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Exploring Key Environmental Factors Impacting Coastal Mangrove Ecosystem Health

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Introduction – Focus of Research

The aim of this research was to study the biotic and physicochemical parameters that significantly influence mangrove presence and productivity.

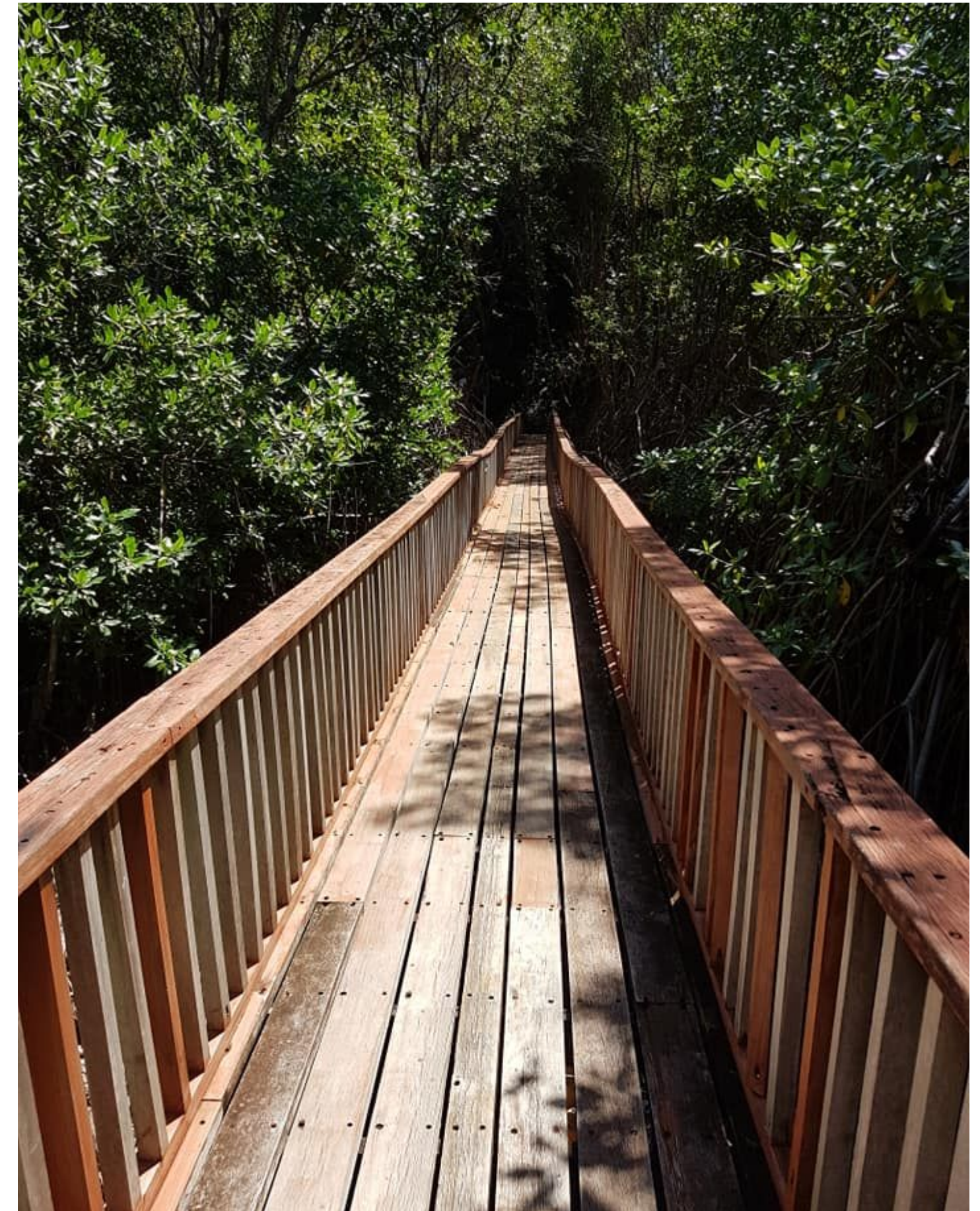
This research tested the immediate environmental conditions present at Fort Jeudy & Levera in Grenada, West Indies, to make a comparison and used literature from similar studies to make an analysis from the results.

