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The mangroves in Guadeloupe: a suspended ecosystem under anthropic pressures

Valérie Angeon, Fred Burner, Aurélie Colomb, Sébastien Cordonnier, Didier Galop, Silvina Gonzales-Rizzo, Vincent Hervé, Daniel Imbert, Patrick Jean-Louis, Josie Lambourdière, Pascal Jean Lopez, Gladys Loranger, Corinne Pardo, Malika René-Trouillefou, Alain Rousteau, Mickael Vaitilingom

« 2012-2022: ten years of OHM results" Session

Why mangroves matter ?

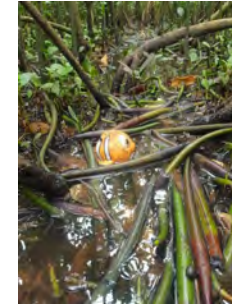
- Home to many species & Nursery grounds
- Stabilizing coastlines & Shelter from the storm
- Carbon storage : $\sim 4\%$ (range 1.3–8%) of C_{org} sequestered by terrestrial ecosystems
- Resources for humans

Mangroves are sustainable solutions for climate change in the Caribbean



Main threats to mangroves

- Climate change: Tsunamis, Hurricanes, Sea level rise ...
- Land-use conversion to agriculture and aquaculture
- Pollutions: Marine litter, Microplastic pollution, Urban wastes, Household waste, Electrical and electronic waste ...



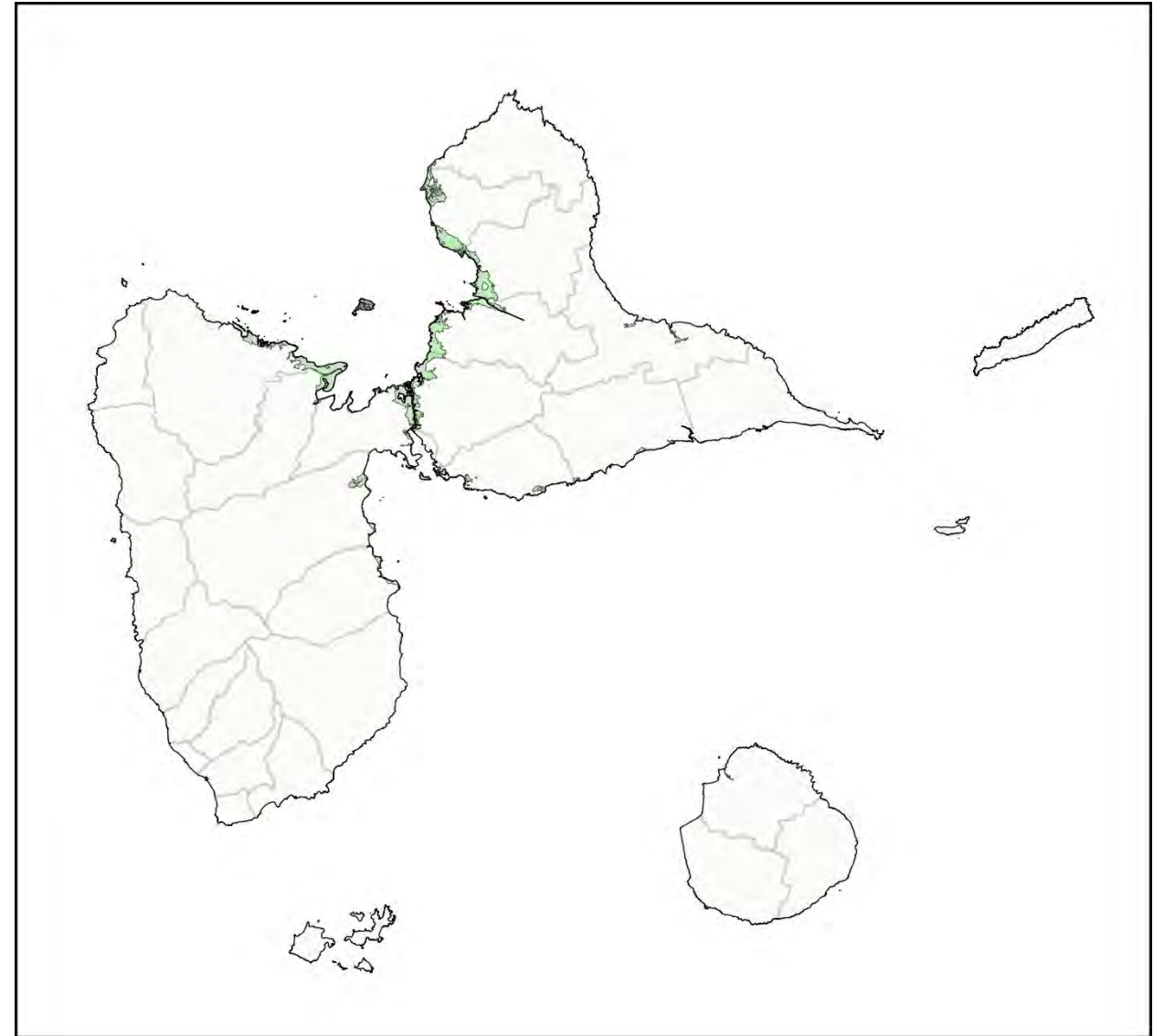
Rivière salée



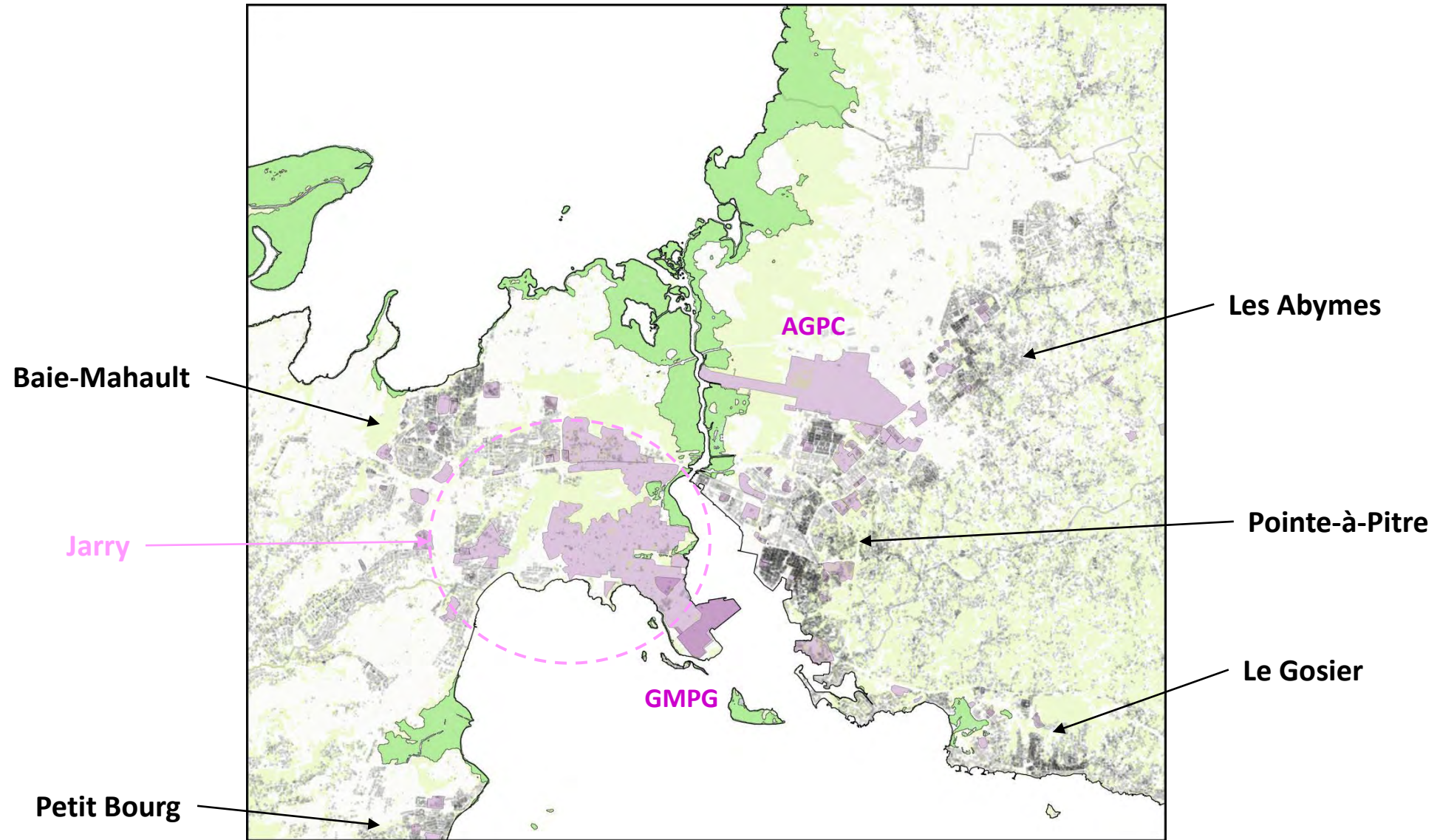
Le Gosier

Where are the mangroves in Guadeloupe?

