Redefining Savanna #25, #26, #29 and #30 Clarifying Savanna #30, #31, and #32 Adding newly noticed Savanna #35

Parque Nacional Laguna del Tigre (PNLT) Reserva de la Biosfera Maya (RBM)

FLAAR MESOAMÉRICA

Nicholas Hellmuth
FLAAR (USA) and FLAAR Mesoamerica (Guatemala)

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CREDITS

The helpful individuals listed below are all part of the FLAAR Mesoamerica research and field work team. The office research team, webmaster, and web designers are additional individuals in the main office in Guatemala City.

AUTHOR
Nicholas Hellmuth

COMPILATION OF BASIC DATA FROM EARLIER BOTANISTS AND ECOLOGISTS
Nicholas Hellmuth

PLANT IDENTIFICATION (GENUS SPECIES)
Nicholas Hellmuth
Victor Mendoza

PLANT USE BY POKOMCHI AND Q'EQCHI'
Byron Pacay
Norma Estefany Cho Cu

BIBLIOGRAPHY TEAM
Vivian Hurtado

EDITOR
Vivian Díaz

PHOTOGRAPHERS
Nicholas Hellmuth
Edwin Solares
Norma Estefany Cho Cu

VIDEO PHOTOGRAPHERS
Vivian Hurtado
Edwin Solares
Haniel Lopez (drone, aerial videos)

PHOTOGRAPHY ASSISTANT
Norma Estefany Cho Cu

DRONE PILOT AND AERIAL PHOTOGRAPHER
Haniel Lopez

GPS DOCUMENTATION AND ROUTE MAPS
Bryon Pacay

DESIGN CONCEPTS FOR GPS ROUTE MAPS
Sergio Jerez

MANAGER OF DESIGN AND LAYOUT
Andrea Sánchez Díaz

LAYOUT OF THIS ENGLISH EDITION
Alexander Gudiel

APPRECIATION FOR ENCOURAGING THE RESEARCH PROJECT

INITIATION AND COORDINATION OF THE PROJECT OF COOPERATION FOR 2021-2025
Licda. Merle Fernandez
(CONAP)
Marla Mercedes Bolvito Jeronimo
(Unidad de Cooperación Nacional e Internacional de la Secretaria Ejecutiva de CONAP)
Licda. Ana Luisa De León N.
(Directora de Educación para el Desarrollo Sostenible, CONAP)
Lic. Apolinario Córdova
(CONAP Peten)
Ing. Jorge Mario Vazquez
(CONAP, Santa Elena, Peten)

COOPERATION AND COORDINATION FOR FLORA, FAUNA, ECOLOGY RESEARCH SOUTHEAST AREA OF PNLT
Ing. Edvin Ramírez Villalobos
(Director Parque Nacional Laguna del Tigre)
Julio Peña
(técnico de CONAP)
Rony Chata Soza
(técnico de CONAP)

HELPFUL COOK AT CONAP CAMP AREA, MARCH 29-APRIL-3, 2022
Maria Xol

HOSPITALITY & ACCESS TO FAR EAST-SOUTHEAST AREA BY LOCAL FINCA OWNER
Julio Trabanino

GUIDES FOR FAR EAST-SOUTHEAST AREA, MARCH 29-APRIL 2, 2022
Julio Peña
(técnico de CONAP)
Mario Mazariegos
(técnico de CONAP)
Josue Perez, park ranger
(CONAP)

GUIDES AND EQUIPMENT PORTERS FROM PASO CABALLOS DURING RESEARCH IN PNLT
Leonardo Cucul
Juan Carlos Col
Gonzalo Caal
Jeronimo Cuc

DRIVER OF LIFTED 4WD, MARCH 31-APRIL 2, 2022
Alex Choc

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Jefe de Manejo Forestal,
CONAP PETÉN

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This donation is from a family in Chicago in honor of the decades of botanical field work of botanist Dr John D. Dwyer, who worked in many areas of Mesoamerica, including in the Yaxha area in the 1970's while the site was being mapped by FLAAR.

This donation is also in recognition of the urgency and need for conservation of both wildlife and rare plants in the bio-diverse ecosystems of the Reserva de la Biosfera Maya (RBM) of Guatemala. Parque Nacional Yaxha, Nakum and Naranjo (PNYNN) and Parque Nacional Laguna de Tigre (PNLT) are two parts of the over 5 million acres of the RBM.

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Introduction to FLAAR Research Project on Savannas and adjacent Wetlands of RBM

I use Satellites.Pro and Google Maps Satellite View to search for savannas of the southern half of the Reserva de la Biosfera Maya (RBM). I use savanna as a generic word for a space with open flatland of "savanna vegetation" surrounded by bajo vegetation and/or hillside vegetation. If I can see an "open area" in a satellite view or in the aerial photos of IGN, then I put this open area in my list (obviously we do not include cattle pastures in the natural, native, open areas). Once we hike to this open area, then we can redefine and improve or correct the classification terms. But in the meantime, "savanna" is a generic term for an area surrounded by bajo forest vegetation. In PNYNN and other areas of the RBM a savanna can also be surrounded by a karst hill. PNYNN Savanna East of Naranjo and Savanna West of Naranjo-Sa'al have a bajo on one side and a limestone hill on the other.

The savannas of the southern half of the RBM are different than the pine savannas of nearby Belize; different than the savannas of Poptun, of La Libertad area and between there and Sayaxche. The savannas we are studying in PNLT and PNYNN tend to be:

- Low grassland savannas with occasional tasiste, morro and nance
- Tasistal savannas with solid tasiste palm (and other vegetation)
- cibales, savannas with tall sawgrass that slices your skin if you attempt to enter

There are also occasional open areas with no tasiste or morro. These may have a lagoon, aguada or simply have vegetation other than tasiste and morro. Nonetheless these areas are visible from satellite photos because the surrounding forests do not cover these open spaces. When I count "how many savannas" are in an area, I include any open area. These are naturally unforested areas. By unforested I mean trees do not form a solid canopy: there are trees and saplings in all savannas, including in tasistal palm areas, but they are not a solid closed forest. A tasistal is a solid closed palm area but this "palm forest" is easy to detect from satellite photos because a tasistal is different color green and different pattern, since the tasiste palms are in oval clusters.

Biologists, ecologists and soil scientists will have different classification nomenclature. But I prefer to use words that express what I see day after day, week after week, since exploring savannas of Parque Nacional Yaxha, Nakum and Naranjo (PNYNN) during our August 2018-July 2019 project of cooperation and coordination with the dual administration teams of that park. Now we have a new 5-year project with CONAP for the entire RBM so I like to focus on every size, shape, and biodiversity of savanna and savanna-like open areas.

