

A photograph of a mangrove forest with dense green foliage and visible roots in the water. A semi-transparent dark grey rectangle is overlaid in the center, containing the title text in white.

# **Assessment and Economic Valuation of Coastal Protection Services Provided by Mangroves in Jamaica**

PHOTO CREDIT: PATRICE FRANCIS

**The University of the West Indies**

# Outline

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- Introduction
- Methodology
- Preliminary Results



# Introduction

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- ❑ Trees and shrubs dwelling in intertidal areas of tropical and subtropical coastlines (Horstman et al. 2016)
- ❑ Adapted to live in saline conditions.

69 species; 4 species found in Jamaica *and Caribbean*:

*Rhizophora mangle* (Red)

*Avicennia germinans* (Black)

*Laguncularia racemosa* (White)

*Conocarpus erectus* (Button)



# Value of Mangroves

## Regulating, Supporting, Provisioning and Cultural/Educational **ecosystem services**

### **Regulating**

- Sediment trap
- Purification (remove nutrients from sewage & fertilizers)
- Shoreline and infrastructure protection
- Carbon sequestration

### ◦ **Supporting**

- Nursery area- fish
- Habitat for other species
- Refuge during hurricanes and severe storms

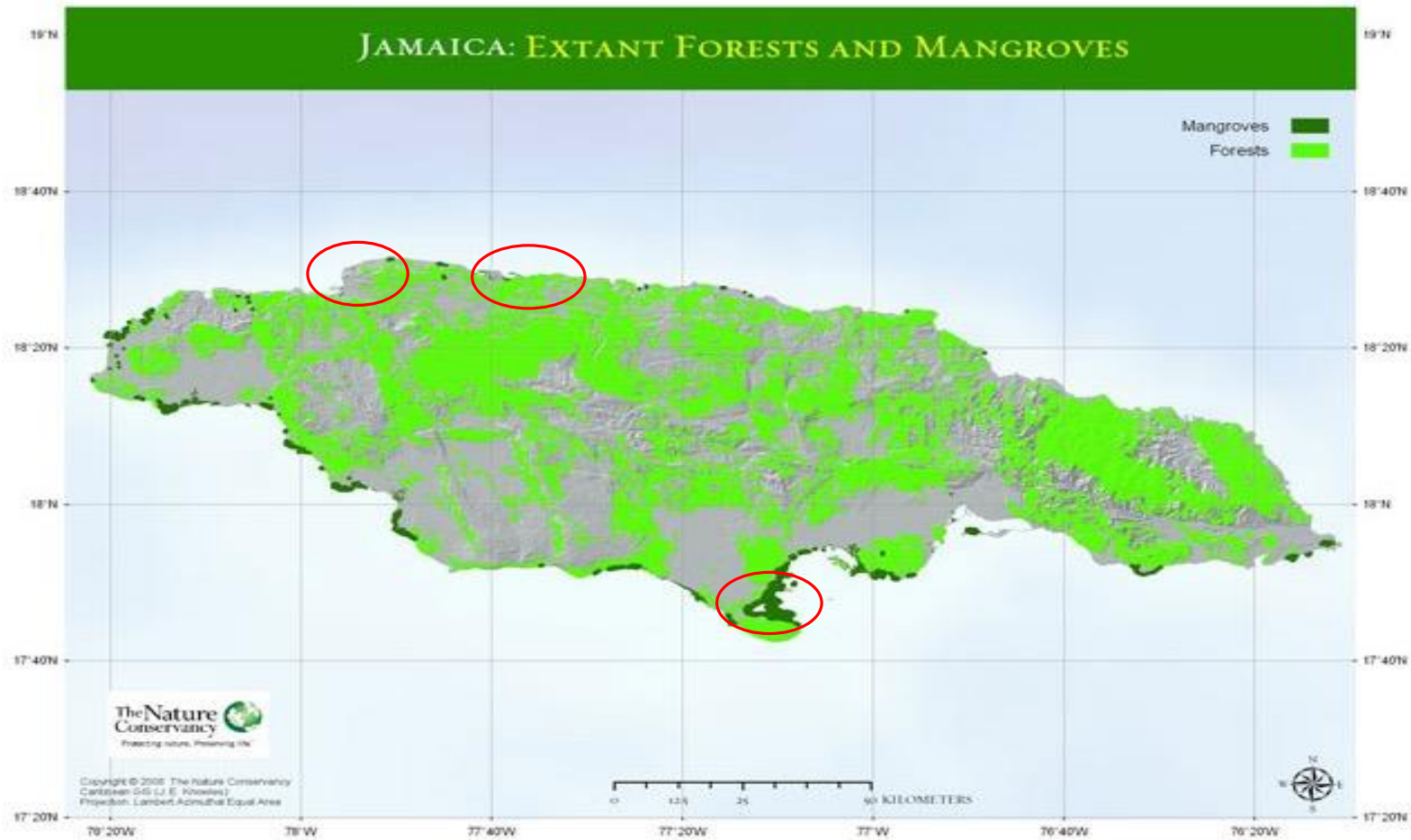
### **Provisioning (Exploitable resources)**

- Medicine- bioactive compounds
- Food (mangrove honey)
- Timber/charcoal
- Tannins

### **Education/Recreation:**

- Tours
- Bird watching
- Teaching
- Recreation

# Jamaican mangrove location & selected sites



# METHODOLOGY

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- a holistic approach that captured socio economic, physical and ecological data across 3 communities were undertaken

## Socio-economic

- A quantitative survey was administered

## Physical

- Flooding and coastal erosion
- Sediment sampling and assessment
- Surface accretion and soil surface elevation
- Wind data
- Bathymetry
- Soil –atmospheric carbon
- Water quality





# Methodology cont'd

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## Ecological

- Mangroves species composition, density & diversity
- Prop root/Aerial root network
- Mangrove trunk diameter
- Mangrove height and canopy width
- Ecosystem services



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# Socio-economic Results



# Context

## Preliminary results

Variables	Portland Bight	Salt Marsh
Highest level of educational Attainment	Secondary- 51.4	Secondary- 48.2
Mean Age of respondent	45.4	39.9
# of persons living in the household	3.3	3.7
Length of residency	54.1	18.9
Main source of Income	Self-Employment- 60% Paid Private Employee – 12.4	Self-Employment- 44.7 Paid Private Employee- 41.2
Participation in Partner	Yes- 26.9	Yes- 34.1

Type of business	Frequency	Valid Percent
Sole proprietorship	29	48.3
Partnership	7	11.7
Corporation	24	40.0
Total	60	100.0

## Livelihoods/ Fish consumption

- Fish is an important livelihood more so in Portland Cottage (35.6% mentioned that they fish within the community)
- Salt Marsh- only 16.7%

### Fishing in mangroves?

- 13 out of the 37 persons who fish, fish within the mangrove area in Portland Bight
- For Salt Marsh- 6 out of the 14

Name of community	Consumption of Fish	
	Yes	No
Portland Bight	93.2	6.8
Salt Marsh	96.2	3.8
Bogue St. James	97.6	2.4

