscoyol palms but zero out in the middle of the tasistal: they were only on the west and north intermediate areas (where the tasistal morphs into the surrounding ecosystems). Of these “huiscoyol” palms only one had spines on the leaves. Thus I estimate that some were a less-spiny species (but all had the local common generic name huiscoyol).



***Acoelorrhaphe wrightii* and a grasshopper**

Photography by: David Arrivillaga. FLAAR Mesoamerica. December 2, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: SONY DSC-RX10M4.

How many other plants are “savanna indicators” besides tasiste, nance, and jicara?

Tasiste palm, nance fruit tree, and jicara calabash tree are, to me, the three most visible indicators of a seasonally inundated savanna of Peten and adjacent areas. Jicara, *Crescentia cujete*, are also found inside a tasistal. And I estimate nance will be found in a tasistal as well (but jicara is easier to spot). But what other plants are found in all seasonally inundated savannas of Peten? But let's start with the three trees which tell you that you are standing in a seasonally inundated savanna.



Crescentia cujete

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. June 13, 2019. Savanna East of Nakum, Parque Nacional Yaxha, Nakum, Naranjo. Camera: iPhone Xs pano mode.

A seasonally wet savanna is a savanna that usually has no pine and thus unlikely any oak. The only potential exception is the pine area about 3 km to the east of the NE corner of Parque Nacional Tikal Nakum Naranjo. If this also has tasiste palm this suggests it may be seasonally inundated. And yes, this pine area does have tasiste palm, but they use the synonym, and slight spelling error (no problem because plant names are in Latin and so you don't always note the spelling error).

Pinares: Corresponde a un pequeño rodal de aproximadamente 200 ha de pino (*Pinus caribaea*), localizado al noreste del Parque Nacional Tikal, fuera de sus límites. Está ubicado en una elevación de terreno rodeado por una amplia área de bajos dominados por tintal (*Haematoxylum campechianum*). Los pinos se encuentran asociados a la palma taciste (*Paurotis whrightii*), encino (*Quercus oleoides*), morro (*Crescentia cujete*) y zacate navajuela (MCD 2003). La altura de los árboles no supera los 20 m. Al igual que los encinales, los pinares de la RBM son probablemente remanentes de las formaciones de vegetación que una vez dominaron esta región de Petén, a la altura del último período glacial (CONAP 2001). (CONAP 2015: 52).

Acoelorrhaphe wrightii is the modern botanical name; *Paurotis wrightii* is the botanical spelling of the Genus species used in past years. Our bibliography will be in the upcoming .PDF edition of *Acoelorrhaphe wrightii* in the Municipio de Livingston, Izabal, as a FLAAR Report.

We have not yet done fieldwork in any of the Belize savannas because they are already well documented by other botanists (plus, there is so much in Peten, Alta Verapaz, and Izabal to keep our team busy). We have not yet done any research in the pine savannas around Poptun nor the savannas around La Libertad (since most of them have been damaged by being cleared for cattle ranches or for commercial farming). We prefer to work in savannas with no cultivation and no cattle.



Widely scattered but clusters of tasite palm in the large Savanna East of Nakum (several kilometers long, but the ecosystems change every 50 to 100 meters, depending on height of the soil and how much water is present or lacking in the dry season. In the wet months (of a wet year) most of the surface is under water.

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. June 4, 2019. Savanna East of Nakum, PNYNN, Petén, Guatemala. Camera: iPhone Xs pano mode.



Widely scattered tasiste palm, but always in clumps or clusters, in the large Savanna East of Nakum. *Crescentia cujete*, another indicator of a seasonally inundated savanna, is clearly visible, Nance trees are also present. But no pine, no oak, and we have not yet found any sandpaper leaf trees.

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. June 4, 2019. Savanna East of Nakum, PNYNN, Petén, Guatemala. Camera: iPhone Xs, pano mode.