As soon as funding is available for high-resolution Phase One iXM 100-megapixel UAV camera to be flown by a DJI M600 drone, then we can better define the plants within each type of savanna. And with mapping software we can map each savanna. In the meantime we do the best we can to locate savannas in the areas we are focusing on for year 2021-2023: the southern half of the RBM.

Our project of cooperation and coordination with CONAP is for five years (2021-2025) and covers all 21,602 square kilometers of the RBM, from Peten to west to Chiapas border, Peten to northwest to the Tabasco border, Peten up north to Campeche border, Peten to the east to Belize border. The area is over 5-million acres and since obviously we do not have funding for 5-million acres of field work, we are initially focusing on studying wetlands and seasonally inundated wetlands.

Every field trip we learn something new about plants and ecosystems. Every hour that I spend in front of two adjacent 32-inch wide 4K quality resolution monitors I am finding additional aspects of biodiversity inside and around each savanna from satellite photos and our drone photos. And as I look at the edges of our research areas I find new savannas: found about four unknown, unnamed mid-sized savannas at west edge of Parque Nacional Yaxha, Nakum and Naranjo (PNYNN). And yesterday noticed more savanna areas of the far southeastern edge of Parque Nacional Laguna del Tigre (PNLT).

And, since a few weeks ago we were hiking into the area of PNLT savannas #23 to #30, I have noticed that the tasistal areas are almost continuous for many kilometers. This means it is not easy to define where one tasiste palm savanna ends the nearby one begins (since often they merge into each other). So I decided to show my estimated "borders" of each savanna in close-up view from satellite images. These borders will be improved each year as we have higher resolution aerial photographs available.

We will return to each savanna as soon as the current April-May heat wave ends and after the upcoming Neotropical June-onward monsoon season is over. We continue research each month, every month, all year, but we will go to other areas when reaching the savannas is not practical. We are curious about the mangrove swamp along Rio San Pedro, that is over 100 kilometers from the sea but nonetheless is a living relic of a mangrove swamp. Almost all this area has been obliterated by cattle ranches but we hope to be able to find at least what little remains and photograph and document it. These mangroves are known and mentioned but have not been adequately photographed on the Peten side of the border. Most of the videos and reports with photos are on this inland mangrove swamp on the Tabasco side of the Peten border (about 100km from the coast). In the meantime, here are our updates on savannas of the far southeast portion of our PNLT savanna research area.

We have visited and hiked through and photographed Savannas #3, 4, 5, 6, 9, 13, 14, 23, 24, south part of 25 and #31. Savannas #1, 2, 11, 12, 13 through 22 we have studied with satellite images and drone photos for Savannas #1 and 11. The present report is on Savannas #24 through #35. We have visited at least the outside of Savannas #24, #25, and #31 and have drone photos of these.

Tasital Savanna # 24

Lots of kilometers hiking from base camp to Savanna #13 (the savanna with a dozen baby crocodiles in a pool of water). Then hiking to Savanna #14 and from there to Tasistal Savanna #24. It was possible to reach this never-before-studied Tasistal Savanna #24 as a result of Byron Pacay and a team of local Q'eqchi' people who help us on every field trip to open a narrow trail. These trails can then serve the local park rangers so they can more easily patrol these areas.

After we accomplish drone photos and panorama photos, we return back to the base camp hiking the same loooong distance. Then we try to put our photos in folders and prepare for the next day's exploration of a different savanna area.

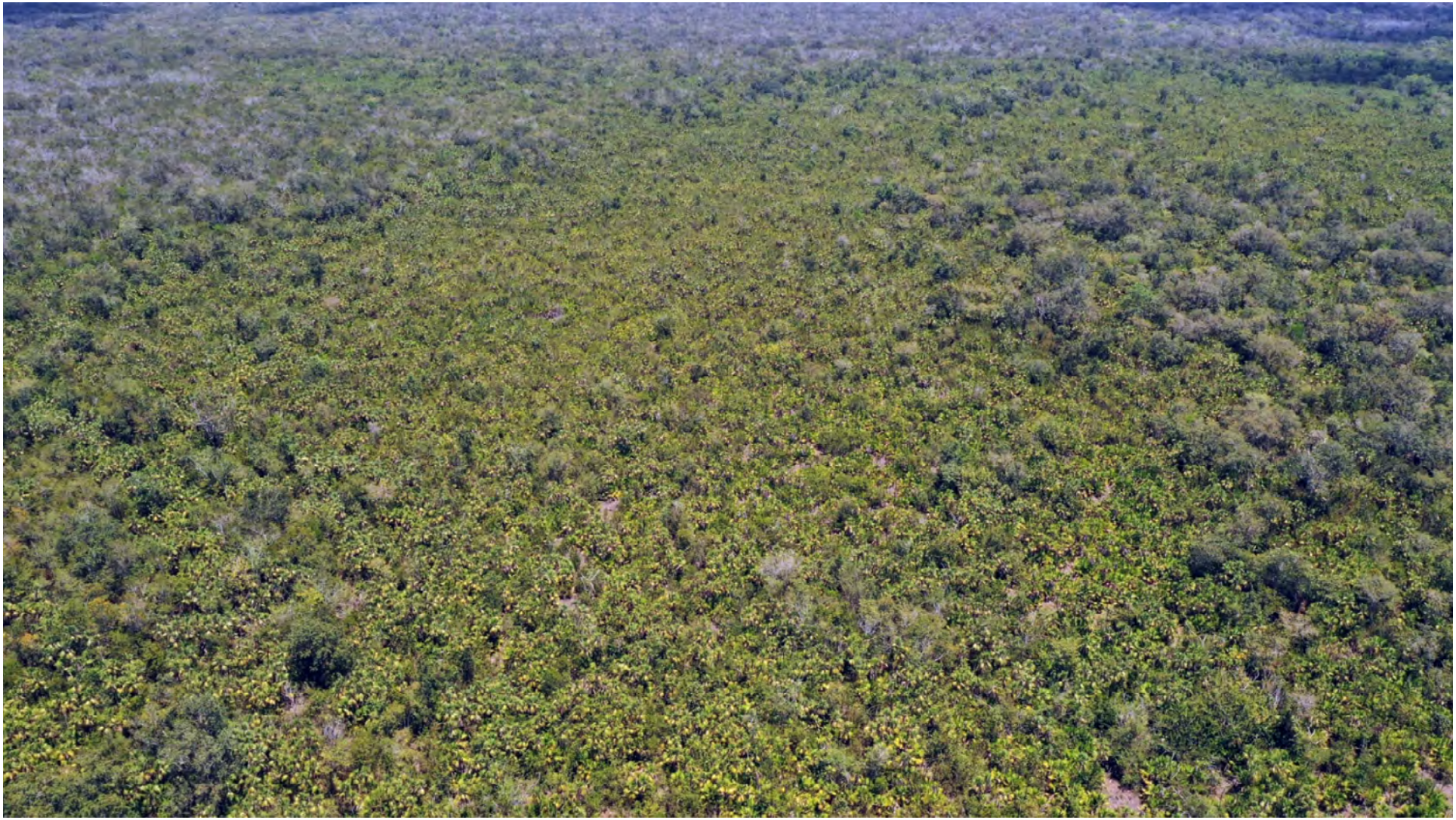
GPS MAPS with Garmin unit of FLAAR by Byron Pacay for April 1, 2022.