- Community composition
- Soil-water characteristics (salinity)
- Litterfall
- Terrain elevation
- Temperature

INTRODUCTION

BACKGROUND

- Anthropogenic activities are increasing globally (Lugo A et al., 2014).
- Altered environmental conditions include:
- Atmospheric CO₂ composition & Sea level rise
- Inundation of low-laying land & Temperature
- Changes in the occurrence and severity of atmospheric events
- Tropical cyclones & hurricanes





What is the Problem?



Photo credit Google Image

- Shield the coastal environment
- 70% of 200,000 km² of mangroves globally have been deforested since colonial times (de Lacerda et al., 2022).
- Mangroves provide a suite of ecosystem services
- The effects of altered environmental conditions on mangroves need to be constantly watched.
- This research provides new valuable field-based and analysis data on environmental parameters that impact mangrove productivity.

Why is this research important?

- Mangrove species are heavily influenced by salinity, inundation, precipitation patterns and drought occurrences.
- Climate change, global temperatures are increasing.
- There are still uncertainties and debates upon salinity tolerance and temperature limitations of mangroves (de Lacerda et al., 2022).
- Data is key to conserving wildlife.
- Gaps in utilizing standard criteria to assess changes in response to climate change and Anthropocene effects (de Lacerda et al., 2022; Gilman et al., 2008; Lugo A et al., 2014).



Photo credit: Reon Lewis Banton

QUESTIONS

- What are the main contributors controlling mangrove presence and productivity of these two ecosystems?
- What are the main similarities and differences among the two sites?

This study addresses these gaps, focusing on parameters that influence mangrove presence and productivity in Fort Jeudy & Levera, on the island of Grenada, West Indies (12.1165° N, 61.6790° W).



