



# **Biotopo “Laguna del Tigre-Río Escondido”**

## **Plants, Birds & Unexpected Ecosystems**

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FLAAR Reports, 2023



## FLAAR Reports Series: Edible Fruits, Trees Native to Guatemala and surrounding Mesoamérica

### Part I: Trees that Fruit “all year long” every year

As part of our long-term research and field work project to find, photograph, document, and publish the edible wild plants of the Mayan areas of Mesoamérica, we are now putting the publications into series. A major series is “Edible Wild Plants of Wetlands of the Maya Lowlands: Food from Swamps, Marshes, and shores of rivers, lakes, lagoons, and aguadas”. For the eastern part of Izabal, Guatemala we have over 20 reports on edible wild plants of those wetlands. Now we are preparing a similar series for edible plants of the wetlands of the Reserva de la Biosfera Maya (RBM), Petén, Guatemala. Two of the initial reports of this series will be one on Tasiste palm (has edible seeds and edible inside of the stem). Second will be on calabash tree, *Crescentia cujete*, since both these plants grow in seasonally inundated savanna areas or near the edges of rivers that flood adjacent areas during the rainy season.

A second series, that we initiate now is “Edible Fruits that Fruit all year long every year for decades.” This series will include lots of trees; we start our list with the obvious ones, and initiate this series with *Parmentiera aculeata*, Cuajilote, since this tree has fruited ALL YEAR LONG and the fruit is edible and nutritious. *Theobroma cacao* fruits much of the year. Based on the variety

and local climate there may be a few months it does not fruit but usually there are fruits up and down the trunk and limbs most of the year.

Mamey Zapote, *Pouteria sapota*, fruits much of the year. This tree can grow to impressive size and thus produce LOTS of tasty edible healthy fruits most months of the year.

Zapote bobo, Zapoton, *Pachira aquatica* fruits much of the year. These fruits are GIGANTIC (the largest wild native fruits of all Mesoamérica). You can make a cacao-like drink from the seeds.

Lots more to come, but let’s start with *Parmentiera aculeata*, Cuajilote, since we see this tree on almost every field trip as we drive to Petén.



#### FRONT COVER PHOTOGRAPH

Photo by: Haniel López, FLAAR Mesoamerica, Feb. 28, 2023.  
Camera: Drone Mavic 3.



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Underwater documentation is crucial since the Surface of the Underwaterworld was a major aspect in Classic Maya concepts of their universe. The Rio San Pedro and its tributaries is a great place to do underwater photography of flora, fauna and the ecology underwater. So it helps that FLAAR has underwater cameras and photographers that like to do photography underwater, as shown here in this photography by: David Arrivillaga, Petén, June 25, 2021. Camera: Sony Alpha A9 II. Settings: 1/320; sec; f/5,6; ISO 2,500.

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## Introduction to the Rio Escondido Field Trip of Feb. 28, 2023

In January 2023 biologist Mirtha Cano, coordinator of Biotopo Rio Escondido, carried out the effort with FLAAR Mesoamerica to document the biological diversity and ecosystems of Río Escondido, since this had not been done before. CECON and FLAAR Mesoamérica team went on a three-day field trip to do the documentation. Professional cameras Sony A1 and Nikon D810 were used, in addition to the Mavic 3 drone for aerial shots. The tours in Río San Pedro and Río Escondido were possible with the support of the CECON team.

Our team has a professional photographer with a registered license to use the drone, in this way it was possible to get lots of helpful digital images of good resolution. These ecosystems have been subject to constant changes caused by human activities like fires, which has caused the fragmentation and decline of the forest. Documentation in this area had not been done before and for the same reason the efforts to protect it have not been as significant. Through this documentation it will be possible to disseminate the importance of this place and information about the species and ecosystems existing in the Biopoto Río Escondido.

We show in this FLAAR Report dozens of photos of each aspect of the plants on both sides of Rio Escondido that intrigued and inspired us to take photos. We make the pages horizontal (and wider than normal) so you can see more detail in the aerial photos at this size and format. There is so much here to study that obviously future return field trips would be helpful. We will work in our office during March, April and May to have separate FLAAR Reports on:

- *Rhizophora mangle*, red mangrove tree area along Rio San Pedro near the Petén-Tabasco area
- *Acoelorrhaphe wrightii*, Tasiste palm along the Rio San Pedro – It is a threatened species, typical of these ecosystems
- *Crescentia cujete*, Calabash Tree, along Rio San Pedro
- *Nymphaea ampla*, water lily, along Rio San Pedro
- Underwater plants photographed underwater by David Arrivillaga
- Barba de Viejo hanging from trees along the Rio San Pedro
- Arroyo La Icoatea (tributary on south side of Rio San Pedro, east of town of Naranjo)
- Rio La Profundidad or better written Arroyo La Profundidad
- Rio San Pedro, Mud Marshes and other Marshes
- Cenote adjacent to south side of Rio San Pedro
- Two areas of Rio San Pedro, east of Naranjo, with “rapids” over unexpected geology

To show you the location of Río Escondido our GPS data team prepared the initial GPS map that we show below. This is by Byron Pacay. It is essential when working on any project to have a GPS map to show where you are every hour of every day. We use a portable Garmin GPSMAP 66sr unit.

### Our field trip team consists of:

- Vivi Hurtado, project manager and field trip coordinator.
- David Arrivillaga, photographer.
- Edwin Solares, photographer.
- Haniel Lopez, experienced drone pilot and aerial photographer.
- Byron Pacay, in charge of equipment packing, GPS mapping with our Garmin GPSMAP 66sr and photography assistant in the field.
- Nicholas Hellmuth, handles concepts, what aspects are to be focused on, photography, and authors field trip reports
- Norma Cho Cu prepares material in the office that needs to be taken on the field trip.
- Sergio Jerez prepares special satellite maps from higher quality sources.

The San Pedro River has a length of 180 km. It runs through the municipalities of San Andrés and La Libertad, both located in the department of Petén. Its journey continues until it reaches Tabasco in Mexico where it acquires the name of the San Pedro Mártir River, later it joins the Usumacinta River. To reach The Biotopo “Laguna del Tigre -Río Escondido” you need to navigate the San Pedro River until you find a narrow entrance, that explains why its name makes reference that it is “hidden”. The Biotopo is part of an area in the northwest part of Parque Nacional Laguna del Tigre (PNLT). The Biotopo Laguna del Tigre - Río Escondido has several names:

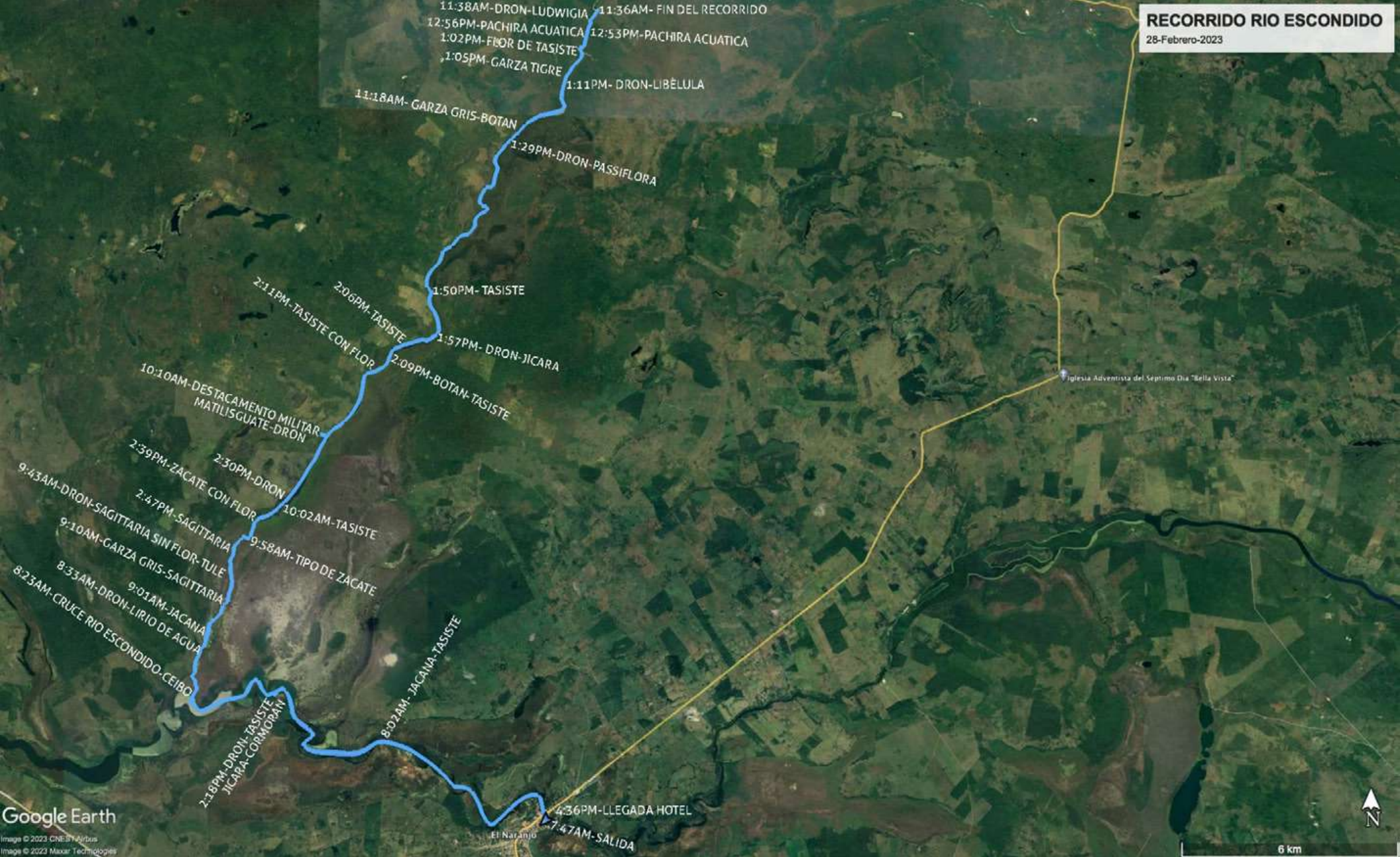
- Biotopo Laguna del Tigre
- Biotopo Laguna del Tigre - Río Escondido
- Biotopo Protegido Laguna del Tigre Río Escondido.

The natural wealth recorded in this area is unmatched. Its banks are full of water lillies, there is also a variety of grasslands and palms and a variety of birds take flight on its surface, some such as: white heron (*Ardea alba*), tiger heron (*Tigrisoma mexicanum*), snail hawk (*Rostrhamus sociabilis*). and malache (*Phalacrocorax brasilianus*)

Half the photos that I see of it show the part of the Rio San Pedro that you see from the tower behind the Estación Biológica Las Guacamayas (which is in PNLT but nowhere near the Rio Escondido). In other words, most reports on the Biotopo Laguna del Tigre - Río Escondido do not show the Rio Escondido whatsoever (because it’s a bit remote and not many people have made the effort, time, and expense to reach the Rio Escondido).

The present FLAAR Report is to show what we saw; our goal is not a full park report (those already exist). What is missing are aerial photos of the Rio Escondido and the marshes on both sides.

On the next page we show the GPS map by Byron Pacay for the Río Escondido portion of our field trip on Feb. 28, 2023.



Most of the fruits are visible on the trunk; but the limbs also have fruits directly from the limb. *Parmentiera aculeata*, Cuajilote tree, aldea of Canaan, alongside Highway AV9. July 11, 2019.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica.  
 Camera: Nikon D810. Settings: 1/250; sec; f/9; ISO 640

## Full Botanical Name

Ironically the first time I was doing field work in the Rio San Pedro downstream from the town of Naranjo was so many years ago I will have to search for the date. This trip was with biologist Mirtha Cano. She was the biologist at FLAAR in those years. I had water lily plants and flowers as a major aspect of my PhD dissertation of the 1980's (published in English and German in 1987). The topic was iconography of flora and fauna associated with the cosmology of the Classic Maya. After getting into the water lily iconography of the 5th to 9th century Classic Maya, in subsequent years I explored the water lilies of the Arroyo Pucte. This is one of the few places in Guatemala where the river water is so pristine clear that the water lilies grow from one to two meters under water. But, that is too deep for them to "rise to the surface and bloom above water." So in the Arroyo Pucte many of the lilies that grow from the deep parts still get sun far underwater (because the water is crystal clear).

So we did multiple field trips to Arroyo Pucte in late 1980's and then we even would set up a camp of tents and stay many days to explore this unexpected aspect of the flowers blooming underwater. Normally

the flowers that you see underwater are withdrawing underwater to wilt and turn into seed pods underwater. But water lilies budding and opening the buds almost a meter underwater was unknown and thus "not allowed" in botanical descriptions. But we did so much underwater photography that we showed the buds and flowers opening underwater. And we explained how this was possible in this totally unique river (totally clear water so the tropical sun reaches all the way several meters down).

Next step was to understand the different parts of the water lily flower and seed pod. This is where biologist Mirtha Cano helped me in the Rio San Pedro.