This map is to initiate better understanding of where Savanna #25 is in between Tasistal Savanna #24 and Tasistal Savanna #26. This map is also to show that the open (looks empty because everything around is green) low grassland area of Savanna #25 is really part of a significantly larger tasistal palm area to the west. My original map intended #25 to refer only to the several low grassland savannas (that look "dirt colored" from a satellite view). But now I realize it is best to expand the boundary of Savanna #25 to include the tasistal area directly around it.

In the future, when we have higher resolution digital aerial views of this areas, I would consider recognizing that Tasistal Savanna #26 is an eastward tasistal extension (like the northeastern area that I did add to Savanna 25 concept.

Our project of coordination and cooperation with the CONAP, an ecosystem, forestry, biotopo and parks department, is for five years (2021-2025) so once we can raise funding for more field trips (so we can hike into each and every part of each savanna) and especially when high-resolution aerial photos are available, then we can not only rewrite the present FLAAR report we can rewrite the description of the biodiversity of savannas that the Classic Maya had (in addition to seasonally inundated swamp bajo forest areas and hillside and hilltop rain forests). For the recent quarter century ecologists, ethnobotanists and archaeologists have documented that the Classic Maya managed much of the forest in order to have edible nuts, fruits, seeds and other edible plant parts (flowers of several wild trees native to the Maya Lowlands are also edible).

Google Maps, satellite view.



Tasistal Savanna #24. Thick bajo forest vegetation visible at right and in upper left and all the background. In the middle is the tasiste area. About 75% tasiste palm and 25% other trees, bushes, plants and vines.

April 1, 2022, registered FLAAR drone DJI Mavic 2 Pro, experienced drone pilot Haniel Lopez. 28mm view.

If we had multi-spectral high resolution digital aerial camera system we would map each area and you could see which species of trees were where. You could measure and count more accurately with a multi-spectral map. Phase One iXM 100-megapixel UAV camera can be combined with special software to achieve results never available to botanists and ecologists

All these tasiste palms have edible seeds (many dozens per inflorescence).

The inner parts of the top 50 centimeters of young stems are edible.

On future field trips we will make lists of as many other plants as we can

The tall thin black trunks standing up are the stems of tasiste palms that have been burned so hard that these stems could not regrow leaves when it rained after the fire was over. Fortunately even if the stems are burned that hard the root mass survives and new stems rise up to form new palms in the same area.

It felt like 40 degrees Celsius in the shade. Local people said that's more like 50 degrees Celsius out in the sun. So we carefully decided to slowly hike back to the base camp to rest

Tasistal Savanna #24. View of the tasistal area showing that tall trees also grow here. The leaves at the left are *Crescentia cujete*, calabash tree, morro. The seeds are edible and the dried seed pods are used as bowls and cups for thousands of years; Tepeu 1 Classic Maya ceramic bowls are a copy of size and shape of a certain shape of jicaro or morro seed pods. *Crescentia alata* jicaro trees grow in bosque seco areas but can be planted in home gardens in most areas of Guatemala.

Nance trees are the third logo tree of savannas of the Reserva de la Biosfera Maya. So the three most common trees all have edible parts. Low grassland savannas have an endless number of vines and herbus and bushes also with edible parts (and these savannas also have tasiste palm, morro and nance trees).

Photo by trail clearing manager Byron Pacay before our late March-early April field trip.

Tasiste palms, all trunks burned but many resprouted at the top when rains camera. When the trunks were burned so hard the entire palm died, they resprout from the root mass

In the middle background is a *Crescentia cujete* tree. We need to return to identify all the other trees that grow within a tasiste.

Tasistal Savanna # 25

C is an open grass land area. G and H are open grassland areas. F needs to be photographed in-person and from the air at high resolution.

E is potentially solid tasiste palm (but need to make sure it is not low bajo vegetation). Originally I defined Savanna #5 as only the open low grassland areas, but after studying it in more detail I decided to add areas E and D. If you study the satellite views of both Google Maps and Satellites.Pro, you need to decide whether to also add the giant probably tasistal area to the east of the G areas. The area outside of G is very similar to the E area. There is what I estimate as bajo vegetation south of E (outside Savanna #25). We have not reached the open low grassland areas C or G of Savanna #25. But we have seen these areas from drone photos taken from the west (looking north and east).

Tasistal Savanna #23 is a solid tasiste in rough triangular shape to the west.

Enormous Tasiste Palm Area: Tasistal Savanna #26

The upper area in this year of this month is more covered with vegetation. In Satellites.Pro image (next photo) this upper area is open grassland with lots of tasiste but not solid tasistal.

Google Earth, satellite view.

Tasistal Savanna #26 in this photo is one of the largest tasistal areas we have found so far (keeping in mind there are other tasistal savannas everywhere around #26).

There are several open areas in #26: lower left, lower right; and a large grassland savanna at the far right. Then upper area is grassland and tasiste (so not solid tasistal as is the rest of the area).

Satellites.Pro

Savanna #26 seen from year 2006 aerial photos of IGN. I do not yet have the maps that show the east side, so on this IGN area I can't yet show the entire expanse to the east, of the incredible size of this tasistal savanna. Note the open grassland savanna is along the south side. Savanna #14 also has pure tasistal at its north and pure traditional open grassland savanna at its south. I have not yet been to Savanna #11 myself but Byron's trail clearing team evidently found a tasistal sector.