### Type of fish consume in:

- Portland Bight: **Grunt (32.7%)**, Snapper (27.7%), Parrot (23.8%)
- Salt Marsh: **Snapper (38.3%)**, Grunt (23.5%), Parrot (2.5%)
- Bogue: **Snapper (65.5%)**, Parrot (14.5%), Grunt (5.5%)

# Coastal Flooding

## Preliminary results

Name of community			Have you experienced any coastal flooding in the community?	
			Yes	No
	Bogue Lagoon, St. James	Count	13	45
		% within Name of community:	22.0%	
	Portland Bight, Clarendon	Count	94	12
		% within Name of community:	88.7%	
	Salt Marsh, Trelawny	Count	29	56
		% within Name of community:	34.1%	
Total		Count	136	113
		% within Name of community:	54.4%	45.2%

***Mangrove removal for home/ business***

Portland Cottage- ***no reported cases***

Salt Marsh – 34.5%

Bogue- 16.7%



# Changes observed in mangrove forest

## Preliminary results

Name of community		Changes observed in the extent of the mangrove forest over the last 10 years			
		Decreased	Same	Increased	Don't know
Bogue Lagoon, St. James	Count % within Name of community:	28 46.7%	5 8.3%	5 8.3%	22 36.7%
Portland Bight, Clarendon	Count % within Name of community:	24 22.6%	19 17.9%	49 46.2%	14 13.2%
Salt Marsh, Trelawny	Count % within Name of community:	39 45.9%	17 20.0%	12 14.1%	17 20.0%
Total	Count % within Name of community:	91 36.3%	41 16.3%	66 26.3%	53 21.1%

# Mangrove Restoration

Community	Willingness to participate in mangrove restoration efforts (%)		
	Yes	No	Don't Know
Bogue	65	13.3	20
Portland Bight	71.7	18.9	9.4
Salt Marsh	67.1	24.7	8.2
Total	68.5	19.5	11.6

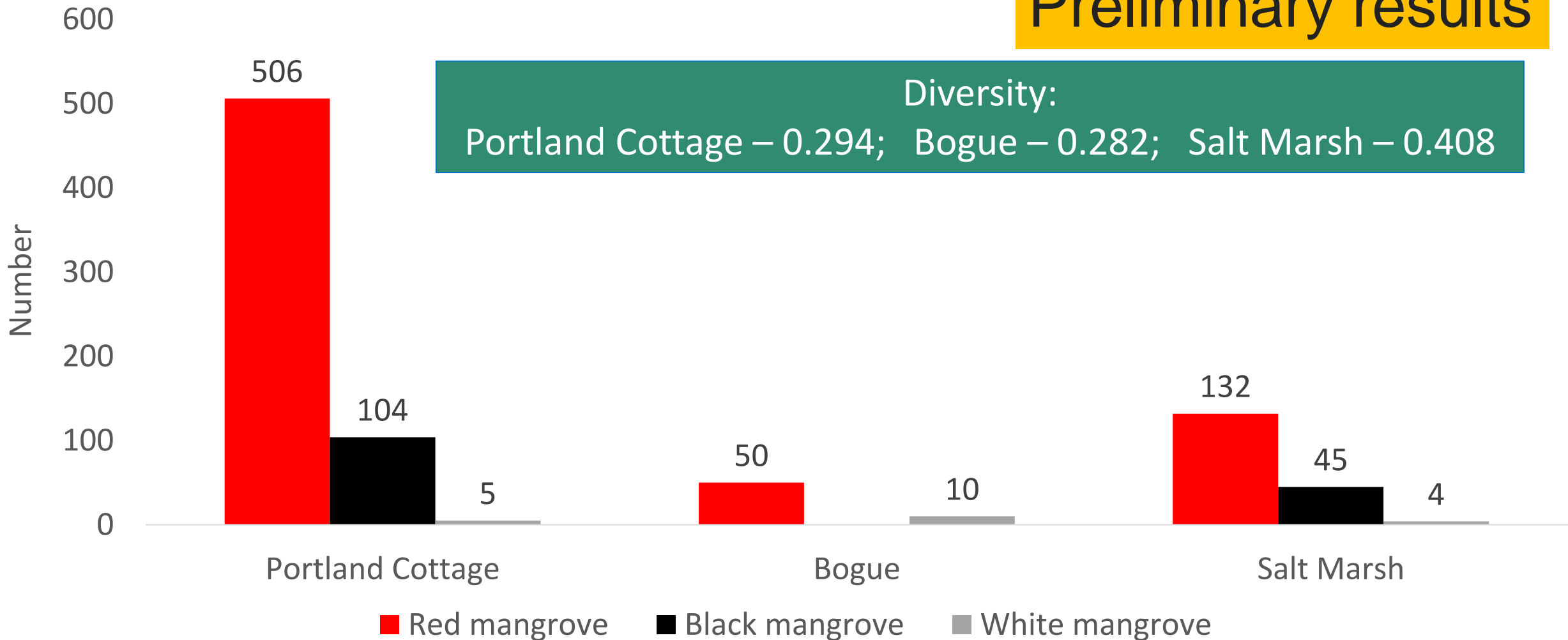
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# Ecological Results