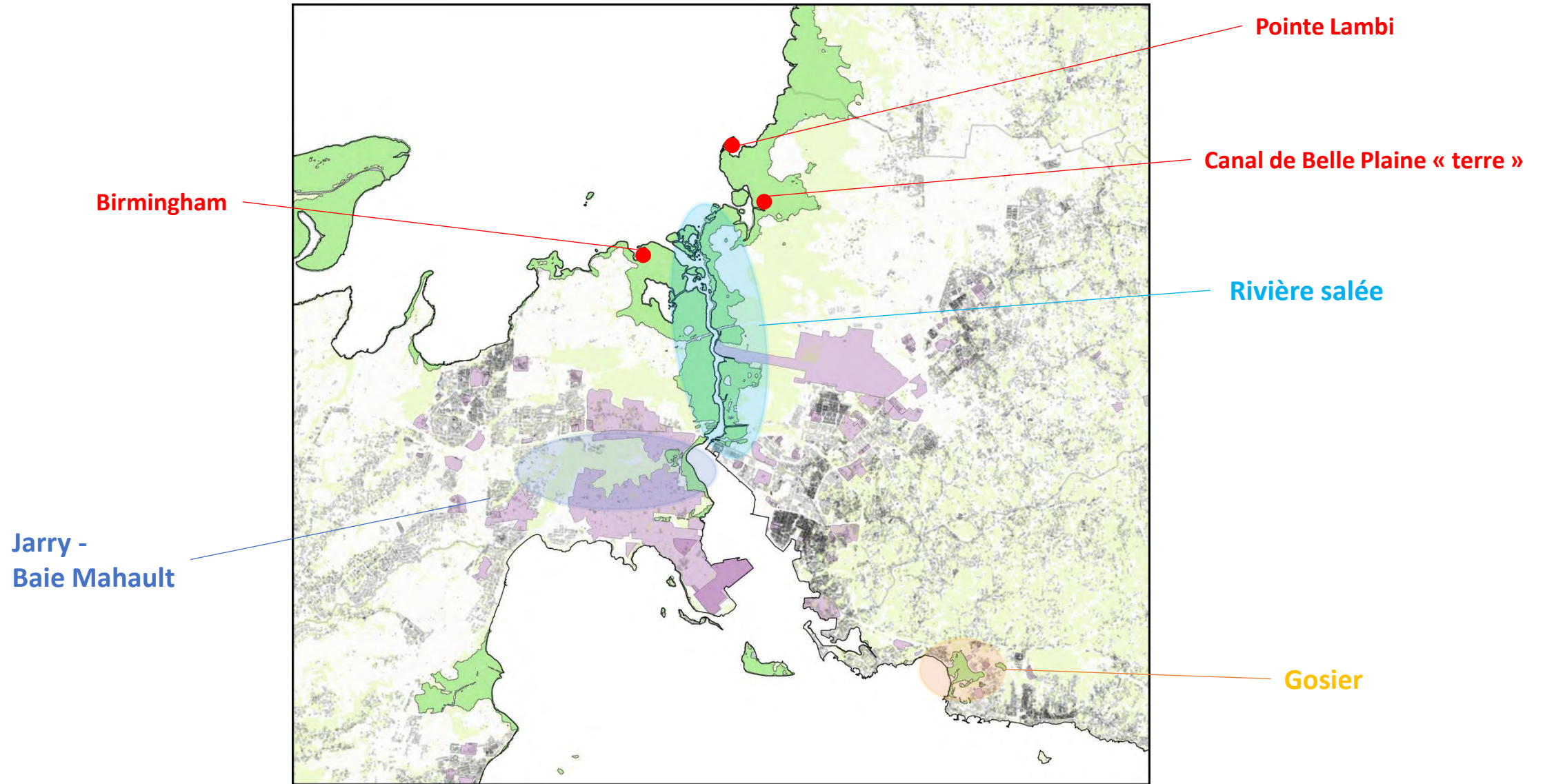
Territories	Surface (km ²)	Mangroves (km ²)	%
Guyane	83846	531,06	0,6%
Nouvelle-Calédonie	18519	281,73	1,5%
Guadeloupe	1628	33,06	2,0%
Martinique	1128	18,56	1,6%
Europa	28	6,26	22,4%
Mayotte	374	6,23	1,7%
Polynésie française	4167	0,411	0,0%
Wallis	96	0,362	0,4%
Saint-Martin	95,83	0,242	0,3%
Saint-Barthélemy	21	0,041	0,2%
Juan de Nova	4,8	0,0023	0,0%



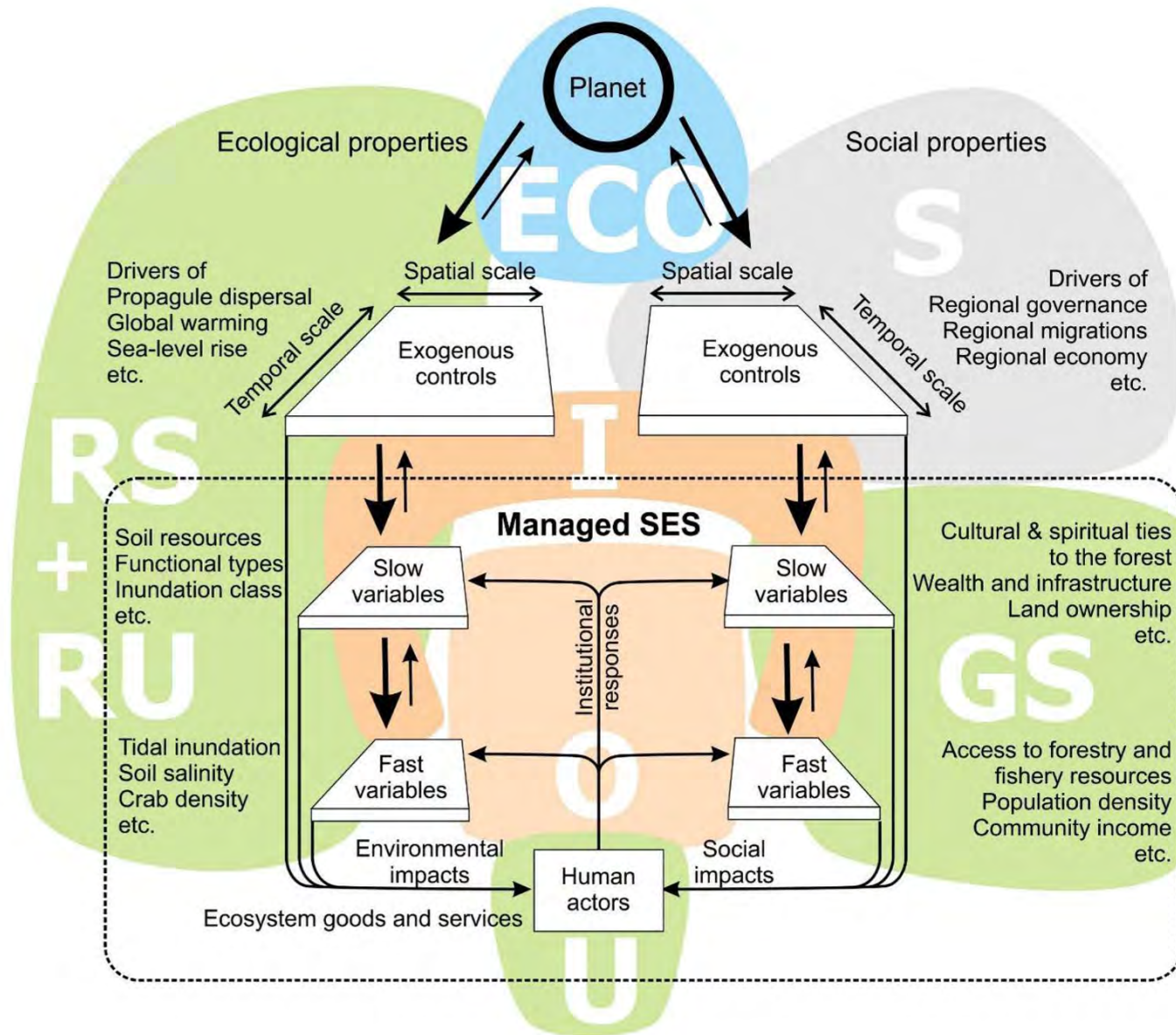
The mangroves are surrounded by commercial, industrial and residential areas