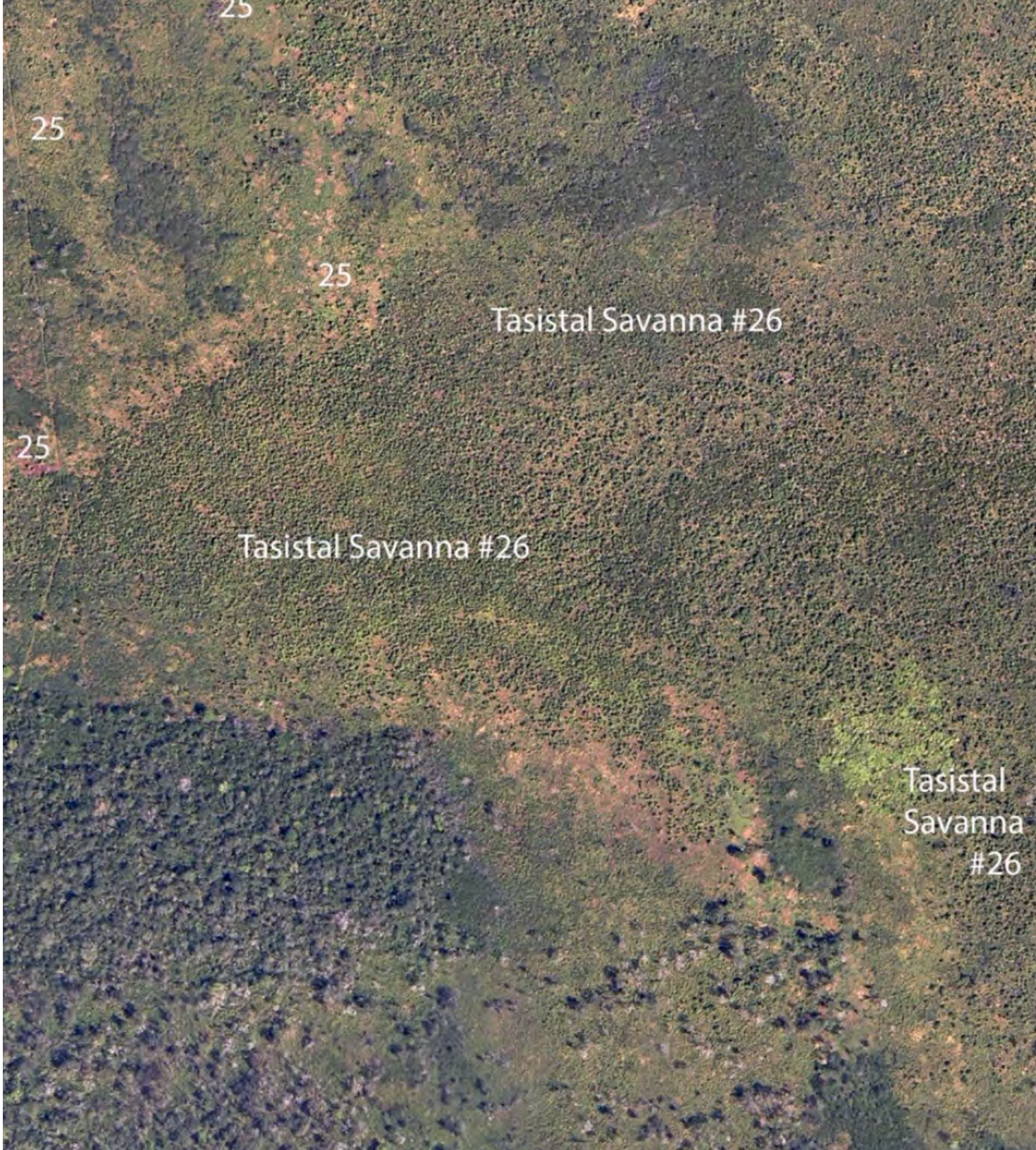
Both Savanna #25 and Savanna #26 need to be remapped and redefined after we have time to reach here in the future. Will need minimum 2 days to cover Savanna #25 (possibly three) and at least four days to cover Savanna #26. "Cover" means hiking through to see each different habitat biodiversity, take panorama photos from the ground and from the 3-meter high ladder, take drone photos and videos from all angles.

95% of Savanna #26 is tasiste palm. This you see from Google Maps satellite view. But there are variations in the coverage; a few areas have narrow open spaces between areas of clusters of the palms. Plus there is a

- non-tasistal area at far east edge of the savanna
- open grassland with intermediate tasistal at the southwest
- a bright green area net to a dark green forest intrusion near the southwest area
- lots of other micro-habitats.

What if Savanna #25 and adjacent Tasistal Savanna #26 were the largest savanna in the entire Reserva de la Biosfera Maya that is still in virgin original preserved condition?