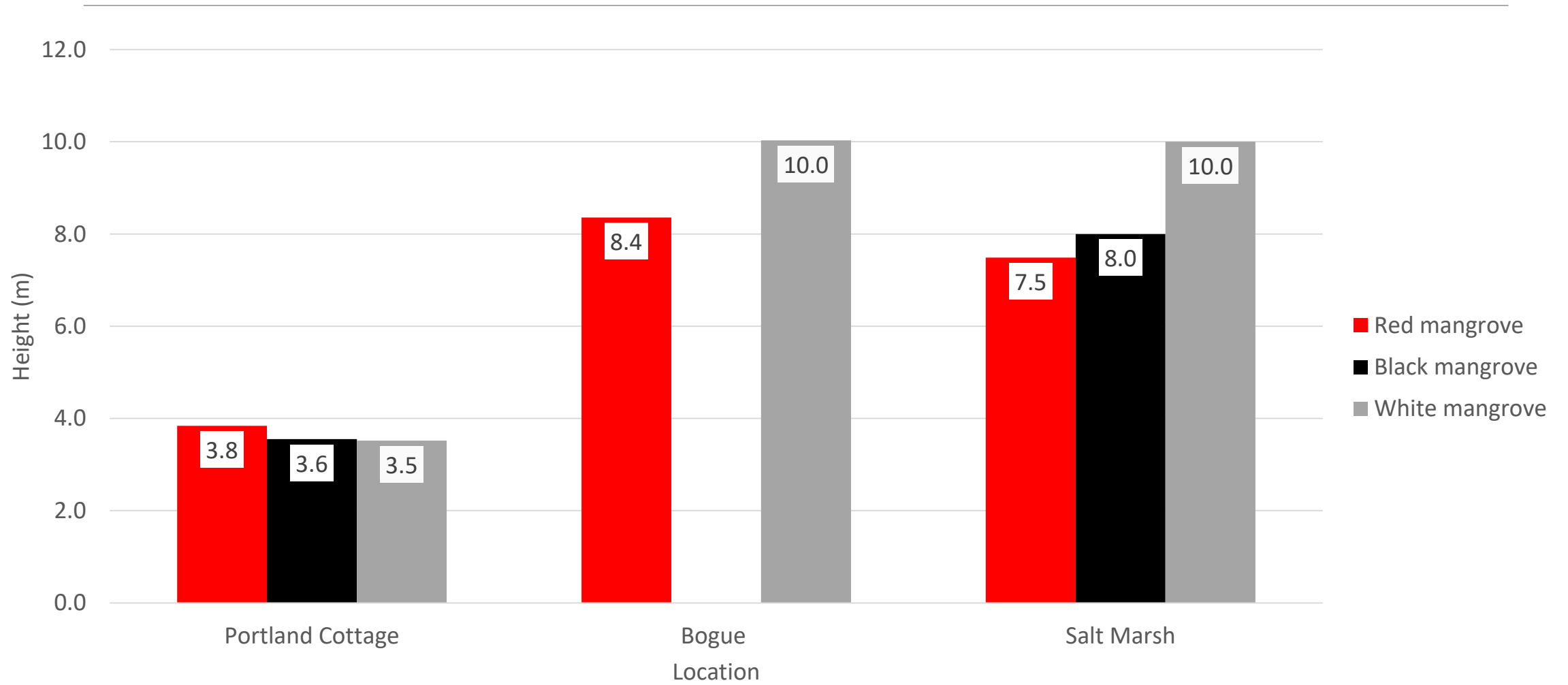
# Tree density & species diversity

Preliminary results



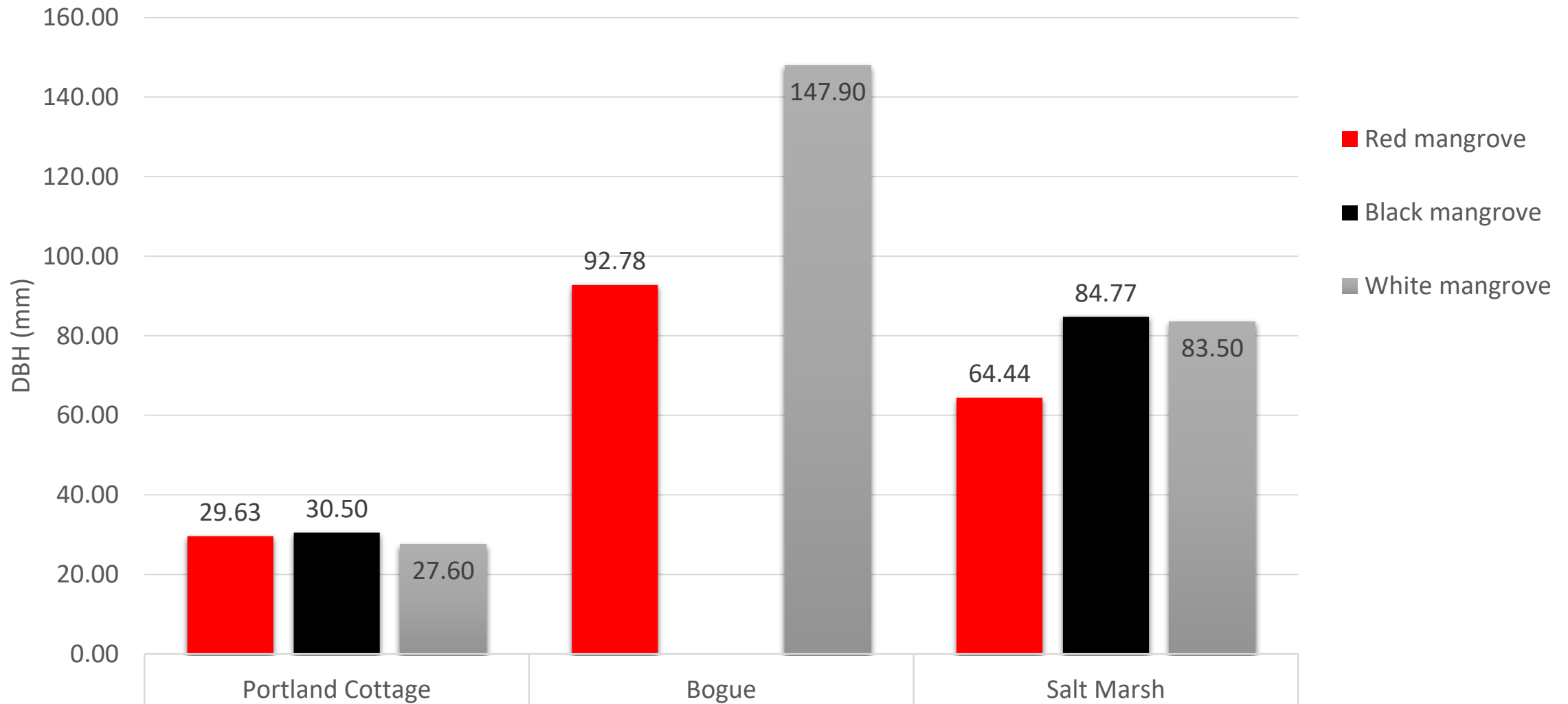
# Height

Preliminary results



# Diameter at Breast Height(DBH)

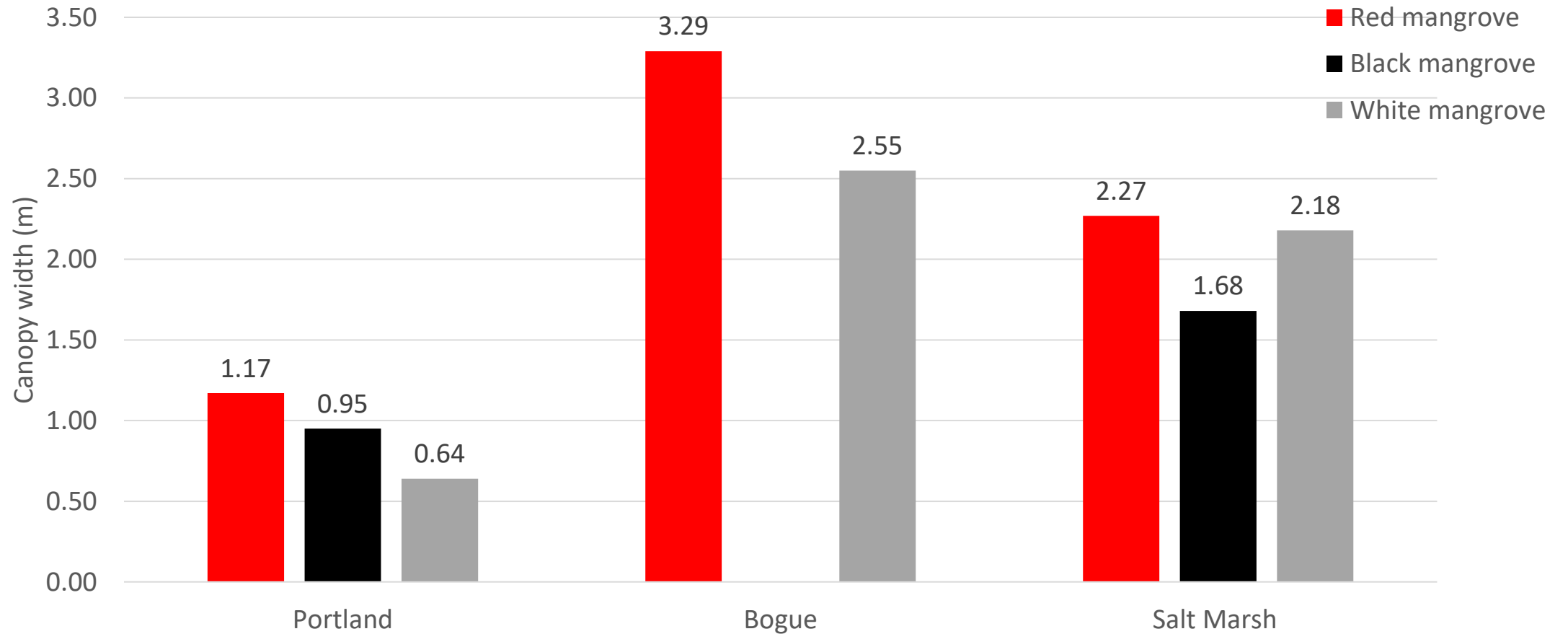