Photo credit: Google Images

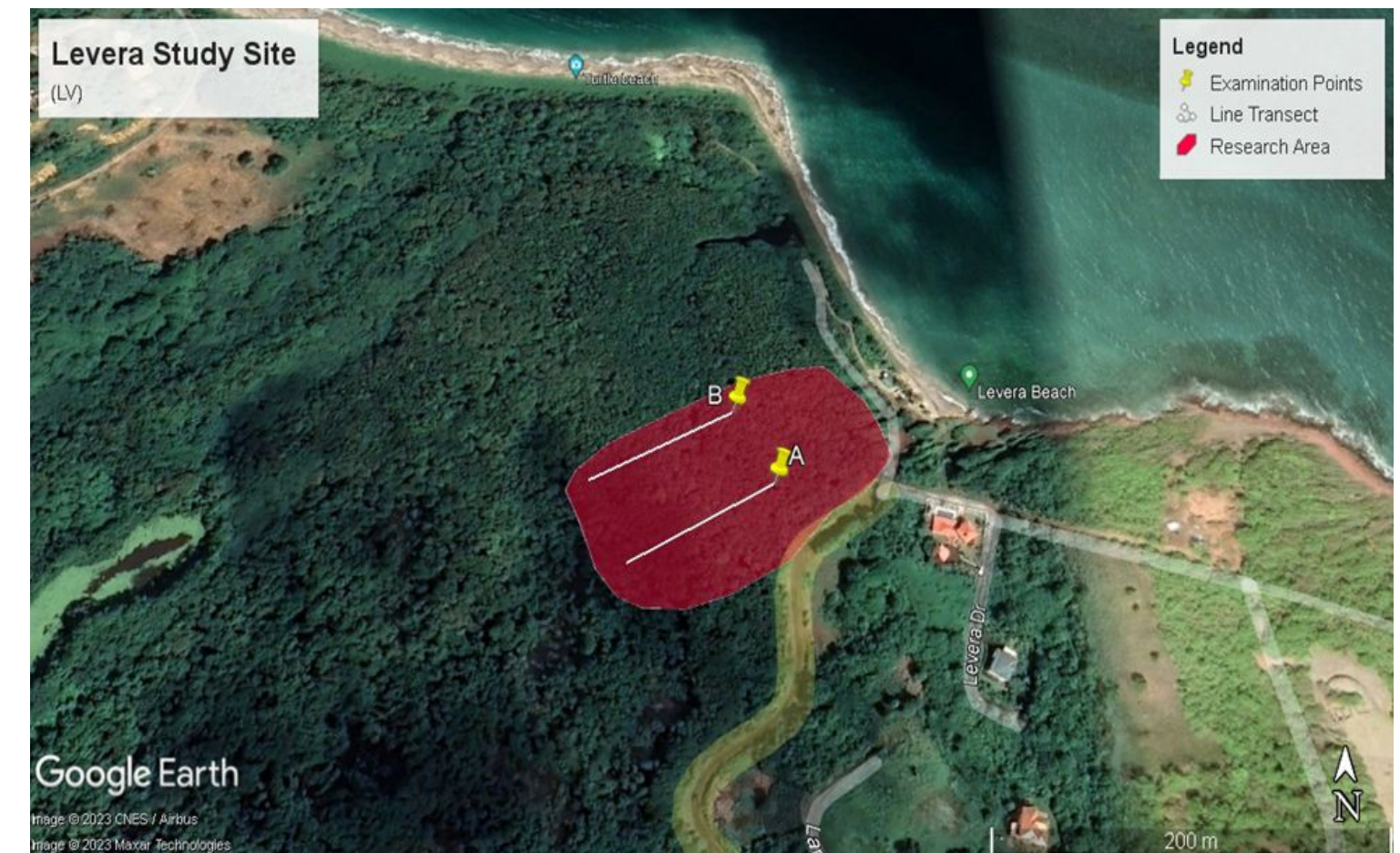
Methodology

Study Area

Fort Jeudy, Grenada West Indies
12.0127° N, 61.7176° W



Levera, Grenada West Indies
12.2248° N, 61.6080° W



Methodology – Field Survey

- Soil and Water Characteristics
- Using two random 1m² subplots a hole was dug to until there was sufficient water.
- The digital probe was then used to monitor the pH and temperature.
- Salinity samples was taken via a pipette and then measured with a refractometer.



(Amazon, nd)
<https://www.amazon.com/Moisture-Temperature-Intensity-Environment-Gardening/dp/B09N36NBG2>



(smartlashes, nd)
<https://www.smartlashes.eu/plastic-pipette-3-ml.html>



(Rudolphresearch, nd)
<https://rudolphresearch.com/measuring-refractive-index-refractometry/>

Methodology – Field Survey cont.

- **Litterfall** - Five arbitrary subplots was be added to determine how much litter is dropped at the site.
- The litter was gathered and classified into leaf, fruit/flower, and branch categories for each subplot using a segmented $\frac{1}{4}$ m² quadrat for each subplot indicated.
- **Rapid Field Transect** – Using 20m intervals, a short transect of the mangrove forest was completed.
- Shoreline to the landward limit.
- Identified and counted the mangal species found within 1m² of the transect tape.



(hccrowder, nd)

<http://www.hccrowder.com/ronald-bog-field-trip.html>

Methodology – Data Analysis

- Assessing community composition allows us to identify and relate abundances of all or specific taxa in a community.
- PH and water salinity are significant indicators for growth and influence the survival and zonation of mangrove species.
- Analysis of litterfall data enables comparisons between the two mangal forest's biomass and nutrient contents, thus relating to the growth and productivity of the forests.
- The rapid transect helps to identify and count the mangrove species present, thus allowing us to compare and expand on the factors influencing the zonation of both areas.



Results – Tree Measurements

- The average circumference for FJ was 0.39 m with a standard error of ± 0.025 m, while LV had an average circumference of 0.814 m with a standard error of ± 0.26 m
- The average length for FJ was 0.45 m with a standard error of ± 0.044 m, while LV had an average length of 1.43 m with a standard error of ± 0.15 m.
- The average height for FJ was 1.38 m with a standard error of ± 0.32 m, while LV was 7 m with a standard error of ± 0 (the measurement of trees in LV was a rough estimate rounded to the nearest meter using an extendable PVC rod).
- The average DBH for FJ was 0.12 m with a standard error of ± 0.008 , while LV had an average DBH of 0.26 m with a

