

# Aquatic ecosystems of Livingston

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Environmental Engineering URL



# Schedule:

- Livingston.
- General concepts of Aquatic Ecosystems.
- Biological Diversity.
- FLAAR's work in the Livingston Ecosystems.

# Livingston

- **Territorial division.** The municipality is divided into 28 villages and 128 hamlets, of these quantities only 66 communities are accessible by waterway.



- The municipality of Livingston belongs to the department of Izabal, in the northeastern region of the Republic of Guatemala.
- It has a territorial extension of 1,940 km<sup>2</sup>.
- It is located at a distance of 317.2 km from Guatemala City and 19 km from the department capital.

# Livingston

- There are more people from the **Q'eqchi** ethnic group than from the **Garífuna** and there is a strong representation of the **mestizo** community, in addition, there is a minimal presence of Hindu descendants.
- 73,492 habitants (INE, 2018)

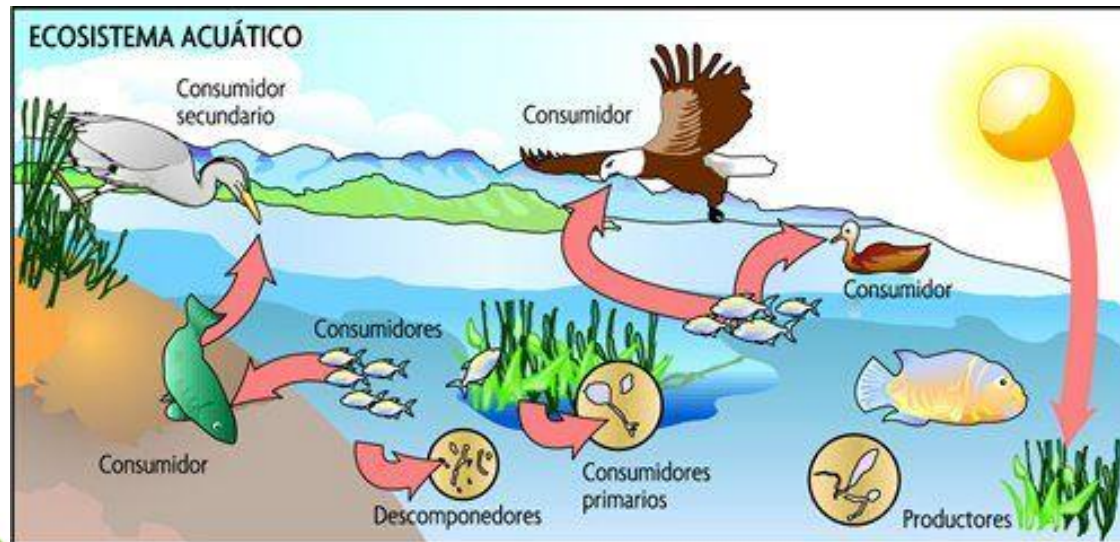
- The municipal seat of Livingston is located in the western part of the mouth of Río Dulce, in the internal part of Amatique Bay.





# Ecology of aquatic ecosystems

**They are ecosystems** that develop in a body of water of diverse size and nature, which includes seas, lakes, rivers, swamps, streams, lagoons and coasts.



# Types of Aquatic Ecosystems

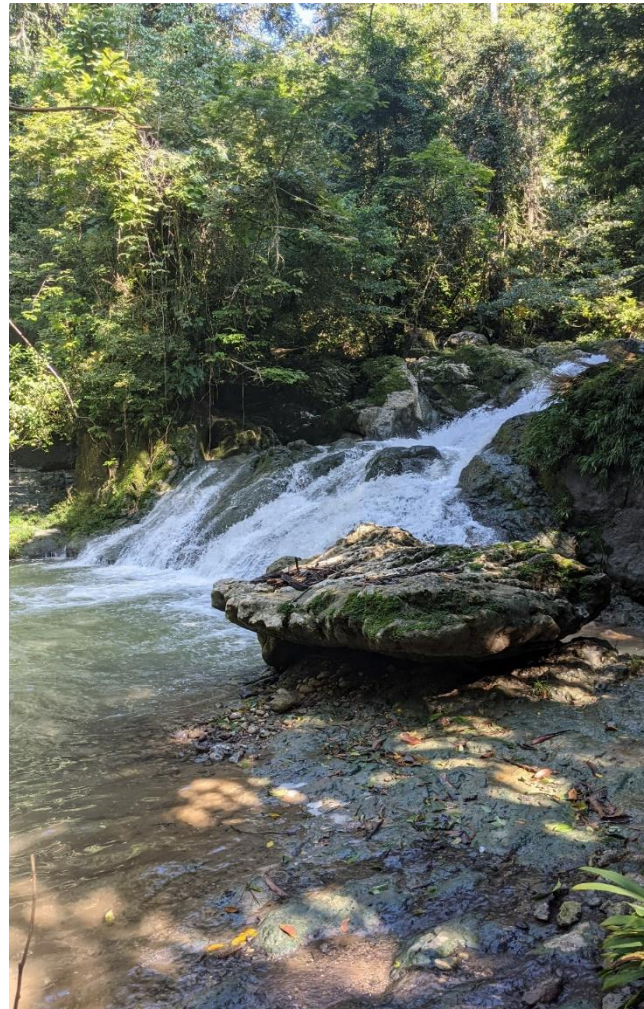
- Lotic Ecosystems
- Lentic Ecosystems
- Wetlands



**Tapón Creek River** – Drone photo by Haniel López - FLAAR Mesoamérica



- **Lotic Ecosystems**  
Rivers and streams



**Lámpara River** – Foto de Roxana Leal -  
FLAAR Mesoamérica

- **Lentic Ecosystems**  
Lakes and lagoons



**El Golfete Lake** – Drone photo by Haniel López - FLAAR Mesoamérica



- # Wetlands

Covered area with water, permanently or temporarily, that harbors biodiversity.

**“Wetlands” RAMSAR Definition:**

Wetlands are understood as "extensions of marshes, swamps and peat bogs, or surfaces covered with water, whether they are natural or artificial, permanent or temporary, stagnant or current, fresh, brackish or salty, including extensions of marine water whose depth in low tide does not exceed six meters”



Chocón Machacas River – Photo by Roxana Leal

**RAMSAR:**(Convention on Wetlands of International Importance Especially as Waterfowl Habitat)

Convention on Wetlands is an intergovernmental treaty that serves as a framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.