Preliminary results





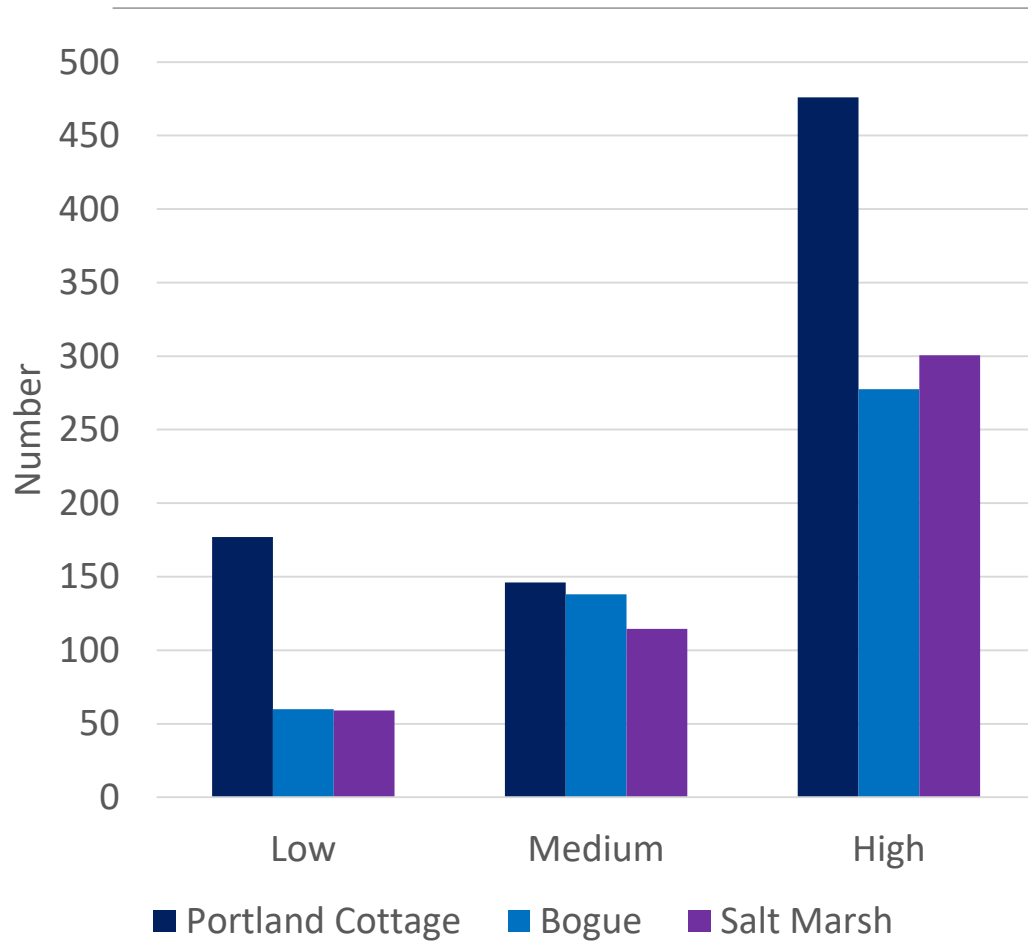
# Tree Canopy width

Preliminary results

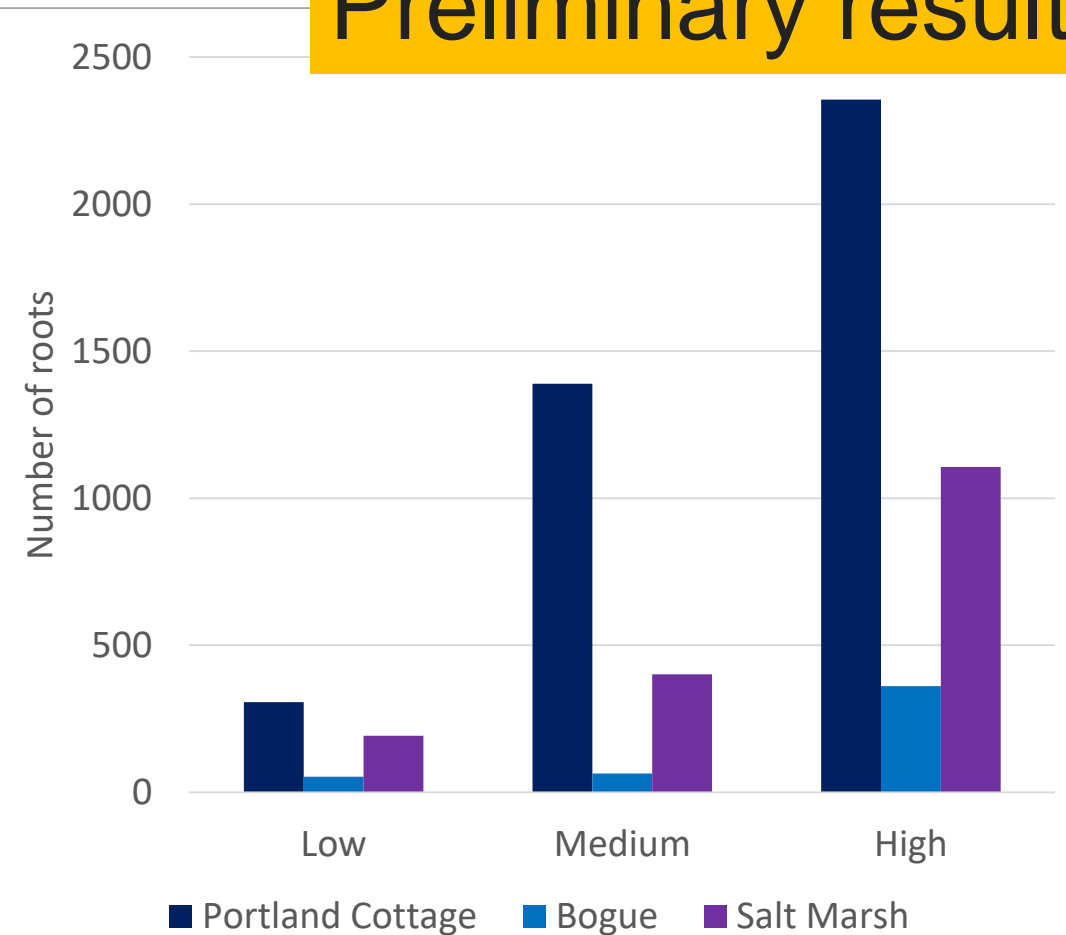


# Results (Prop roots /aerial roots network)

Preliminary results