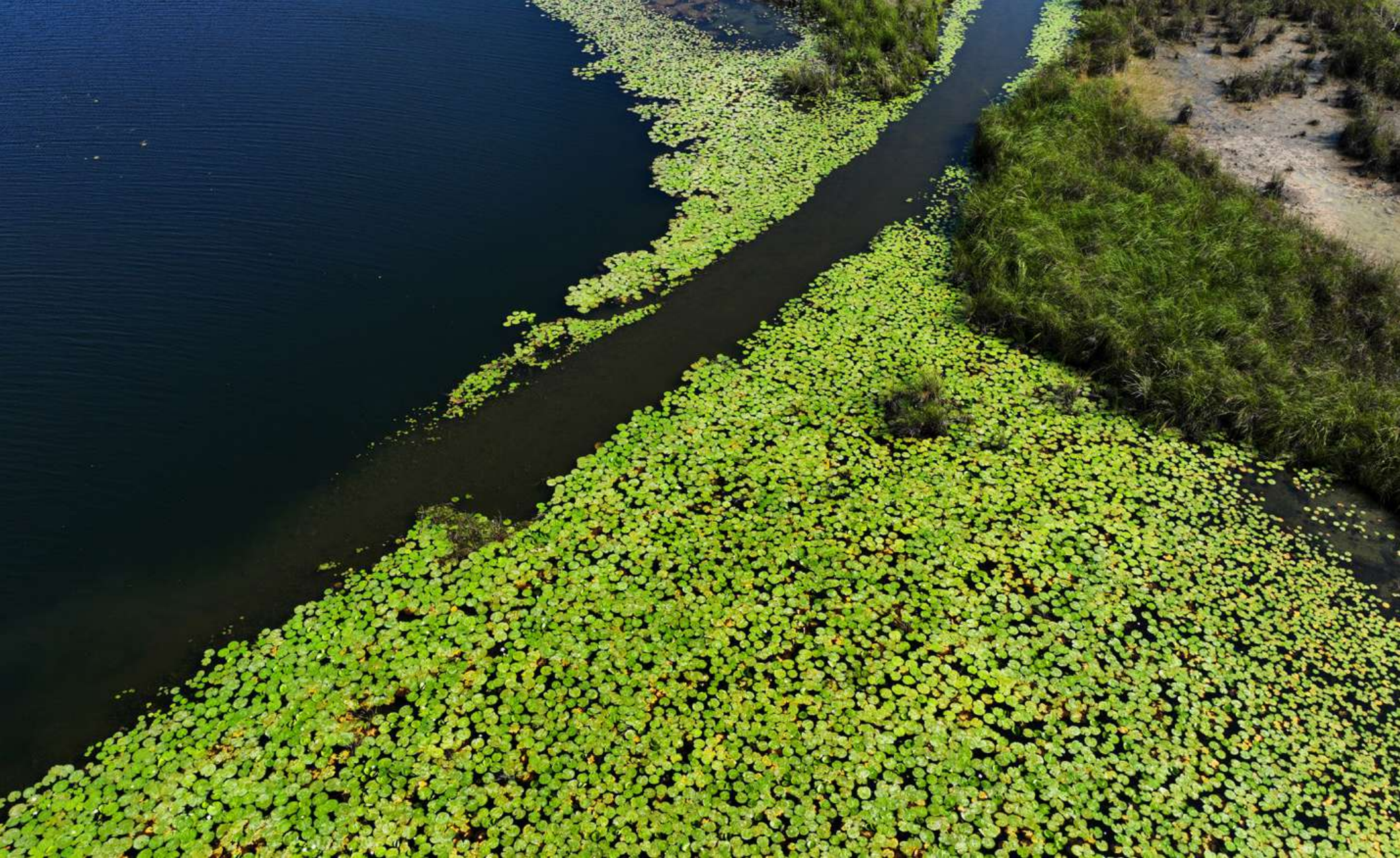


This is where biologist Mirtha Cano helped me in the Rio San Pedro. We knew one of the families who owned property along the river due to meeting her while filming two episodes of a TV documentary on plants of Guatemala (Sabor de Mi Tierra). She said there were thousands of water lilies along the Rio San Pedro near their property, so we drove to Naranjo and took a boat (over a decade ago). This is when and where we took the seed pods apart and studied them in more detail than I had done decades before in Arroyo Pucte (a tributary of Rio la Pasion not far from Sayaxche, Peten). So iconic that both our field trips to Rio San Pedro area are associated with experienced biologist Mirtha Cano.

Another reason why we are focused on photographing and publishing these photos of water lilies is to assist iconographers, epigraphers and archaeologists who are studying Maya water ecosystems and water symbolis



The water lily flowers begin to open in the morning. Bee pollinators arrive even before the flowers are completely open. The dark aspect on the flower is the buzzing bee. Photo by Nicholas Hellmuth, Feb. 28, 2023, 9:02am with Nikkor 200mm lens on Nikon D810 camera.



This solid mass of water lily pads is typical in an environment that makes these *Nymphaea alba* water plants happy (mud not far from the surface and sun all day from early morning on). This is the entrance where Río Escondido flows into the north side of Río San Pedro. You can see this on the GPS map, and in Appendix A we show much clearer satellite images from other sources.



Now you can see the "mud flats" that are common along Río San Pedro and common along Río Escondido. We show the mud areas in later chapters within this FLAAR Report on Río Escondido shore biodiversity. At the far upper right another stream is entering Río San Pedro. In this area three streams enter Río San Pedro; Río Escondido is on the east of these three.

Aerial photo by Haniel López with FLAAR drone Mavic 3. Feb. 28, 2023, 9:19 am.

In some places there is a forest of trees to the edge of the Río Escondido.

In other places there is a few meters of marsh then the forest starts.

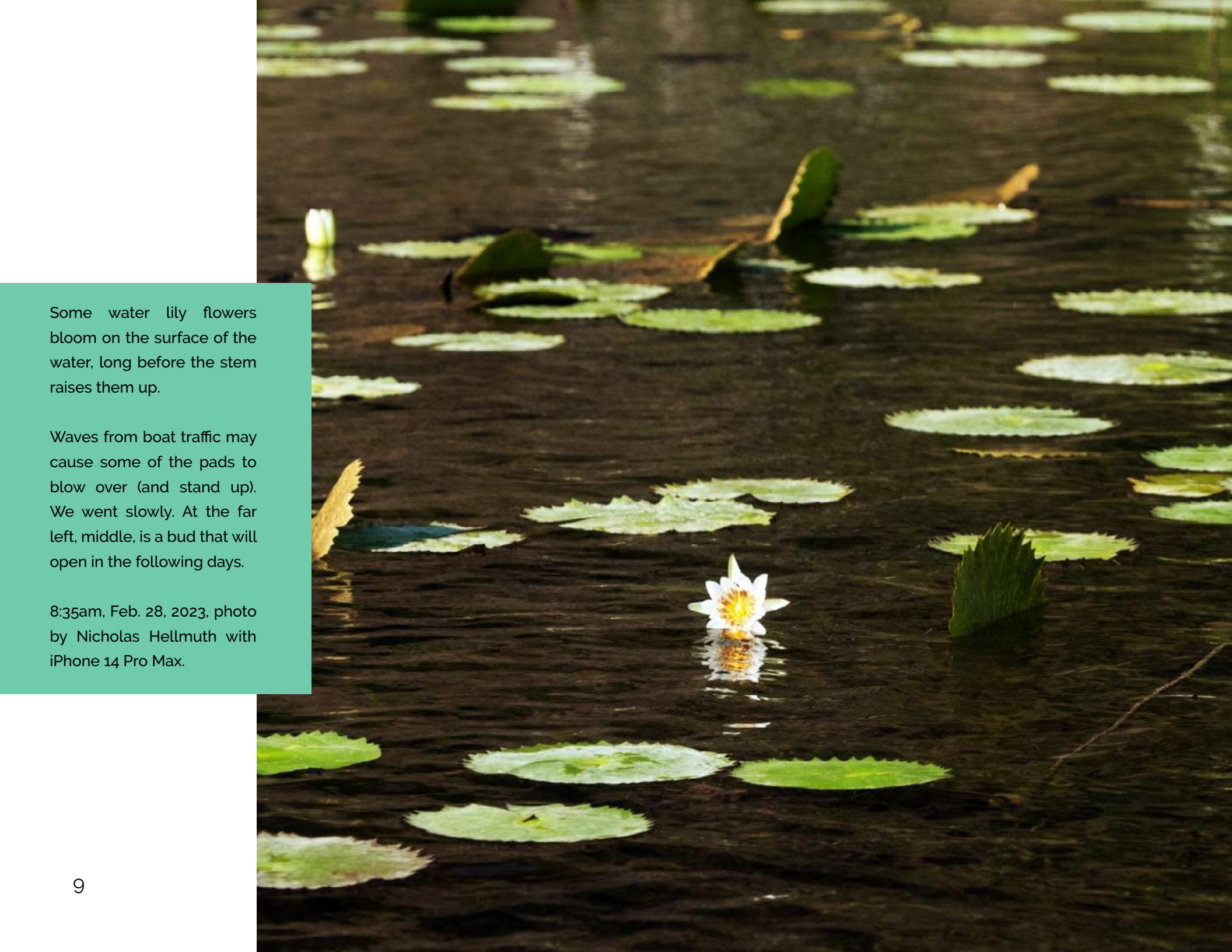
In more areas there is solid marsh (reeds-sedges-grasses marsh or mud marsh) with no trees until the hills begin.

The water is sometimes clear enough so you can see the mud at the bottom of this part of the Río Escondido.

8:32am, Feb. 28, 2023,

Photo by Nicholas Hellmuth with iPhone 14 Pro Max.





Some water lily flowers bloom on the surface of the water, long before the stem raises them up.

Waves from boat traffic may cause some of the pads to blow over (and stand up). We went slowly. At the far left, middle, is a bud that will open in the following days.

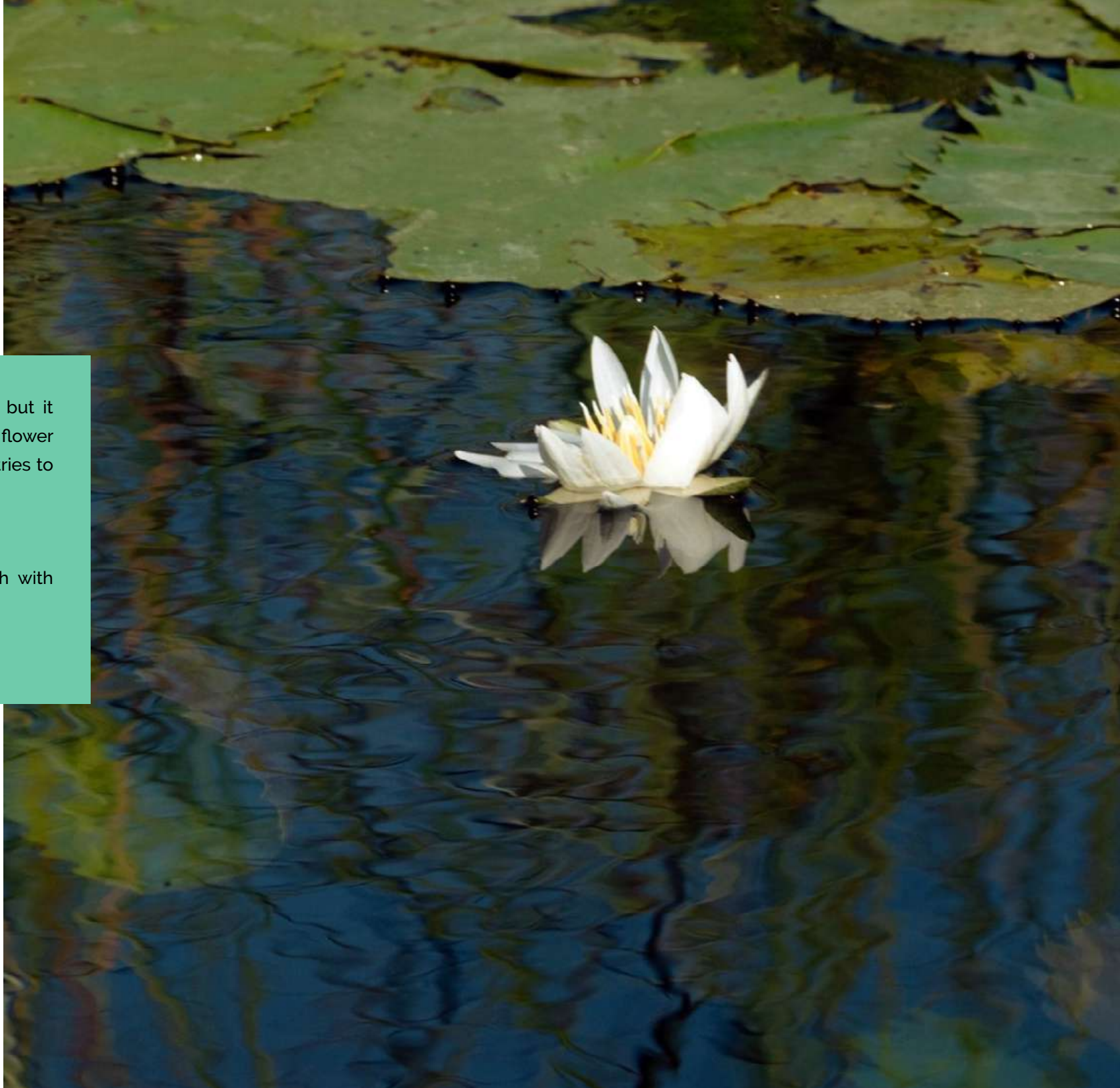
8:35am, Feb. 28, 2023, photo by Nicholas Hellmuth with iPhone 14 Pro Max.