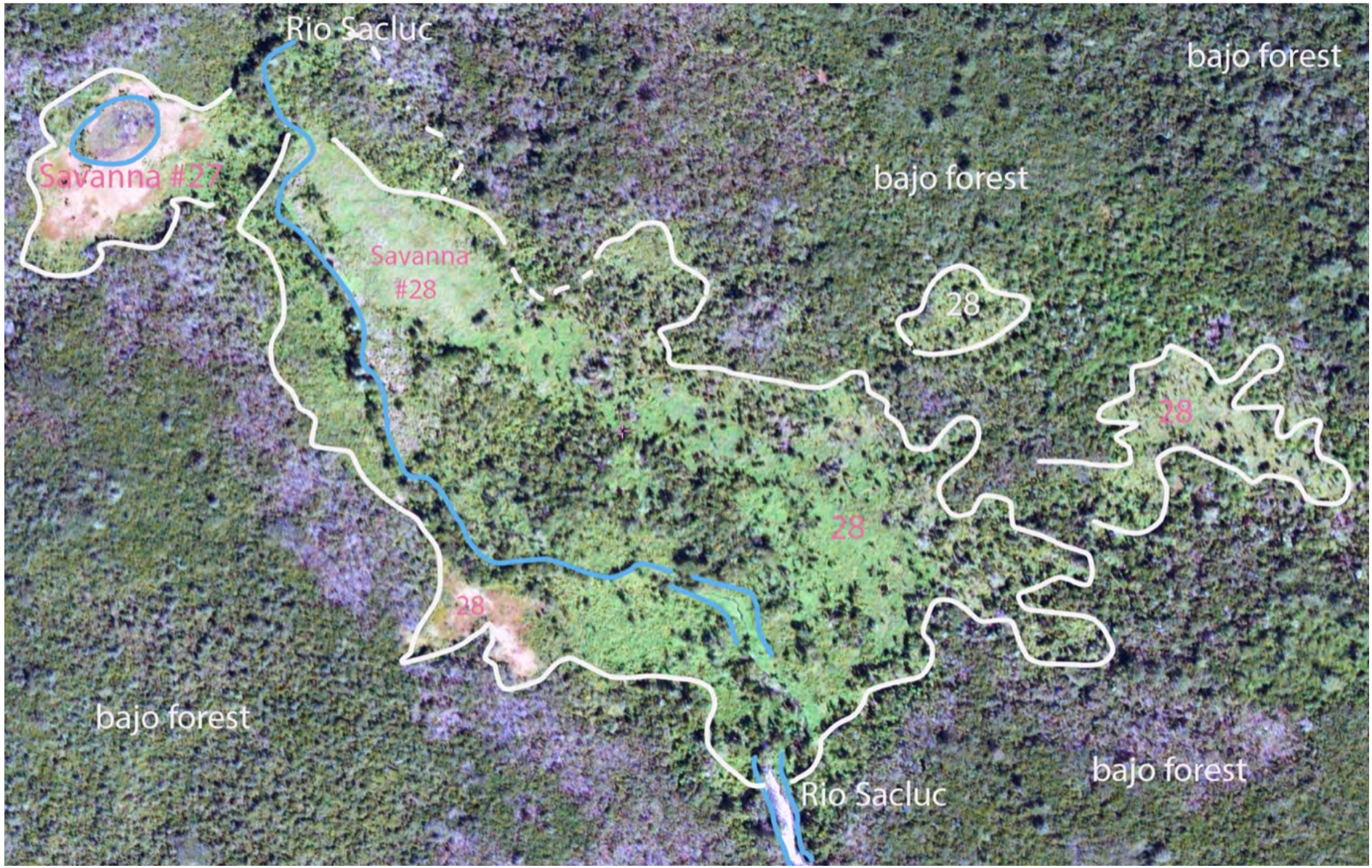
Savanna #23, #24, #25, and #26 are one giant connected tasistal palm ecosystem probably larger than grassland savannas #10, #11 and #12 put together. I estimate for sure these may be the largest preserved tasistal area of Guatemala: the two tasistal areas of Municipio de Sayaxche have their tintal bajo swamps around them being chainsawed every day for the last several decades (for fence posts for haciendas). The other Petaxbatun area tasistales we have not yet visited but most are destroyed by cattle ranches.

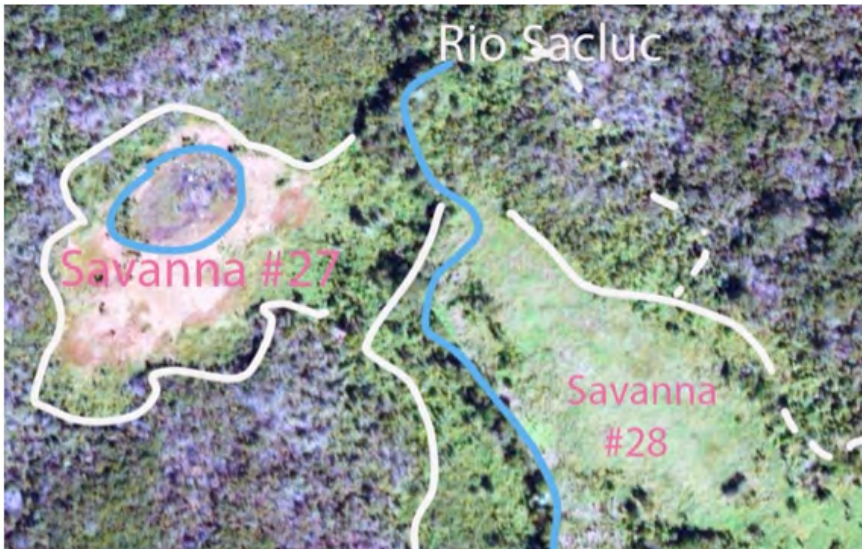


Savanna #27 with an Aguada

Savanna #28 (Sawgrass Cibal, Low Grass Savanna and inner Forested Area)

We have only seen these two savannas from drone photos and satellite photos. We look forward to hiking here as soon as possible.



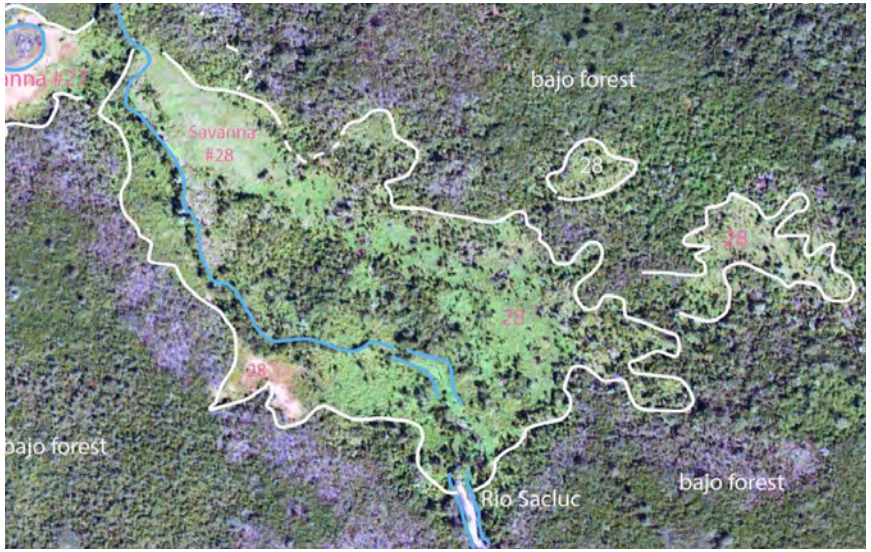


Haniel Lopez was able to reach this savanna from the sky so we have photographs from the air and videos. Here is a satellite view.

Savanna #27 could be considered an extension of #28, but since #27 has an aguada and low grass, I name it separately.

Savanna #28 has high sawgrass probably because the Rio Sacluc flows through it (every stream in this area is given the same generic name, Rio Sacluc).

What is atypical of this savanna is the literal forest in the middle. Here is a perfect example of why a 100-megapixel drone is essential, so we can identify these tree species from the air. We need to learn whether this is a bajo forest in the middle or a thickly forested part of the savanna.