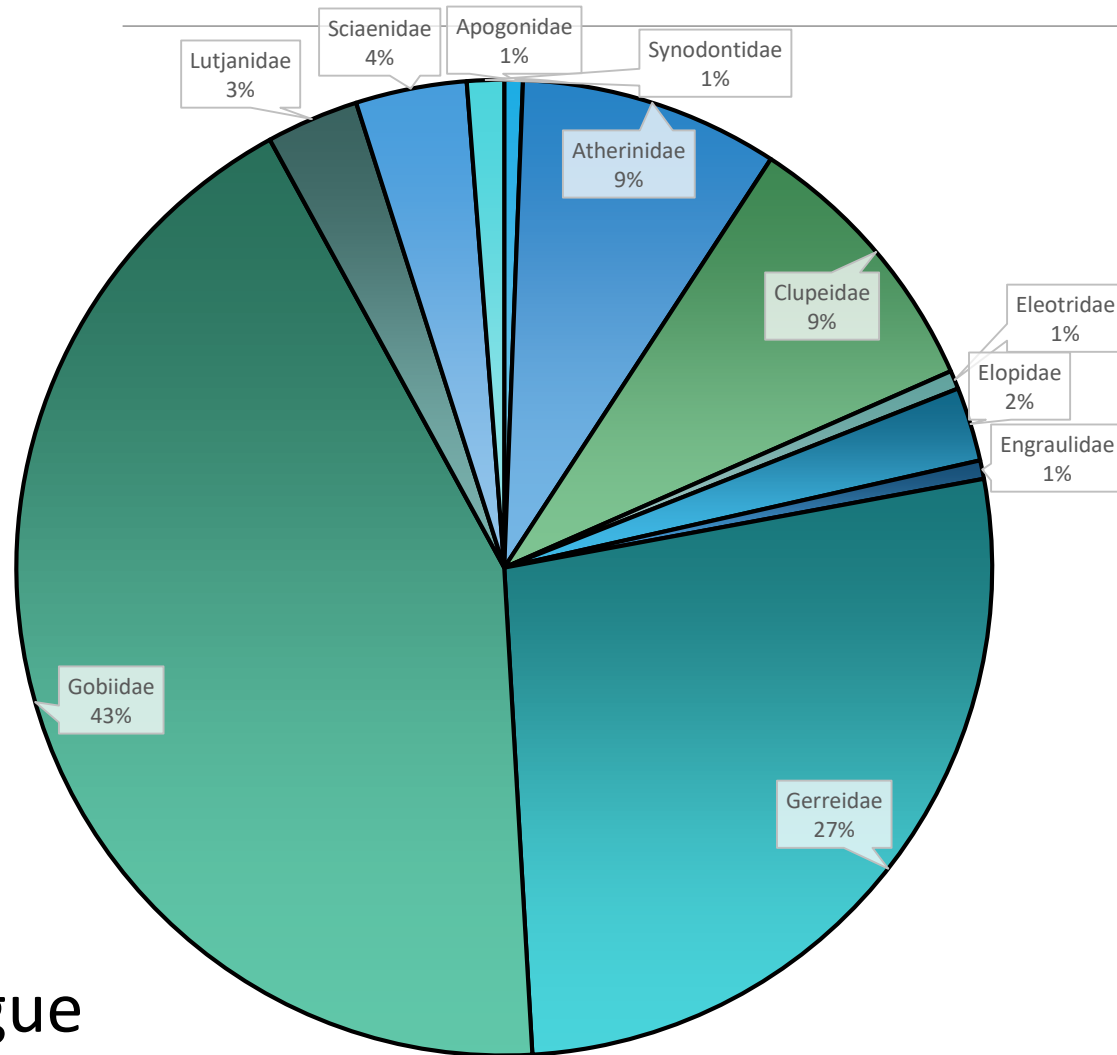


PROP ROOTS



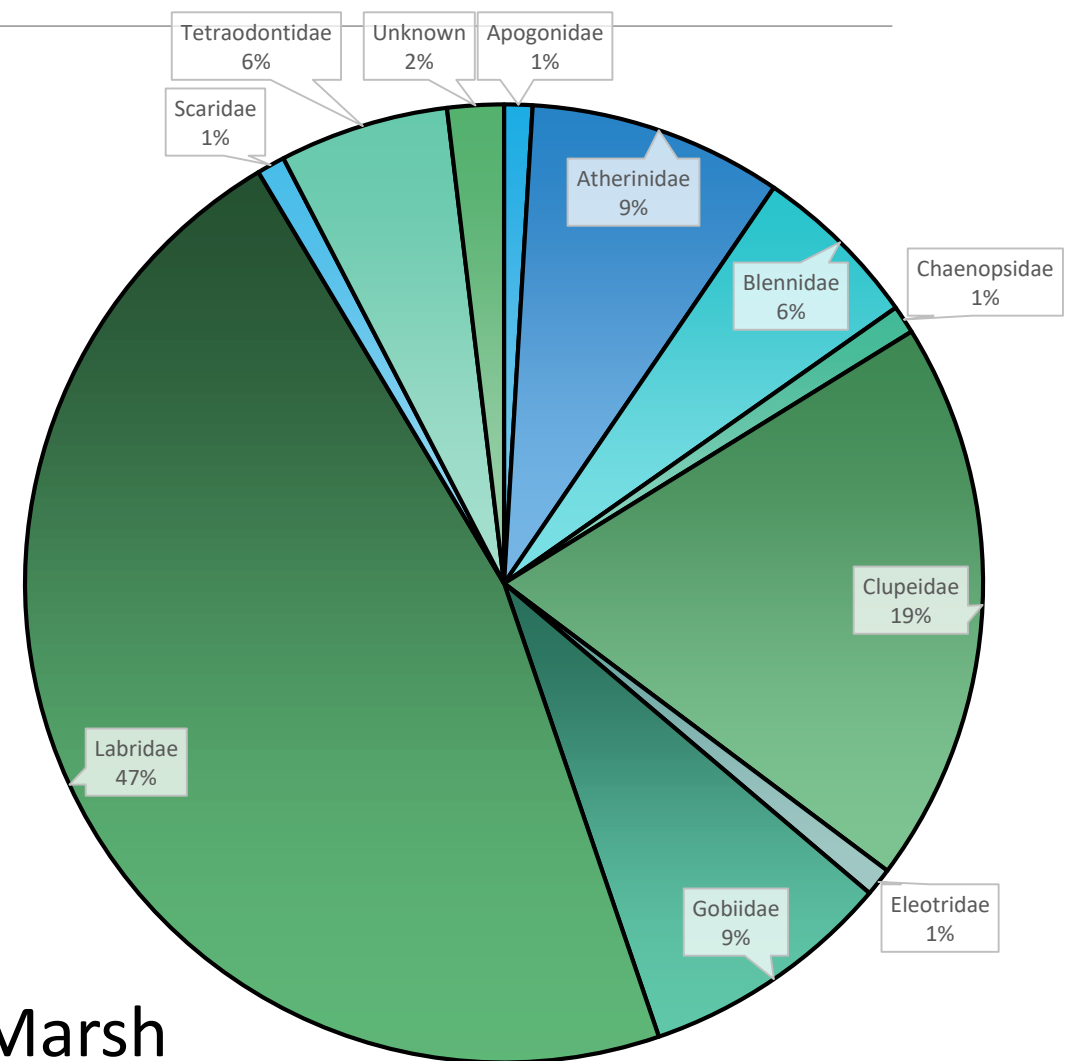
PNEMATOPHORE/AERIAL ROOTS

# Fisheries



Bogue

## Preliminary results



Salt Marsh

# Fisheries: Post larvae & Juvenile