So far we have found no chaparro at Yaxha, Nakum or Naranjo

Chaparro, sandpaper leaf tree, *Curatella americana*, is common in Pine savannas, such as on a hillside savanna we have documented several years ago overlooking Rabinal, Baja Verapaz). Nance is as common in the same dry chaparro savannas as nance is also common in wet tasiste savannas. We will check whether jicara or morro are present in chaparro-pine savannas. We do not expect any tasiste palm in a dry savanna (but there are other palms that have adapted to dry savannas). However no exception would surprise me (and we hope other botanists can find what plants besides tasiste, nance, and jicara are a savanna indicator). But for now, the presence of these three in the same area usually means you are in a savanna (keeping in mind that every savanna we have document in the last 8 months is slightly different from each other: one is filled with ferns, for example, of at least three species).

We thank archaeologist Vilma Fialko and architect Raul Noriega for teaching us about the flat ecosystem adjacent to Naranjo; we thank Horacio Palacios for guiding us there.

We thank IDAEH team at PNYNN (Jose Leonel Ziesse, director, and Lorena Lobos, park biologist; and Mario Vásquez, director of the CONAP team at PNYNN; and park ranger Teco (Moises Daniel Perez Diaz) for locating the trails to facilitate us reaching the Yaxha savanna and the Nakum savanna that I noticed on aerial maps.

We thank the photographers and botanists of FLAAR Mesoamerica for their library research, many weeks of field research. And checking the nice herbaria of USAC and UVG.



Curatella americana

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. November 5, 2015. Ranibal, Baja Verapaz, Guatemala. Camera: Nikon D8. Lens: Nikon AF-S NIKKOR 600mm FL ED VR. Settings: 1/250, f/13, ISO 400.

Several plants in the tasistal are edible

Nance is an edible fruit. Seeds of jicara are edible (and the calabash pods themselves can make drinking cups, musical instruments, etc.). Senaida Ba noted that the seed pod pulp of subin, bullhorn acacia, *Acacia cornigera* is edible. In future visits we look forward to finding additional plants which are edible and usable (to encourage local people to not burn down the tasistal every year).

But to make use of jicara and everything else, a training program is essential: training manuals especially. Funding would be appreciated for a viable program to help save the tasiste palms in every ecosystem in which they grow.



Nance

Photography by: Erick Flores. FLAAR Mesoamerica. April 19, 2018. Yaxha area, Petén, Guatemala.
Camera: Canon EOS-1D X Mark II. Lens: Canon EF 24-105mm L IS USM. Settings: 1/125, f/5, ISO 400.

Tasiste seeds are potentially edible

Seeds are the part of tasiste palm that are potentially edible. Access to these seeds could help chemists test them to find out potential health benefits.



December was rather late in the year for seeds, but we found a few seeds still on the inflorescences in one area of the tasistal. Here are some photographs.

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 5, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs.

Whereas the fresh stems of several palm, and of junco (kala) are edible, Teco says that an 86 year old Q'eqchi' but Peten chiclero told him that the stems of tasiste are not edible. *Carludovica palmate* has fronds that from far a way look just like a guano or tasiste palm; but *Carludovica palmate* (despite its name) is neither a palm nor even a relative. But its fresh stems are edible.



Tasiste Seeds are very helpful as food for local birds

Another reason to develop a program to protect the tasistal ecosystems is that the seeds of *Acoelorrhaphe wrightii* are helpful food for local birds (Teco, personal communication, 2020).



Tasistal seeds

Photography by: David Arrivillaga. FLAAR Mesoamerica. December 5, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: SONY DSC-RX10M4.

In transition zone from tasistal to tintal, lots of other plants: these grasses are but one example

It would help for a botanist or ecologist, or student (for a MS thesis or PhD dissertation) to list

- every plant in the middle of the tasistal
- every plant in the transition at the south (to the tintal)
- every plant in the transition to the west (to tintal but different ecosystem than southern area)
- every plant at northern transition (to flatland forest, corozo etc.)

In this set of pages we show several photographs of a tall “marshland” “wetlands” grass. But this is perhaps 100 or 150 meters from the Arroyo Petexbatun. However most of the tasistal, and the adjacent tintal, have standing water several centimeters in rainy months and in some years up to a meter high during the height of the rainy season.