This flower has a long stem, but it did not rise straight up. The flower is partially submerged as it tries to open.

8:43am, Feb. 28, 2023,  
Photo by Nicholas Hellmuth with  
iPhone 14 Pro Max.

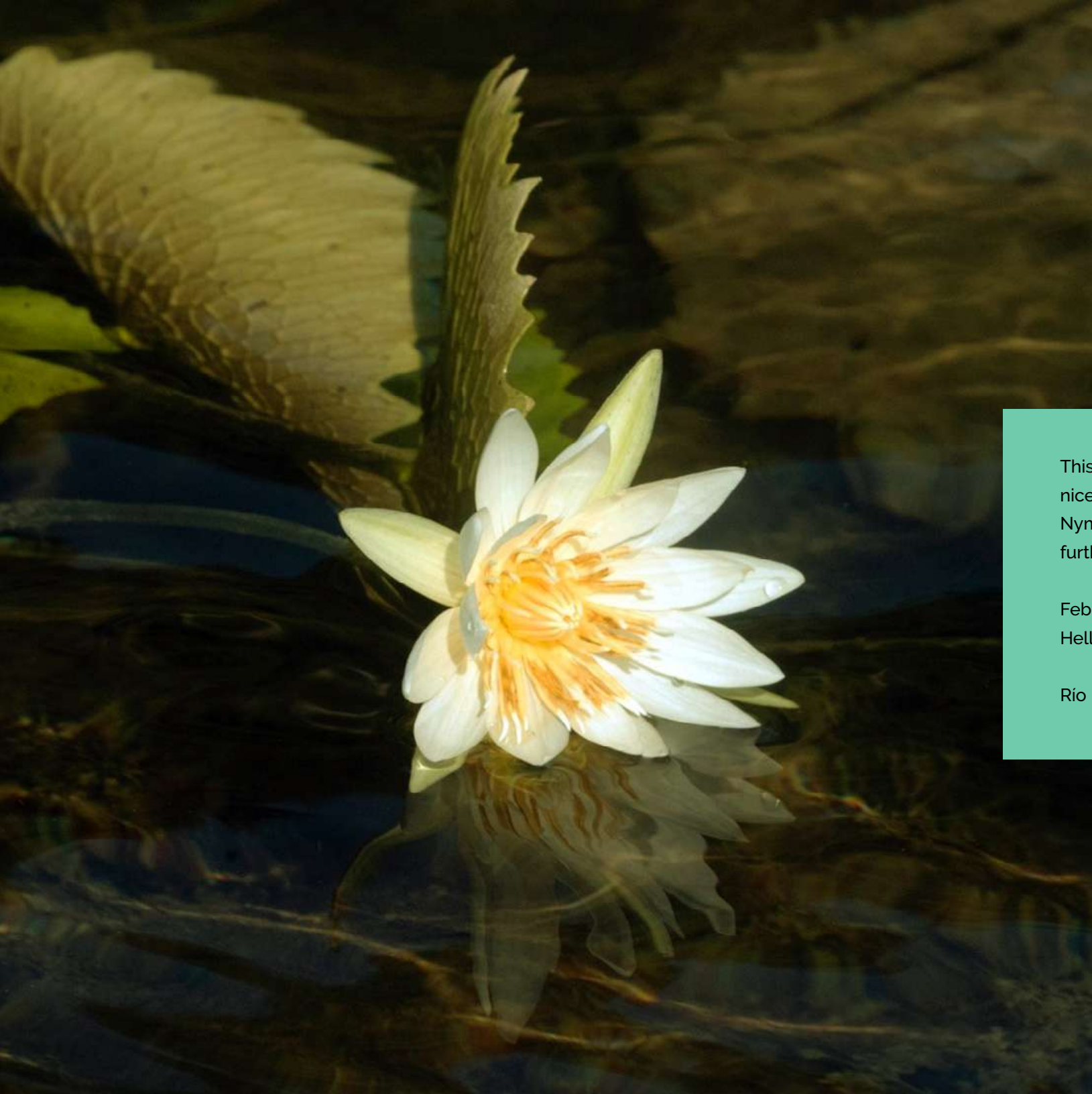
Río Escondido



Another flower has a stem, but it did not rise straight up. The flower is partially submerged as it tries to open.

9:01am, Feb. 28, 2023,  
Photo by Nicholas Hellmuth with  
iPhone 14 Pro Max.

Río Escondido.



This flower has just opened, so a nice view into a freshly opening *Nymphaea ampla* flower. It will open further since it is only 8:43am.

Feb. 28, 2023, photo by Nicholas Hellmuth with iPhone 14 Pro Max.

Río Escondido.



By 9:01am the bees are  
already actively at work.

Feb. 28, 2023, photo by  
Nicholas Hellmuth with  
iPhone 14 Pro Max.

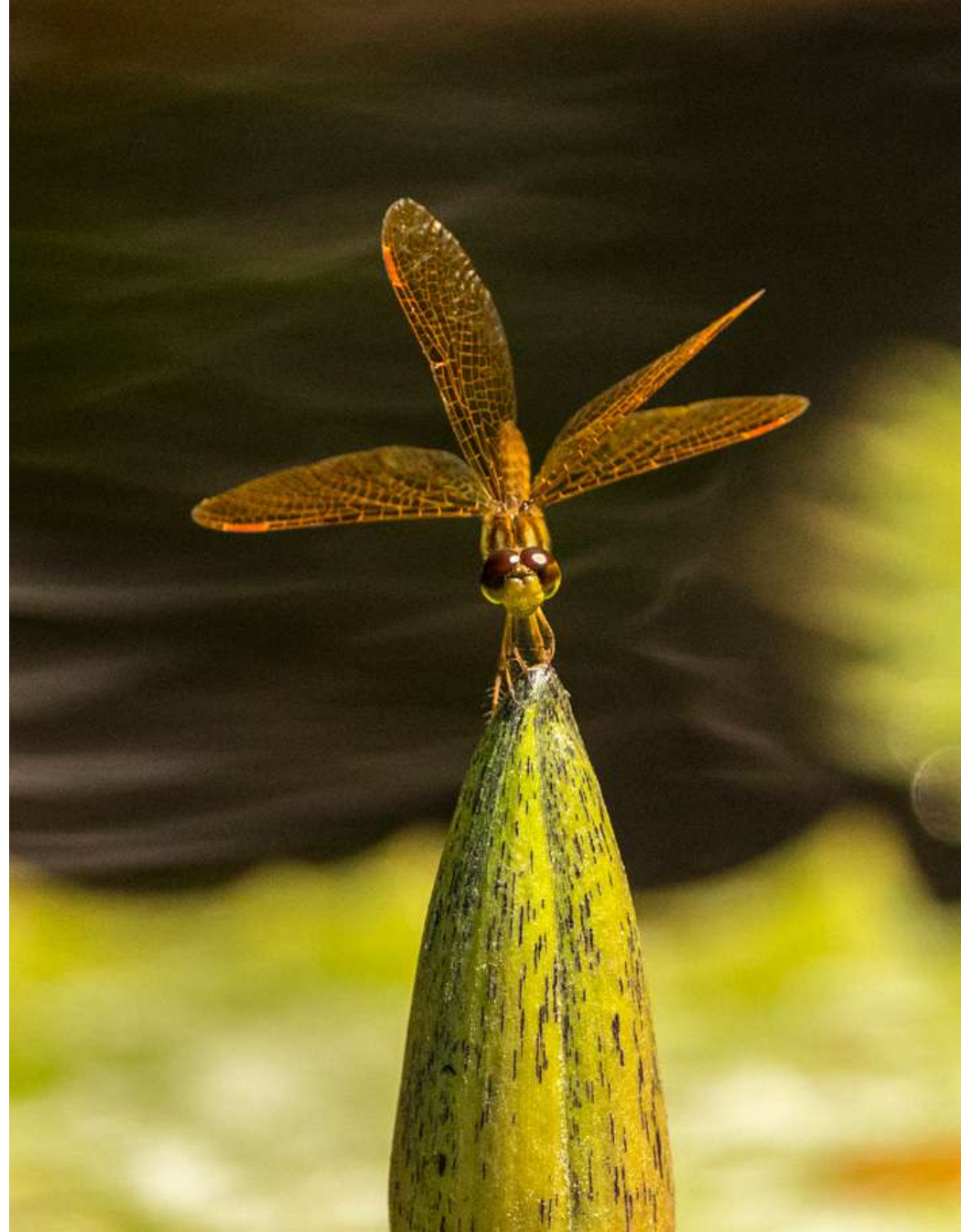
Río Escondido.





Cropped from the previous photo to show the bee that is pollinating this flower.

9:01am, Feb. 28, 2023, photo by Nicholas Hellmuth with iPhone 14 Pro Max. Río Escondido.



This bud is not yet open at 12:33pm which means it will keep growing and open in the following days. This is a golden dragonfly.

Photo by: David Arrivillaga, FLAAR Mesoamerica.



A wider view shows that the other water lily is open this afternoon. Where there are thousands of water lilies you will see every phase at many different hours because not every plant is "well organized."

9:02am, Feb. 28, 2023. Notice that the flower in the lower middle is nowhere near open but all the others are. One flower did not "get its act together".

Photo by Nicholas Hellmuth with 200mm lens on Nikon D810 camera.

Río Escondido.





9:06am, Feb. 28, 2023, photo by Nicholas Hellmuth with 200mm lens on Nikon D810 camera.



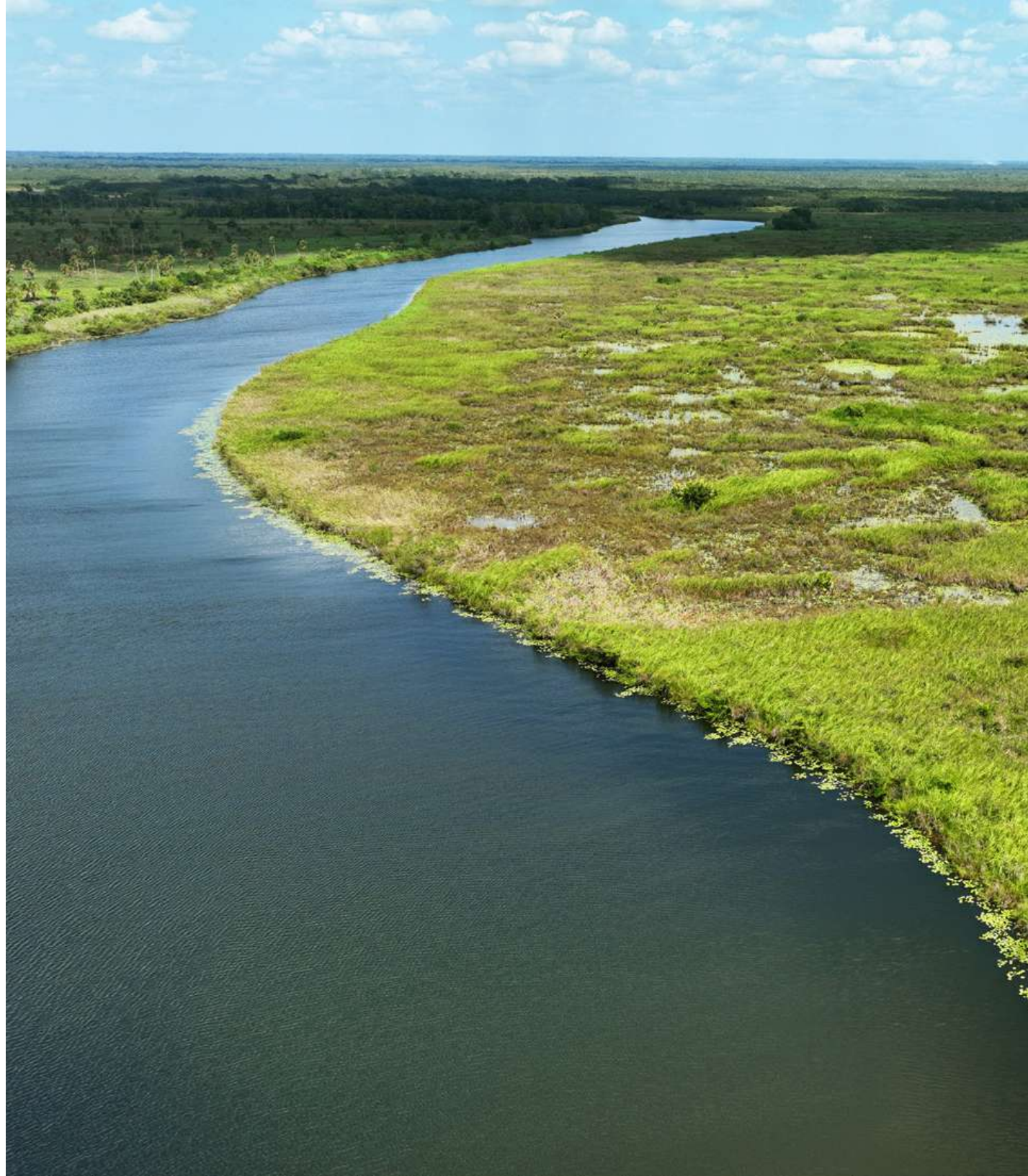
Lots of *Nymphaea ampla* water lilies. On the right a sedge-reed-grass marsh for a few meters than a different ecosystem. On the right a mud marsh with islands of sedge-reed-grasses. On the right side you can see that in the past year a dugout canoe went through that area, but the lily pads are growing back to cover it. We avoided criss-crossing the water lily areas as we do not want to open an empty area. Our goal is to have all these photos available to ecologists, geographers, archaeologists who are giving presentations at the many seminars and symposia on water, wetlands, of the Maya areas.