# Wetlands of Guatemala (Sitios RAMSAR)

n.º Ramsar	Puesto	Sitio Ramsar	Departamento	Fecha de adhesión	Área (ha)
0488	GUA-01	Parque Nacional Laguna del Tigre	Petén	26 de junio de 1990	335 080
0725	GUA-02	Manchón-Guamuchal	San Marcos	25 de abril de 1995	13 500
0813	GUA-03	Refugio de Vida Silvestre Bocas del Polochic	Izabal	20 de marzo de 1996	21 227
1016	GUA-04	Punta de Manabique	Izabal	28 de enero de 2000	132 900
1599	GUA-05	Parque Nacional Yaxhá-Nakum-Naranjo	Petén	02 de febrero de 2006	37 160
1623	GUA-06	Ecorregión Lachúa	Alta Verapaz	24 de mayo de 2006	53 523
1667	GUA-07	Reserva de Usos Múltiples Río Sarstún	Izabal	22 de marzo de 2005	35 202



# Wetlands Benefits

- Aquifer loading and unloading
- Protection of the coasts against wind and wave erosion.
- Habitat of the juvenile stages of fish, molluscs and crustaceans.
- Temporary habitat of migratory birds.
- Stabilization of microclimates
- Water for human consumption and crops
- Fishery resources and aquaculture production
- Flood control
- Conveyance
- Recreation and tourism
- Associated cultural values



***Ardea alba* – Garza blanca** – Photo by Victor Mendoza



**Grande Lagoon, Sarstún** Drone photo by Haniel López



# Threats and Challenges

- Change of land use on the riverbank.
- Change in water flow due to overexploitation.
- Change in the course of the water.
- Alteration in sedimentation.
- Contamination by solid and liquid waste.
- Introduction of invasive alien species.



**Río Sarstún** – Photo by Haniel López - FLAAR Mesoamérica

# Dynamics of the aquatic ecosystems

- Ecosystem stratification can be spatial (vertical or horizontal), and temporal (periodicity).
- Each stratum constitutes a microhabitat or microecosystem.



**El Golfete – Waterlilies** - Photo by Roxana Leal – FLAAR Mesoamérica

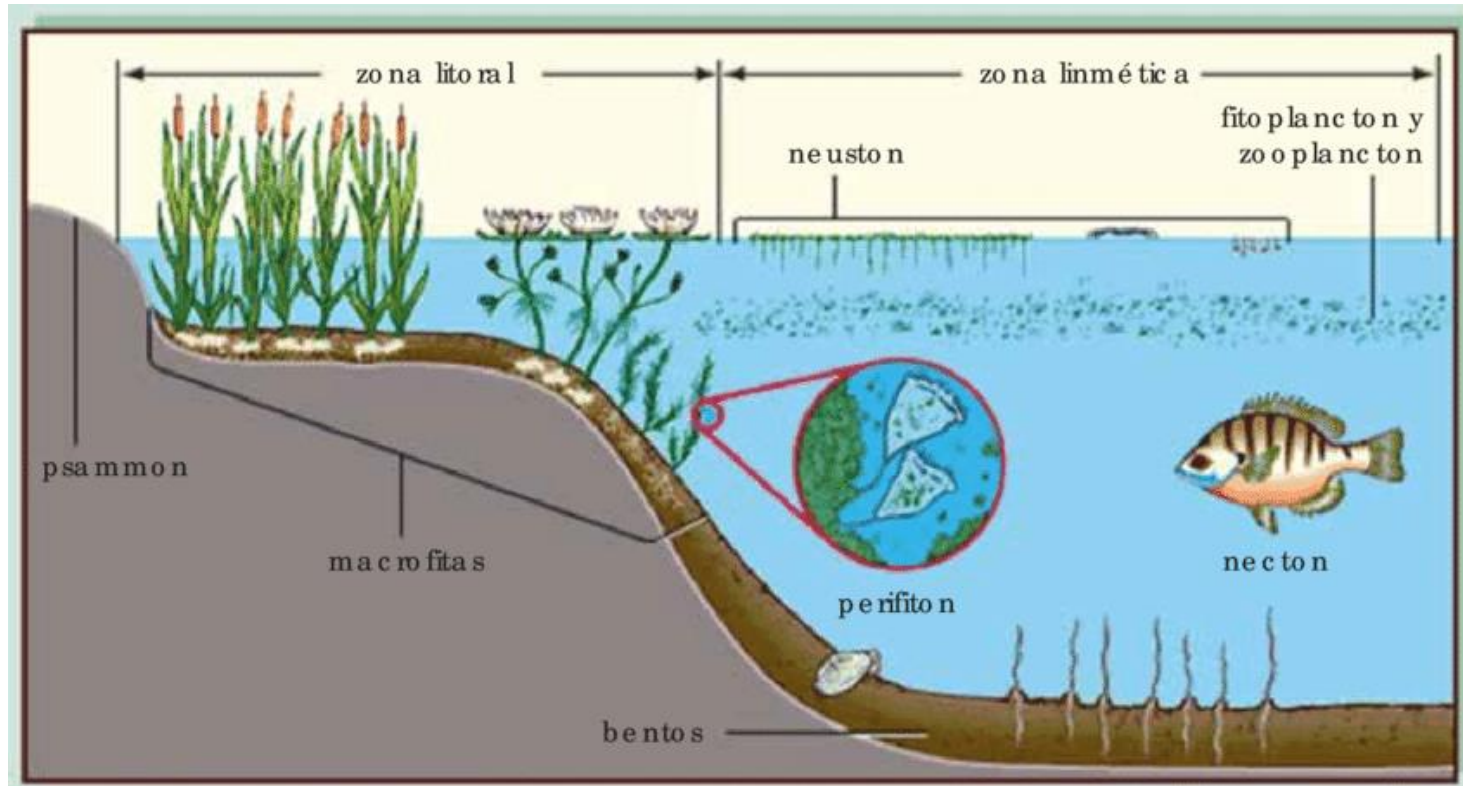
# Horizontal stratification of lotic systems



- **High course:** Large slope, little flow, few organisms, few nutrients. Canyons in relief.
- **Medium course:** Medium slope, medium flow, medium nutrients, organisms begin to abound. Waterfalls and rapids highlighted
- **Low course:** Small slope, high flow, abundant organisms, abundant nutrients. Relief in the form of meanders, deltas or channels.