Principal mangrove study areas



Mangroves : a complexe & integrated Social-Ecological System (SES)



- S** = Social, economic and political settings
- RS** = Resource Systems
- RU** = Resource Units
- GS** = Governance Systems
- U** = Users
- I** = Interactions
- O** = Outcomes
- ECO** = Related Ecosystems

From: Farid Dahdouh-Guebas, F. et al. (2021)
Estuarine, Coastal and Shelf Science, **248**, 106942

Mangrove action projects by OHM Littoral Caraïbe and DRIIHM

SES-RS: Equilibrium properties, Productivity of system, Storage characteristics, Clarity of system boundaries

SES-RU: Growth or replacement rate

SES-ECO: Pollution patterns

- Elévation de la Mer dans les Mangroves des Antilles (EMMA) : dynamique de la végétation côtière au cours des 6 derniers millénaires (2017)
- EMERAUDE : Ecologie microbienne des eaux urbaines et marines de Guadeloupe (2017)
- COMMANGA : Communautés microbiennes des mangroves Guadeloupéennes et anthropisation (2019)
- Emission de composés organiques volatils par les palétuviers du Petit Cul-de-sac marin (2019)

SES-U: Socio-cultural services

SES-RS: Clarity of system boundaries (*e.g.* fragmentation, fringing mangroves burnt to expand paddy cultivation)

SES-I: Conflicts among users

- EducOHM - Mangroves (2020)
- EVOLUM - EVOLution des représentations et Perception du changement des Mangroves (2022)
- Caractérisation des pratiques agricoles et aquacoles traditionnelles en zones littorales de sous-bois de Guadeloupe : cas des culs de sac marin, versant Basse-Terre (2020)

SES-RS: Equilibrium properties, Productivity of system, Storage characteristics, Clarity of system boundaries

SES-RU: Growth or replacement rate

SES-GS: Property-rights systems

SES-ECO: Pollution patterns

SES-I: Conflicts among users

- JA-COMO: Cartographie des communautés microbiennes et décomposition de la matière organique au sein de la ZAC de Jarry (2022)



Cycle 4 [further learning]: 5^e, 4^e, 3^e

3 key thematic areas

- Mangrove ecosystem, definition and characterization
- Anthropic and climatic pressures
- Mangroves and people: Impacts and interactions

7 Subsections

9 Activity statements

Evolution of representations and perceptions of change in mangroves [SES-U]

Objectives:

- ✓ **Enrichment of the existing document** by the integration of new sheets dealing with wetland ecosystems, specificities of Guyana's mangroves and more social representations
- ✓ **Development of the third axis** of the booklet in terms of **Human/Environment interactions**, and more precisely on the evolution of social representations of mangroves
- ✓ **Translation of some materials into local languages** and the drafting of a thesaurus "Mangrove" in Portuguese / Antillean and Guyanese Creoles / Palikur ...
- ✓ **Adaptation of some subsections to Cycle 3 [Consolidation cycle]:** CM1, CM2, 6^e



A bipolarized perception of mangroves:

- **Between idealization and repulsion**

- Hostile environment (difficult to access, untamable, dangerous, evil, deadly, etc.)
- Matriarchal figure: cradle, source of life, rebirth, contemplative space

- **Vernacular and scientific knowledge not always in phase**

- Identification and recognition of functions and services by stakeholders not always proven, although scientific knowledge exists
- Difficulties in appropriating knowledge

Representations associated with mangroves :

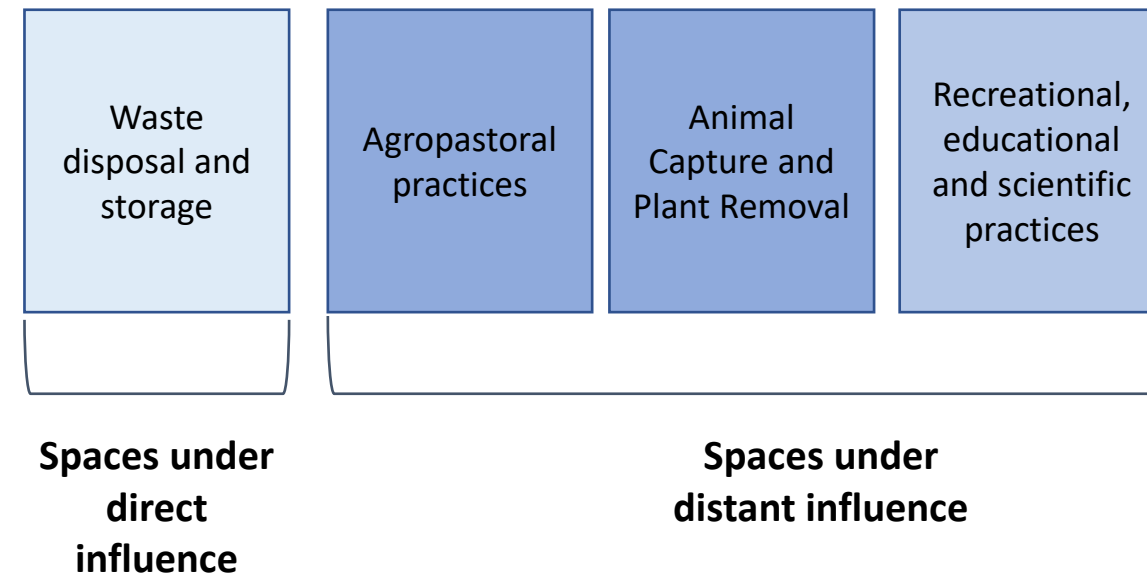
The mangrove is not a subject in itself

- ≠ object of attention
- = unthought of by farmers
- = problems for local residents: humidity, hygiene, presence of insects