## Preliminary results



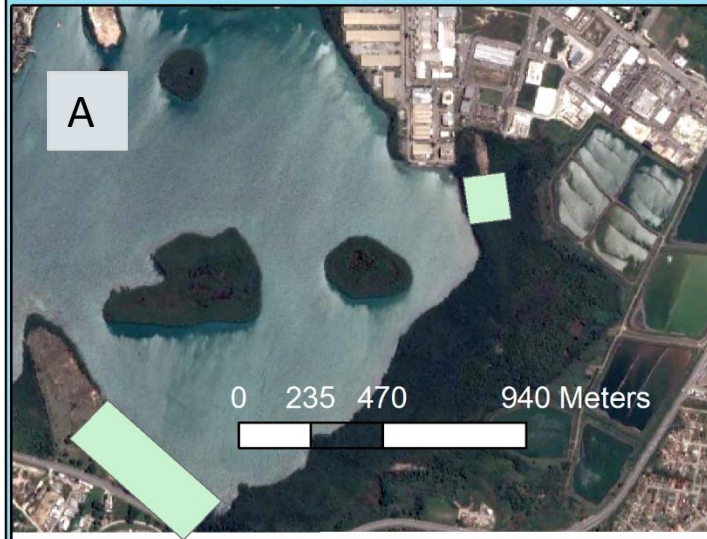
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# Physical Results

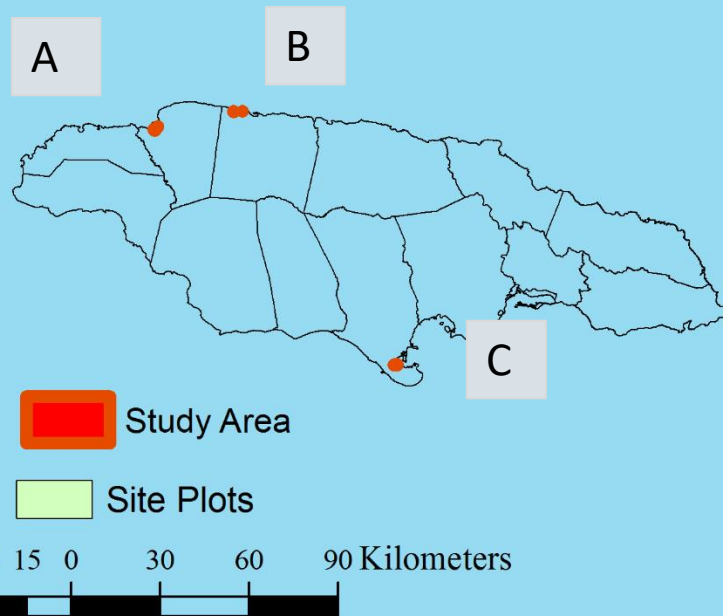


# Preliminary results

Montego Bay (Bogue)



