



FLORA
YAXHA



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MESOAMÉRICA

MOSS ISLAND

Tillandsia usneoides (L.) L.

BROMELIACEAE

Topoxté Island, Yaxha,
Guatemala

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MOSS ISLAND

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This report was made with the cooperation of the administrators of the Yaxha, Nakum and Naranjo National Park to share knowledge about the neotropical flora and fauna that exists in this area of Guatemala. This material can be used by students, teachers, and researchers to communicate the potential of Yaxha, Nakum and Naranjo Park for research and tourism. It also includes a learning tool for biodiversity conservation for any person and organization.



PHOTOGRAPH FROM COVER:

Tillandsia usneoides (L.) L.

Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, August 20th, 2018. National Park, Yaxha, Nakum and Naranjo, Guatemala. Camera: Nikon D810. Lens: Nikon AF-S NIKKOR 600mm FL ED VR. Values: f/13, 1/100, ISO 3200.

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Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, December 19th, 2018. Topoxté, Petén, Guatemala. Camera: Nikon D5. Lens: Nikon AF-S NIKKOR 600mm FL ED VR. Values: f/10, 1/250, ISO 1600.



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PHOTOGRAPHY FROM CONTENT PAGE:

Tillandsia usneoides (L.) L.

Photography by: Erick Flores, FLAAR Mesoamerica, May 9th, 2018. Topoxté, Petén, Guatemala.
Camera: Canon EOS-1D X Mark II. Lens: Canon EF 300mm IS II USM.
Values: f / 5, 1/640, ISO 1250.

SERIE





FLAAR Mesoamerica (**Foundation for Latin American Anthropological Research**) is a nonprofit Guatemalan institution founded under the direction and enthusiasm of experienced Biologist Eduardo Sacayón and Dr Nicholas Hellmuth. Dr Hellmuth, a specialist of Classic Mayan iconography and temple-pyramid, palace and ballcourt architecture. Hellmuth's research evolved to focus on edible and utilitarian plants of the biodiverse ecosystems of Guatemala that were available to the Maya of past and present.

The work done at FLAAR Mesoamerica consists of the methodological compilation of facts about nature, flora, fauna, history, and cultures of Mesoamerica. It also includes publishing it to a larger audience, both in Guatemala and around the world. One goal is to promote the country around the world for its diversity of birds, pollinators, mammals, amphibians, reptiles, photogenic flowering and non-flowering Neotropical plants in wetlands, forests, savannas, and other remarkable habitats from bosque seco, monte espinoso, seasonal rain forests to cloud forests.

We have an experienced team specialized in advanced high-resolution digital photography and wide-format inkjet printing. Our in-house graphic designers can produce educational material about nature to donate to school classrooms in remote mountain and rain forest areas. Our Mayan-speaking team facilitates having our educational material in several Mayan languages, and we will be adding material in Garifuna for our project in Municipio de Livingston.

Likewise, our work has arisen from the interest and support of the board directors of FLAAR Mesoamerica, President Flor de María Setina, Vice president María Alejandra Gutiérrez, Secretary Rodrigo Girón, Treasurer Oscar Lambourg, and (Vocal) Elsa Morales.

One of our main objectives at FLAAR Mesoamerica is to increase consciousness

about caring and protecting Mesoamerican natural diversity. By utilizing high-resolution photography, we can better showcase the remarkable flora and fauna of Guatemala. These photographs, and the accompanying information, will awake the admiration and desire in those who follow our work. Thus, the FLAAR Mesoamerica teams create educational material about the biodiversity that deserves recognition and protection.

We also are inspired to provide for all our readers plenty of annotated suggestions of lots of other reports, articles, thesis, dissertations, and web sites via our bibliographies of suggested additional reading. Our goal is to generate materials that are easy to read, educational, reliable, and visually pleasing by using lots of full-color photographs -just like this report!

Our newest project is to adequate this technical information to help children learn about biodiversity and how to protect endangered species by MayanToons books and educational animated videos. Our illustrated books and animations are made for primary school children and Mayan families in Guatemala to have access to information about the need to protect the fragile ecosystems and flora and fauna throughout this country.