Would really help to do drone aerial photography of the tasistal when it is flooded. But the water level varies by month and sometimes by week. In the Municipio de Livingston in the morning we had to wade chest deep to get across Tatin creek (the creek that feeds the water flowing into Cueva del Tigre). When we hiked back to Plan Grande Tatin three hours later the water level had dropped almost 1 meter.



At all edges of a tasistal there is a transition zone into neighboring vegetation, either high forest (at the north side) or tintal (at the east and south side).
Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs.



Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs.



Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs.



Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs.



In a seasonally inundated tasistal you also get areas of "marsh grass" as you can see here and in the following photographs.

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs pano mode.

Destructive fires burning down much more than just Amazon jungle

Local people set fire to most savannas throughout Central Peten once a year. Even the savannas within the Parque Nacional Yaxha Nakum Naranjo are occasionally destroyed by fire set by illegal entries (fortunately this year, 2019, the park was able to protect the savannas and no fires were set at least in any of the three savannas within PNYNN). It really helps when enthusiastic groups visit these savannas; intruders are not as likely to feel free to set fire to everything if there are research teams or tour groups, tour guides, and obviously if park rangers are patrolling these areas. If no one ever visits a savanna the local people feel it is abandoned and that thus they can hunt tapir, deer, and set fire to the savanna vegetation at the height of the dry season.

But the fire damage in previous years to the savanna adjacent to the west side of Naranjo is well documented. And the Savanna East of Nakum was also burned in past years. The tasistal savanna we were studying in October and December (far away from any national park) was incinerated earlier this year (before we learned of the presence of this awesome ecosystem).



Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs.



If there is a strong wind the fire burns through the tasistal quickly, incinerating the palm fronds and blackening all the palm trunks.

In a few instances the trunk can regenerate fronds later on (when it rains) but probably in 75% of these black trunks you can see the fronds are gone (which means this palm is dead).

All photos are with an iPhone Xs by Nicholas Hellmuth, in the Tasistal Petexbatun, visited with the permission of the finca administrator and property owner, lead by two helpful local guides.

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 5, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs.



Tasiste palm burned

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 5, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs.



Photography by: David Arrivillaga. FLAAR Mesoamerica. December 5, 2019. Tasital Arroyo Petexbatun, Petén, Guatemala. Camera: DJI.



Photography by: Maria Alejandra Gutierrez. FLAAR Mesoamerica. December 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: Canon EOS-1D X Mark II. Lens: Canon EF 100mm Macro USM. Settings: 1/3200, f/1.1, ISO 2500.

When did burning of savannas begin?

Occasional comments in articles that “the burning of savannas is recent” is highly unlikely because the tasiste palm is the only palm that grows inside a tasistal or inside the other three savannas that FLAAR Mesoamerica has documented. There are corozo palm, guano palm, and occasional huiscoyol palm in forests near and even surrounding most savannas. But, literally, zero of these common palms are inside any of the now four savannas that we have hiked through (three in PNYNN and a new tasistal savanna that far to the southwest and is nowhere (that we yet know of) previously listed or documented).

Tasistal palm root systems are able to send up fresh shoots when it starts to rain after the fire of the earlier dry season. I highly doubt a plant would develop this ability only in recent years. If there was tasiste palm 2000 years ago it most likely was already able to survive fires.

We are working to document the destruction so we can learn what needs to be protected. We are working to find and identify each plant to ascertain which plants are edible, which plants have potential medicinal benefits (all species of saw palmetto are considered potentially helpful for prostate health, a topic we have begun to work on together with experienced medicinal plant professor Armando Caceres).



Acoelorrhaphe wrightii

Photography by: David Arrivillaga.
FLAAR Mesoamerica. December 2,
2019. Tasistal Arroyo Petexbatun, Petén,
Guatemala. Camera: SONY DSC-
RX10M4.



Tasiste palm burned

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 5, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs.

Additional Research would be helpful: How were these savannas used by the Classic Maya?