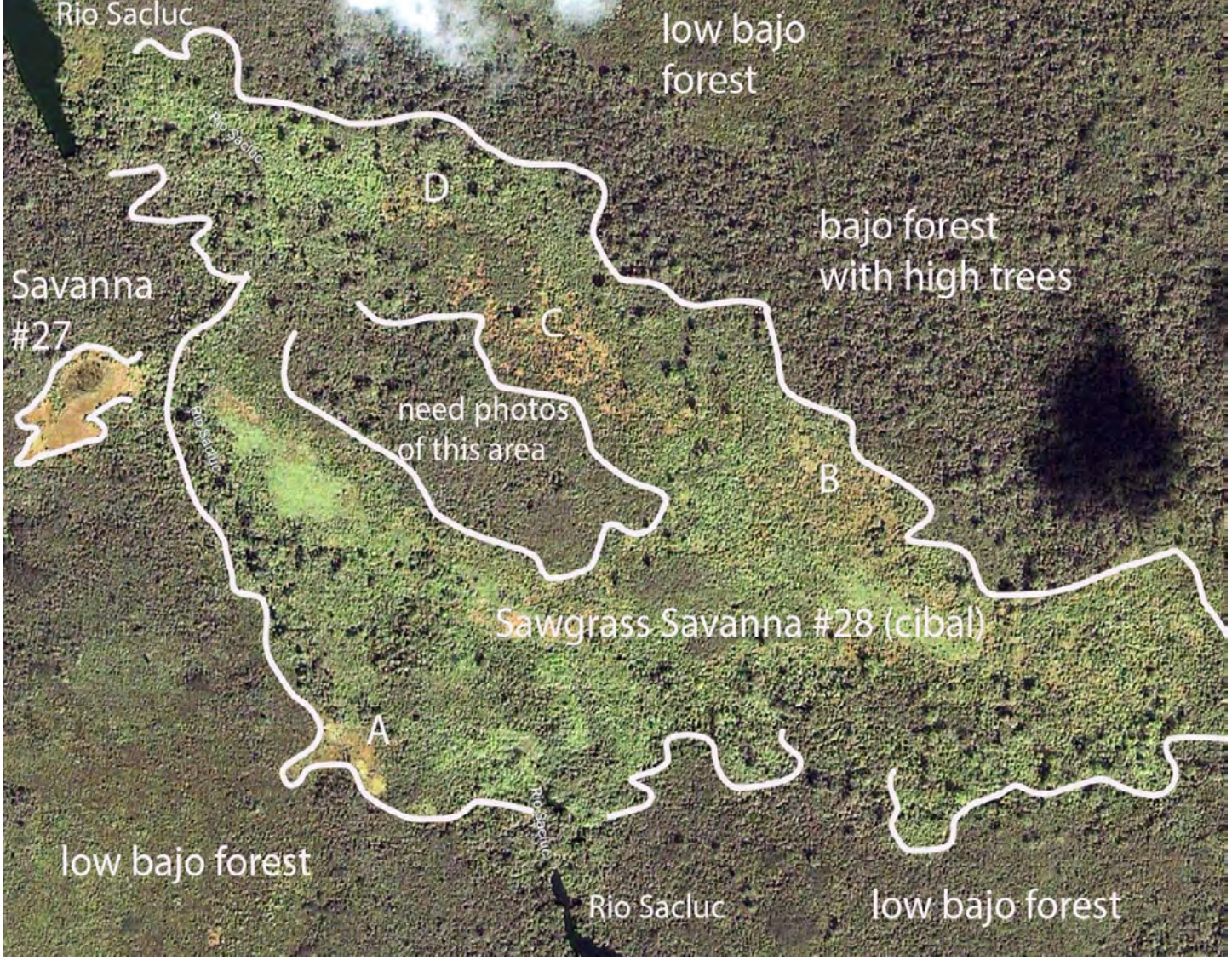


The year 2006 aerial photograph of IGN (that we show on the next page) allows showing different extension of Savanna #28 along the stream at the southeast.

The two small savanna areas to the left I include as part of Savanna #28. If an ecologist in the future prefers to give them separate numbers, that is fully understandable.

The bajo forest that surrounds these savannas appears as gray in many areas and green in other areas. I estimate some is relatively high tree bajo; and other areas are lower trees with scrub. A patient botanist or ecologist could achieve a PhD dissertation just on the different varieties of bajo vegetation in this area. With multi-spectral digital photos such a dissertation should win grants and awards.

Satellites.Pro



Whatever year, whatever month (of Google Maps) shows a very different vegetation than shown on same area for Satellites.pro. So I redefine the boundaries of the Savanna #28. Savanna #27 is the same as seen on Satellites.pro; the remains of the aguada are clearly visible (with years of hiking through the Peten, you can recognize an aguada even when it has no water).

A, B, C, and D are low grass areas. D may have lots of tasiste palm (possible also for B and C areas).

The island of potentially non-savanna vegetation needs photos of this area before I can comment on whether this is bajo vegetation or not. A perfect assignment for a high-resolution UAV camera with multi-spectral software. But even with regular digital photos, if 100-megapixel resolution is available, we can identify many of the plants from the air. Plus we obviously need to hike to this far far away savanna to study each area in-person and take photos of each different aspect.

Google Maps, satellite view.


28
27
28
Savanna #28
28
28

The resolution of the IGN (Instituto Geografico Nacional de Guatemala) aerial photographs are better than either Satellites.Pro or Google Maps satellite view. So with the IGN aerial photograph shown here we can see the savanna area may need to be mapped differently. No matter how we map it once we have higher resolution photographs we can do a better job. But at least we are introducing this savanna to the world.

Savanna #28 has open grassland, probably high sawgrass (cibal), potentially areas of lots of clumped tasiste palms (possibly even tasistal-like areas). Since a stream flows through the left side and out the bottom right side there will be plants of a marsh and potentially trees of a swamp.

Relocating Savanna #29 Savanna #29 and Marsh, Cibal, Wetlands on both sides of Rio Sacluc

The bright green area parallel to both sides of Rio Sacluc could be cibal, marsh or other wetland (since the river rises in the wet season). Need to see whether bog moss or other plants are present. The area where the letters Sav of Savanna are located is an open grassland savanna. An area of different vegetation separates Savanna #20 from #31.

If you had time to do a PhD dissertation, you could have a better classification of each area of "Savanna #29" since much of this area would best be defined with different ecological terms. But you have to get here on foot, do panorama photography, macro photography, and aerial photography with a drone. That is our goal for all 35 savannas of this far southeastern part of Parque Nacional Laguna del Tigre.