We are open to work with, share, and expand our accomplishments with other organizations, institutions, or companies that share our vision. You can find more of our work throughout the different digital platforms of our directory:



www.FLAAR-mesoamerica.org
www.digital-photography.org
www.maya-ethnozooology.org
www.maya-ethnobotany.org



YAXHA, NAKUM AND NARANJO NATIONAL PARK

The Yaxha, Nakum and Naranjo National Park is a site of great natural and cultural importance for our country. In addition to the diversity of flora and fauna species it protects, the park is listed as a RAMSAR site as it includes three types of wetlands identified by the Convention on Wetlands: temporary lagoons, karst systems and peatlands. Of these three types of wetlands, the lagoons Yaxha and Sacnab stand out, followed by Lankaja, Champoxte and Juleque lagoons.

This protected area is also of cultural importance since it protects heritage from the Pre-Hispanic Mayan period including 292 sites of interest, four are monumental archaeological sites: Yaxha, Nakum, Naranjo and Topoxté. Also, it has six intermediate archaeological sites: Naranjito, El Carmen, La Pochitoca, Poza Maya, El Bajón and El Pital, as well as 282 other minor archaeological sites within its limits (PNYNN Master Plan, 2006).



View of Laguna Yaxha (Yaxha Lagoon) from the Greater Observatory of the Greater Astronomical Observation Complex in the Yaxha Park. Laguna Yaxha is one of the wetlands declared by RAMSAR.

Photography by: María Alejandra Gutiérrez, FLAAR Mesoamerica, May 9th, 2018.
Topoxté, Petén, Guatemala.
Camera: Canon 60D. Lens: Canon EF 300mm IS II USM. Values: f/4, 1/320, ISO 4,000.

PREFACE

I have had the opportunity to travel throughout Latin America and the United States, and I have seen many times what we commonly know as “Spanish Moss” (a *Tillandsia* of the bromeliad family), hanging from the branches of trees. But frankly, in the last decades I had not found any place with such a large amount of moss as I saw it in Yaxha, specifically, in the Island of Topoxté. This is a magical place by itself, as it housed a part of the Mayan civilization, it is an island, and because it is where this species of flora concentrates, along with more nature, flooding the structures that were built there.

It is true that this type of epiphyte or “moss”, *Tillandsia usneoides* (L.) L. exists in all parts of America, however, the Island of Topoxté deserves a special mention. If you like artistic photography as well, Topoxté is the perfect place to capture the essence of a tropical Mayan jungle next to the waterfalls of moss hanging from the treetops.

In September 2018, the FLAAR Mesoamerica team visited Paxté, the island adjacent to Topoxté, thinking that we would also find *Tillandsia* but we did not. On our next visit to Yaxha, Nakum and Naranjo National Park, we hope to visit Isla Canté to verify if *T. usneoides* is also present as in Topoxté or if it is absent as in Paxté.

- DR. NICHOLAS HELLMUTH
FLAAR USA - FLAAR MESOAMERICA



Nicholas Hellmuth setting the photographic equipment in Topoxté.
Photography by: Erick Flores, FLAAR Mesoamerica, May 9th, 2018. Topoxté, Petén, Guatemala.
Camera: iPhone 6

CONSERVATION OF THE ARCHAEOLOGICAL LEGACY

Preserving the monumental mayan architecture of Topoxté, and the adjacent islands of Paxté and Canté, is of vital importance since the ancient Postclassic cities found around the lagoon were destroyed long ago by the Spanish conquerors. Archeology and history show that there was an abandonment of the first island during the 9th century, and that it became repopulated a couple of hundred years later (Hermes & Noriega, 1998).

Archaeologists Prudence Rice and Don Rice have written reports on this site, as well as Bernard Hermes' team and his colleagues in the 1990s. The present report will focus on the impressive amount of mosses that grow on the tops of the tallest trees in the rainforest on Topoxté Island.



Topoxté buildings

Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, December 19th, 2018. Topoxté, Petén, Guatemala.
Camera: Canon 60D. Lens: Canon EF 300mm IS II USM. Values: f/5, 1/80, ISO 1,000.

ARCHITECTURAL ASPECTS OF THE ISLANDS

-TOJÍN BENITO MALCHIC

The islands are located in Laguna Yaxha (Figure 1) and are related to the homonymous site where there is evidence of monumental and residential constructions during the Late Classic (800 to 900 AD), contrary to what happens in most of the Mayan lowland sites (Hermes & Noriega, 1998).



Figure 1. Laguna Yaxha (Yaxha Lagoon) map and the location of the three islands. (Hermes & Noriega, 1998).