Trelawny

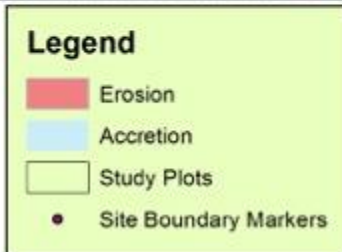


Portland Cottage



# Erosion & Accretion of Coastlines Sites at Trelawny (1966-2017)

Preliminary  
results

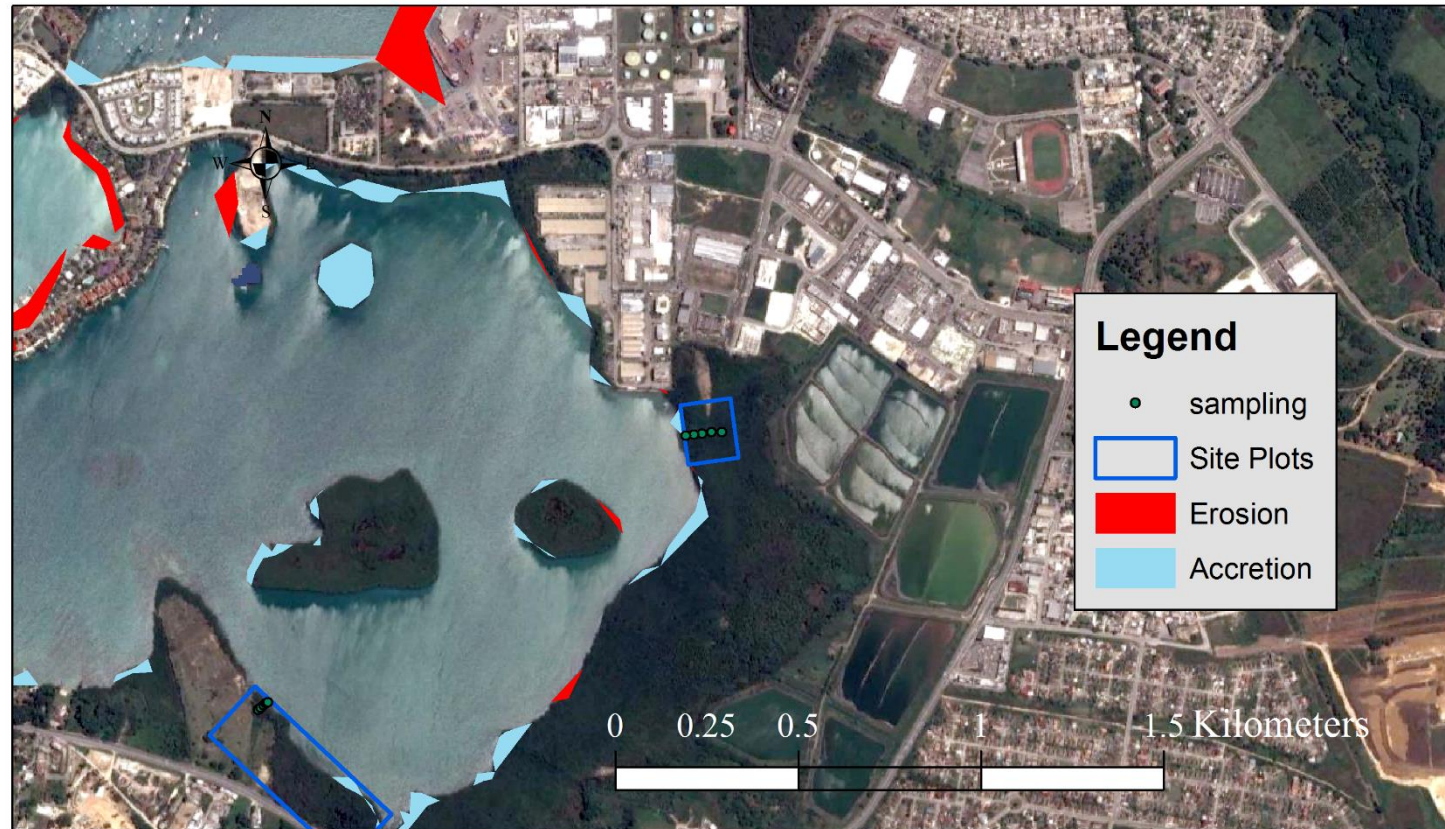


Trees are moving seaward as the conditions permit which if sustained will build more land by stabilizing and trapping more sediments.



# Erosion & Accretion of Coastlines Sites at Bogue (1966-2017)

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Preliminary results

# Erosion & Accretion of Coastlines

## Portland Cottage (1966-2017)

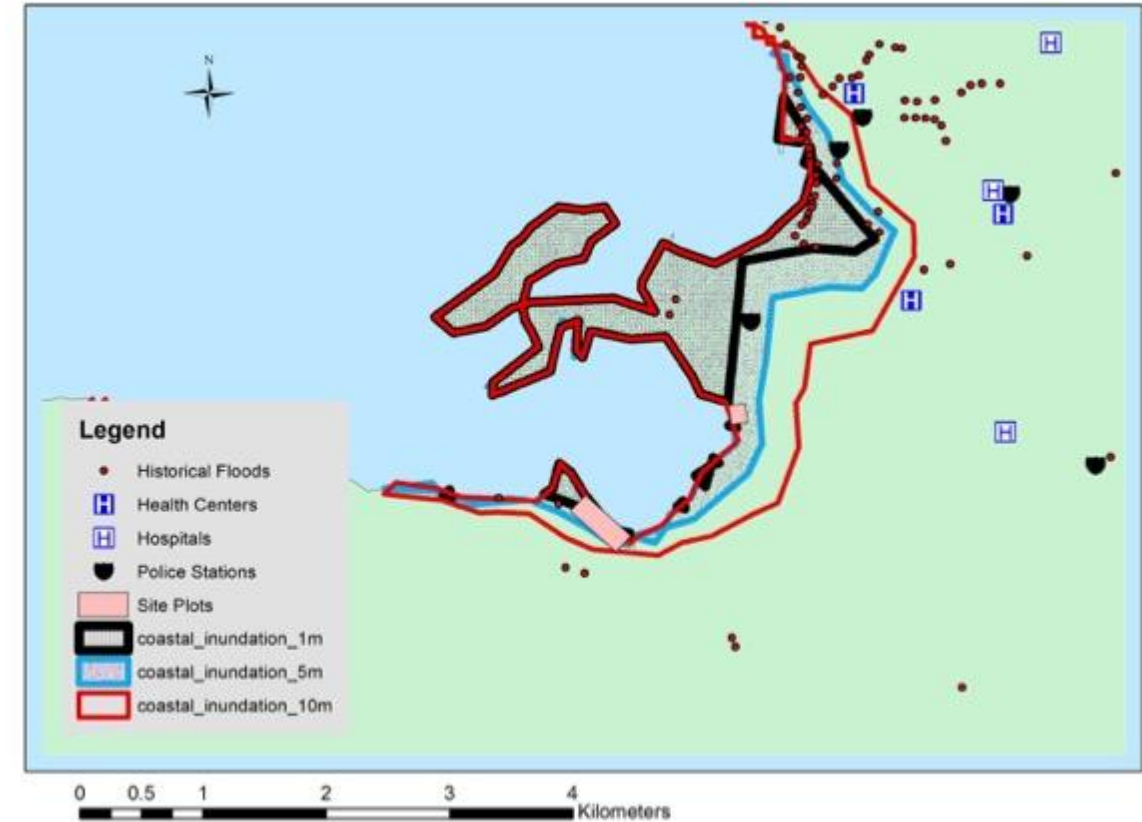
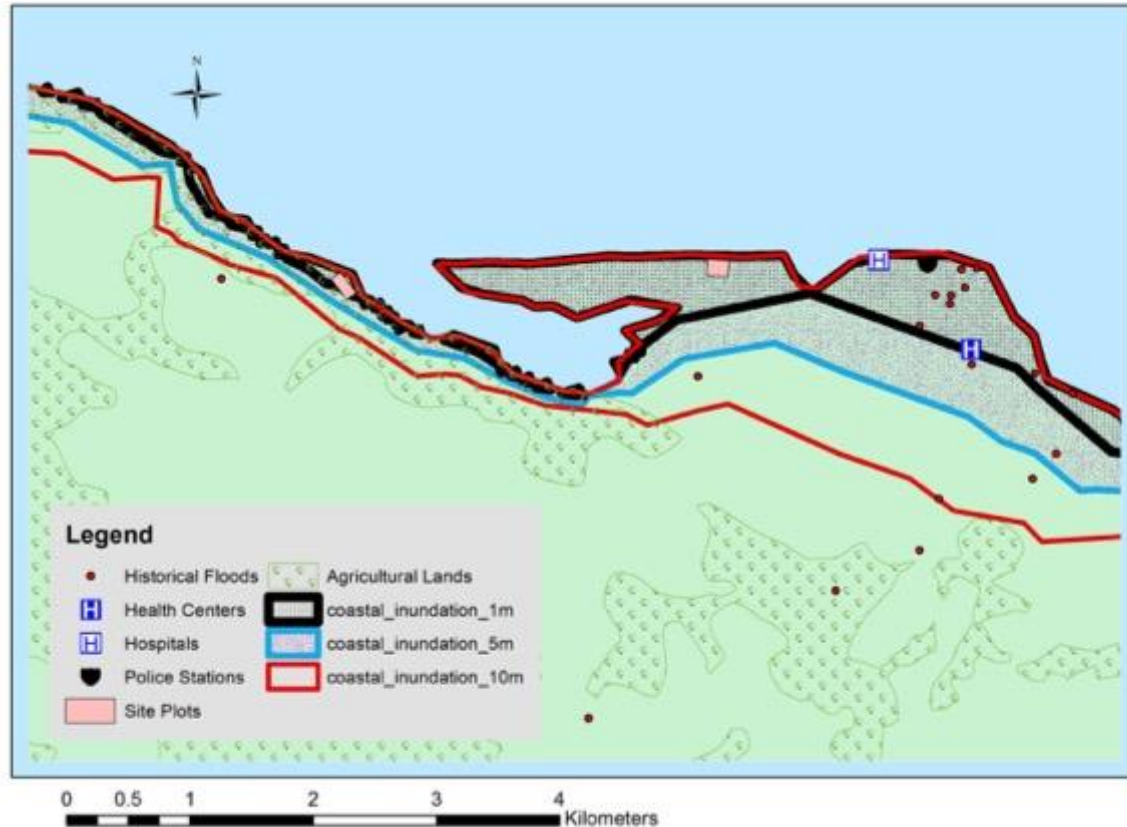
### Preliminary results