It would help if ecologists could do scientific analysis here to figure out how the Classic Maya used these flatlands. The obvious questions are: were these areas savannas during the Classic Maya period? And how were these flatlands used by the Classic Maya? As soon as LIDAR is available for the Yaxha, Nakum, Naranjo areas of Peten it should be possible to see to what degree the Classic Maya may have modified parts of at least the progression of bajo-into-savanna-into-cibal-into-jimbal adjacent to Naranjo. For example, Aguada Maya (near Poza Maya three or four kilometers north of Yaxha) is clearly a modified seasonally inundated area, but its modifications by the Classic Maya are obvious: including the fact that it is a rectangle.

But we doubt either of the two tasistal areas of Petexbatun were modified. Nonetheless, it would be worth studying via LiDAR.



Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs

Since the two tasistal areas that we have found so far in the Petexbatun wetlands area have encouraged me to ask around and learn where other tasistal areas can easily be found. The immediate answer was that additional areas of massive density of tasiste palm have been seen by other individuals (but never fully documented).

So, if there are more of these ecosystems, this is all the more important to learn how the Classic Maya utilized this kind of terrain. This would be for capable geologists, soil specialists, ecologists, and archaeologists. Our focus is finding and documenting the location of each tasistal and then making this information available to colleagues.

If you are coming to Guatemala to see waterbirds, Maya archaeology, then be sure to add one extra day to your time in the Petexbatun wetlands and have Julian or members of his family or his colleagues take you across the river to allow you to experience this frankly remarkable “palm rain forest.”

**Tasiste palm**

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. June 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs.

Additional Research to find all the other tasistal ecosystems

I estimate there are 3 to 7 more tasistal ecosystems in Peten and potentially 1 to 3 in northern Alta Verapaz.

There is a Campamento Tasistal in Campeche (near Tabasco) (https://satellites.pro/El_Tasistal_map#18.283500,-91.934000,11) and lots of wetlands in Tabasco and adjacent Campeche.

There are places with local name “Tasistal” or campamento “El Tasistal” in Quintana Roo (Pérez 2014: 207). So hopefully botanical colleagues in Quintana Roo and adjacent areas of the Peninsula of Yucatan can document all the tasiste or tasistal areas that are there. Our focus is on Guatemala.



Acoelorrhophe wrightii

Photography by: Nicholas Hellmuth.
FLAAR Mesoamerica. December 4,
2019. Tasistal Arroyo Petexbatun, Petén,
Guatemala. Camera: iPhone Xs

Summary of our savanna ecosystem research for 2018-2019

During 2019 we found Tasiste palm, nance fruit trees, and Crescentia cujete calabash trees in the three savannas of Parque Nacional Yaxha, Nakum, Naranjo:

- one was a seasonally inundated grassland “Savanna East of Nakum”;
- the other was a “Savanna of 3 Fern Species” (west of Yaxha; parts were a bog surrounded by a narrow swamp with aquatic shore orchids); a rectangular eastern extension we have not yet photographed because it takes 5 to 6 hours just to hike back and forth (including several steep hills and at the end a steep ravine (the bog and an adjacent Laguna Perdida are on the top of a hill, far above the level of Laguna Lankaja and Lake Yaxha));
- the third was the only grassland previously mentioned in the literature: parallel to Naranjo (a mixture of bajo-tintal vegetation turning into a savanna vegetation which a hundred meters further on turned into a cibal sawgrass habitat which then merges into a thorny bamboo habitat, locally named a jimbal).

In all of these three seasonally inundated grassland savannas the tasiste palms are one clump every 20 to 40 meters (so a normal savanna). Tasiste palms tend to grow in clusters (you do not often get one single tasiste all by itself). In a normal savanna each tasiste palm cluster is separated from other tasiste clumps by open grassland.

In distinction, a tasistal has palm clusters so near each other you can often not walk forward at all. We literally estimate that potentially as many as one million (or more) tasiste stems are in this one single Tasistal Arroyo Petexbatun.

To document the thickness of growth, I conclude this report of FLAAR Mesoamerica with panorama photographs of the southeast portion of this tasistal.



Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs



These two photographs show only a fraction of what you see when you try to hike into the tasistal. In many areas you simply can't enter because the palms are so thick. Their saw-like fronds and row of "barbed hooks" don't help either.

Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs



Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs



Would help to record this tasistal every two months for an entire year. Since different plants are flowering every two months.

Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs

So with the two tasistals we have found so far, with three grassland savanna areas in PNYNN with tasiste trees, and with our documentation of tasiste palm trees flowering on river banks in the Municipio de Livingston we have gathered quite a lot of helpful information (which is in a series of five reports, of which this is the first).

Our helpful plant scouts have notified us of multiple additional massive tasiste ecosystems that have not been documented with panorama views nor helpful photography. So if helpful funding is available, we can visit these other tasistal “jungles” and then we will have a level of photographs and information to create a substantial coffee table book. This is one way to raise public awareness for the need to protect these fragile ecosystems.



Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs

Appendix A

Our December Schedule for exploring Tasistal #1 Tasistal Arroyo Petexbatun, Municipio Sayaxche, Peten

On Monday, December 2, 2019 we arrived at the hotel Paso Caribe in time to have a nice almuerzo. It is considered appropriate to provide a minimum of an entire hour to your staff for lunch time, so we rested for 30 minutes after the meal.

We then sorted through the camera equipment to decide what to bring for several hours of inspecting the tasistal. Tomorrow would be an entire day in the several kilometer length of the tasistal, so today was just to check for what equipment we would need for the full day. For example we do not need a 300mm, 400mm, 600mm, or 800mm prime lens; there are no birds notable in the tasistal and only a few tall trees (and none need a multi-ton lens, gimbal tripod head, and sturdy Gitzo tripod). I decided for these two hours to use only my iPhone Xs, since I needed to accomplish dozens of panorama views. To use a DSLR camera for pano would require the nice Manfrotto head and a sturdy tripod; this we can do tomorrow.

Julian, our host and guide, told us there were several trails. He suggested which trails he recommended. So with Senaida and Norma, both capable assistants, we hiked the trails.

We still do not know the length of the tasistal but all of us estimate several kilometers. And we still need to measure the width of the tasistal, but I estimate it is between 120 and 240 meters wide. We can measure it from any of the maps of IGN.

The tasiste trees are packed solid the entire kilometer distance we hiked.

There are lots and lots of nance, of at least three different kinds: red fruit nance, yellow fruit nance and another nance. The most common nance was the common tree nance. None of the nance or tasiste had flowers.

There are *Crescentia cujete* trees about every 20 to 50 meters. But they seem less common than nance and other trees. But the reality check is that the *Crescentia cujete* trees are easy to see, even when young shrub-size. But my brain still can't immediately register a nance tree.

Dec 3, 2019 we returned in the morning, this time with an additional local guide. He took us further along the road that crossed the west end of the tasistal. This road goes all the way to the cattle pasture. Here we turned right and hiked to a 4WD track that led back into the tasistal. The area where the forest gradually changes to a tasistal has varied trees: some has local forest but a few tasiste palm (but 20 to 50 meters outside the mero tasistal). Once you get closer to the tasistal you still get a variety of forest species, such as pucte.

We found an area of about 40 m by 30 m of 4-petalled yellow flowers (probably *Ludwigia* species). This plant is common where a lot of surface water is available. But since this year was not very wet I was surprised to see so many in full bloom. This was an area within the pure tasistal.



Ludwigia

Photography by: David Arrivillaga. FLAAR Mesoamerica. December 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: NIKON D5. Lens: AF-S VR Micro-Nikkor 105mm G IF-ED. Settings: 1/500, f/13, ISO 500.



***Ludwigia* with a bee.**

Photography by: David Arrivillaga. FLAAR Mesoamerica. December 5, 2019. Arroyo Petexbatun, Petén, Guatemala. Camera: SONY DSC-RX10M4.