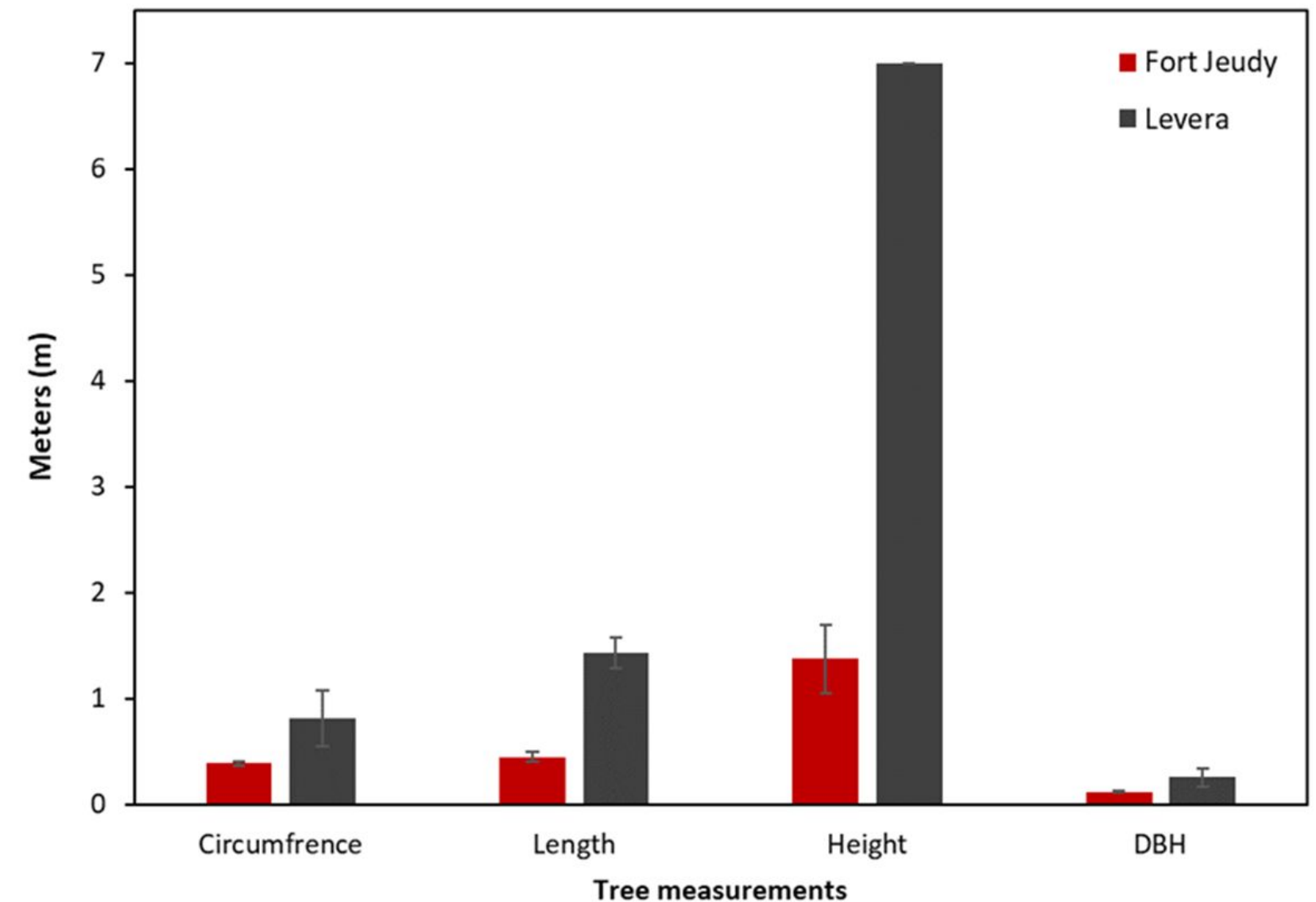


Figure 1. Showing a comparison between the average circumference, length, height, and diameter at breast height for FJ and LV.

Results - Salinity, pH & Temperature

Levera				
Point Coordinates	Point	Salinity (ppt)	pH	Temperature (°C)
12°13'27" N 61°36'33" W	A	15	7.49	31.6
	A	15	7.68	31.6
12°13'28.56"N 61°36'33.82"W	B	15	7.67	31.6
	B	15	7.69	31.6

Fort Jeudy				
Point Coordinates	Point	Salinity (ppt)	pH	Temperature (°C)
12°0'41"N 61°43'16" W	A	35	7.43	35.5
	A	35	7.43	35.5
12°0'41"N 61°43'15" W	B	35	7.35	35.5
	B	35	7.35	35.5
12°0'43"N 61°43'14" W	C	35	7.36	35.5
	C	35	7.36	35.5