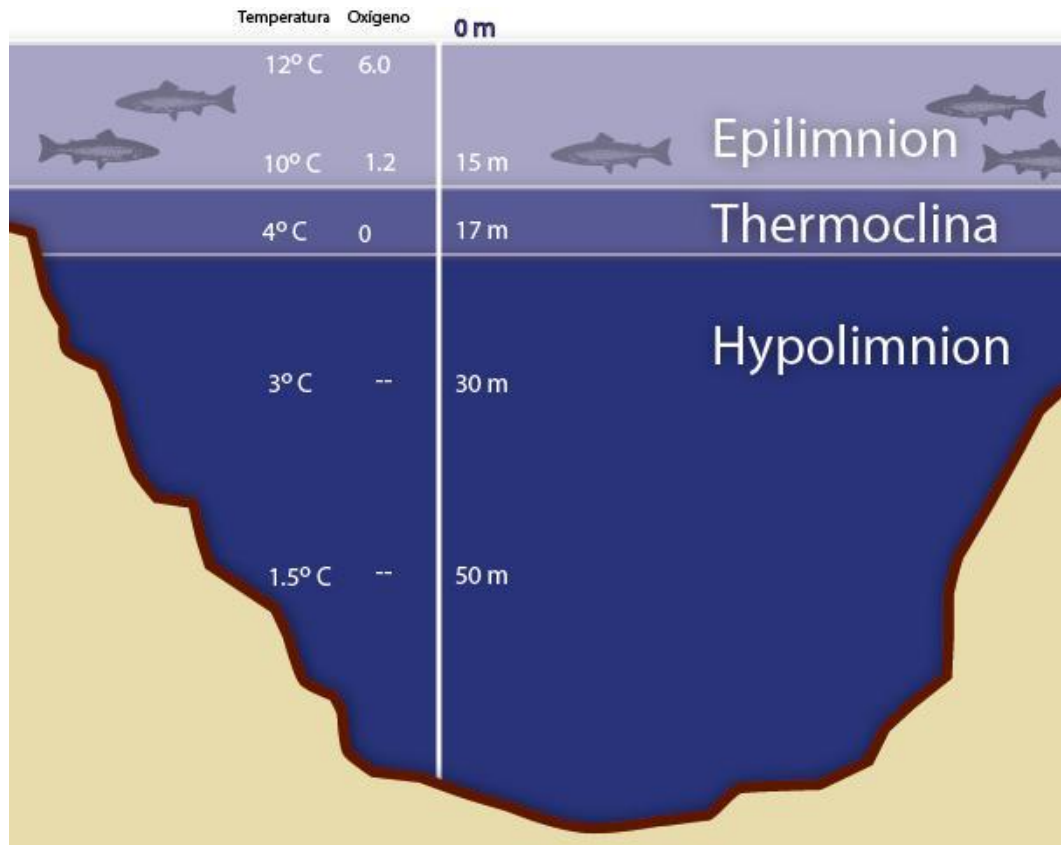


# Horizontal stratification of lentic ecosystems



- **Coastal Zone:** Interface between the land and the pelagic zone where there is great diversity.
- **Pelagic zone:** also called limnetic, open zone, diversity suspended in the water.

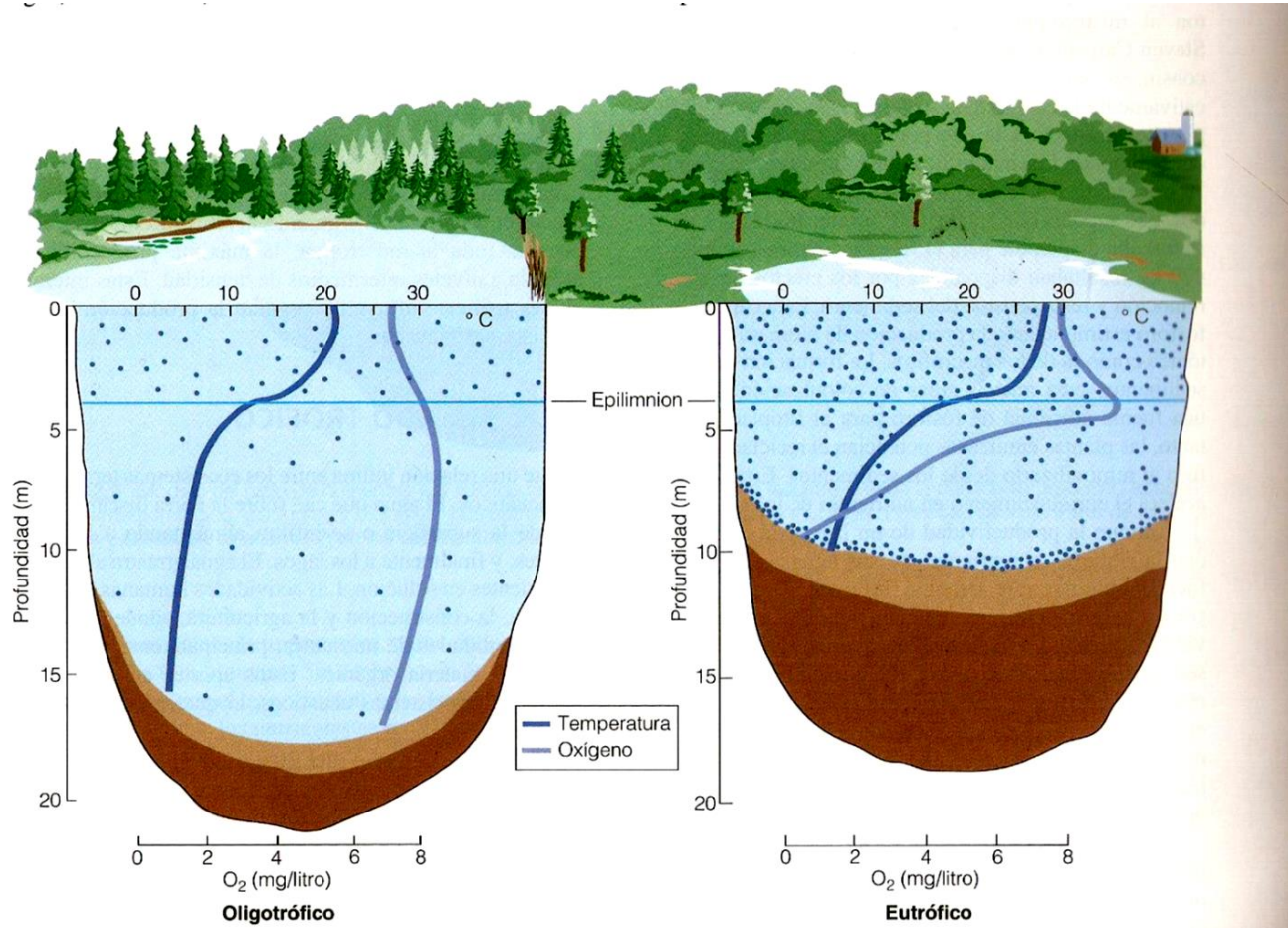
# Vertical stratification of lentic ecosystems



- **Epilimnion:** area with the highest amount of oxygen, light penetration and number of organisms.
- **Thermocline:** temperature barrier, from this layer the temperature drops drastically.
- **Hypolimnion:** zone without sunlight, very little oxygen and very few organisms.