The mangrove is a functional object

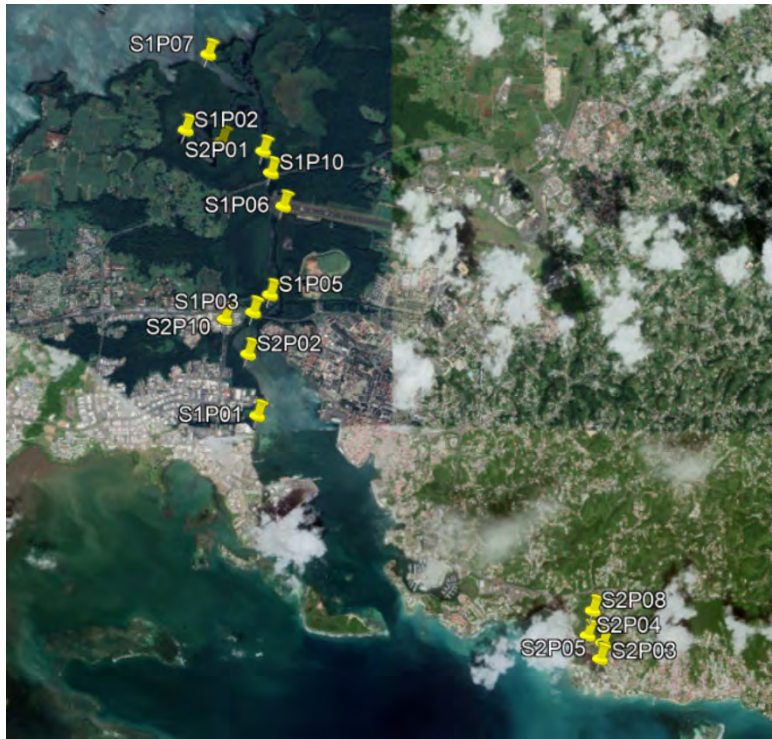
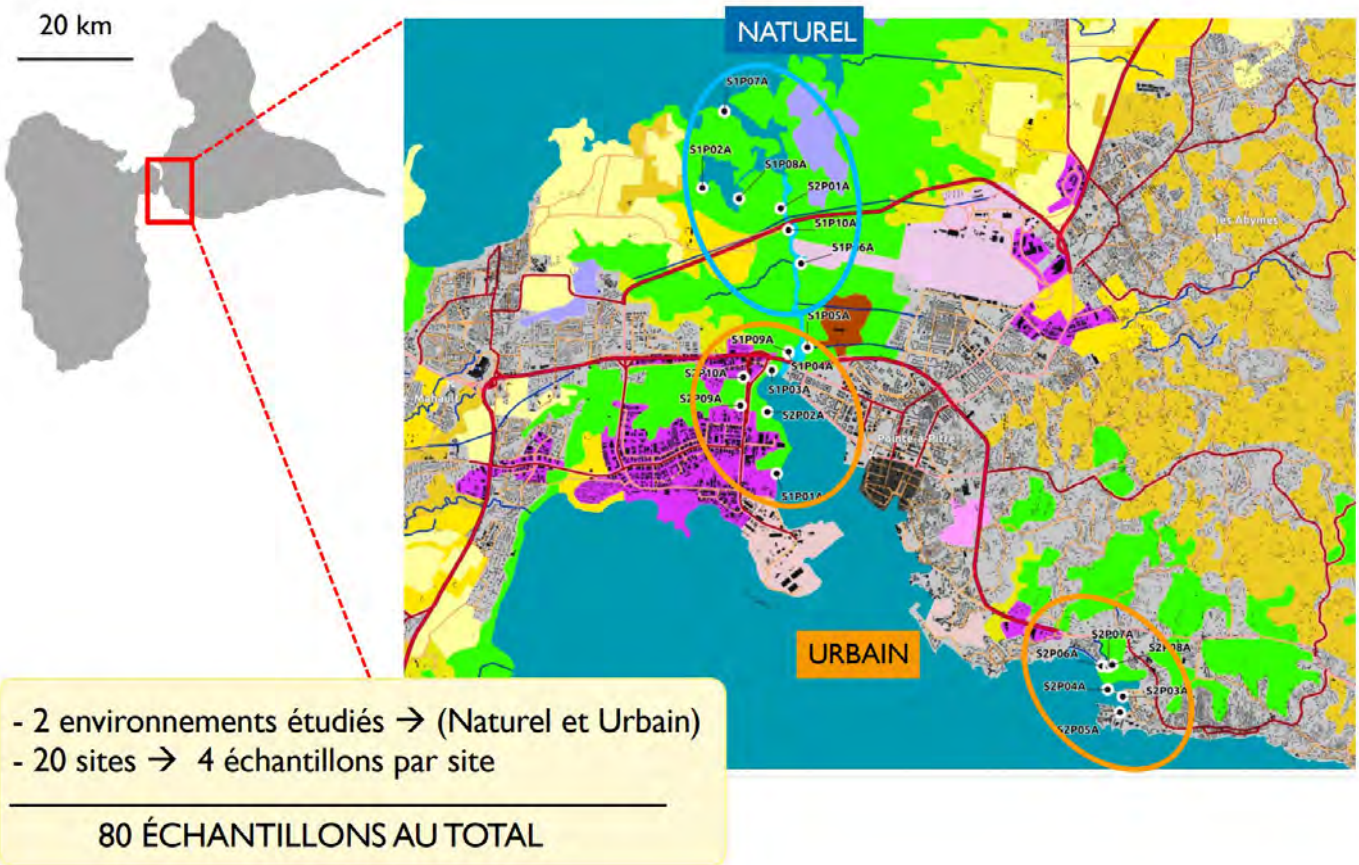
- Gaining ground on the environment: sanitizing, draining and draining to cultivate
- Propitious to rejection and waste

Typology of uses :



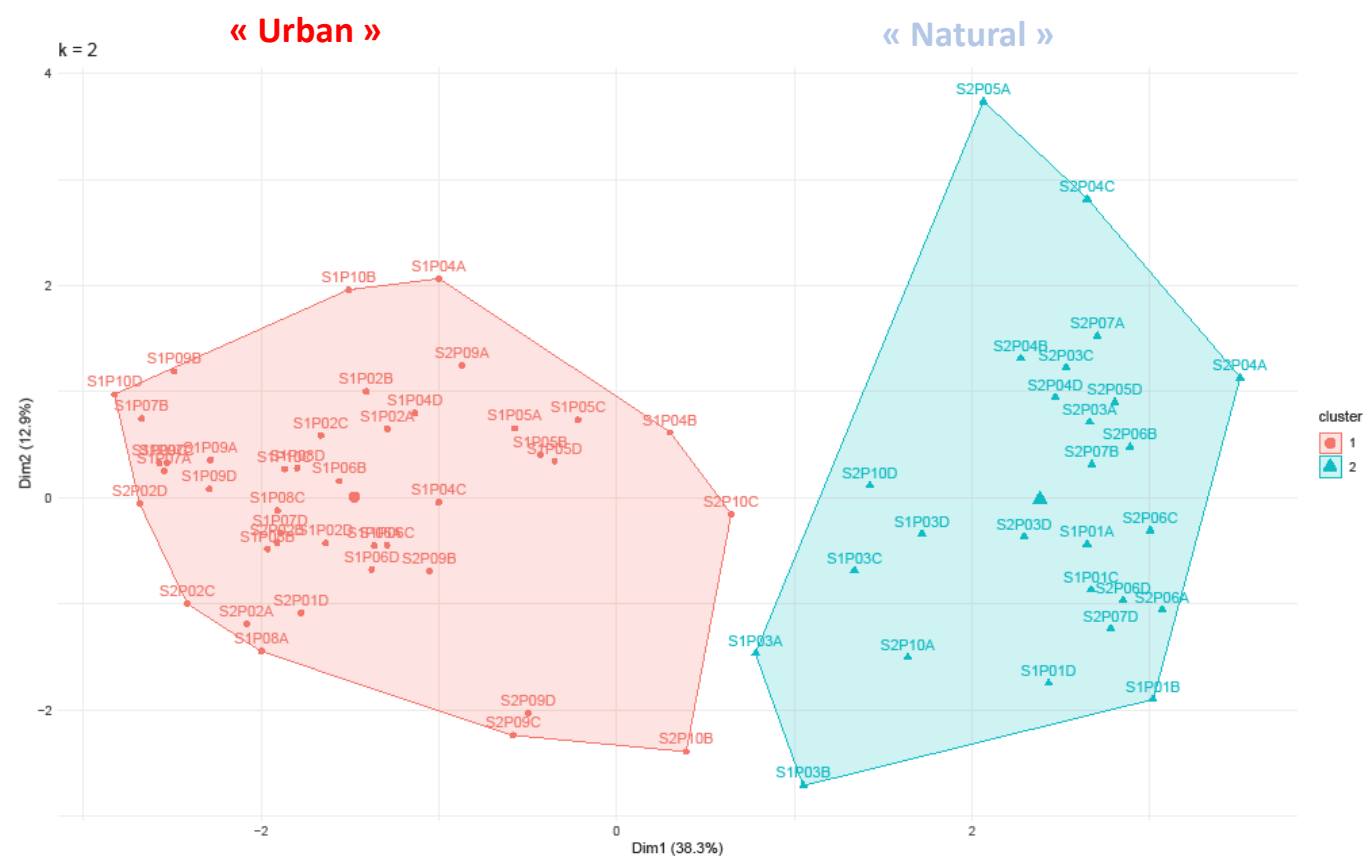
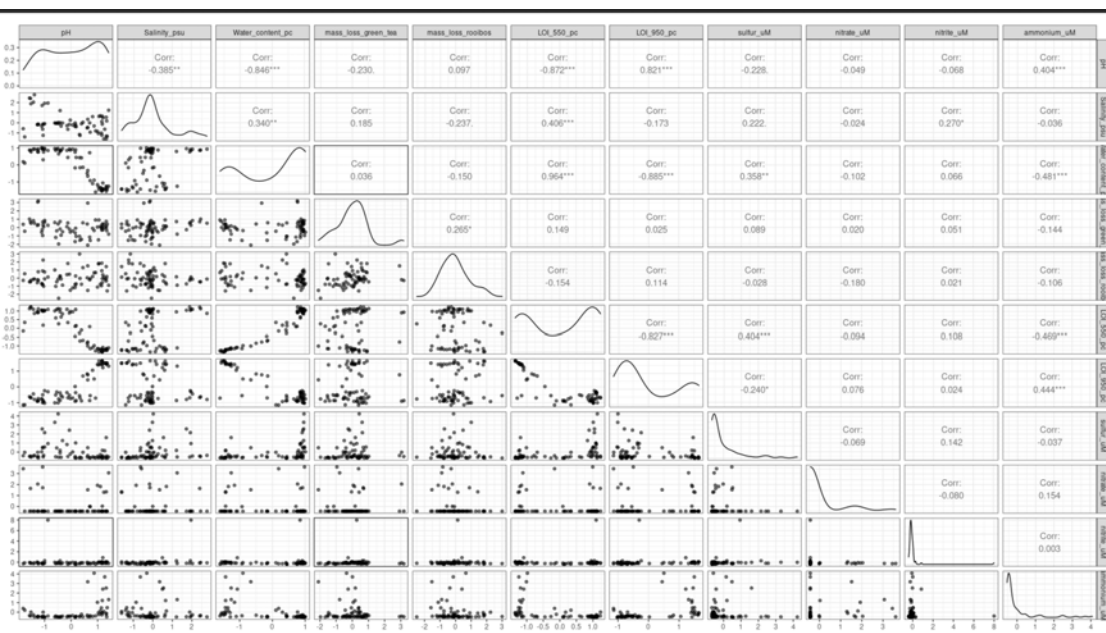
Microbial communities of Guadeloupean mangroves and anthropization [SES-RS / SES-RU / SES-ECO]