## Water Lilies in Ponds inside Mud Flats inland From Río Escondido

This is Río Escondido, west of the town of Naranjo.

This kind of mud flat is not often studied because they are rare in PNYNN and there are no large open areas like this in PANAT. But in the areas of PNLT and adjacent, you get kilometer after kilometer of mud flats. Of course, the amount of water varies by month and by year. 2022 was very wet. This photo is from early 2023 so the rain from the previous year is still in the mud flats.

Aerial photo by Haniel López with FLAAR drone Mavic 3. Feb. 28, 2023,





Sedges and/or reeds with water lilies where there is water more permanently. Aerial photo by Haniel López with FLAAR drone Mavic 3, Feb. 28, 2023, 1:30pm.





I look forward to learning about the ecological jargon for a wetland like this. I prefer to avoid using international jargon which is based on wetlands mainly in USA, Europe and Asia. It is more realistic to have classification nomenclature based on wetland biodiversity in Guatemala and adjacent countries (since the Río San Pedro flows into Tabasco, Mexico).

Aerial photo by Haniel López with FLAAR drone Mavic 3. Feb. 28, 2023, 1:30pm.



This zoom-in is possible when you have a drone camera with good resolution.

Cropped by Nicholas Hellmuth from aerial photo by Haniel López with FLAAR drone Mavic 3. Feb. 28, 2023, 1:30pm.



Aerial photo by Haniel López with FLAAR drone Mavic 3. Feb. 28, 2023, 1:32 pm.



Although I am focused on wetlands, I am also curious about the "open forest" on the upper side.

Aerial photo by Haniel López with FLAAR drone Mavic 3. Feb. 28, 2023, 1:32pm.



## Mud Flats

Water lily areas; reed-sedge-grass-marsh; but then "mud swamp" also.

Aerial photo by Haniel López with FLAAR drone Mavic 3. Feb. 28, 2023, 8:54am.



Forests are only in certain areas. Other areas are endless reed-sedge-grass marshes. But there are mud swamps with pools of water. I have not seen anything like this in Central Petén not during our wetland's ecosystem project in eastern Izabal area of Guatemala. Río Escondido,

Aerial photo by Haniel López with FLAAR drone Mavic 3. Feb. 28, 2023, 8:50am.



Triangular area of water lilies at the right. But it's the "mud marsh" to the left that intrigues me.

Aerial photo by Haniel López with FLAAR drone Mavic 3. Feb. 28, 2023, 8:40am.



Aerial photo by Haniel López with FLAAR drone, Feb. 28, 2023, 8:40 am.





Aerial photo by Haniel López with FLAAR drone Mavic 3. Feb. 28, 2023, 8:45am.



Welcome to the wetlands. Welcome to the Mudlands of the Maya. Imagine what could have been cultivated here 2,000 years ago.

Aerial photo by Haniel López with FLAAR drone Mavic 3. Feb. 28, 2023, 9:21 am.



What would help is an aerial mapping system. LiDAR is one, but we prefer to see the plants. With a Phase One iXM UAV aerial camera we could map this area and provide mosaics for other scholars to have available for their own research.



Aerial photo by Haniel López with FLAAR drone Mavic 3. Feb. 28, 2023, 9:22am.



Aerial photo by Haniel López with FLAAR drone Mavic 3. Feb. 28, 2023, 8:50am.



Reed-sedge-grasses marsh for kilometers with lots of mud-marsh and lots of pools of stagnant water filled with *Nymphaea ampla* water lilies. Remarkable the biodiversity that the Classic Maya had available 2,000 years ago.

Aerial photo by Haniel López with FLAAR drone Mavic 3. Feb. 28, 2023, 1:32pm.



Mud marsh is at the right and across the entire top (until the ground level rises a few centimeters and no more mud/water area and so trees grow. Curious that there is no swamp: the water areas are 90% open. What keeps the trees out?

Aerial photo by Haniel López with FLAAR drone Mavic 3. Feb. 28, 2023, 2:42pm.



Welcome to the remarkable biodiversity of the Río Escondido area between Naranjo and the Petén-Tabasco border. These are the first aerial photos of this quality available at this size. No peer-reviewed journal would have this photo more than a few centimeters high.

Aerial photo by Haniel López with FLAAR drone Mavic 3. Feb. 28, 2023, 8:45am.





*Nymphaea ampla* along the shore. *Sagittaria* species about a meter inland (we show close-up later this this report). Then the common marsh plant.

What if this marsh plant has edible parts?

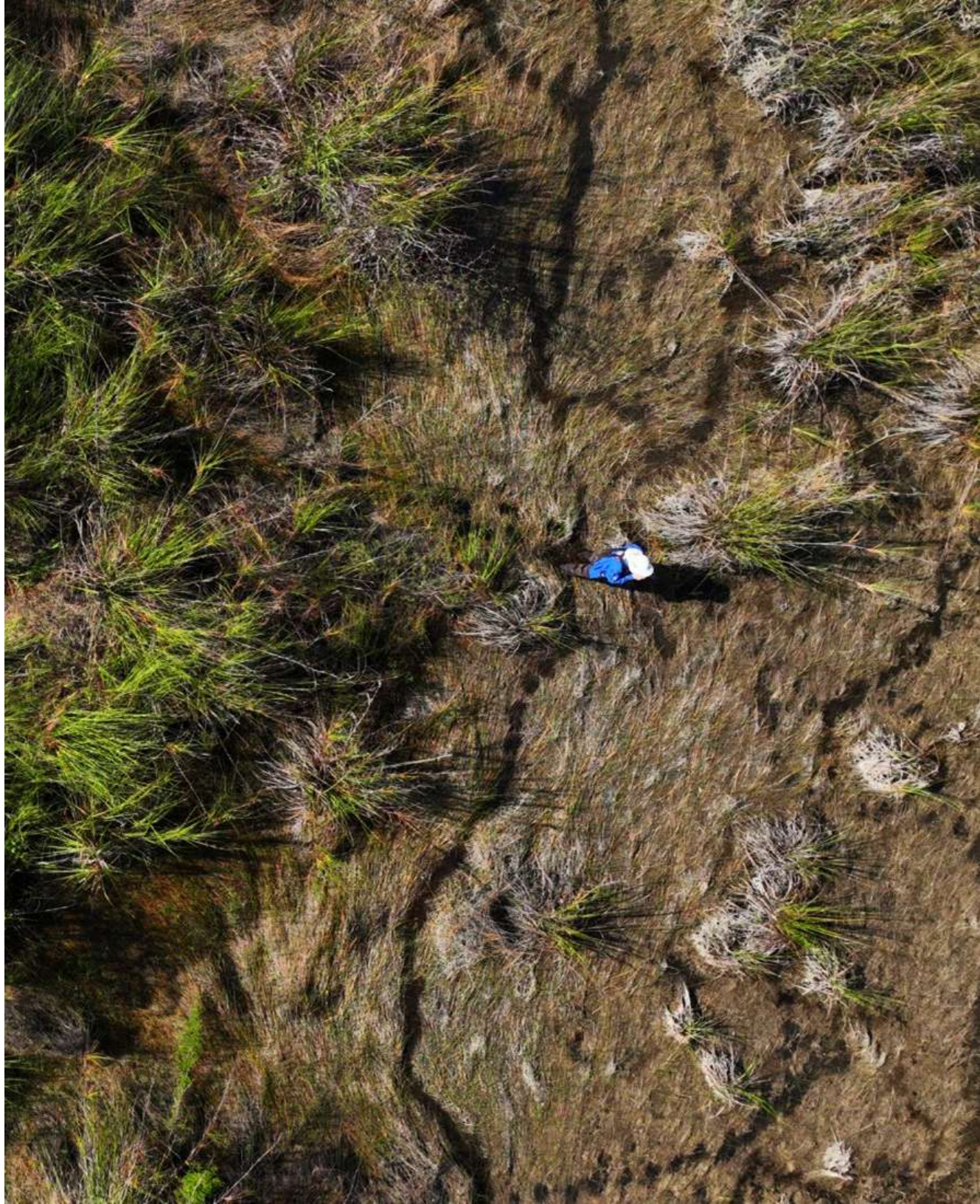
9:43am, Feb. 28, 2023.

## Inside the Dry Part of a Mud Marsh adjacent to Río Escondido

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I had a reflective hat and dark blue shirt, trying to walk into the mud-marsh without sinking (since all the rest of the team are intelligently staying safely in the boat). But when I do sink into a river, swamp, or marsh, they do come to rescue me. The emergency room nurses and doctors know me quite well (you often scrape all the skin off parts of your legs as you either sink into or are pulled out of a hole in a marsh).

February 28, 2023, 9:24am, aerial photo by Haniel Lopez with FLAAR drone, Mavic 3.





Sedges, reeds, grasses everywhere. But lots of open areas. Is this because Tapir trample these areas along Río Escondido during the night?

Panorama mode, iPhone 14 Pro Max, Feb 28, 2023, 9:21am.



## Río Escondido inland, Snails in Dry Mud Marsh Area

Many freshwater and land snails of Guatemala are edible. This is another source of food for these wetlands for the Maya 2,000 years ago.  
Photo by Nicholas Hellmuth, Feb. 28, 2023, 9:22 and 9:27am, iPhone 14 Pro Max.



In the future it would help to do panorama photography of each wetland. This requires finding a place that you can get out of the boat without sinking so deep into the mud that you can't get out (this happened the first time I tried to get out of the boat; I sank up to my knees and could not move forward or backwards: I just kept sinking centimeter by centimeter).

Mud marsh area alongside Río Escondido, Feb. 28, 2023, 9:24am, photo by Nicholas Hellmuth, iPhone 14 Pro Max in Panoramic mode.

## Río Escondido Shore Plant: Tiny Ground Flower

This photo allows you to notice that no leaves are visible. This does not mean no leaves are present, just that you can't see them. You would need to get down on your knees and move your hands to remove the other vegetation and try to find the leaves.

This photo also shows how high the stem is, to raise the flower as high as possible (probably to attract pollinators).

Amazing how such a small plant survives totally "covered" by reeds, sedges or grasses. This white-flowered plant also survived seasonal inundation, when the river rises up and covers the marsh on both sides.

If you are a Botanist lots to study here.

If you are an ethnobotanist, lots of edible plants grow in these marshes (we can't say that about this white-flowered plant because we don't yet know its name).

If you are an archaeologist, there are endless square kilometers of rich soil along the Río San Pedro and all its tributaries. How many ways could this soil have been used by the Classic Maya? EL Perú-Waka' is many kilometers away, upstream. Did this site control this rich farmland?





The “ground” here is pure muck. You sink into the mud every step (and can barely pull your foot out of the mud to take the next step forward). I had only an iPhone with me, so the photos need to be re-taken on a future field trip with a camera with 1:1 macro lens.

Since 4-petalled flowers are symbolic in Late Classic Maya art (painted on vases, bowls and plates), it is important to document every wild native 4-petalled flower of Guatemala and document in what ecosystem it occurs. Most (but not all) 4-petalled flowers are in wetlands, such as here. The 4-petalled, 4-sepalled *Ludwigia* flower is also in the same muddy wetlands.

## Río Escondido, Round-Green-Leaf Plant on Muddy Marsh adjacent to the Stream

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We have found these beautiful concentrically round leaves in marshes in several wetlands in other areas of Guatemala. Notice how the leaves are all turned to an angle to collect the most sun possible.

Photo by Nicholas Hellmuth, iPhone 14 Pro Max, Feb. 28, 2023, 9:33am. Knowing the hour and minute allows you to see where this photo was taken on the GPS route map for this day.







## Probable Passiflora Vine growing directly along the edge of Río Escondido

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I estimate this vine is a Passiflora. This genus of vines is common in seasonally inundated wetlands from marshes to savannas. The fruits of several species are edible. We will need a flower to document the genus species.

This vine is literally right at the edge of the water. In a wet rainy month, the water will cover this vine.

Photo by Nicholas Hellmuth, shore of Río Escondido, Feb. 28, 2023, 1:23pm, with iPhone 14 Pro Max.

## Flowering Plants in these Marshes

Found *Sagittaria lancifolia* flowers at 9:16am., 9:44am, and again at 2:51 pm. Lots more could be found but you have to get out of the boat and try not to sink knee deep in the mud. So there were not many opportunities. But at least now we know that this edible wild plant was available to the Maya 2,000 years ago in these wetlands.