# Trophic State

It is the relationship that exists between the state of nutrients in a body of water and the growth of organic matter in it.



**Eutrophication process:** it is the process of change from a trophic state to a higher level one by adding nutrients and organic matter.



# Estuaries



- Ecosystems where rivers extend over a large area when reaching the sea, or where the force of the sea enters the river
- Combination of fresh and salty waters mixed by the tides.
- They have high biological diversity and productivity, because the condition of the tides causes nutrients to be retained

# Mangroves



**Lagunita Creek, Rio Sarstún, Young mangrove** – Nicholas Hellmuth –  
FLAAR Mesoamérica

- It is made up of species tolerant to salinity.
- They are tropical and subtropical with aquatic and terrestrial characteristics.
- They are located in the zone between tides of protected or little exposed coasts, river mouths that periodically receive fresh water by runoff.



# Mangroves



**Lagunita El Salvador, Rio Dulce, Mangrove** – David Arrivillaga - FLAAR Mesoamérica



# Mangrove benefits



**Turtle on roots of a mangrove** – Victor Mendoza - FLAAR Mesoamérica

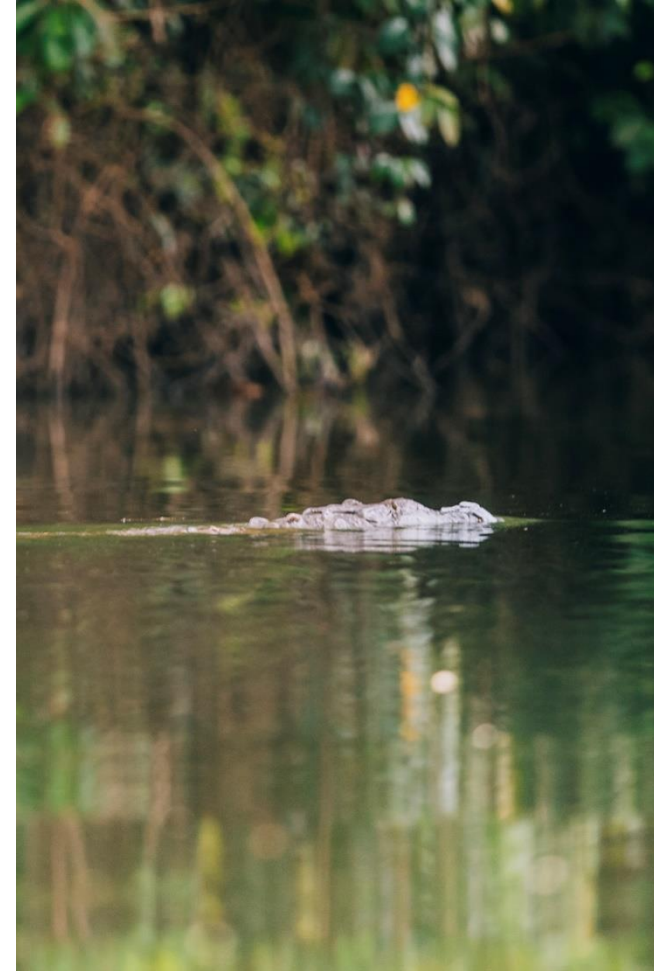
- They absorb CO<sub>2</sub> and release O<sub>2</sub>
- They protect the coasts from erosion, strong tides, winds and hurricanes.
- They are the habitat of many species of flora and fauna.
- They trap pollutants and sediment and maintain the balance of nutrients in the water.
- They generate economic benefit (goods and services)

# Biological Diversity

Influential factors:

- Species interaction.
- Productivity.
- Introduction of species.
- Habitat type.
- Colonization.

## CLASSIFICATION



**Cocodrilo en Rio Chocón Machacas –**  
Victor Mendoza - FLAAR Mesoamérica

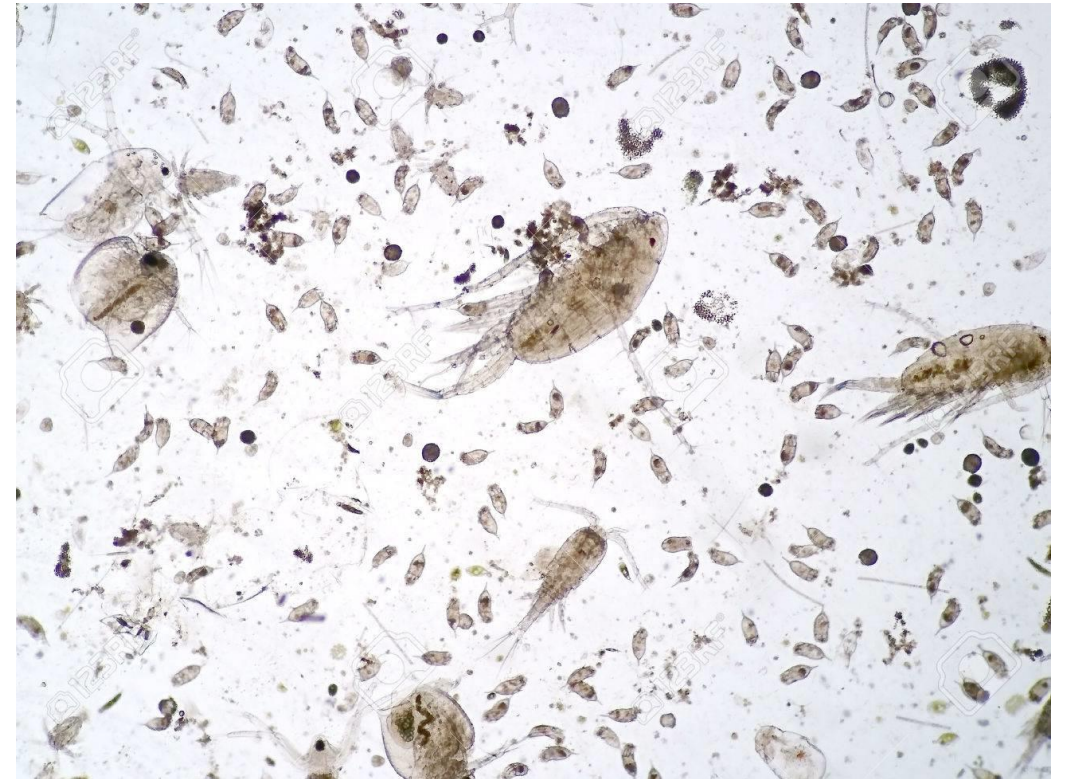


# Plankton

Suspended in the water.