What are the links between eukaryotic and procaryotic communities ?
What is the influence of the distance to anthropization areas ?

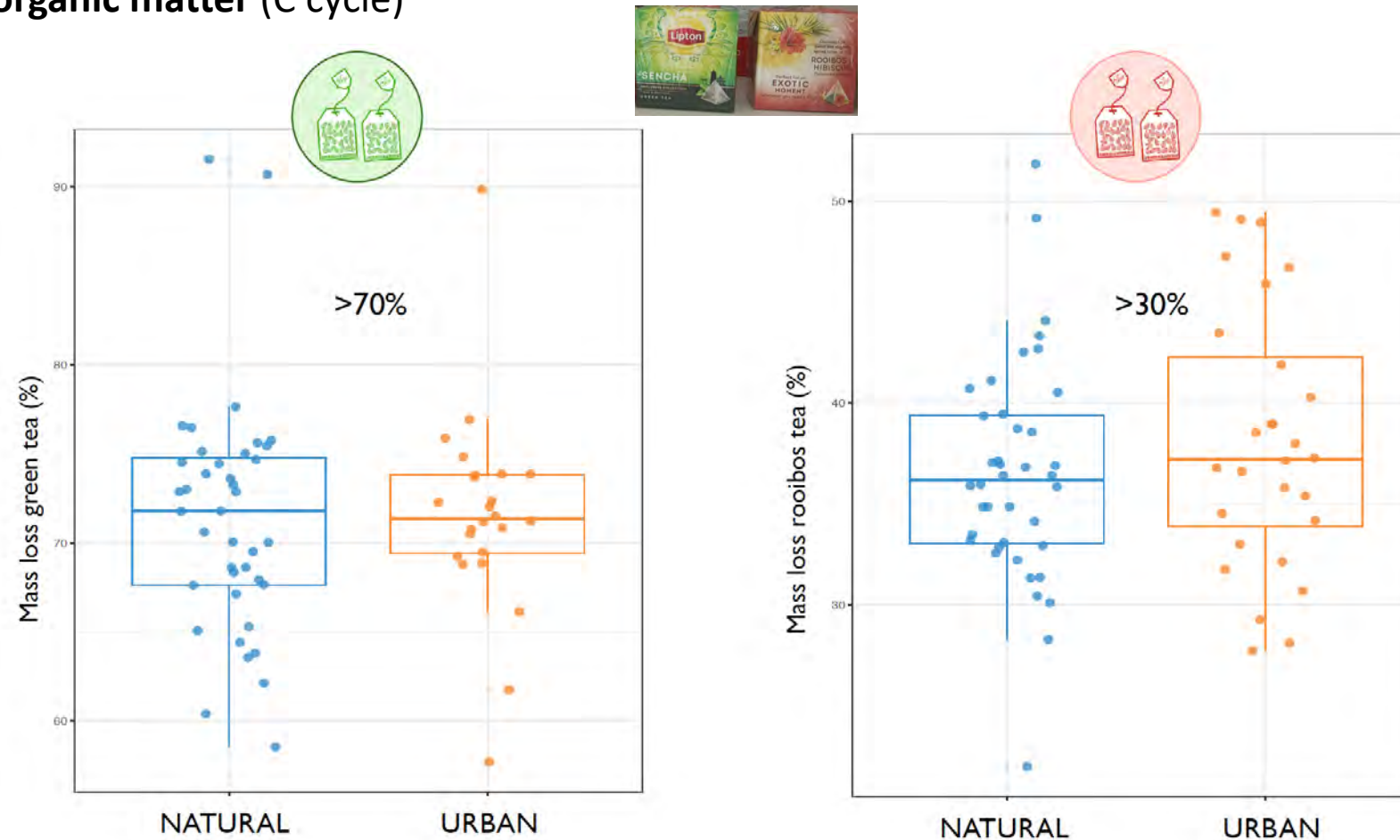


Microbial communities of Guadeloupean mangroves and anthropization [SES-RS / SES-RU / SES-ECO]

Biochemistry



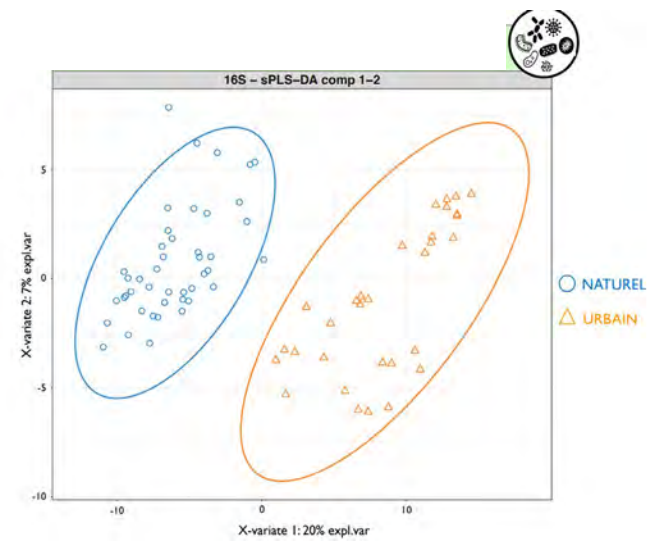
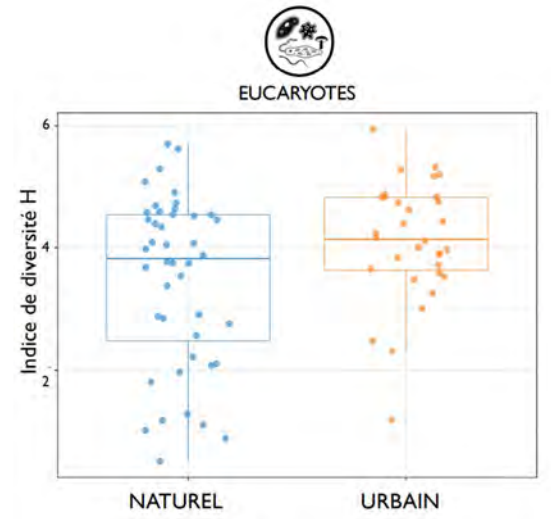
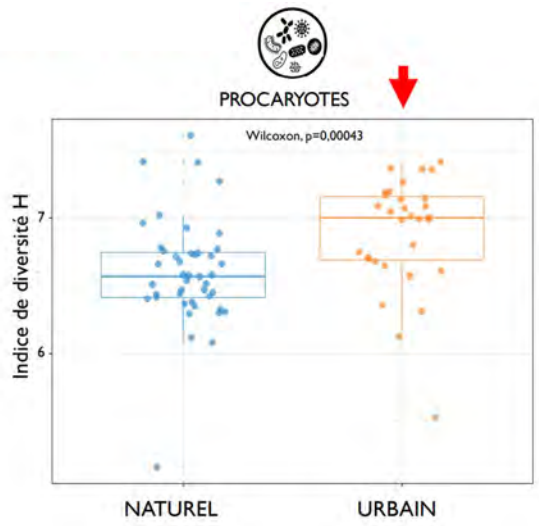
Decomposition of organic matter (C cycle)



Functional redundancy of microbial communities ?