Marsh, Swamp, Savanna #30
Wetlands along both sides of western Rio Sacluc

This green area parallel to both sides of Rio Sacluc is mostly a marsh. Need to visit in-person to document to what degree this area is a cibal (high sawgrass) or a regular marsh with lots of grasses, sedges and reeds but not 90% sawgrass. While visiting this area in the future need to determine whether tasiste palms are present. Satellites.pro and Google Earth satellite view are not high enough resolution to tell for sure.

Note that the area with a question mark has the same two pools of water, but at the far lower left the open area does not enter the bajo as much as in the Google Maps satellite view.

Not enough trees to consider the whole thing as a swamp, but surely small areas of swamp.

The two trails look almost wide enough to get a vehicle here, though usually these surveyor's breaches are made for motorcycles.

Grassland-Tasistal-Sawgrass (Cibal) Savanna #31

Suggested outline of Savanna #31. Savanna #30 is in the top left corner (separated from Savanna #31 by a band of thick seasonally inundated bajo forest vegetation).

Our first numbering of savannas from #1 through #33 was on a single sheet. But this meant each savanna was too small to see. So then we made the map on two sheets: one for Savannas on the north and northwest area; and one map for Savannas #12 through 33. But as we began to hike to these savannas I noticed the map needed more detail, that I needed to define each individual savanna at high resolution and full page size. That is the reason for the current FLAAR Report (to show pertinent savanna areas so you can see more details. I also found several more savannas (now the total number is 35).

When we have high resolution aerial photos I can discuss areas A, B. C, D, E, F and G.

Once I have the IGN aerial photos I can make even better definitions, but I wanted to at least start with satellite photos of Satellites.Pro and Google Maps satellite mode.

In this month of this year the vegetation in this Google Maps image was slightly different than the view from Satellites.Pro. This is a result of fires and amount of rainfall in that year or that month.

Now that I have 64-inches of high resolution monitors (to replace my years of just 16" laptop monitor) I can see more details plus I can compare the year shown by Satellites.pro with the different month and/or year shown by Google Maps satellite view. When enlarged on two adjacent 32" 4K monitors I can see significantly more, so I am improving the list and showing each savanna in close-up (page size) view. We can do even better with a Phase One iXM 100-megapixel UAV camera flown by a DJI M600 drone. But since we do not have our own funds for that, we are working with what is available (April 2022).

Satellites.Pro view. Every stream in this part of PNLT is called "Rio Sacluc" by Satellites.pro and Google Maps.

In this month of this year the vegetation was slightly different than the view from Satellites.Pro. This is a result of fires and amount of rainfall in that year or that month.

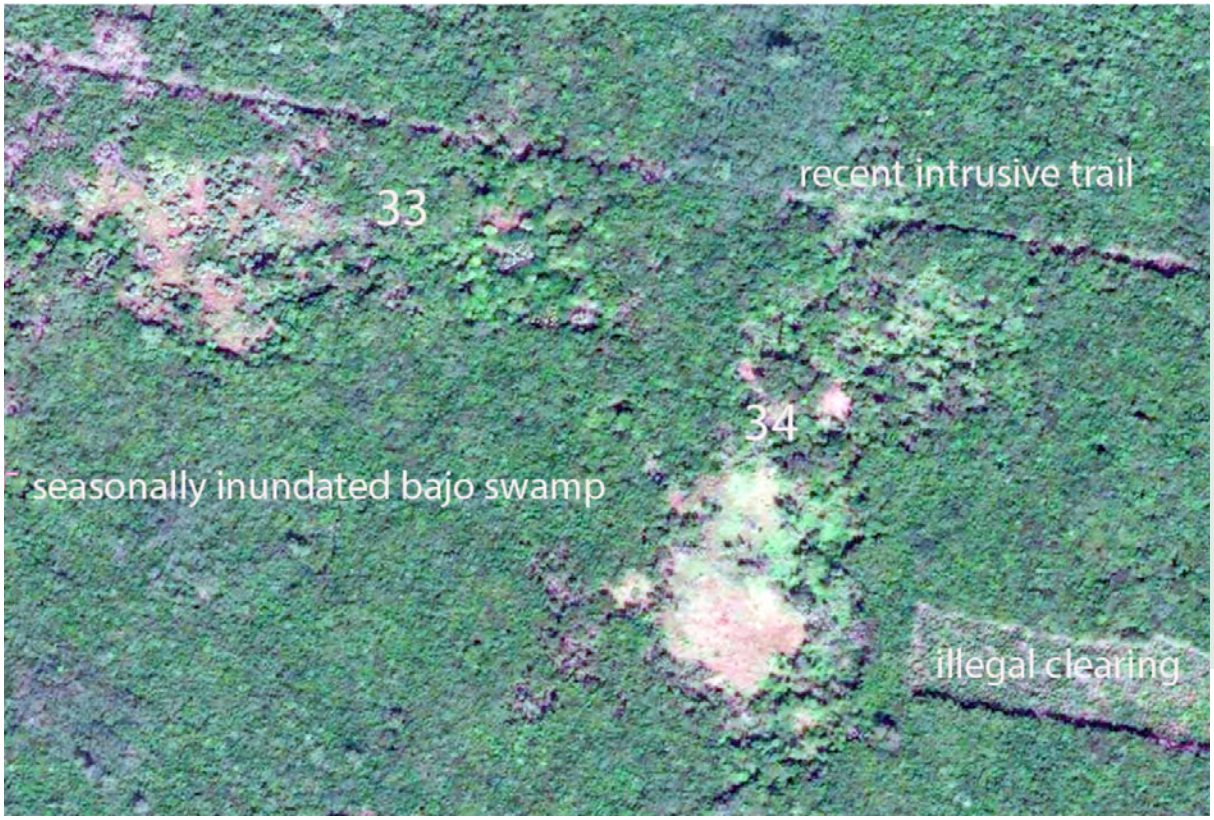
View from Google Maps satellite view.

Savanna # 32, below #31

Closeup of Savanna #32 (recently renamed 32). Bottom of Savanna #32 is in top left. At full page size this view shows its inadequate resolution. With a 100-megapixel UAV camera with a drone we could show all the details that would help conservation institutes realize the importance of preserving this part of the little remaining original vegetation of the former Classic Maya homelands.