PHYTOPLANKTON



ZOOPLANKTON



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# Necton

They move by themselves.



**Pepescas** – Victor Mendoza, FLAAR Mesoamérica



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# Neuston

Organisms that live in a very thin layer on the surface using surface tension.



# Benthos

They are found in bottom sediments.



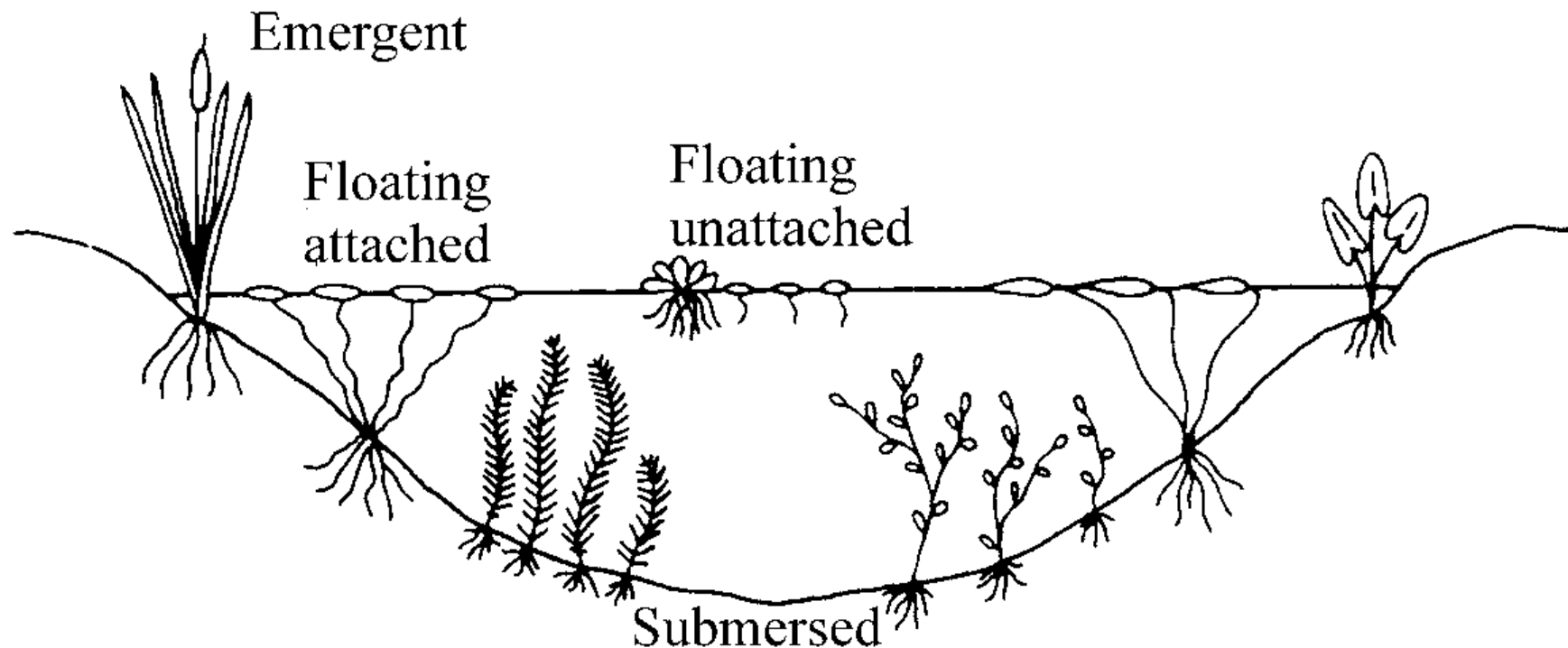
**Jute** – Foto de Victor Mendoza, FLAAR Mesoamérica



**Burrito** – Foto de Victor Mendoza, FLAAR Mesoamérica



# Coastal vegetation zoning



- **Macrophytes:** They are called aquatic plants, they are represented by all that type of vegetation that grows in the littoral zone of bodies of water.