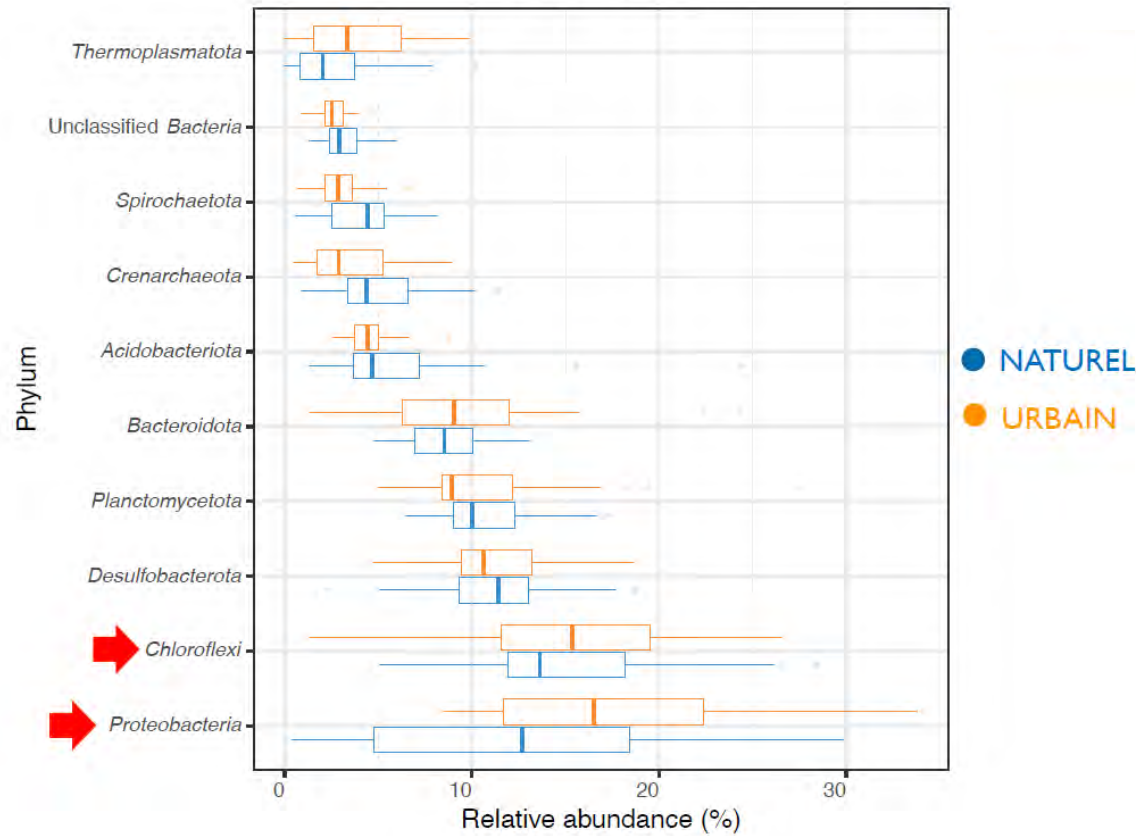
Microbial communities of Guadeloupean mangroves and anthropization [SES-RS / SES-RU / SES-ECO]

Richness: 50,399 Procaryotic OTUs
13,155 Eucaryotic OTUs



Alpha diversity analyses reveal that the prokaryotic diversity in the « urban's » mangrove is higher than in the « natural » ones

Beta diversity analyses reveal that prokaryotic communities present in the « urban » and « natural » mangroves are clearly distinct



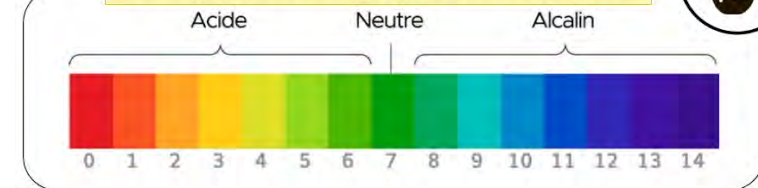
50 OTUs DISCRIMINANTES IDENTIFIEES

2 OTUs du phylum CHLOROFLEXI

OTU 10 → URBAIN

OTU 08 → NATUREL

En fonction du pH du milieu



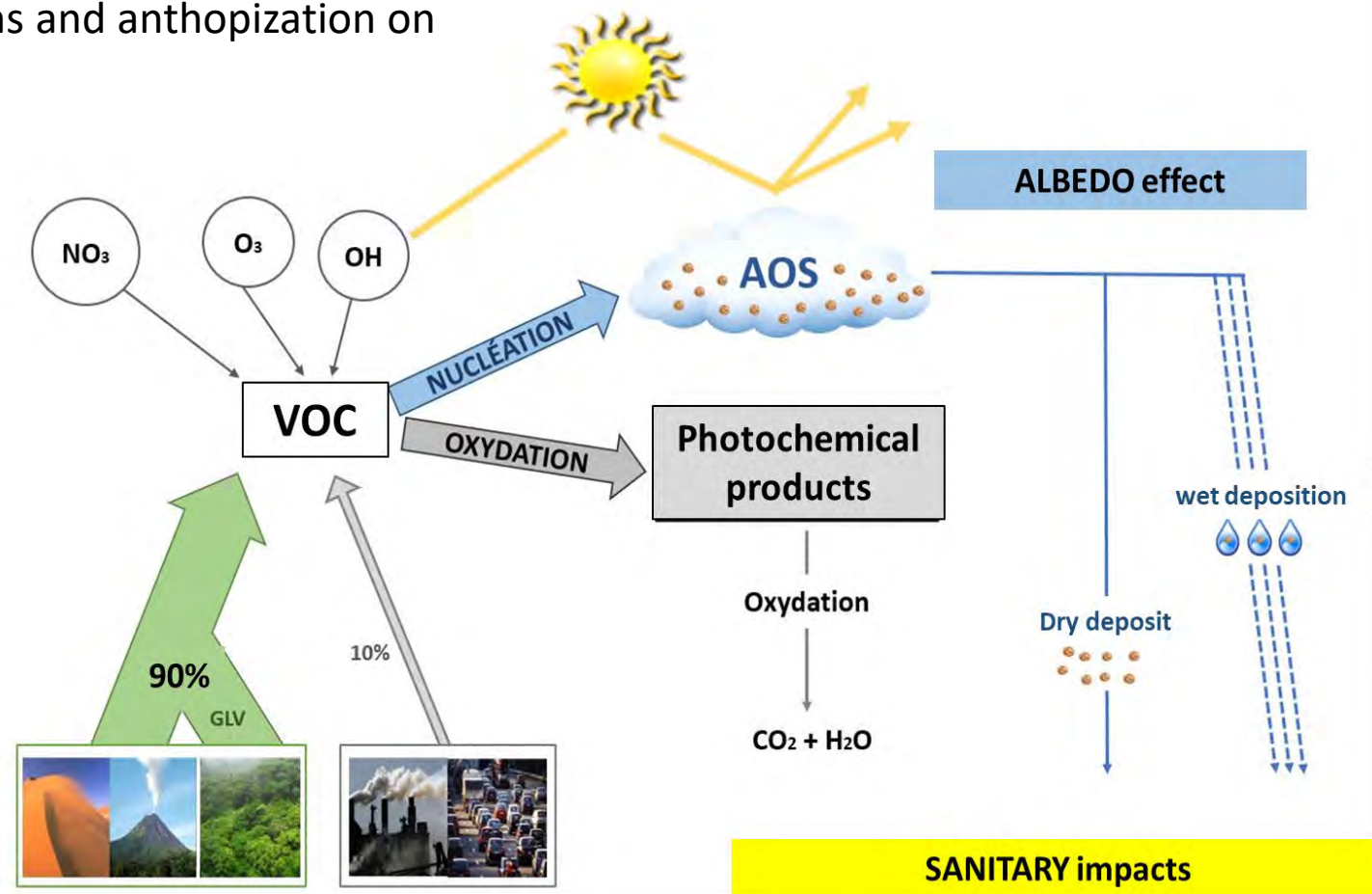
Identification of prokaryotic environmental biomarkers

Emission of volatile organic compounds by mangroves in the Petit Cul-de-sac marin

[SES-RS / SES-RU / SES-ECO]

What are the Volatil Organic Compounds (VOC) emitted by mangroves trees?