This view from Google Maps satellite view shows this savanna as separate from Savanna #31. But Satellites.Pro shows #32 as potentially an extension of #31. I would not hesitate to consider Savanna #32 as part of Savanna #31 but it is easier to discuss the different habitats if the area of #32 has its own number.

Savanna #33 and Savanna #34



These are mostly open low-grassland savannas, though we will find much more when we have drone photos and when we hike here to inspect each area in-person. Once we are inside each savanna we can take panorama photos plus close-ups. And macro photos of each flower (to help identify each plant in the savanna).

Illegal clearing for intrusive cattle ranches is already about to destroy Savanna #34. So we need to get here before everything in this area is totally decimated. No wildlife conservation agency is working here because these fragile biodiverse ecosystems are not in any report, not in any plan, not in any publication. This is why we of FLAAR (USA) and FLAAR Mesoamerica (Guatemala) are dedicating ourselves to finding, locating, showing these areas and then getting to a base camp (1,000 kilometer round trip from our main office in Guatemala City). From a base camp, with the help of CONAP park rangers and local Q'eqchi' Mayan guides, we can figure out how to hike to these areas.

Upon arrival, a drone is essential. Plus panorama photography from the ground. We also accomplish macro photography of flowers. If we find crocodiles we photograph them with telephoto lenses. There are two aguadas on the right side of Savanna #33 so we can expect *Crocodylus moreletii* crocodiles here. Crocodiles prefer a river, but they often raise their young in pools of water in savannas.

Savanna #34 is a low grass savanna (dirt color) with cibal sawgrass at the right (bright flat green). These are estimates from our experience.

Satellites.Pro. We show Savanna #35 in the Google Maps satellite view below. Since each of these different websites uses satellite photos from a different year or month, they each show aspects not in the other. The Satellites.Pro are more recent so show the illegal clearing to destroy the original rain forest in order to have a cattle ranch.

Shows the location of Savannas 33 and 34 in relation to Savanna #31 and #35.

Would be a helpful MS thesis or PhD dissertation to understand why open grassland Savanna #35 has irregular open grassland areas and then thickly "forested" green areas. We need to learn whether the solid green ares inside #35 are bajo vegetation or tasistal palm areas. We have not yet found access to Savanna #35 but will definitely find a way to hike here.

The trails you see on all these maps are by people trying to grab land to completely deforest it and turn it into cattle ranches. But the savannas you see are not the result of modern clearing. They are not the result of modern milpas either. This area has been relatively protected (other than the survey lines and entry corredors cut here in recent years.

GoogleMaps satellite view.

Newly Noticed Savanna #35

Now that I have two 4K HMDI Samsung monitors I can enlarge satellite photos so I can see more details. With two of these monitors side-by-side I can put a view of each area by Satellites.pro on my left monitor and Google Maps satellite view on my right monitor and I can learn a lot more than when I had just the 16" monitor on my Apple laptop computer.

Savanna # 35. Google Maps, satellite view. I can see two pools of water at the top middle.

Savanna # 35.

Satellites.Pro, satellite view. The open area around the two pools of water in the year/month of Google Maps has been totally overgrown with surrounding bajo forest; in Satellites.Pro the water is surrounded by forest, not savanna. The areas of what appears to be dry forest needs significantly higher resolution in order to figure out why certain areas are gray-brown instead of green. I really look forward in finding which park rangers know this area and how to get here on a future field trip.

You can see that ranchers are destroying the rain forests as quickly as possible. Look at the rectangular area along the end of the north-south trail. The diagonal east-west trail is to help the intrusive ranchers get into the remote areas to clear everything for cattle ranches. If you look at aerial views of the area you see that large cattle ranches have destroyed much of the area to the east of this savanna.

Map showing the savannas on the west side of the road heading to Paso Caballos and savannas on the east side of the same dirt-gravel road.

There are also savannas north of Paso Caballos and a few west of Paso Caballos. But the Savannas #1 through 35 are in one area that we can hike too. Savannas #34 and #35 are not on this older map; we will do a new map this month.

For savannas further east of where we are working we would need to find how to reach these areas. So for 2021-2022 we are focusing on the initial Savannas #1 through 35.

Savannas #12 through #33. This is the old map we have been using on the initial field trips. But now that we have been three days in the areas of #23, 24, 25, 26, and 30, I realized that I needed to improve the map (hence the present FLAAR Report to better show the savannas up close). So we will discard this map and prepare an improved version with corrected numbers (for #30 through #35; #34 and #35 are not on this map).

The team of FLAAR (USA) and FLAAR Mesoamerica (Guatemala) are finding unexpected edible plants: vines, herbs, water plants, palms, tree fruits, grasses of savannas that are edible. This raises the question "did the Classic Maya utilize managed savannas, cibales, tasistal savannas and other areas surrounded by the bajos as a "savanna garden"? Even if savannas were not a bread basket as could have been the adjacent larger seasonally inundated bajos, tintal bajos, corozal bajos, I propose that savannas were a potential notable source of food for thousands of years. The documentation of savannas that we initiated in 2018 and is continuing full-steam-ahead in 2022 suggests that future books on "The Classic Maya," in chapters on ecology and food sources, can have a segment on Savannas as a Potential Source of Edible Wild Plants (in addition to these areas being open to agriculture and raising of wild mammals, reptiles, turtles and fresh water land snails that are all edible). Some savannas have enough natural water to also facilitate raising fish (in addition to turtles and fresh water (jute) snails that are edible). The snail shells we find in many savannas are apple snails, which are even larger than jute snails. Apple snails are edible.

The savannas introduced in this FLAAR report are just a dozen or so. There are about 70 more savannas about 90 kilometers to the east that we began to study in late March (and will continue to undertake hiking to these remote open habitats in May). Plus we have studied and published the Savanna East of Nakum, small Savanna West of Naranjo Sa'al, the small Rectangular Savanna adjacent to the Savanna of 3 Fern Species (all of Parque Nacional Yaxha, Nakum and Naranjo (PNYNN). Last week, from satellite photos, I found about lots more additional savanna, cibal, or aguada grasslands of PNYNN that I was not aware of in our previous field trips. So, a lot more savanna documentation to come.

A wild native tasistal palm savanna. April 2, 2022.

Less than a kilometer away, a wild native tasistal savanna burned to the ground. April 2, 2022. Photos with FLAAR drone, DJI Mavic 2 Pro by experienced drone pilot Haniel Lopez.

This burning is at the far southeast part of the park. These photographs provide documentation to assist in preventing this in the future. Note: 90% of the savannas in the RBM are burned each year.

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