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# Emerging



***Pontederia cordata*** –  
Nicholas Hellmuth , FLAAR Mesoamérica



***Typha dominguensis*** –  
David Arrivillaga , FLAAR Mesoamérica

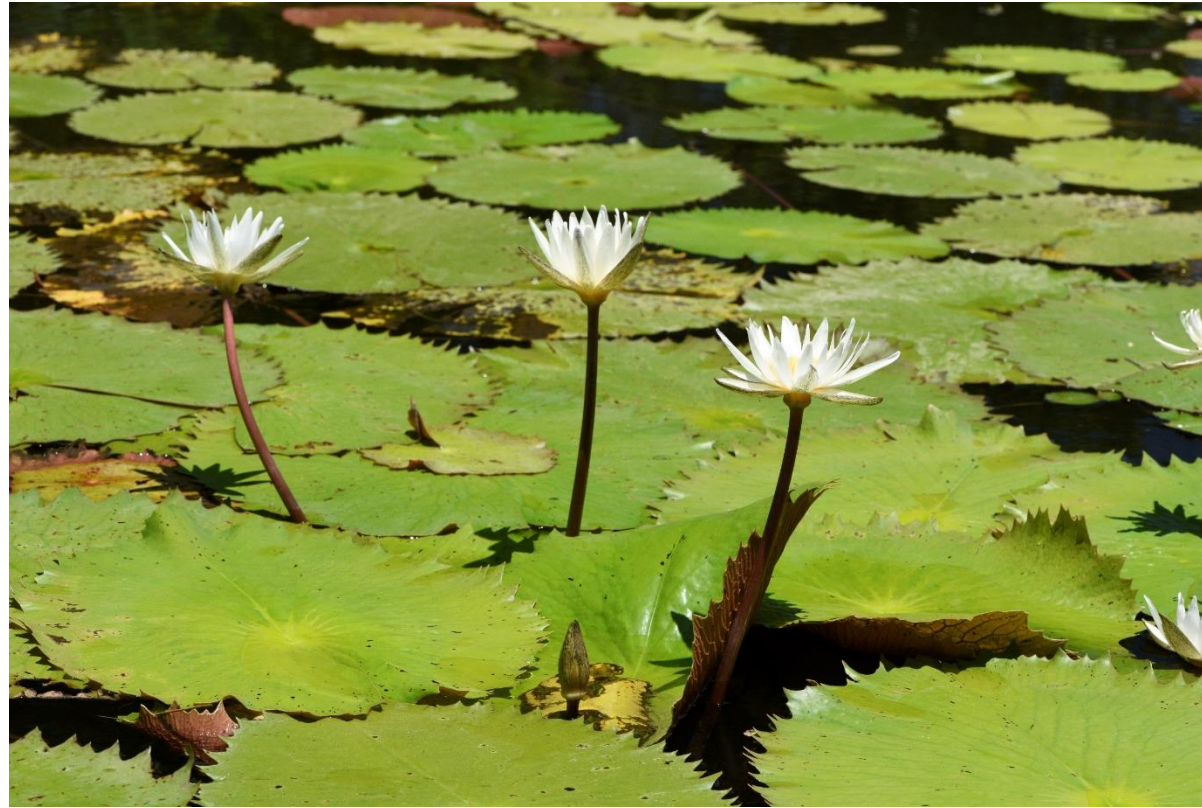
# Floating



*Pistia sp.* – Lechuguilla No Nativa



# Rooted Floating



***Nymphaea ampla*** –  
Nicholas Hellmuth , FLAAR Mesoamérica

# Rooted submerged



*Elodea* sp.



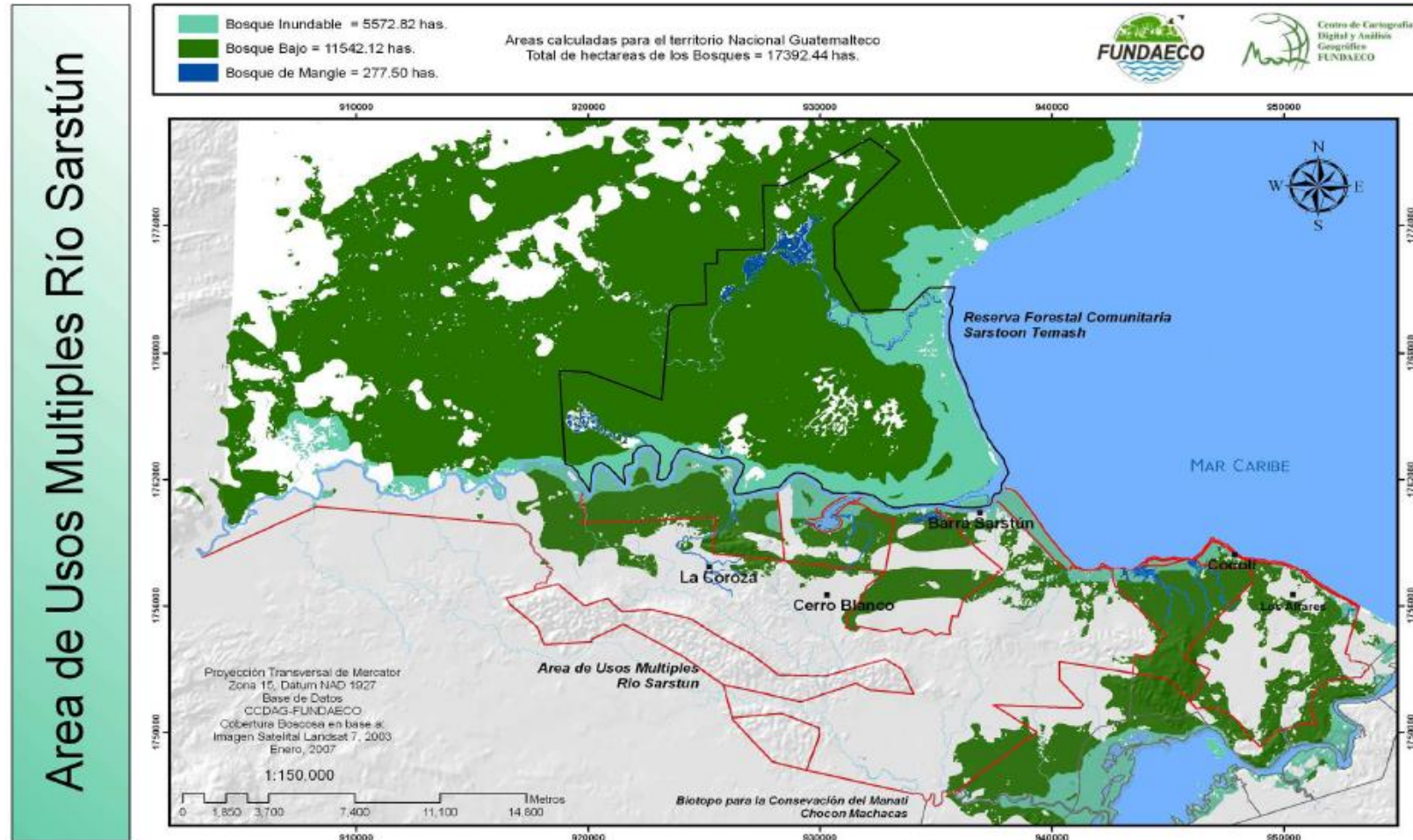
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# FLAAR's work in the Livingston Ecosystems.