Results - Litterfall

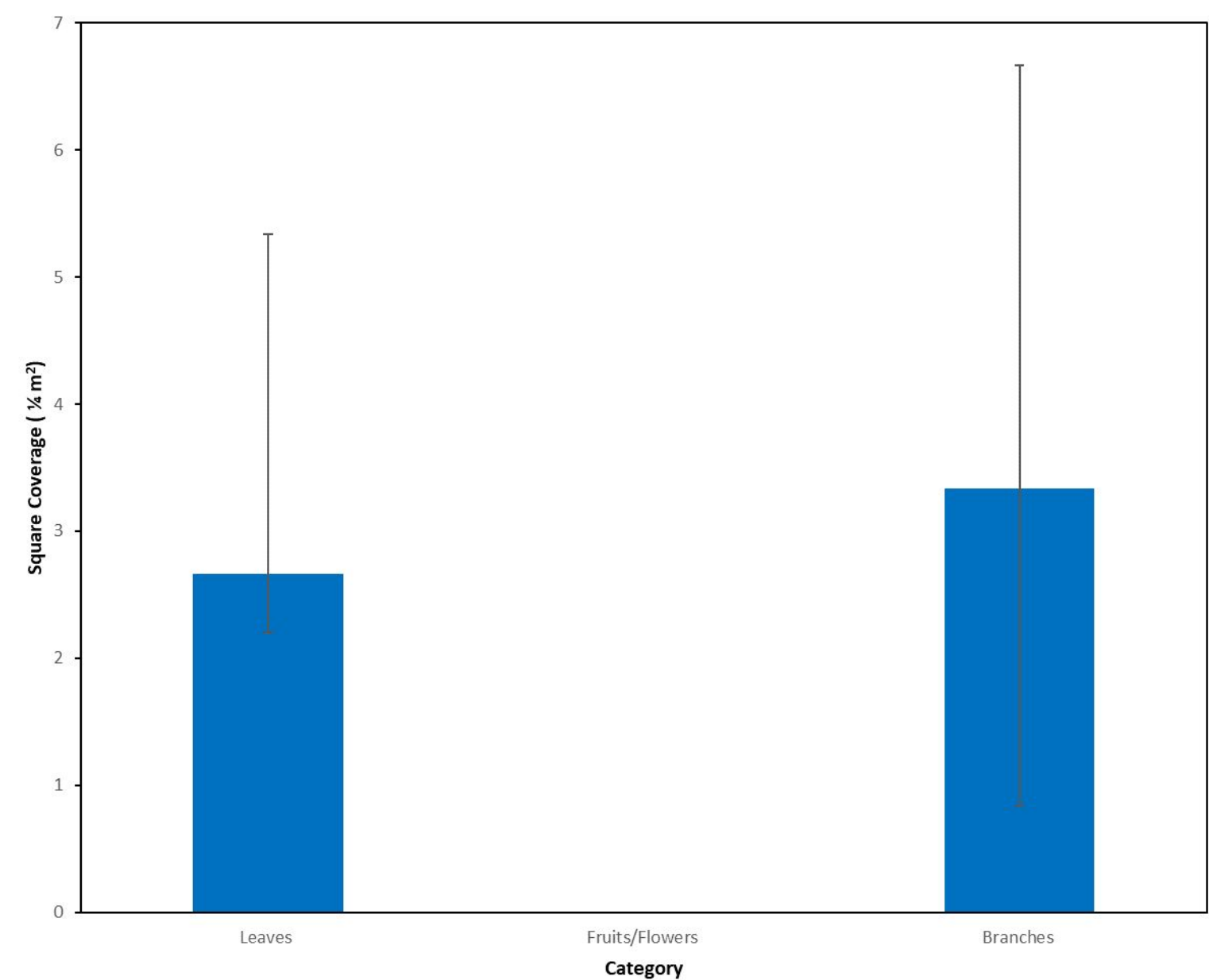


Figure 2. Showing the average square coverage (¼ m²) of litterfall in FJ.