What is the influence of the meteorological conditions and anthropization on these VOCs emission ?



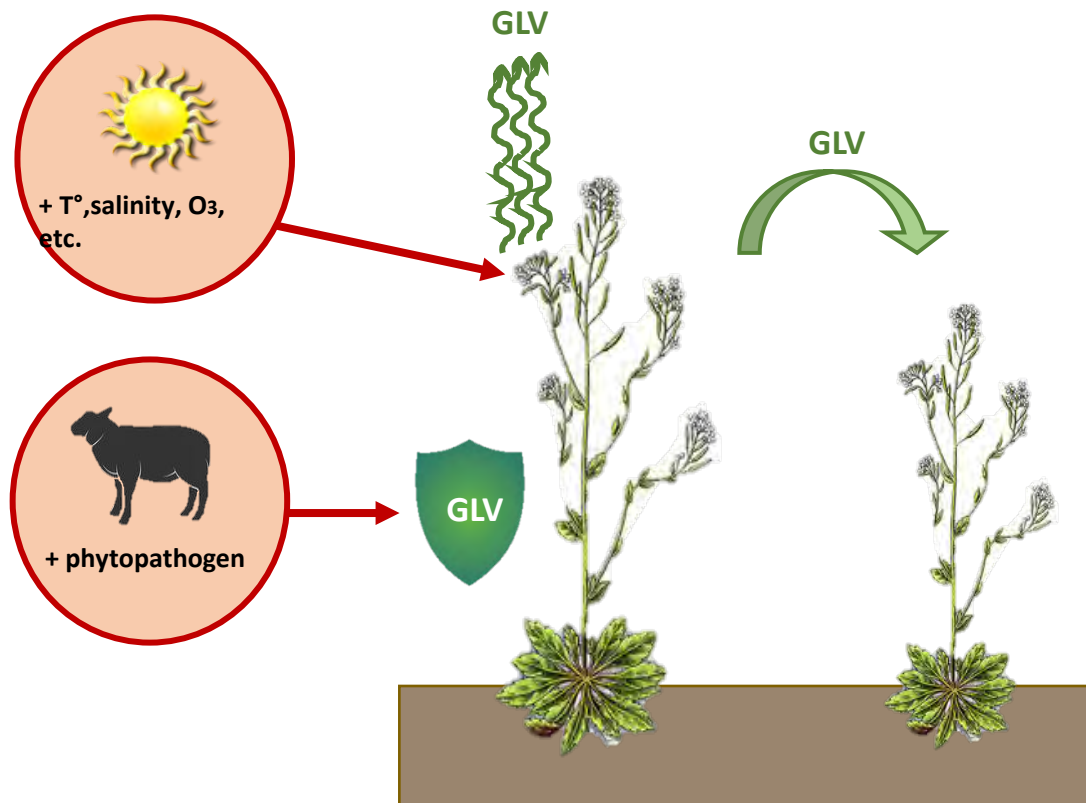
« 2012-2022: ten years of OHM results" Session

Emission of volatile organic compounds by mangroves in the Petit Cul-de-sac marin

[SES-RS / SES-RU / SES-ECO]

Under stressful conditions, the forest react by producing VOCs, also call Green Leaf Volatils compounds (GLVs)

These GLVs is a way of communication between trees but also a defense against pathogens and physical damages



Example: Inflammable are produce by some trees in drought condition

→ **ELEMENT TERRE**

Portugal : l'eucalyptus met le feu aux poudres



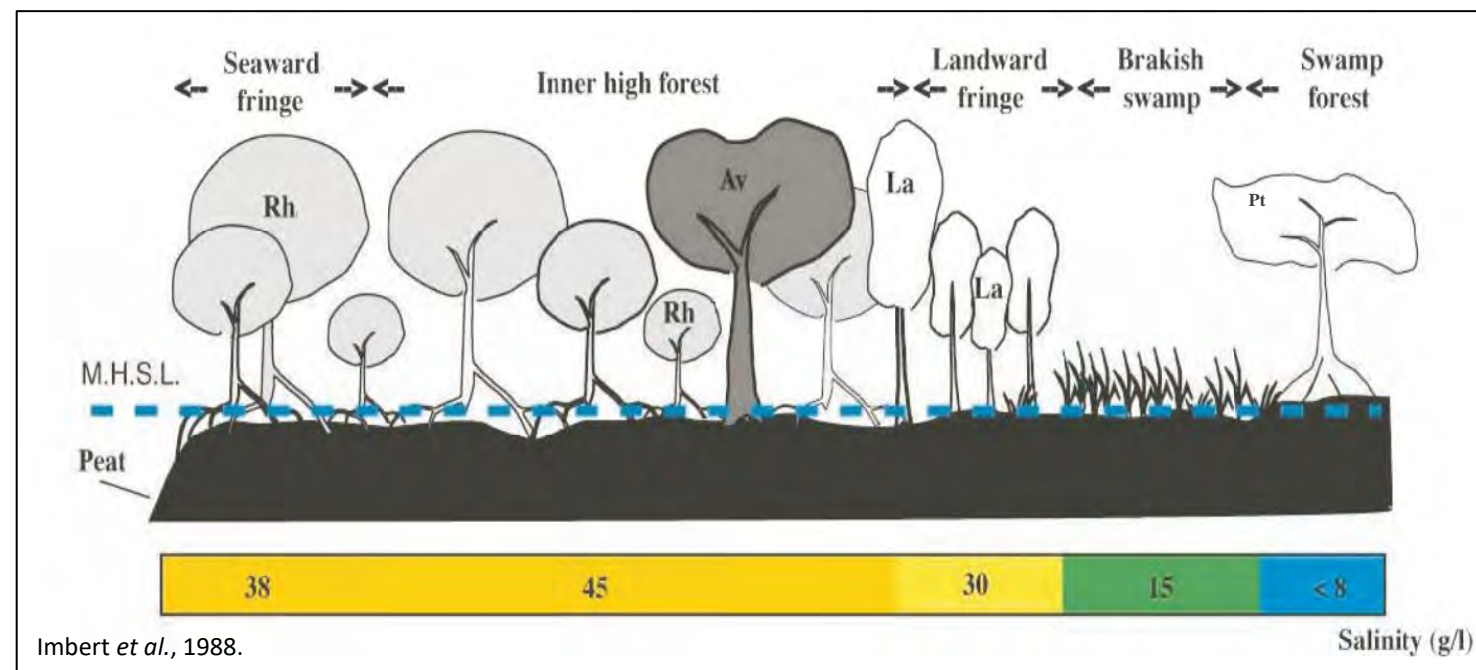
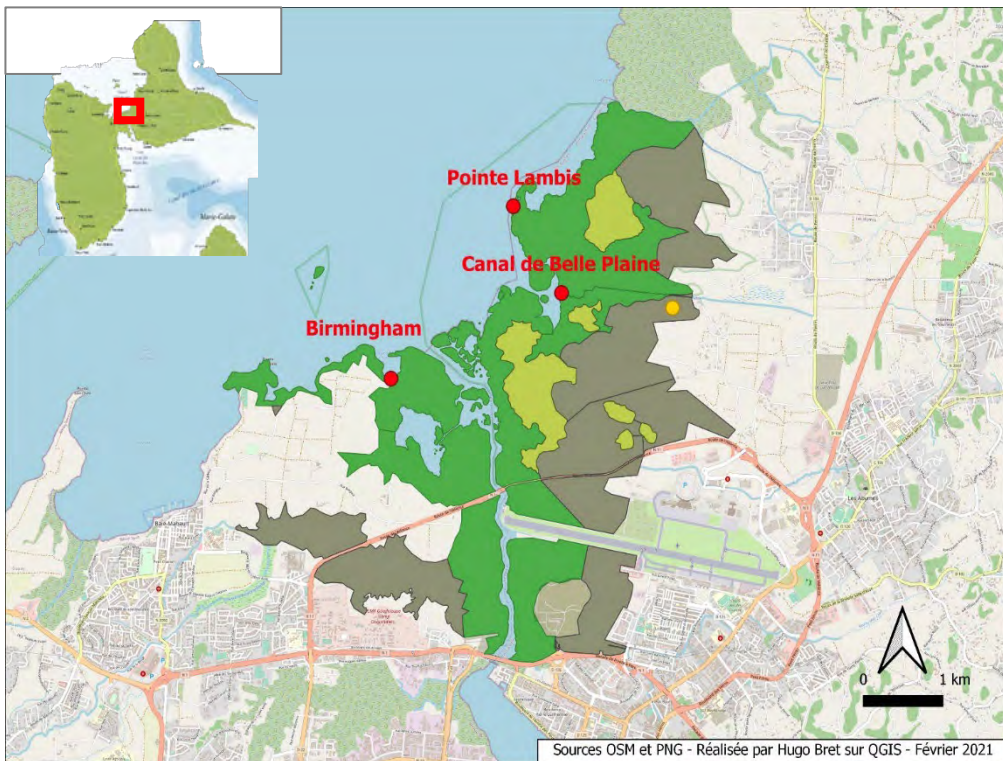
Publié le : 13/07/2018 - 17:14