# Sarstún River Multiple Use Area



Sarstún River Multiple Use Area, Map – Master Plan - FUNDAECO





**Lagunita Creek – Rio Sarstún** – Drone photo by Haniel López , FLAAR Mesoamérica





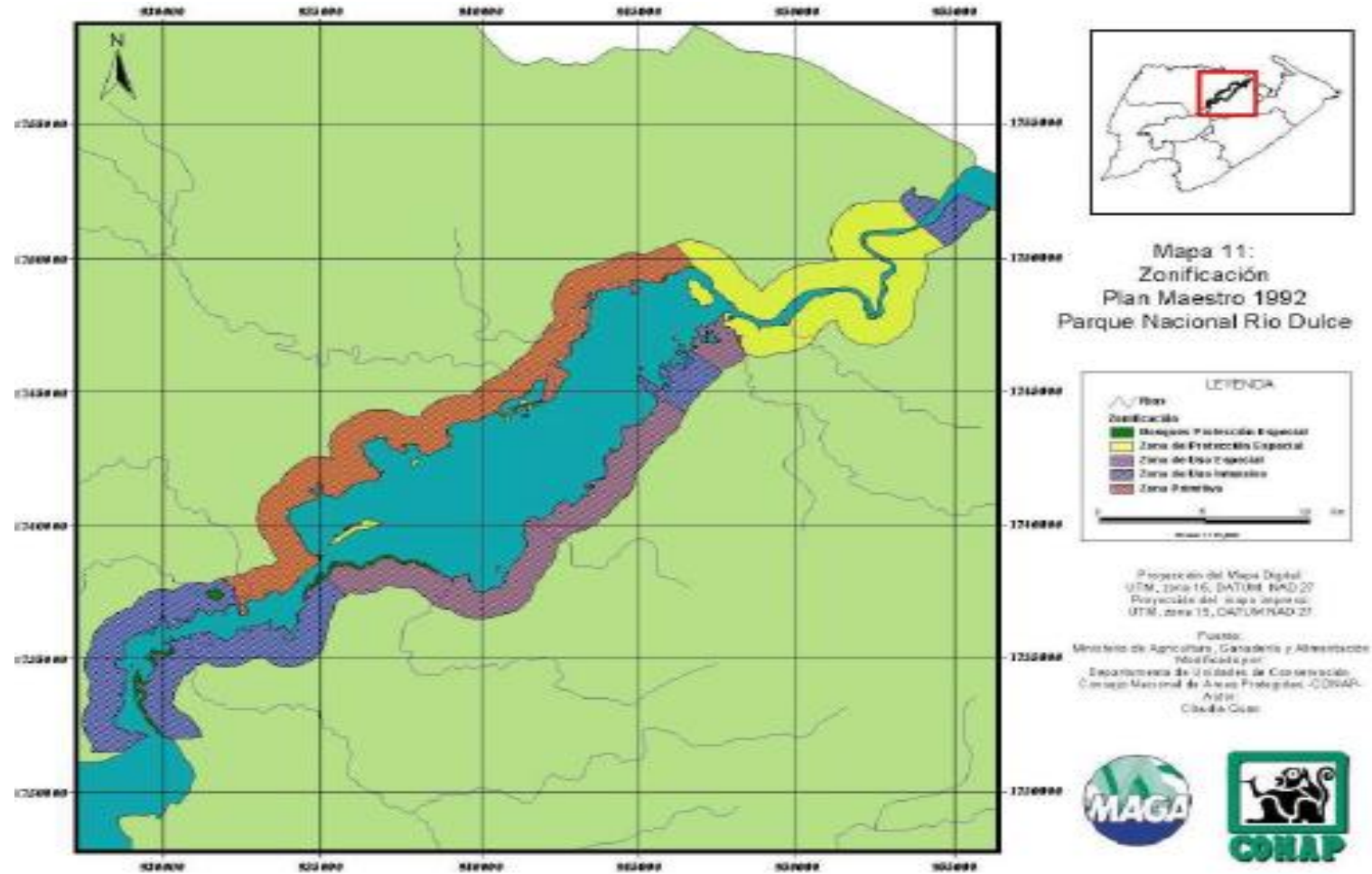
**Tapón Creek – Aldea Buena Vista** – Drone photo by Haniel López , FLAAR Mesoamérica





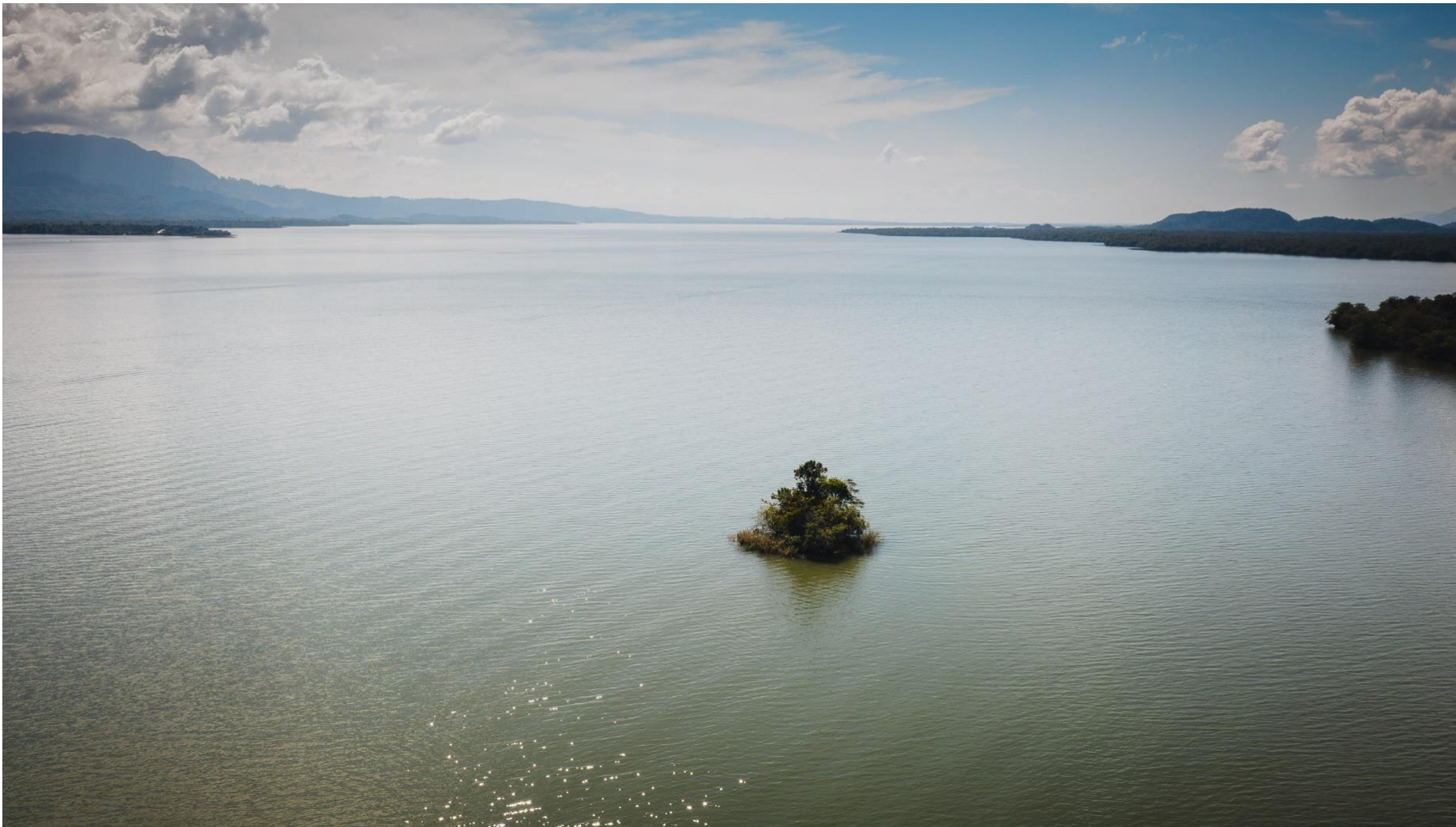
**Quehueche Beach – Gangadiwali** – Drone photo by Haniel López, FLAAR Mesoamérica