Topoxté is the largest island, with almost 100 structures and the largest ceremonial center of the three. It is followed in size by Canté Island and the smallest is Paxté.

In Topoxté diverse researches have shown 10 construction stages of which 3 are from the Postclassic. The first stage is when an immense effort of monumental architecture is made. In the second stage, monumental works were also developed although remodeling is already beginning. Therefore, the last stage corresponds only to remodeling work. Structure C, in Topoxté, is the greatest exponent of monumental architecture from the Postclassic that is still standing (Figure 2) (Pinto, 1995; Hermes & Noriega, 1998).

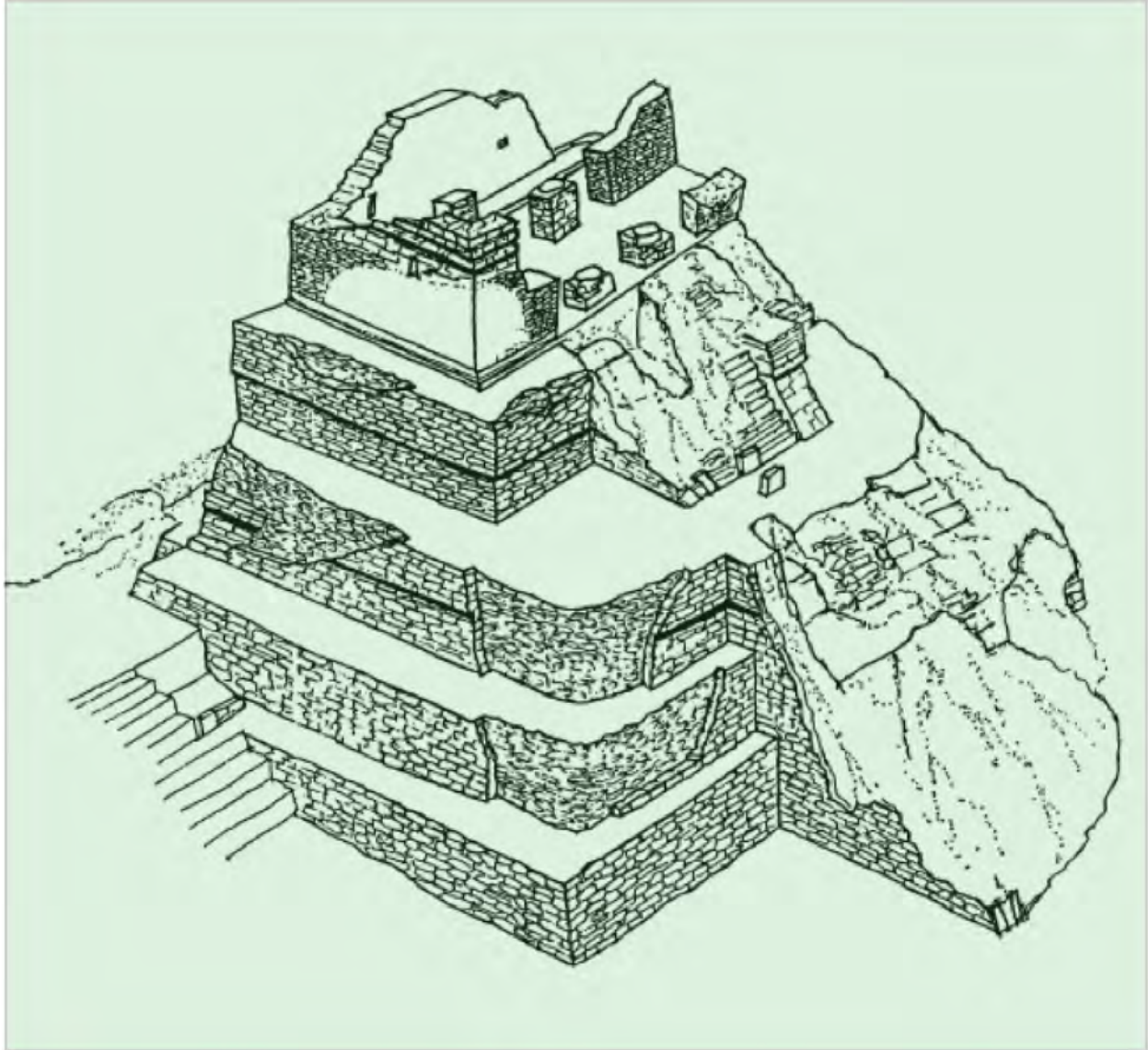
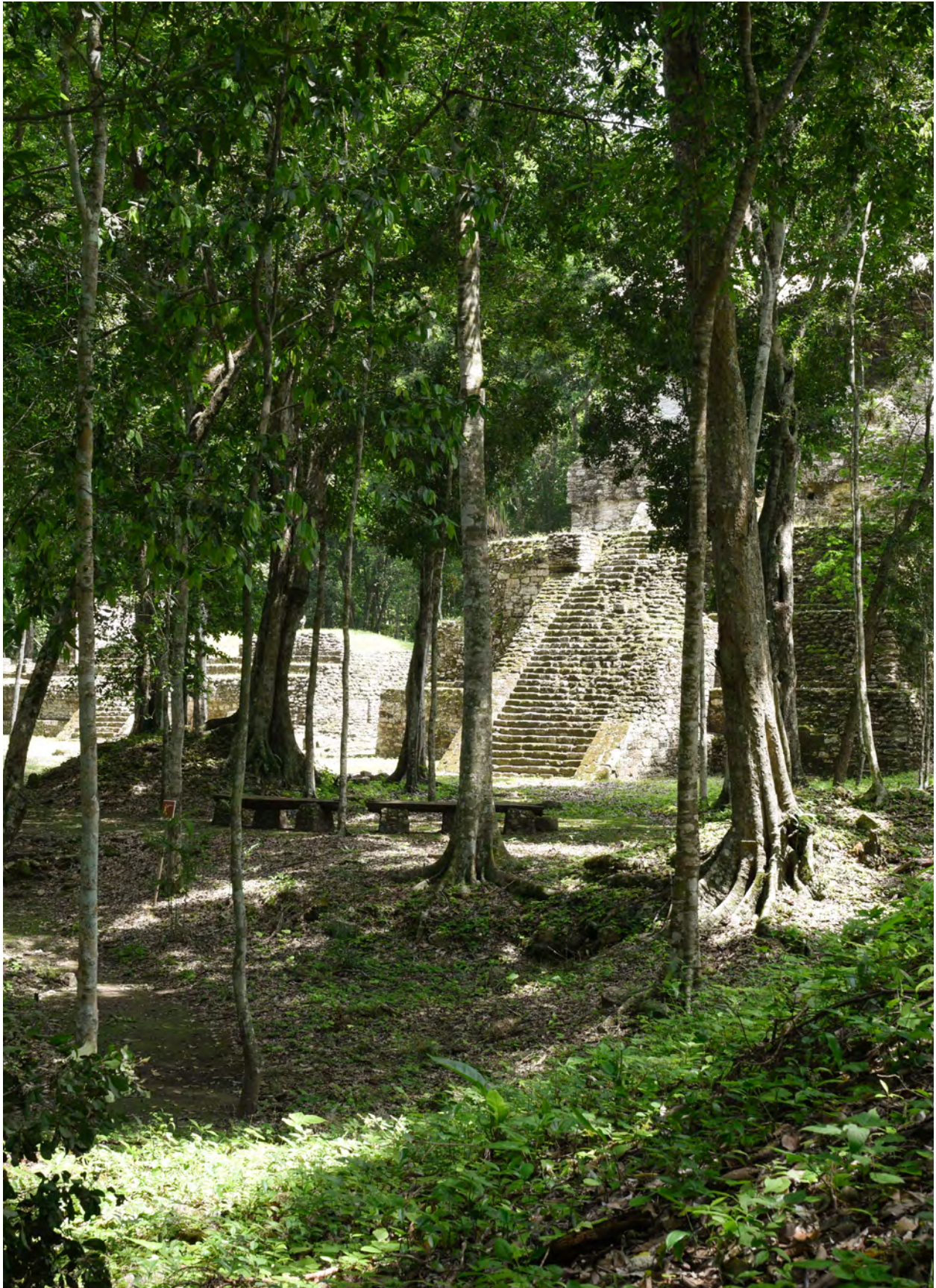


Figure 2. Isometric of Temple C of Topoxté (Pinto, 1995).

Other architectural features, typical of the period, are the stairways; the lack of interest in symmetrical details, stelae and smooth altars of small dimensions. There is a sculpture in the shape of a serpent's head, similar to one reported in Mayapan.