Appendix B

Suggested Photography Equipment for Botanical and Ecological Research Photography

A Phase One XT would be the single best camera for high-resolution photography. We rather obviously do not have funds to obtain this camera. I have been at the Phase One headquarters over 15 years ago and have tested Phase One, Kodak, Leaf, and Hasselblad digital backs. Today (and for the recent several years), Phase One is by far the most sophisticated. Their Schneider and Rodenstock lenses are outstanding. And Phase One makes their own software (Capture One, which is more functional for high-resolution images than Adobe Photoshop).

The benefit of doing photography with a camera of 100MP or 150MP is that then you can study each plant in the photograph: you can see the detail of every leaf (of the plants other than the taste palm). I can remember using a Phase One P25+ with antiquated Hasselblad lenses (Made by Zeiss, but



Using Soft box

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. March 12, 2020. Livingston, Izabal, Guatemala. Camera: Google Pixel 3 XL



Taking photos of the vegetation along Rio Dulce Canyon, Municipio de Livingston, Izabal, Guatemala. It helps to have telephoto lenses to photograph trees.

Photography by: Juan Pablo Fumigalli. FLAAR Mesoamerica. Camera: Google Pixel 3XL.

not yet engineered for digital sensors). But the photos from this 25 megapixel camera 15 years ago literally blow away any 25 megapixel Nikon or Canon camera today. So imagine what a 100MP or 150MP Phase One XT camera could accomplish today.

In the meantime, we use Nikon D810 and Nikon D5 and Canon EOS 1D X Mark II cameras with a wide assortment of lenses. There are several capable photographers at FLAAR Mesoamerica so on a field trip we each have a separate camera.

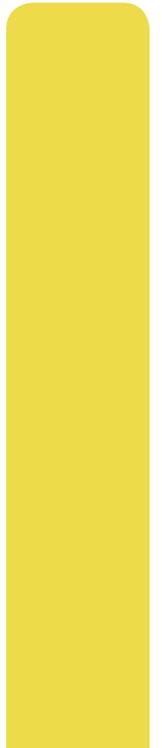
For our March 2020 field work recording Neotropical rain forest flora and fauna in Municipio de Livingston we are trying out the recent model Sony a7R IV and newest model Sony a9.

But when you need to hike many kilometers each day, we are learning that you can accomplish more if you have an iPhone Xs and a Google Pixel 3XL. We now use these in Izabal. Back in December 2019 I had the iPhone Xs. It is great for panorama mode; great for photographs of ecosystems. But the Google Pixel 3XL is better for close-up photos (neither does 1:1 macro adequately, for that you need the Nikon, Canon, or Sony with 1:1 macro lenses, or Canon with 5x macro lens).



***Acoelorrhaphe wrightii* in tasital**

Photography by: Juan Pablo Fumigalli,. FLAAR Mesoamerica. December 4, 2019. Tasital Arroyo Petexbatun, Petén, Guatemala. Camera:Google Pixel 3XL.





Acoelorrhaphe wrightii

Photography by: Nicholas Hellmuth. FLAAR Mesoamerica. December 4, 2019. Tasistal Arroyo Petexbatun, Petén, Guatemala. Camera: iPhone Xs.

We used Hasselblad and Leica cameras in the 1960's through 1990's (and 4x5" and 8x10" Linhof also). Today we have top of the line Nikon, top of the line Canon, and 61MP top of the line Sony cameras. But an iPhone Xs is actually more efficient when you are hiking through a dense thicket of solid stems of tasiste palms.

Yes, it would help if a foundation or individual could donate funds so we can have access to a Phase One XF 100MP medium format camera. I have been to the Phase One headquarters (in Denmark, decades ago) and have tested their earlier cameras; plus cameras of Leaf). But until we have a Phase One XF camera available, we use Nikon D5, Canon EOS 1D X Mark II, and Sony alpha Aa7R IV cameras, plus iPhone Xs and Google Pixel 3XL.

The photo you see on this page was taken with an iPhone Xs. But if you wish to do a photo exhibit, and show these palms, literally, at life size, that you can do easily with a digital image from the Phase One. You can't enlarge a smart phone photo to life size for a photo exhibit (but for these FLAAR reports, the iPhone Xs is great and I estimate the iPhone 11 would also be nice (though we do not have one).