# Río Dulce



National Park Río Dulce, Map – Maester Plan - CONAP





**El Golfere – Río Dulce** – Drone photo by Haniel López , FLAAR Mesoamérica



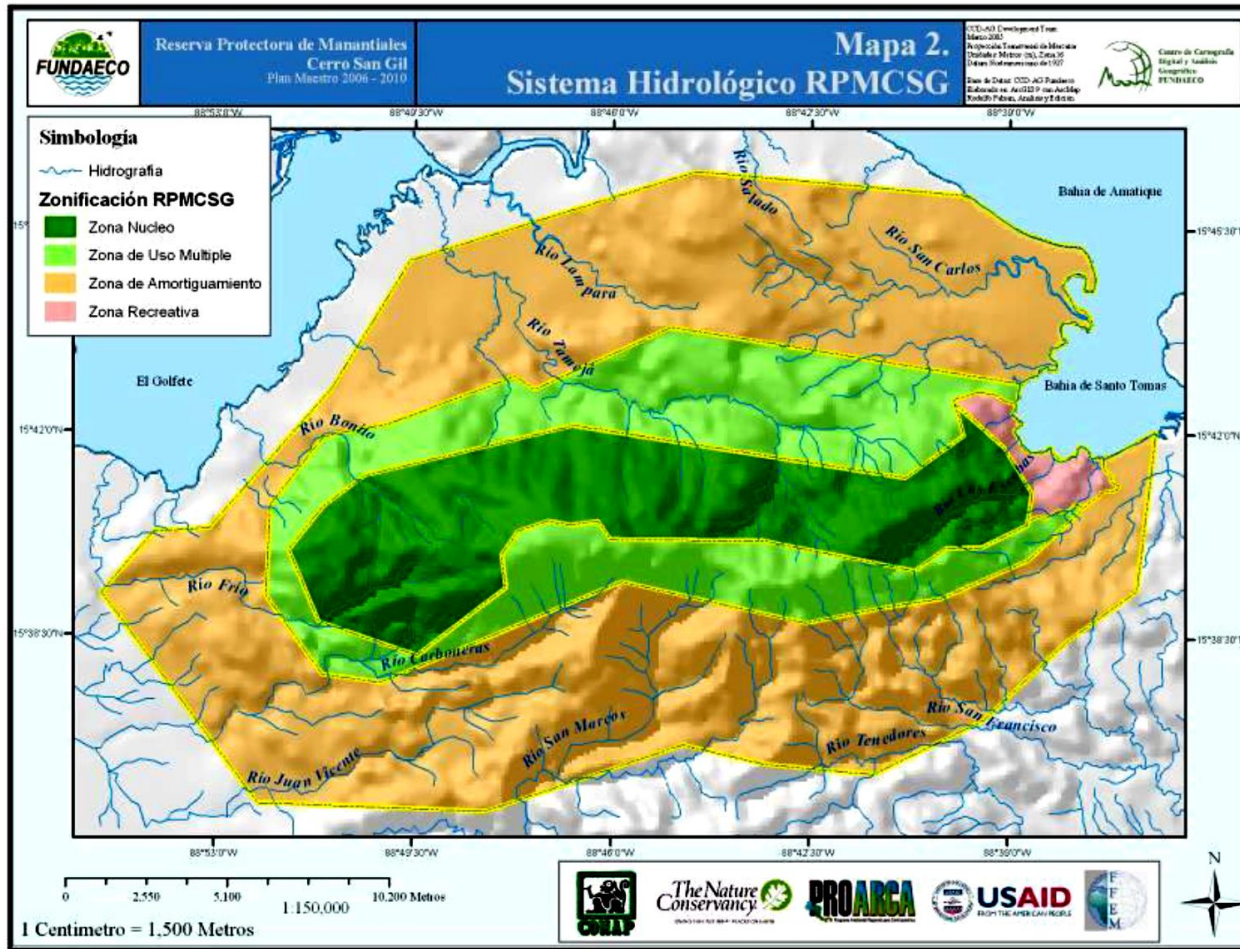
**Cañón de Río Dulce** – Drone photo by Haniel López , FLAAR Mesoamérica



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# Cerro San Gil



Cerro San Gil, Map – Master Plan - FUNDAECO





**Sendero Las Escobas – PB** – Drone photo by Haniel López , FLAAR Mesoamérica



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**Biological station – Carboneras – Cerro San Gil**

Photo by Victor Mendoza , FLAAR Mesoamérica





# FLAAR MESOAMERICA VIDEO

[https://www.youtube.com/watch?v=HvkK-zl\\_BgQ&ab\\_channel=FLAARMesoamerica](https://www.youtube.com/watch?v=HvkK-zl_BgQ&ab_channel=FLAARMesoamerica)



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# BIBLIOGRAPHY

- <https://www.ramsar.org/es/humedal/guatemala>
- <https://aprende.guatemala.com/historia/geografia/municipio-de-livingston-izabal/>
- <https://ecosistemas.ovacen.com/acuaticos/>
- **Abarca, R.** (2005). *“La Limnología, una ciencia de síntesis: Conceptos y Breve historia de la Limnología”*. Recuperado de Internet en. <https://limnologiauniquindio.files.wordpress.com/2012/08/la-limnologc3ada-una-ciencia-de-sc3adntesis2.pdf>
- **Roldán, G. & Ramírez, J.** (2010). *“Fundamentos de limnología neotropical”*. Editorial de la Universidad de Antioquia. 2da edición. 440 páginas.
- **FAO.** (2010). *“Ecosistemas acuáticos continentales”*. Recuperado de Internet en. <http://www.fao.org/fishery/ecosystems/inland/es>



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# THANK YOU!!

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