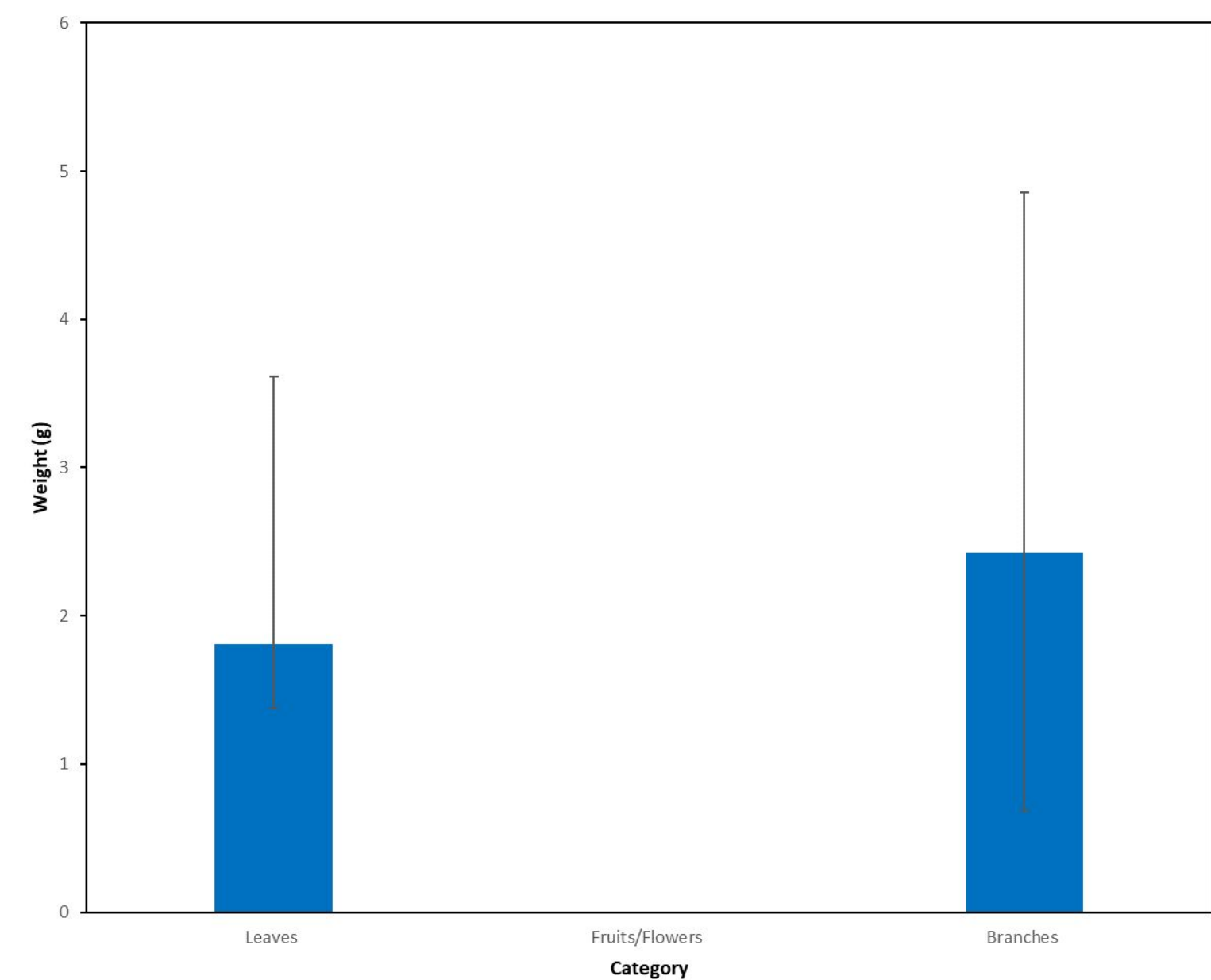


Figure 3. Showing the average weight (g) of different litterfall categories in FJ.