Photo by David Arrivillaga, FLAAR Mesoamerica. with Sony Alpha 1, Feb. 28, 2023, 9:16am.





After you have been hiking to and through seasonally inundated wetlands throughout the Reserva de la Biosfera Maya you can recognize *Sagittaria* leaves even when there are no flowers. We found lots of these also in marshes and edges of swamps of eastern Izabal, the Caribbean part of Guatemala.

These are a fast-growing plant with edible parts. These wetlands would have been a potential breadbasket for the Classic Maya.  
Photo by Nicholas Hellmuth with iPhone 14 Pro Max, Feb. 28, 2023, 9:44am.



If you have time to stop the motorboat and look around you, into the marsh, you notice lots of plants, such as these upright leaves of Sagittaria plants.

If you have funds to facilitate visiting here every month, you can find flowers of different plants every month (such as the vine I see climbing in the background). It helps to have flowers to document each species.

Photo by Nicholas Hellmuth, with iPhone 14 Pro Max, 2:51pm, Feb. 28, 2023.



*Nymphaea ampla* water lilies along most of the edge of Río Escondido (and also along the edge of Río San Pedro and other tributaries).

*Sagittaria lancifolia* grows where the soil on the bank is about half a meter above the level of the river in this month. Level of the water varies by month and by year (since some years are rainy, as was 2022, and other years are dry; as were years before). One species of marsh "grass" is the most common. But there are two other genera in other parts as well. We show all that in the chapter on sedges, reeds and grasses.

At 9:44 in the morning the water lily flowers still must open even more. Photo by Nicholas Hellmuth with iPhone 14 Pro Max.



## Río Escondido shore plant, Yellow 4-Petalled *Ludwigia*

Flowers with four petals are common on Tepeu 2 Late Classic Maya vases, bowls and occasionally plates. These 4-petalled designs come in many shapes. Since I discovered two bowls with 4-petalled flowers in the Tomb of the Jade Jaguar (Tikal Bu. 196), and since no ceramicist or archaeologist had identified more than a few such flowers, I spent several years doing field trips driving in diverse parts of Guatemala to find and photograph flowers with 4-petals, 4-sepals and plants with 4-leaves in a quadrilateral pattern.

Turns out many of these plants are wetlands plants: swamps, marshes, or rivers. The genus *Ludwigia* that we show here lives in ground that is either wet from downflow from a hill or normally in flat areas that are marshes or otherwise quite wet much or most of the year. In these photos I show the petals and sepals arranged in two patterns, so you can match the design on Maya vases, bowls or plates.



Several different species of this 4-petalled yellow flower like to grow in marshes or other wetlands. These petals are either a tad old or there was a lot of wind blowing.

Río Escondido, 11:35am, photo by Nicholas Hellmuth with iPhone 14 Pro Max on Feb. 28, 2023.

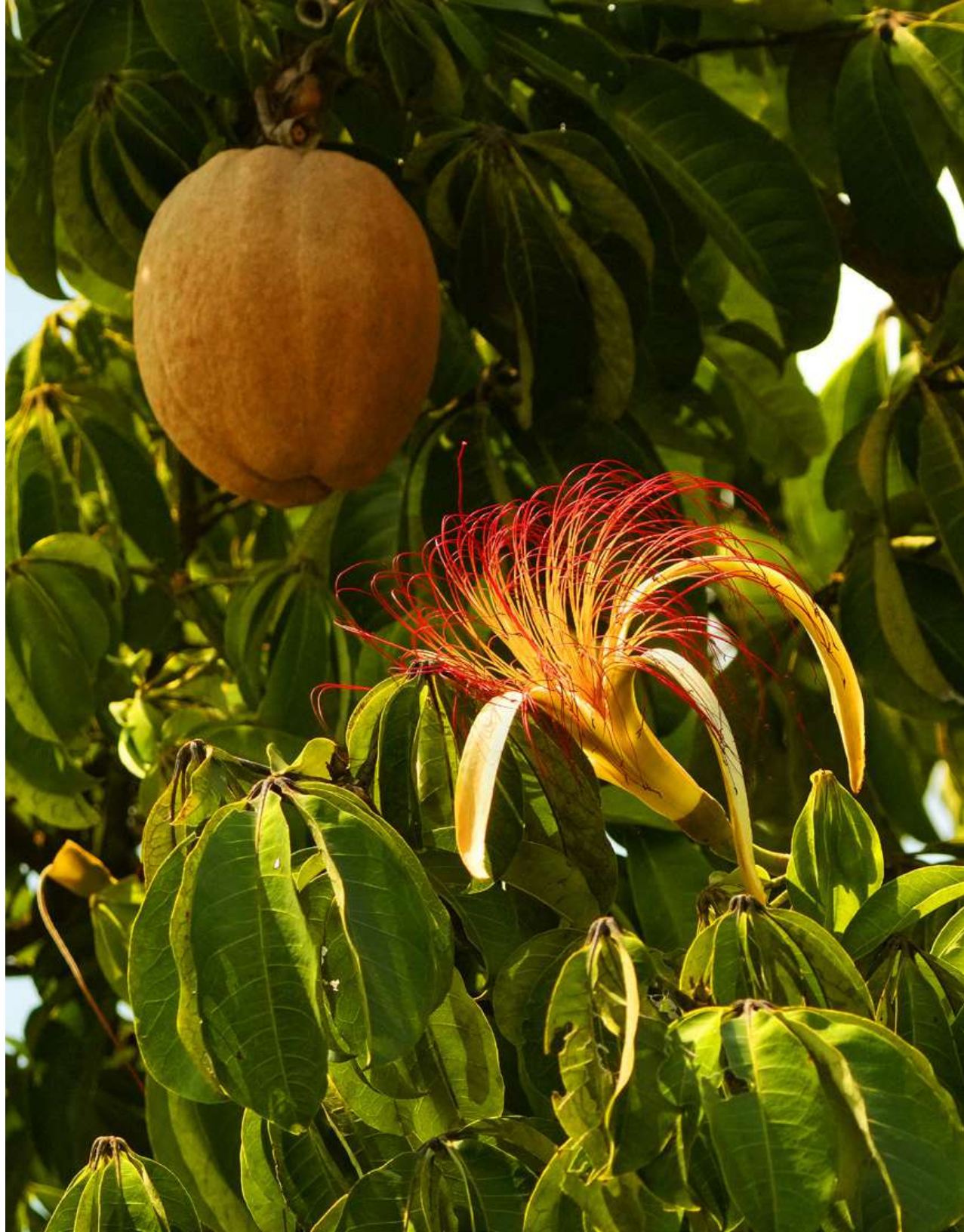
## Río Escondido shore plant: *Pachira aquatica*, Zapotón

There are thousands of *Pachira aquatica* trees along all the lagoons, lakes, creeks and rivers of the Río Dulce and El Golfete areas of eastern Izabal. This tree surely has adapted to accept occasionally brackish water (from the Caribbean).

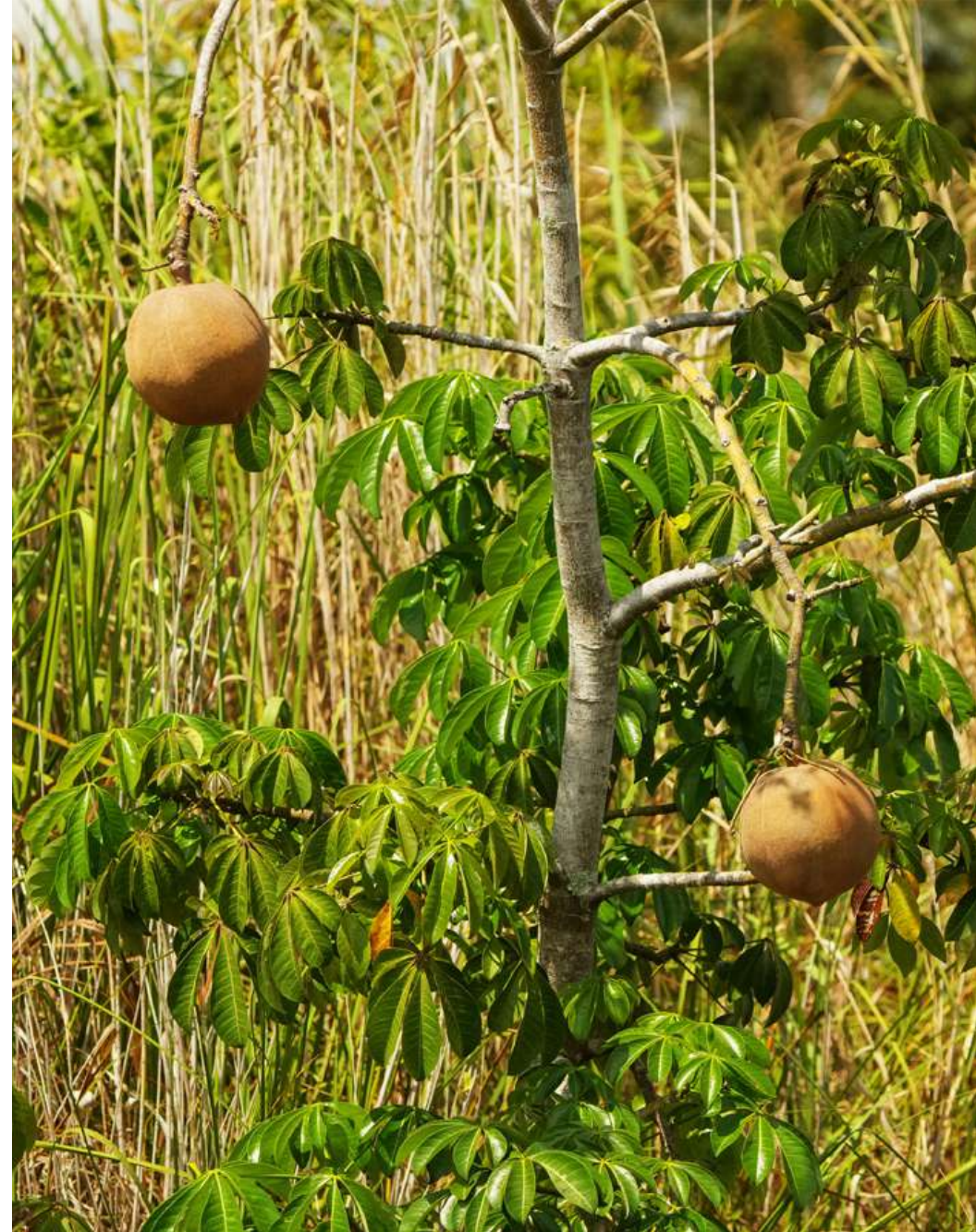
There are scores of *Pachira aquatica* trees along the upper Río San Pedro, so it was nice to see them here in the lower Río San Pedro. This tree cluster had three bright flowers and one large Zapotón fruit.

This is one of the 10 most beautiful flowers of all trees of Guatemala. The Zapotón fruits are the largest of all Mesoamerica. You can make a cacao-like beverage from their seeds although not many people still use them today.

Photo by David Arrivillaga, FLAAR Mesoamerica.  
Feb. 28, 2023. Camera: Sony Alpha 1.  
Settings: 1/800; sec; f/9; ISO 2,000.







No matter how many textbooks talk about the leaf size and shape, etc. I prefer to know where a tree species has adapted to thrive. *Pachira aquatica* is literally named an aquatic plant: the seeds can sprout in the water and in the photo at the left you see how the roots are adapting to hold the tree trunk safely in position over the water. In the other photo you see two of the large Zapatón fruits.

Río San Pedro, 12:57pm, Photo by David Arrivillaga, FLAAR Mesoamerica. Feb. 28, 2023.