In addition, the architecture presents similarities with that of sites located to the west (central Petén), east (Belize) and northwest (Belize and Quintana Roo), which indicates continuity of links with these areas. Likewise, the presence of obsidian in Ixtepeque (south coast) and El Chayal (highlands) shows a commercial relationship and changes in routes over time (Rice, 2002).



Temple C. Structure that represents the monumental architecture that developed on the island.
Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, September 10th, 2018. Topoxté, Petén, Guatemala.
Camera: Nikon D810. Lens: Sigma 35mm DG. Values: f/10, 1/125, ISO 1,600.

HUMAN SETTLEMENTS AND THEIR DIET

-TOJÍN BENITO MALCHIC

Despite having buildings from previous periods, it seems that Topoxté was not inhabited during the Late Classic period, while the other two islands show evidence of habitation. Repopulation during the Postclassic began around AD 1150-1120, continuing until a few years after 1450 AD. C. (Johnson, 1985).

The handled hypothesis is that the elites of the moment decided to abandon the site due to a political re-accommodation, and the centers around Lake Peten Iztá when the provinces were united in confederation (multepal) (Hermes & Noriega, 1998).



It is believed that the inhabitants of Topoxté belonged to migrant groups, such as the Itzá, or that they were descendants of local groups (Hermes & Noriega, 1998).



Topoxté Mural in the Yaxha, Nakum and Naranjo National Park Museum. You can visit the mural that is in one of the Museum rooms in the park's Visitor Center.

Artist: Otto Saravia (1996).

Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, September 10th, 2018. Yaxha, Nakum and Naranjo National Park Museum.
Camera: Nikon D5. Lens: Nikon AF-S NIKKOR 600mm FL ED VR. Values: f/5, 1/60, ISO 200.

Paleobotanical studies, carried out on some of the bone remains found, show that during the Late Classic and Postclassic there was no major difference in the consumption of corn, although there was in the consumption of protein. It also showed a lower consumption of red meat and a higher consumption of beans, freshwater snails, turtles, among other things, those being products from the lagoon (Goldstein & Hageman, 2009).



Topoxté. Fragment of the mural that represents how the city of Topoxté could have been with its inhabitants, customs and economic dynamics. Artist Otto Saravia (1996)

Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, September 10th, 2018. Yaxha, Nakum and Naranjo National Park Museum. Camera: Nikon D5. Lens: Nikon AF-S NIKKOR 600mm FL ED VR. Values: f/5, 1/60, ISO 200.

THE NAME OF THE ISLAND

In the Recognition Guide of the Genus *Tillandsia* of Guatemala, it is mentioned that the common names for *T. usneoides* are (Véliz, 2010):

- | Musgo (moss)
- | Musgo blanco (white moss)
- | Barba de viejo (Old man's beard)
- | Tzin-í
- | Paxte

i!

The words *te o che* (which are usually accented) are the Mayan words for most plants that are trees or related to trees (Polian, 2015).

The least common name -Paxte- has made us wonder if the name of the island Topoxté has something to do with this Mayan word, since “Topoxté” has a phonetic and orthographic resemblance to “Paxte”. Therefore, we have generated the hypothesis that the name of the island Topoxté is derived from the word Paxte, and may mean “Island of moss”.



T. usneoides (L.) L. At one of the lookouts at Yaxha site, you can closely observe the “old man's beard” hanging from the trees.

Photography by: María Alejandra Gutiérrez, FLAAR Mesoamerica, December 1st, 2018. Topoxté, Petén, Guatemala.
Camera: Canon 60D. Lens: Nikon 200mm AF-D Macro. Values: f/4, 1/320, ISO 4,000.

The island of Topoxté and its trees have a large number of mosses hanging from the height indeed.

We would love to do some research on the different Mayan language words for Spanish Moss and its origins, but the information is scarce. Little by little the mayan speakers have been decreasing, since these languages are not transmitted to the new generations and there are not enough written records of it.



Moss is capable of absorbing water and nutrients from the atmosphere, therefore, *T. usneoides* is capable of being an indicator of air quality (Calvario, Beltrán, Del Razo, Vázquez, & Lucho, 2012).



***T. usneoides*.** Example of moss in Paxté Island, Yaxha Lagoon, across the Ixtinto River from Topoxté Island.

Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, June 9th, 2018. Paxté Island, Petén, Guatemala.
Camera: Nikon D810. Lens: Nikon AF-S NIKKOR 600mm FLE D VR. Values: f/10, 1/1000, ISO 400.