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Emission of volatile organic compounds by mangroves in the Petit Cul-de-sac marin

[SES-RS / SES-RU / SES-ECO]



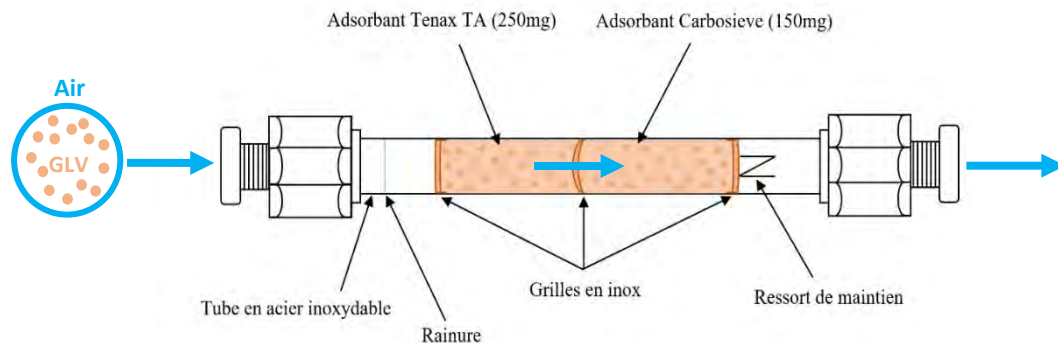
Rh : *Rhizophora mangle* (palétuvier rouge)
La : *Laguncularia racemosa* (palétuvier blanc)

Av : *Avicennia germinans* (palétuvier noir)
Pt : *Pterocarpus officinalis* (mangle-médaille)

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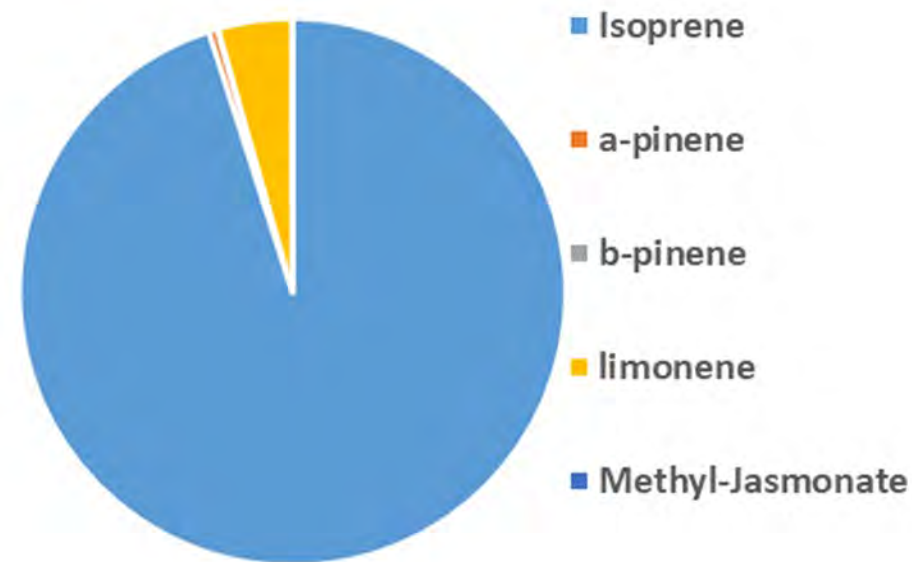
Emission of volatile organic compounds by mangroves in the Petit Cul-de-sac marin

[SES-RS / SES-RU / SES-ECO]



Preliminary result of the first year of sampling

Canal de Belle Plaine

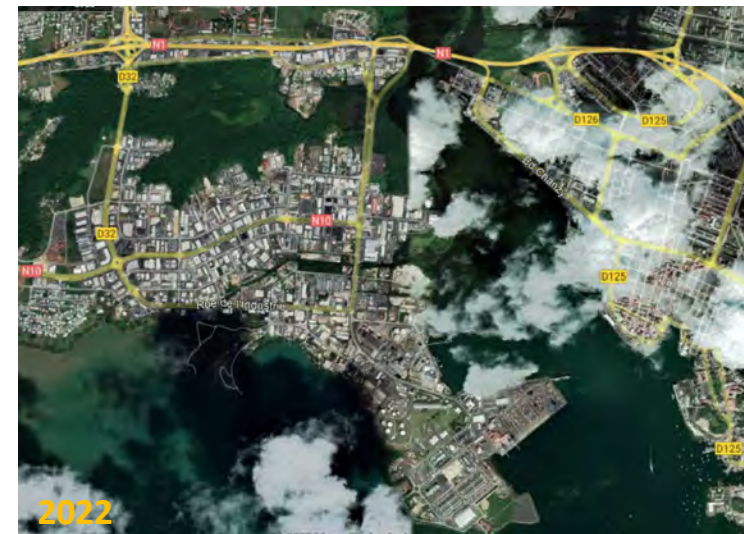
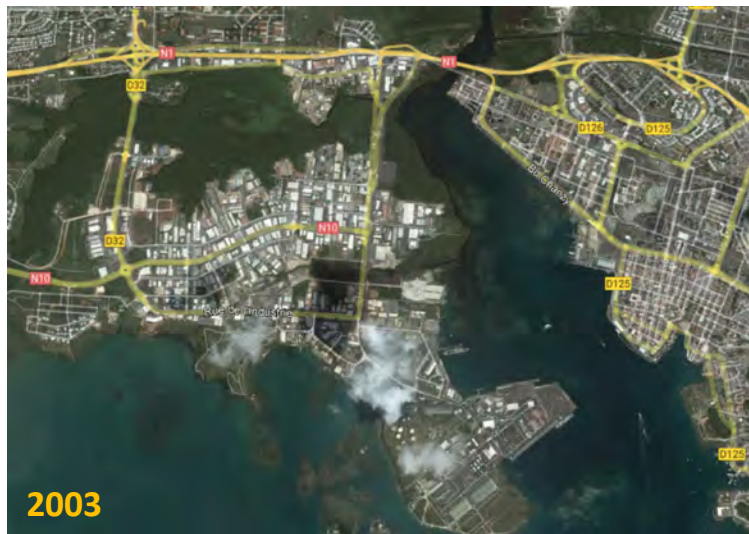


To be continued ...



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Spatio-temporal changes



Central Jarry: A putative Global Ecology Study Site [SES-RS / SES-RU / SES-GS / SES-ECO / SES-I / SES-S]

- **Ecosystems:** mangroves and swamp forests
- **Biodiversity knowledges and pollution datas:** COMMANGA (OHM, APR-2020), JACOMO (OHM, APR-2022), Conservatoire du Littoral ...
- **Anthropic pressures:** historical and current industrial activities including the GPMP & power industries, main road traffics ...
- **Highly dynamic commercial area:** 9,211 private or public companies / 25,067 employees / 725 new business establishments in 2020
- **Ongoing ecological & restauration projects:** OFB, Office de l'eau de Guadeloupe, TotalEnergies Foundation, Région Guadeloupe, Conservatoire du Littoral
- **Two ZHE sites:** Pôle relais zone humide, IUCN, Collège Gourdeliane, Cap Excellence, Conservatoire du Littoral, Educ'OHM Mangrove (APR-2020), EVOLUM (APR-2022)



Analyzed sites by the Conservatoire du Littoral



Merci de votre attention