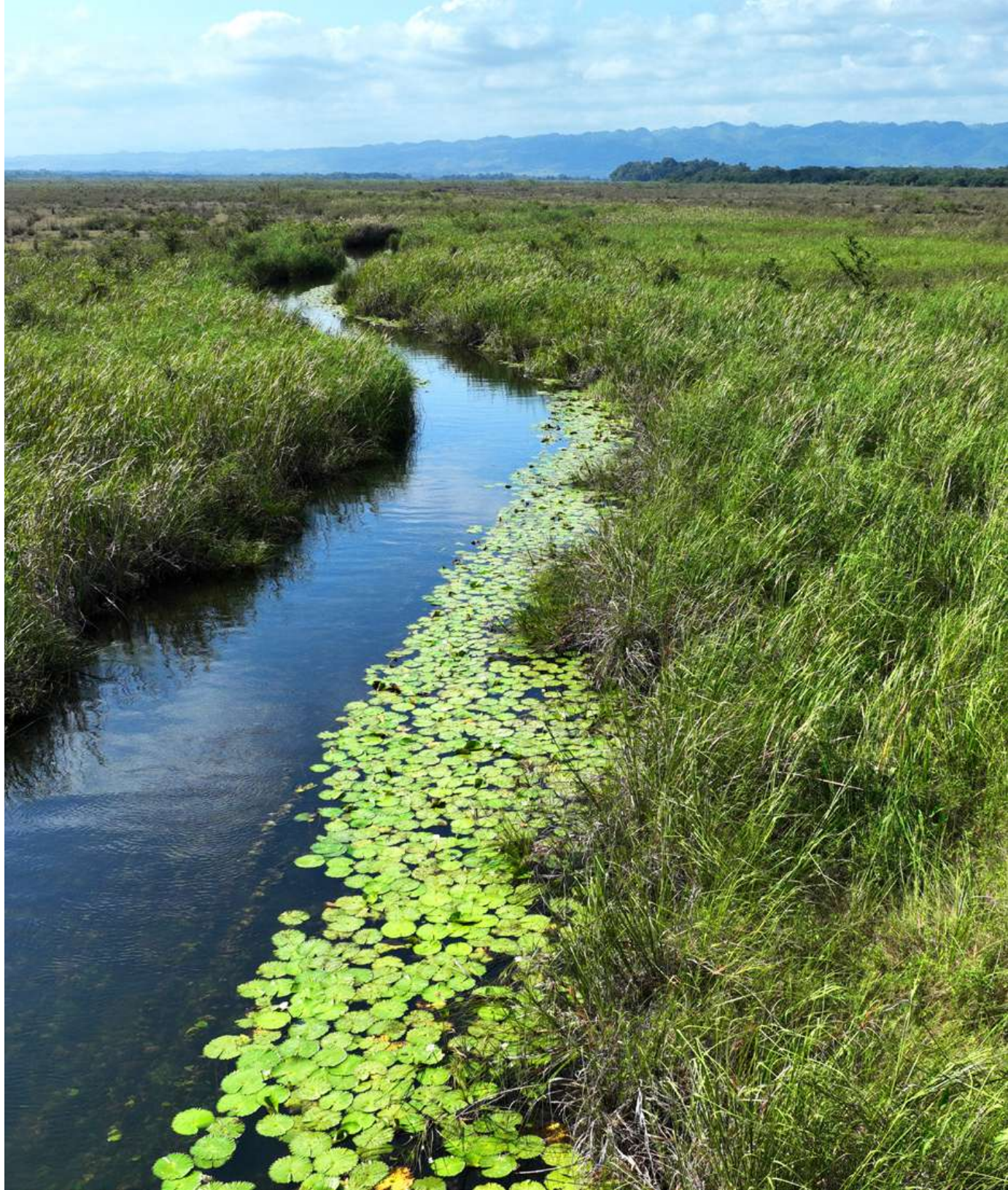
## Río Escondido shore plants, Marsh Reeds, Sedges and Grasses

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Curious that the water lilies are only one side of the Río Escondido here. Also, the river is very narrow here.

The reeds, sedges and grasses stretch for miles on both sides. In the background at the upper right is a forest of trees. Across the far background is the mountain range of Sierra del Lacandón.

Aerial photo by Haniel Lopez with FLAAR drone Mavic 3, Feb. 28, 2023, 9:46am.





At this angle you can see the transition from water lilies to reeds and sedges that are bright green (because of the water) and then darker color plants and bushes and shrubs.

Across the top is the noticeable "mountain range" of Sierra del Lacandón, an adjacent national park. We would love to photograph and document and publish all the amazing biodiversity in that karst area but would need realistic funding to be donated by an individual interests in flora, fauna and/or biodiverse ecosystems that have not been studied or photographed at the digital quality of the FLAAR team.

Aerial photo by Haniel Lopez, Feb. 28, 2023, 9:46am.



We used to have only a Mavic 2 Pro. One of several advantages of the Mavic 3 is its ability to get a tad closer to the ground. At this angle you can see the bushes and shrubs working hard to grow in this seasonally inundated swamp like marsh.

Aerial photo by Haniel Lopez with FLAAR drone Mavic 3, Feb. 28, 2023, 9:46am.



I have cruised up and down canals of Venice, but I prefer to cruise up and down the rivers in remote non visited areas of Petén.

I have taken the incredible evening/night cruise up and down the river through Shanghai, China. I prefer to see the flora and fauna along the rivers of Guatemala. I have taken a cruise along the river that passes through St Louis, Missouri. I prefer the streams of this part of northwestern Petén.

Aerial photo by Haniel Lopez with FLAAR Mesoamerica. Feb. 28, 2023, 9:46am. Camera: Drone Mavic 3



Río Escondido is a narrow river for a kilometer or so, and then widens into a long series of lagoons.

You can see marshes of sedges and reeds for miles, plus lots of water lilies along the narrow part of the river.

Aerial photo by Haniel Lopez with FLAAR drone Mavic 3, Feb. 28, 2023, 9:51am.



This is the narrow part. If no boats ever went up and down this river it might be solid water lilies. But 2,000 years ago, more dugout canoes went up and down this river. Today only one or two boats a day go up and down.

You can see the different colors of reeds and sedges. If a kind person, family or foundation could provide funds for a Phase One iXM aerial camera and the M600 drone to carry it (with two separate interchangeable lenses) we could use multi-spectral software and photography to map which species were in which area(s).

Aerial photo by Haniel Lopez with FLAAR drone Mavic 3, Feb. 28, 2023, 9:51am.



A karst hill is in the upper left background. All land that is not a swamp has been clear-cut for invasive cattle ranches.

In the seasonally inundated marshes on both sides of the river you can see lots of biodiversity of what trees and bushes are growing here.

Drone photos at a low diagonal super helpful.

Aerial photo by Haniel Lopez with FLAAR drone Mavic 3, Feb. 28, 2023, 1:55pm.





This is the same area but seen from higher above. So now you can see an entire range of hills (all clear-cut for cattle ranches).

Fortunately the marshes are dangerous for cattle; they would sink into the mud and not be able to get out.

Aerial photo by Haniel Lopez with FLAAR drone Mavic 3, Feb. 28, 2023, 2pm.



This side of the river is marshes for as far as the eye can see. You can see the "islands" with bushes or trees.

Many of these marsh areas are incinerated every several years; all the plants resprout but no trees grow tall because they get burned down to their trunks in such a fire.

Aerial photo by Haniel Lopez with FLAAR drone Mavic 3, Feb. 28, 2023, 1:33pm.



The river is in the far background. In front is the marsh of sedges, reeds and grasses. Notice the dozens of pools of permanent water (at least long enough each year to keep the water lilies alive). Water lilies can survive a bit of dry months. We have seen this in aguadas inside savannas of the southeast part of PNLT.

Aerial photo by Haniel Lopez with FLAAR drone Mavic 3, Feb. 28, 2023, 1:33pm.



More of the same area. The darkness in the background is because of cloud cover.

Aerial photo by Haniel Lopez with FLAAR drone Mavic 3, Feb. 28, 2023, 1:33pm.

## Río Escondido shore plant: *Acoelorrhaphe wrightii*, Tasiste palm

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Tasiste palm in "full flowering mode" with healthy inflorescences of these *Acoelorrhaphe wrightii* palms, Río Escondido.

Because of the deep, sticky, mud between the river and these palms it was not realistic to get close to taking macro photos of the inflorescences.

Tasiste palms have an edible part inside the fresh stem; local people have given it to me to eat, raw. The seeds are edible and medicinal.

The Classic Maya over a thousand years ago would have had millions of these Tasiste palms available to eat and harvest the seeds. They grow vigorously; survive most fires, and regenerate from their root stock almost automatically when cut down. When I was an archaeology student at Harvard in the 1960's and a Post Graduate Research Fellow for over a decade at Yale, no one mentioned or talked about Tasiste palm as a major edible resource.

Photo by Nicholas Hellmuth, Nikon D810 with 200mm telephoto lens, cropped, 2:12 pm, Feb. 28, 2023.





Tasiste palm in "full flowering mode" with gorgeous golden color. Inflorescences of *Acoelorrhaphe wrightii* palms, Río Escondido.

Photograph by David Arrivillaga with Sony Alpha 1 (a1), with Sony 200-600mm telephoto lens, 1:04 pm, Feb 28, 2023.



## Was there once a Tasistal Savanna in some areas?

Tasiste palms are almost NEVER solitary (only if all the others have been chopped down or burned down and only one survives). That's because each root mass sprouts up to a dozen, or more, stems. A dozen complete palms grow within a few centimeters of their brothers and sisters from the same root mass. Aerial photo by Haniel López with FLAAR drone Mavic 3, Feb. 28, 2023, 1:11pm. Behind there is a forest of taller trees because that area is not underwater more than occasionally (really wet month of exceptionally wet year). Tasiste can survive water over their roots for several months a year.



We saw area after area being incinerated for commercial agriculture but mainly for cattle ranches. It's healthy that these Tasiste palms are still surviving.

Aerial photo by Haniel López with FLAAR drone Mavic 3, Feb. 28, 2023, 1:12pm.





Marsh across the front: water lilies where there is permanent water; sedges-reed everywhere else. Then a slightly raised area that has thick clumps of Tasiste trees. They are so thick it looks like a narrow mini-tasistal savanna. Then the forest behind (so areas that are not under water very long even at the height of a long rainy season).

Aerial photo by Haniel López with FLAAR drone Mavic 3, Feb. 28, 2023, 1:15pm.

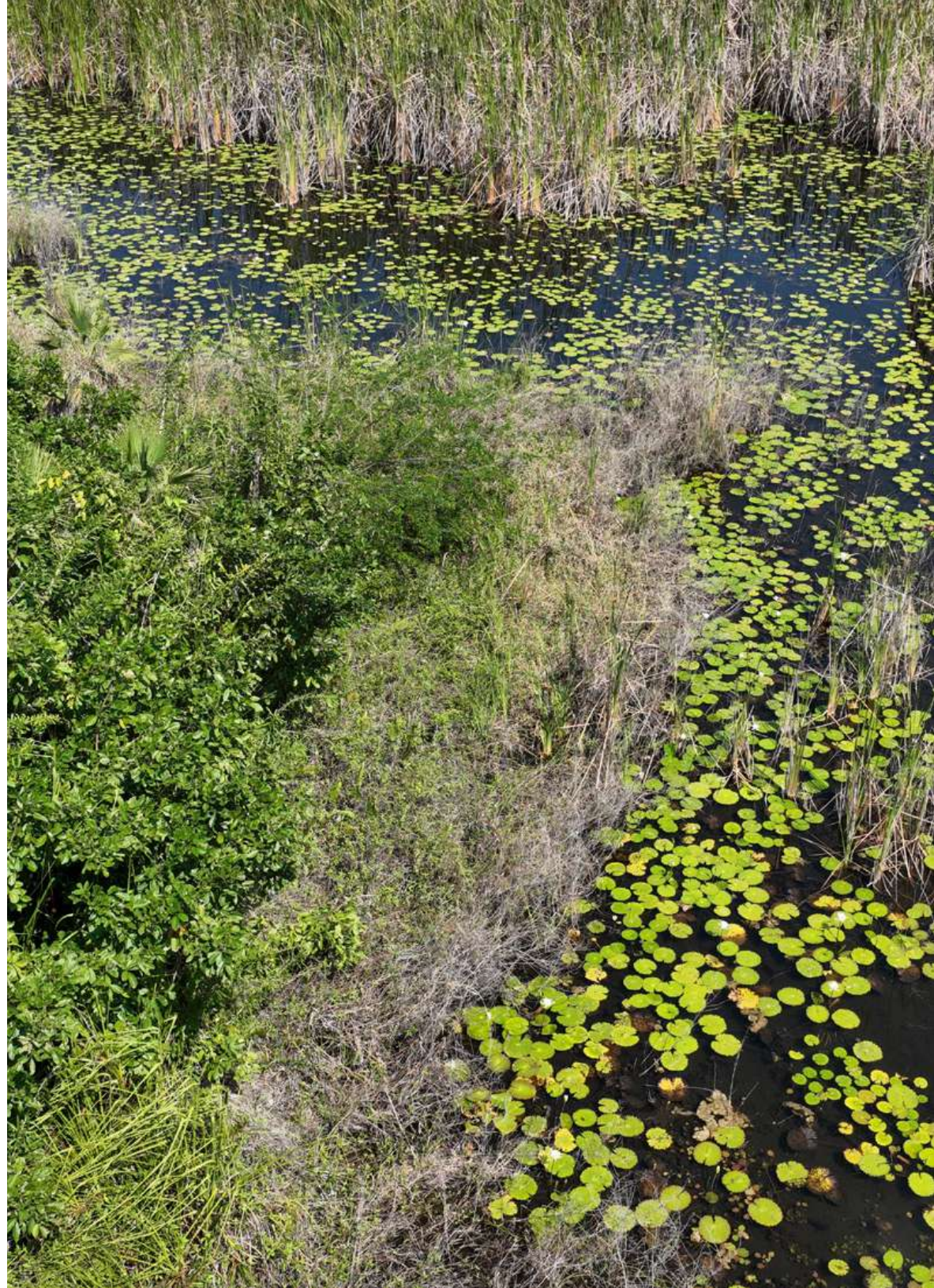
## Río Escondido shore plants: *Acoelorrhaphe wrightii*, Tasiste palm together with *Crescentia cujete*, Calabash Tree

---

We were surprised to see lots of *Crescentia cujete*, Calabash trees, only a few meters inland from the shore of Río San Pedro. We have a separate FLAAR Report on those river ecosystems. When I looked closely at the aerial photos of tributary Río Escondido, I also noticed leaves that I estimate are *Crescentia cujete*.