T. usneoides. More Spanish Moss on the Island of Paxté, Yaxha Lagoon. There is also a red bromeliad in the upper right corner.

Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, June 9th, 2018. Paxté Island, Petén, Guatemala.
Camera: Nikon D810. Lens: Nikon AF-S NIKKOR 600mm FL ED VR. Values: f/10, 1/60, ISO 320.



This plant is used by people in an ornamental way in traditional festivities related to Christmas. It is also used for upholstery because it is an elastic fiber (Hanan & Mondragón, 2009).

T. usneoides. Spanish moss or "old man's beard".
Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, August 21st, 2018.
Topoxté Island, Petén, Guatemala.
Camera: Nikon D5. Lens: Nikon AF-S NIKKOR 600mm FL ED VR. Values: f/11, 1/250, ISO 2,000.



Canté Island.
Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, December 21st, 2018. Island of Paxté, Petén, Guatemala.
Camera: Nikon D5. Lens: Nikon AF-Micro-NIKKOR 200mm IF-ED Macro. Values: f/10, 1/320, ISO 200.

WHERE CAN *T. USNEOIDES* BE FOUND?

In addition to finding this plant throughout the journey taken on the island of Topoxté, you can find and photograph *T. usneoides* around the monumental Mayan palaces, pyramids and acropolis of Yaxha. In the following photographs you will see some examples that you should take into account on your next visit to this protected area.



We have observed that it is common to find moss on deciduous trees, probably because the foliage of evergreen trees does not allow the moss to adhere properly to the branches of the tree.



T. usneoides. View of the moss on the trees of the Yaxha, Nakum and Naranjo National Park. Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, August 20th, 2018. Yaxha, Nakum and Naranjo National Park, Guatemala. Camera: Nikon D810. Lens: Nikon AF-S NIKKOR 600mm FL ED VR. Values: f/13, 1/100, ISO 3,200.



T. usneoides. From the first part of the tour of the Mayan ruins you can see the old man's beard hanging from the trees.
Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, May 9th, 2018. Yaxha Plaza C, Petén, Guatemala.
Camera: Nikon D5. Lens: Nikon AF-Micro-NIKKOR 200mm IF-ED Macro. Values: f/16, 1/320, ISO 3200.



East Acropolis. As you walk through Yaxha you see paxté curtains every minute, as seen on the walk to the East Acropolis. Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, May 9th, 2018. Yaxha, Petén, Guatemala. Camera: Nikon D5. Lens: Nikon AF-Micro-NIKKOR 200mm IF-ED Macro. Values: f/16, 1/200, ISO 5,000.



Spanish moss is used medicinally as an antiepileptic and astringent (Alanís, Muñoz, López, Cuervo & Raya, 2007).

Spanish moss is one of the most common *Tillandsia* species in America, it can be found from the southeastern United States through Mexico, to Argentina and Chile (Véliz 2010).



T. usneoides.

Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, August 15th, 2018. Yaxha, Nakum and Naranjo National Park, Guatemala.
Camera: Canon EOS-1D X Mark II. Lens: Canon EF 100mm Macro USM. Values: f/5, 1/320, ISO 125.

BOTANICAL DESCRIPTION

Common names:

- Moss
- Tzin-í
- White Moss
- Paxte (Véliz, 2010).
- Paxtle
- Paixte
- Spanish Moss
- Barba de Viejo or Old Man 's Beard (Hanan & Mondragón, 2009).

Synonyms

According to The Plant List (2012), *Tillandsia usneoides* (L.) L. is the accepted name with around 19 synonyms, the most recognized are:

- *Dendropogon usneoides* (L.) Raf.
- *Renealmia usneoides* L
- *Strepsia usneoides* (L.) Nutt. ex Steud.
- *Tillandsia crinita* Willd. ex Beer
- *Tillandsia filiformis* Lodd. ex Schult. & Schult.f.
- *Tillandsia trichoides* Kunth



T. usneoides.

Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, December 19th, 2018. Island of Topoxté, Petén, Guatemala.
Camera: Nikon D5. Lens: Nikon AF-S NIKKOR 600mm FL ED VR. Values: f/13, 1/250, ISO 1.600.