Results – Rapid Transects

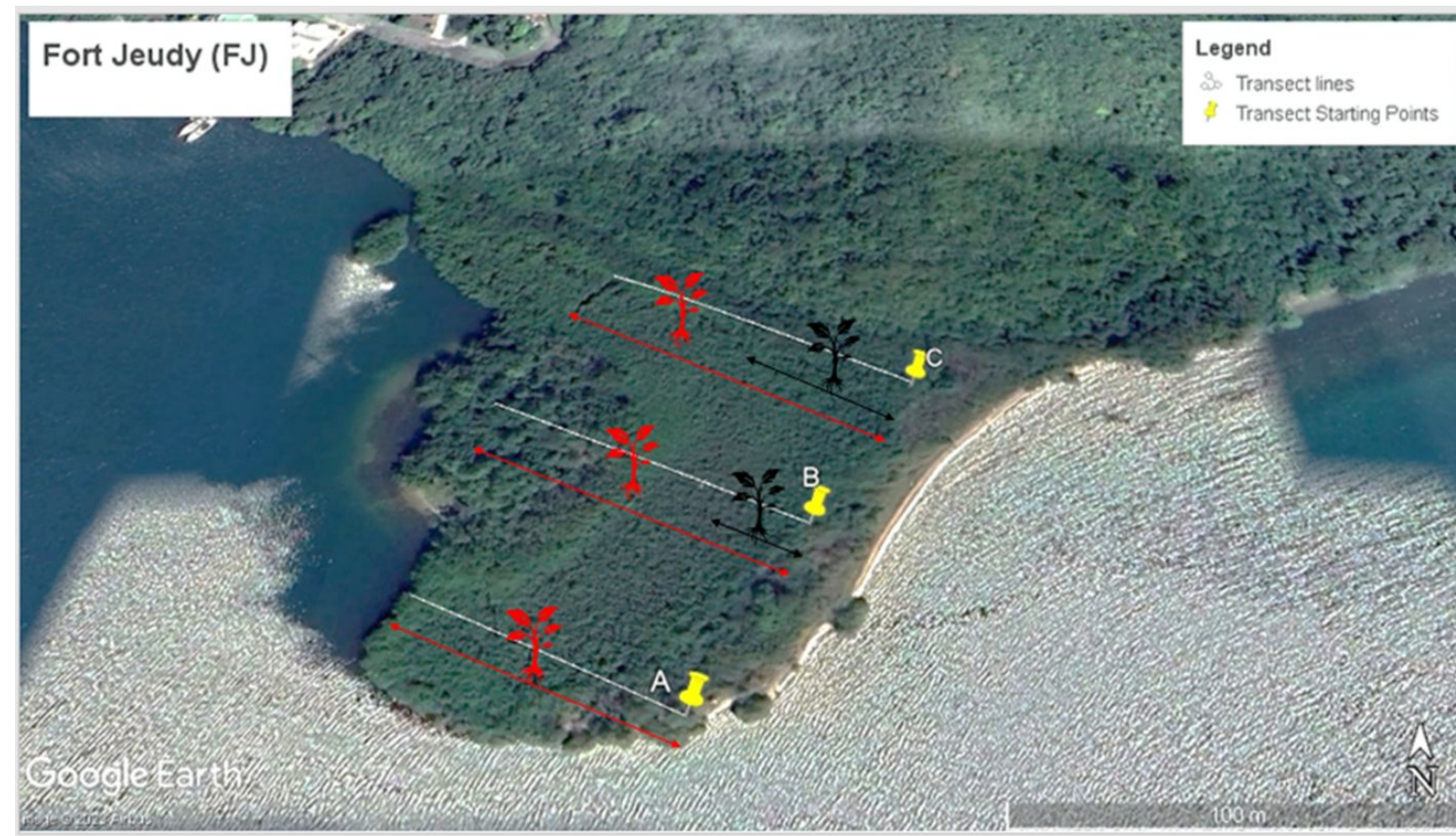
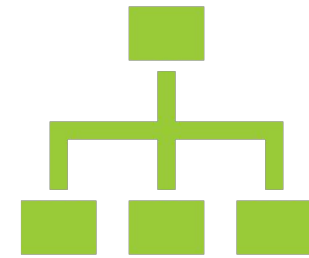


Figure 4. Showing the Mangrove Species Present Along Transect Lines at Fort Jeudy (FJ).



Figure 5. Showing the Mangrove Species Present Along Transect Lines at Levera (LV).

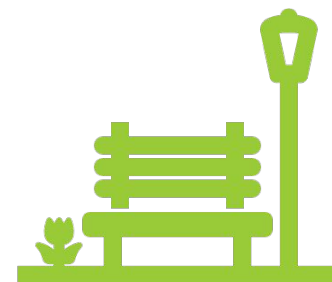
Significance of research



Management



Policies



Conservation



New Available Data
&
Future studies

Involving the local communities



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Thank you!



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