These trees are usually near or not far from Tasiste palms. In the photo here they are next to each other.

Aerial photo by Haniel López with Mavic 3, a model with good resolution. 1:59pm, Feb. 28, 2023.





With a drone it helps when the pilot photographs key habitats at different angles. We have about six photos of the same area.

Aerial photo by Haniel López with FLAAR drone Mavic 3, Feb. 28, 2023, 1:58pm.



A herbarium drawer has helpful information for Botanists for hundreds of years. But I prefer to have a reference archive of photos because this way you can see where each species lives.

Here you have a marsh with water lilies and sedges-reeds all around. Where the soil is a tad different, or perhaps a few centimeters higher, you get Tasiste palm, Calabash tree, and other trees in a thick cluster. The next two photos identify the two primary species.

Aerial photo by Haniel López with FLAAR drone Mavic 3, Feb. 28, 2023, 1:58pm.



All the palms here are Tasiste palms (top left and middle right). All the branches with rows of narrow leaves I estimate are all *Crescentia cujete*, Calabash Tree. This tree is common in seasonally inundated grassland savannas of PNYNN and PNLT. This tree is also present in tasistal savannas (an area of solid Tasiste palms, up to a million Tasiste palms in an area 360 meters wide by two km long that we documented near Arroyo Petexbatun several years ago).

Nance trees are also in these same areas but since this photo is from a drone we don't have close-up to facilitate ID the trees other than the obvious Tasiste and Calabash tree.

Aerial photo by Haniel López with FLAAR drone Mavic 3, Feb. 28, 2023, 1:58pm.



A closer view so you can see the leaves of the Calabash Tree.

There are *Crescentia alata* in dry plains and *Crescentia cujete* in seasonally inundated wetlands.

The words Jícaro and Morro are used for both. I prefer Jícaro for *Crescentia cujete* and Morro for *Crescentia alata*.

Cropped from aerial photo by Haniel López with FLAAR drone Mavic 3, Feb. 28, 2023, 1:58pm.



Narrow band of water lilies along the shore. Then a few meters of reeds-sedges; then large clusters of Tasiste palms. Each root mass gives rise to up to a dozen stems (so up to 12 entire palms grow from one single solitary root mass). And usually there are lots of root masses near each other.

Aerial photo by Haniel López with FLAAR drone Mavic 3, Feb. 28, 2023, 10:28am.



I zoomed in to show how totally different the top of the Botan palm is from the hundreds of Tasiste palms nearby.

Tasiste palms like to grow along rivers and grow in savannas that are seasonally inundated. We have several FLAAR Reports available online on *Acoelorrhaphe wrightii* of rivers of eastern Izabal, of tasistal areas near Arroyo El Faisán and Arroyo Petexbatún upstream from Sayaxché. On Feb. 27, 28, and March 1, 2023 we found thousands of Tasiste palms and two or three areas where Botan palms were nearby and rose above them.

Also notice the difference in color between a Botan palm and a more non-vibrant color of Tasiste.

Cropped from aerial photo by Haniel López with FLAAR drone Mavic 3, Feb. 28, 2023, 10:28am.



## Birds Photographed along Río Escondido, Feb. 28, 2023

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Various documents in our bibliography list all the birds you can see in this area. We did not see one single solitary crocodile, yet on the upper part of Río San Pedro (from Paso Caballos downstream, we often saw one every kilometer). All these wetlands of Río Escondido are probably beloved by tapir but that would require a separate project (and endless time). But it's not easy to hike across a mud marsh!



*Tigrisoma mexicanum*, Garza Tigre, bare-throated tiger heron, a common wading bird in wetlands of Guatemala and surrounding countries.

Cropped by Hellmuth from digital photo by David Arrivillaga, with mirrorless Sony Alpha 1, Sony 200-600mm telephoto lens. 1:09pm, February 28, 2023.

*Jacana spinosa*, Northern Jacana (even though this is “Middle” America). We see this bird literally “walking on water” in every water lily area of Petén and elsewhere in Guatemala. Of course, it is walking on the lily pads; not on the surface of the river.

Photo by David Arrivillaga, with mirrorless Sony Alpha 1, Sony 200-600mm telephoto lens. 8:07am, February 28, 2023





Garcita Verde, marsh area alongside Río Escondido, 9:15am, Feb. 28, 2023.

Photo by David Arrivillaga, with mirrorless Sony Alpha 1, Sony 200-600mm telephoto lens.

## Tree Flowers & Birds in the Area behind the Military Camp

*Tabebuia rosea*, Matilisguate, about a hundred meters inland from Río Escondido, at the military base.

Photo by David Arrivillaga, 10:32am with mirrorless Sony Alpha 1, Sony 200-600mm telephoto.





We stopped at the military base to give greetings and to indicate we were here for flora, fauna, and ecosystem research.

While there the team photographed interesting flowering trees and birds, as you see here.

Several national parks in Guatemala have a military station. Yaxhá (PNYNN) is a good example. In every park we have always been welcomed by the military; we have permits to do research in these parks plus obviously we have been doing research in these areas for many decades.

Photo by David Arrivillaga, 10:39am with mirrorless Sony Alpha 1, Sony 200-600mm telephoto.

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Photo by David Arrivillaga, 10:39am with mirrorless Sony Alpha 1, Sony 200-600mm telephoto.



## Summary and Concluding Remarks

The photo archive of aerial photos for Río Escondido is unprecedented for this remote area of the PNLT. That is our goal at FLAAR, to provide documentation to assist biologists and ecologists.

We saw not one single crocodile. And no bamboo whatsoever. If there is the wild native bamboo (that we see along Río Holmul, along Arroyo Petexbatún, and in Bio Ytzá area), then it is not close enough to Río

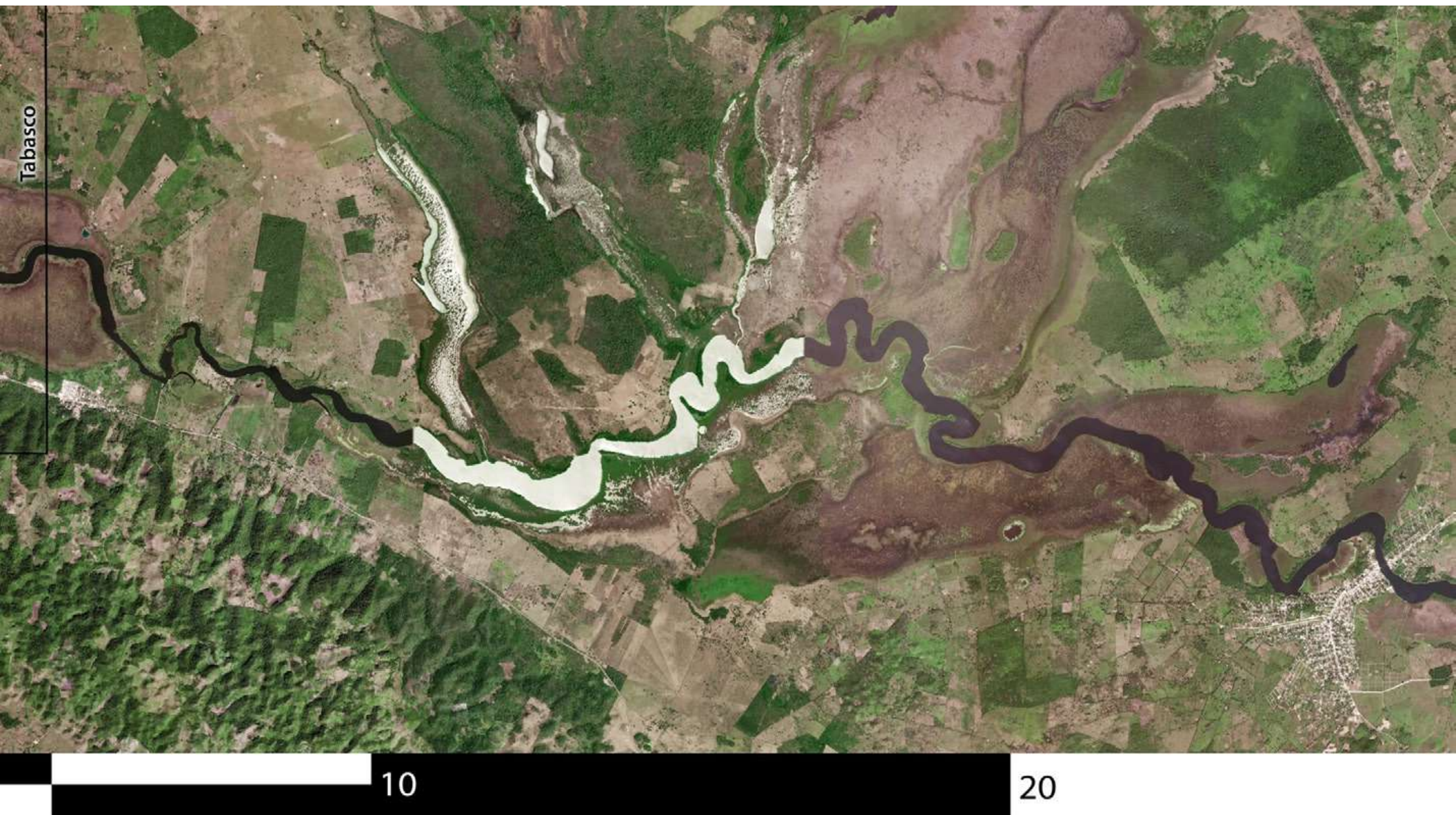
Escondido to notice it. Or, if present, it is mixed with so many other plants that we did not notice it from our boat.

Park rangers say that most of the marshes are *Cladium jamaicensis*. Would help if a future project could map some of the marshes and show how many different species of sedges, reeds or grasses are present, and where.

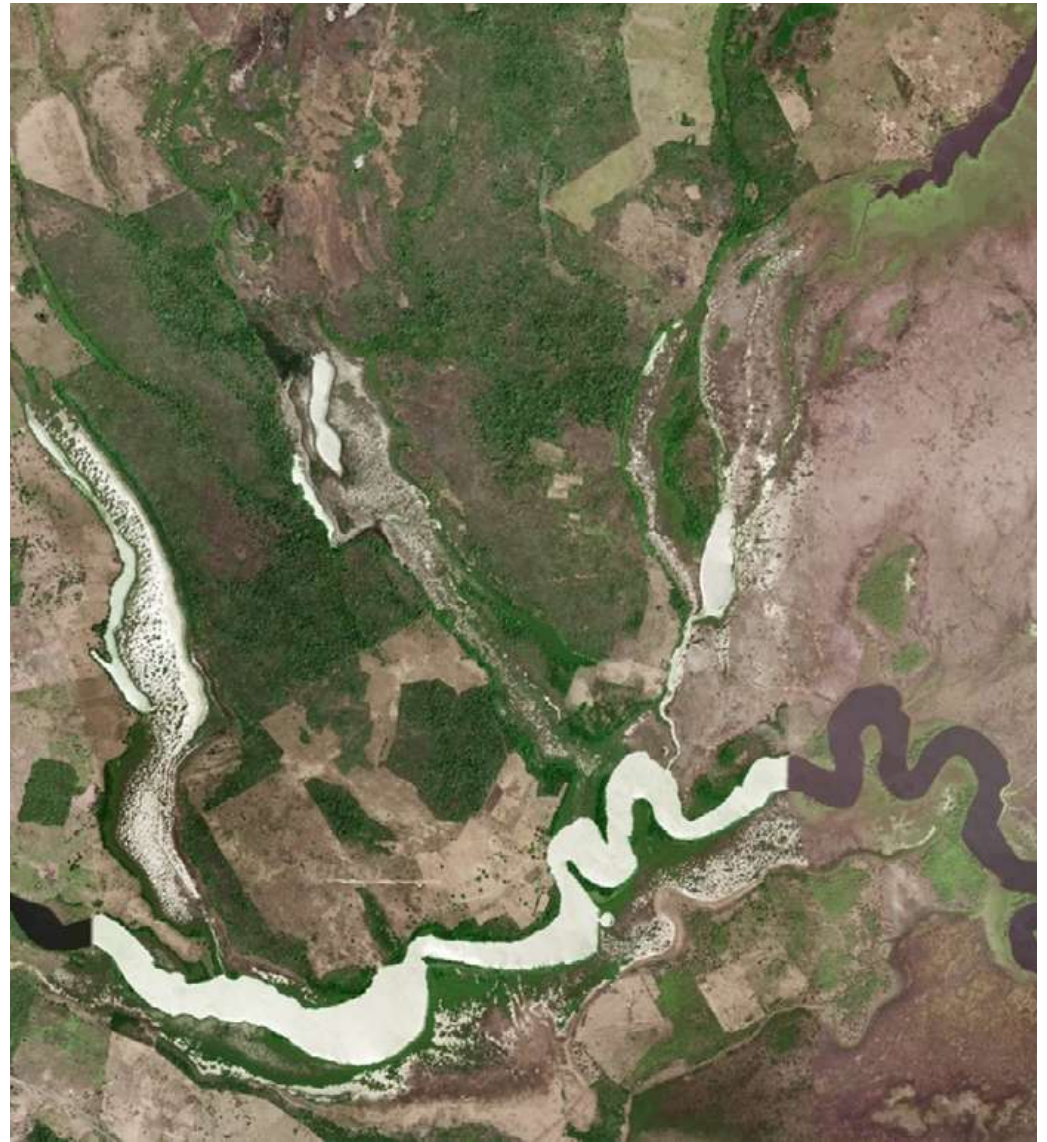
## Satellite Maps to show location of Río Escondido relative to town of Naranjo to the East and Petén (Guatemala)-Tabasco (México) border to the West

For the following attributions correspond to each layer of the Caltopo images that were used as photographic background for satellite maps put together by Sergio Jerez (FLAAR Mesoamérica) note the following:

Photographic background from Caltopo.com. The images were generated with caltopo.com @CALTOPO and are reproduced with permission. They contain layers from Caltopo, MapBox © mapbox (© Mapbox [www.mapbox.com/about/maps](http://www.mapbox.com/about/maps), © OpenStreetMap [www.openstreetmap.org/about](http://www.openstreetmap.org/about): Maxar, used under the terms of the Creative Commons Attribution-NonCommercial 4.0 license (CC BY-NC 4.0 <https://creativecommons.org/licenses/by-nc/4.0/legalcode>): the USDA Farm Service Agency (U. S. Department of Agriculture, Farm Service Agency), and EX IT (Sentinel-2 cloudless - <https://s2maps.eu> by EX IT Services GmbH - Contains modified Copernicus Sentinel data 2019).