It is an epiphytic plant of the Bromeliaceae family, which grows on the branches of trees or even on electrical wiring and other structures. It is not considered as a parasitic plant because it obtains water and nutrients from rain and wind. According to Hanan & Mondragón (2009), it has the following characteristics:

- **Stems:** grayish branched which can be up to 8 meters long.
- **Leaves:** narrow with a wide base, they can be up to 5 cm long.
- **Root:** usually without roots.
- **Flowers:** its flowers are sessile with greenish petals, very tiny, 11 mm long. They produce narrow, cylindrical seeds capable of moving in the wind.
- **Fruits:** cylindrical capsule 2.5 cm long.



T. usneoides.

Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, September 5th, 2018. Yaxha Plaza C, Petén, Guatemala. Camera: Canon EOS-1D X Mark II. Lens: Canon EF 100mm Macro USM. Values: f/3, 1/640, ISO 1,250.

***T. usneoides.***

Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, September 5th, 2018. Yaxha Plaza C, Petén, Guatemala.
 Camera: Canon EOS-1D X Mark II. Lens: Canon EF 100mm Macro USM. Values: f/5, 1/240, ISO 1,650.

***T. usneoides.***

Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, December 19th, 2018. Topoxté, Petén, Guatemala.
 Camera: Nikon D5. Lens: Nikon AF-S NIKKOR 600mm FL ED VR. Values: f/10, 1/250, ISO 1600.

***T. usneoides.***

Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, December 19th, 2018. Topoxté, Petén, Guatemala.
 Camera: Nikon D5. Lens: Nikon AF-S NIKKOR 600mm FL ED VR. Values: f/13, 1/250, ISO 1600.

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Lic. Leonel Ziesse –Park’s Director, Ing. Jorge Mario Vázquez –Park’s Director (CONAP). Biolg. Lorena Lobos (CONAP), and Arq. Jorge Mario Ortiz.

All the helpful and knowledgeable guides of IDAEH CONAP who accompanied us each day. It is essential to have either an IDAEH and/or CONAP guardabosque or comparable when doing flora and fauna research.

We appreciate the 16 years of knowledge of birds and plants of “Teco” (Moisés Daniel Pérez Díaz). We also appreciate the assistance of park ranger Ricardo Herrera.

A special thanks to Tojin Benito Malchic, who collaborated with the information on the archaeological aspects for this report. Tojin is in the last semester of an Archeology Degree from the School of History of the University of San Carlos de Guatemala. During his career, he has found interest in Maya iconography and epigraphy. Throughout his academic training he has collaborated with projects in the east, in the Guatemalan Highlands, and now in our Photographic Report on the island in Laguna Yaxha.



T. usneoides.

Photography by: Nicholas Hellmuth, FLAAR Mesoamerica, December 19th, 2018. Topoxté, Petén, Guatemala.
Camera: Nikon D810. Lens: Nikon AF-S NIKKOR 800mm FL ED VR: f/13, 1/250, ISO 1,600.

MUCH MORE THAN A PARK

The **Yaxha, Nakum and Naranjo National Park** raises within its objectives the protection and conversation of the natural resources of the area, as well the conservation of the ancient Mayan cities. Thanks to its natural beauty, the inspiration is for this place to be attractive to visitors and a source of income for the communities. It also aims to be a tool for environmental education, scientific research and ecotourism, leveraging the natural potential that exists in this protected area.

That is why FLAAR Mesoamerica, with the support of the authorities that manage the park, has created the material you have in your hands, to generate interest among students, researchers and tourist visiting the area. FLAAR Mesoamerica has specialized in the photographic documentation of species of flora and fauna, and in the compilation of biological, botanical, ethnobotanical and ethnobiological research to make known the variety of natural resources that exist in the region.

For more information:

● /PN_YNN
● /pnynn.guatemala
● /FLAARM

● www.destinoyaxha.com
● www.flaar-mesoamerica.org
● www.visityaxha.com





HOW TO GET TO YAXHA?

MAP LEGEND

- Archaeological sites
- Airports
- Earthworks
- Highway



PROTECTED AREA



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Go to the Mundo Maya airport in Santa Elena and then you will find a services of tourist vehicles to go to the archaeological site. If you want to go by car from Guatemala City, take the following route: Río Dulce - Poptún-Flores. At the junction further on you will find on the left the route to Tikal. Go straight on to the right towards Yaxha (towards Melchor de Mencos). In km. 521 at the village La Maquina, turn left to the site. Ecolodge El Sombrero is 50 meters before the entrance to National Park Yaxha - Nakum - Naranjo.

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