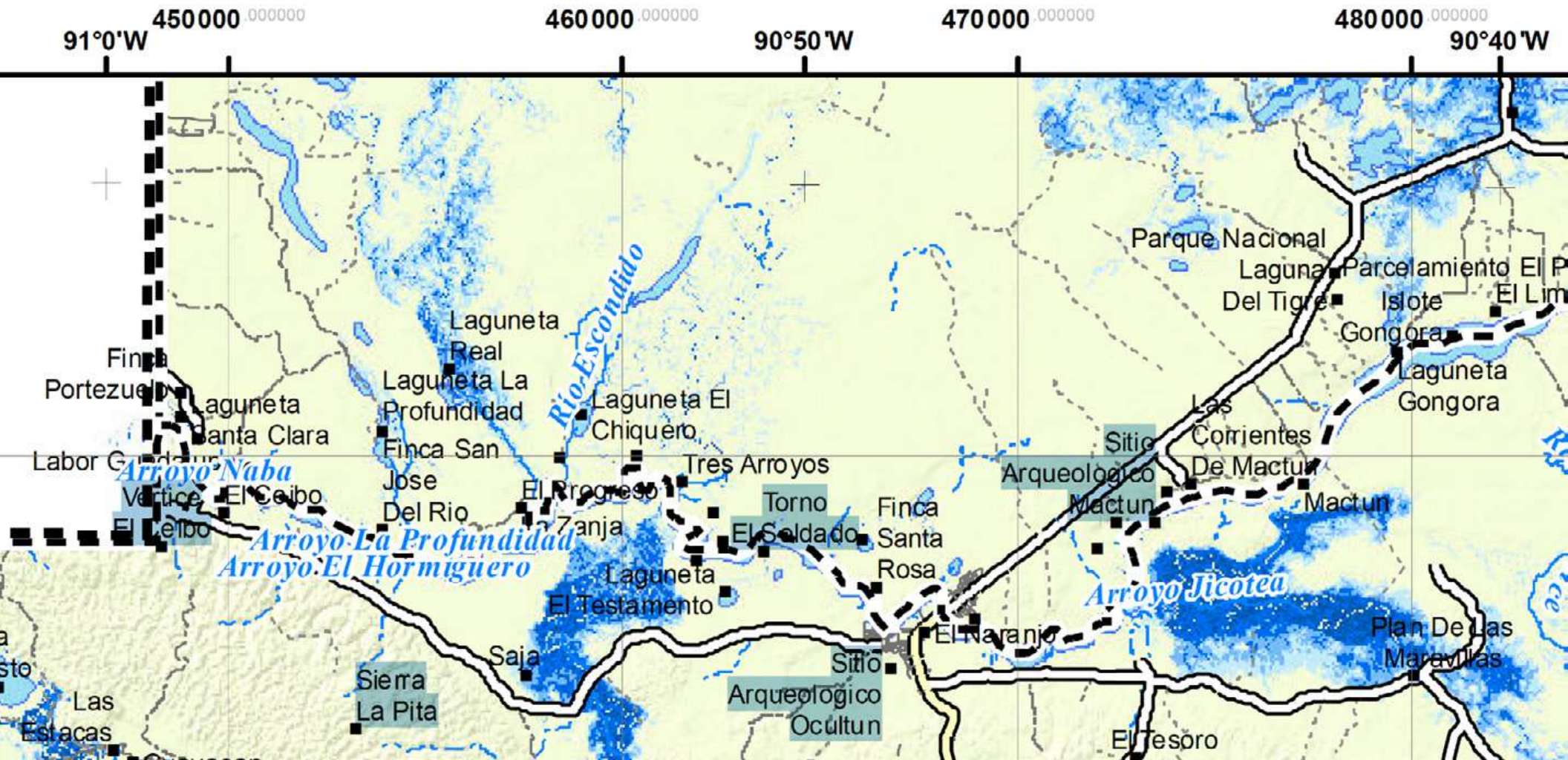






Río Escondido is the eastern of three streams that flow north-south, all three empty into Río San Pedro. We show the Río Escondido portion in the satellite map at the left.

So far, we have no local name for the small stream that is to the left of Río Escondido. The other stream to the west we are trying to get its name.



So far, other than Río Escondido and occasionally Arroyo Jicotea (Icotea) I have not seen Arroyo La Profundidad named on any map of any report on PNLT or the Biotopo Río Escondido (of if names are there, the size is too small to notice much less to read). I thank Sergio Jerez for finding this IGN map. What we do not yet know is which is "Arroyo El Hormiguero". If you search the Internet you see it is under (south of) Río San Pedro

Instituto Geografico Nacional 2010-2015, Codico: 1713, downloadable

[Click here to read more.](#)

## APPENDIX A

### Folder Names of Photographs of Río Escondido by FLAAR photographers on Feb 28, 2023

A more complete list will be in the updated final edition; below are just the folders of Hellmuth; need to add folders of Arrivillaga and Lopez.

Río-Escondido-water-lilies

Río-Escondido-downstream-from-Naranjo-Nymphaea-ampla-water-lily-Feb-28-2023-morning-Nikon-D810-200mm-NH

Río-Escondido-Sagittaria-NEEDS-ID-Feb-28-2023-916am-iPhone-14ProMax-NH

Río-Escondido-tiny-ground-flower-NEEDS-ID-Feb-28-2023-928am-iPhone-14ProMax-NH

Río-Escondido-snail-NEEDS-ID-Feb-28-2023-921am--iPhone-14ProMax-NH

Río-Escondido-Ludwigia--4-petalled-flower-sepals-Feb-28-2023-iPhone-14ProMax-NH

Río-Escondido-Pachira-aquatica-Zapatón-Feb-28-2023-iPhone-14ProMax-NH

Río-Escondido-marsh-grass-sedges-reeds

Río-Escondido-Acoelorrhaphe-wrightii-Tasiste-palm-Feb-28-2023-iPhone-14ProMax-NH

Río-Escondido-downstream-from-Naranjo-Acoelorrhaphe-wrightii-Tasiste-inflorescences-Feb-28-2023-Nikon-D810-200mm-NH

Río-Escondido-Entrada-LiRíos-de-Agua-Landscape-Fotos-Drone---Mavic3-28mm-839am-Feb-28-2023-HL

Río-Escondido-Acoelorrhaphe-wrightii-Tasiste-palm-Feb-28-2023-DJI-Mavic-HL

# Introductory Bibliography

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2000 A Biological Assessment of Laguna del Tigre National Park, Petén, Guatemala. Evaluación Biológica de los Sistemas Acuáticos del Parque Nacional Laguna del Tigre, Petén, Guatemala. *RAP Bulletin of Biological Assessment*, 16. Center for Applied Biodiversity Science (CABS), Conservation International (CI) CI-PROPETÉN, Consejo Nacional de Areas Protegidas (CONAP), Centro de Estudios Conservacionistas (CECON), Asociacion Guatemalteca para la Conservacion Natural (CÄNAN K'AAX), Comision Nacional del medio Ambiente (CONAMA).

## **CONAP**

2006 PLAN MAESTRO 2007-2011, Parque Nacional Laguna del Tigre y Biotopo Laguna del Tigre-Río Escondido. CONAP, Alianza Kanteel, Wild life Conservation Society.

## **PARKSWATCH**

2005 Perfil de Parque—Guatemala, Parque Nacional Laguna del Tigre y Biotopo Protegido Laguna del Tigre-Río Escondido. ParksWatch. 47 pages.

## ACKNOWLEDGEMENTS TO FLAAR MESOAMÉRICA

**Flor de María Setina** is in charge of the financial administration of the institution and supports the supervision of daily activities.

**Jorge Luis Arana** supports the financial administration of the institution and operative activities.

**Vivian Hurtado** is the current project manager of the FLAAR divisions: Flora & Fauna and MayanToons. She is also an environmental engineer and a passionate researcher.

**Victor Mendoza** environmental engineer in charge of the photographic database and its taxonomic identification. He also helps with the coordination of research activities.

**Sergio Jerez** agronomy engineering student involved in the identification of plants and support in research topics.

**Flor Morales** is a biologist that collects information and bibliographic references to feed our electronic library of flora and fauna and support research for reports and websites.

**Mariana Rivas** is a biologist that edits the information of our flora and fauna reports. She also helps in other research activities.

**Myrna Galindo** is a biologist who manages all our social media and digital community to transfer information on biodiversity and the topics that FLAAR is interested in.

**Byron Pacay** is our assistant during field trips to handle GPS data. He also assists in the main office with different tasks.

**Norma Cho** is a helpful photography assistant during field trips. She also assists in the main office with different tasks.

**Edwin Solares** is a photographer and videographer during our expeditions. Later, he edits this content to be used in our different materials.

**Haniel López** is a drone pilot and photographer during our expeditions.

**Pedro Pablo Ranero** with a degree in communication is responsible for editing videos of flora and fauna to create content on our sites.

**Andrea Sánchez** graphic designer who helps prepare the graphic line of our publications. She is our editorial art director.

**Jaqueline González** graphic designer who combines text layout and photo editing to create our reports.

**Heidy Galindo** graphic designer who combines text layout and photo editing to create our reports.

**Josefina Sequén** is an illustrator for MayanToons.

**David Arrivillaga** is an experienced photographer and graphic designer. Sometimes he is a photographer during our expeditions, but he also designs our flora and fauna reports.

**María Alejandra Gutiérrez** is an experienced photographer who is now in charge of the preparation of photographic catalogs. She was also coordinator of the field trips for the research project in Livingston, Izabal.

**Paulo Núñez** is an engineer and our webmaster. He is the person in charge of the maintenance and programming of the entire network of FLAAR websites.

**Juan Carlos Hernández** is a graphic designer and part of the web team. Receive the material we produce to place on our sites.

**María José García** is a graphic designer and part of the web team. Receive the material we produce to place on our sites.

**Andrés Fernández** is a graphic designer and in charge of keeping our websites updated and more efficient for the user.

**Karla Cho** helps with general research and design assistant in the office.

**Luis Molina** is a professional illustrator specialized in line drawings of Maya vases, bowls, and plates.

**Valeria Áviles** is a graphic designer and illustrator. She is in charge of coordinating the activities of MayanToons, as well as making illustrations for the different materials that we prepare.

**Laura Morales** is a digital content engineer, She is in charge of directing the animation area of our MayanToons project.

**Paula García** is part of our MayanToons animation team. Her job is to bring our favorite characters to life.

**Niza Franco** is part of our MayanToons animation team. Her job is to bring our favorite characters to life.

**Isabel Trejo** is a graphic designer and illustrator for MayanToons and for social media posts.

**Andrea Bracamonte** is a graphic designer and illustrator for MayanToons and for social media posts.

**Rosa Sequén** is an illustrator for MayanToons.

**Karan Arana** assists in the planning and management of FLAAR USA and FLAAR Mesoamerica activities. She also provides English lessons to the Mayan-speaking team working with FLAAR Mesoamerica.

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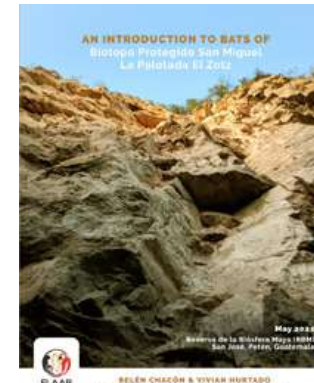
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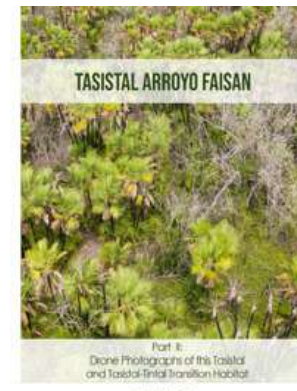
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