Dead trees on the edges potentially evidence of the retreat



# Prediction of Flooding in Proximity to Infrastructure, Study Plots & Reported Flood Events

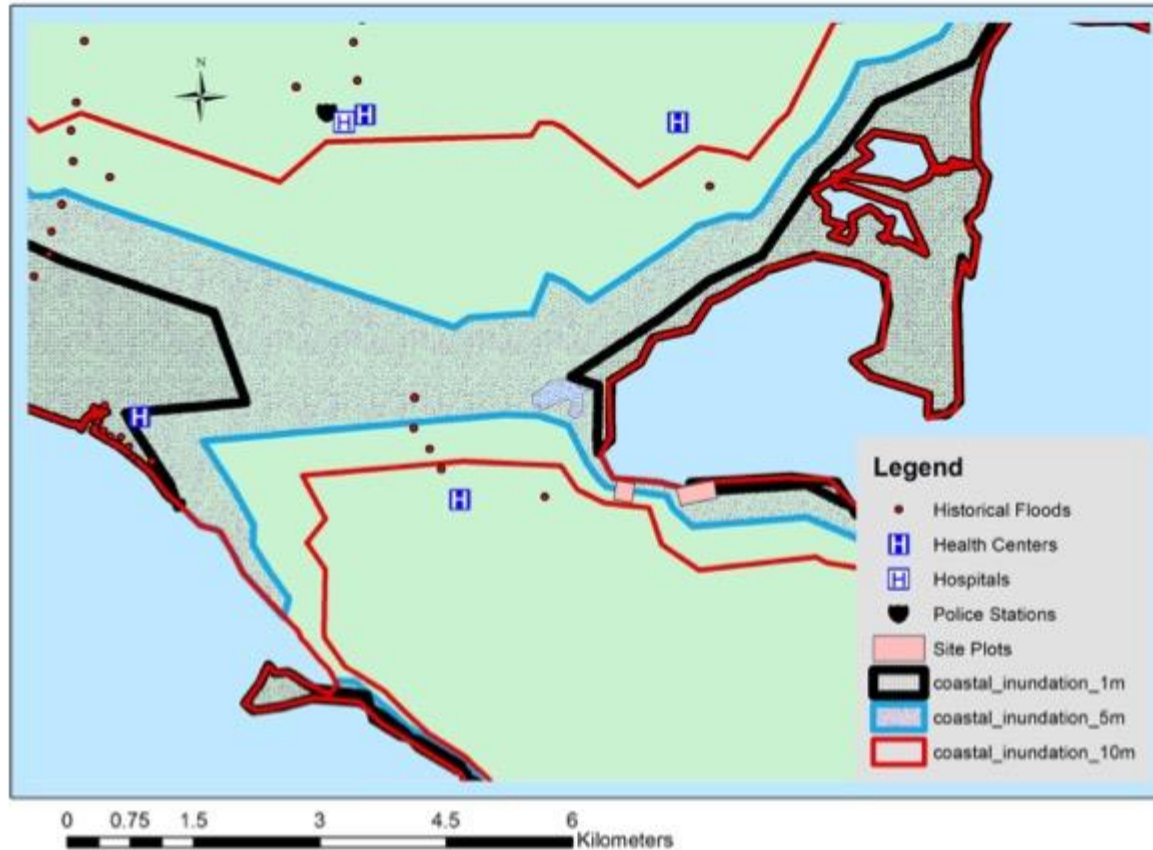


Preliminary results



# Prediction of Flooding in Proximity to Infrastructure, Study Plots & Reported Flood Events

Preliminary results



Jamaica Gleaner 2017, Portland  
Cottage house affected by flooding

# Erosion & Accretion within Mangroves at the Site Level

Preliminary results

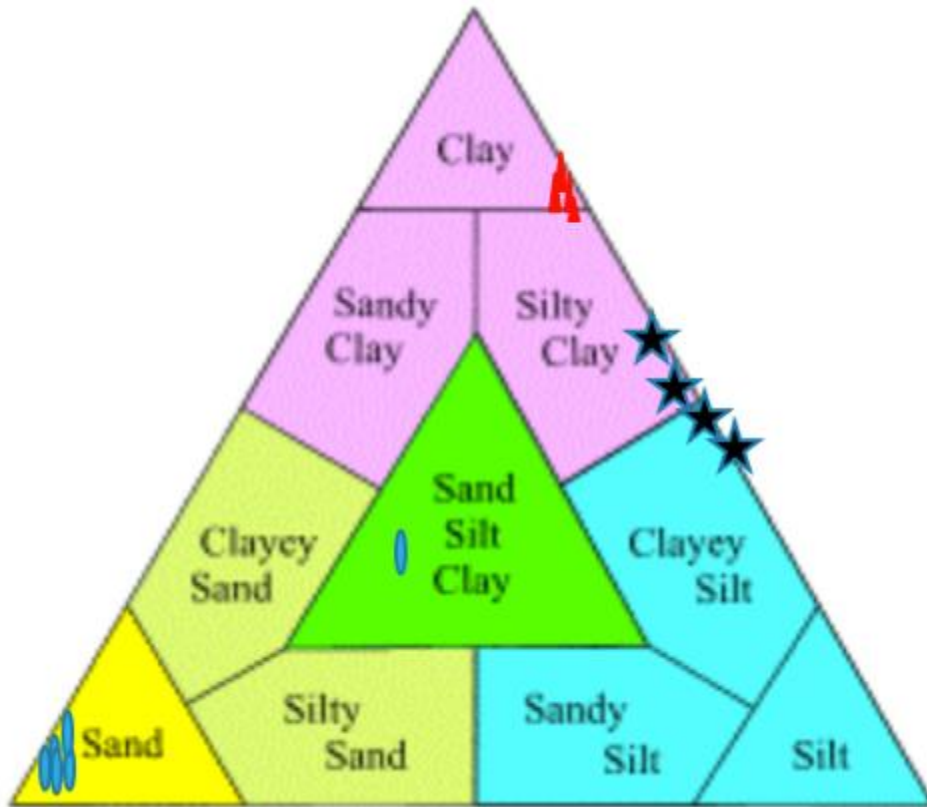
Study Site	Mean Surface Elevation Change (mm/m)	Vertical Accretion (mm/m)	Shallow Subsidence (or uplift) (mm/m)	Record Length (months)
Portland Cottage Plot 1	-1	Eroded	<-1	4
Portland Cottage Plot 2	1	0.1	0.9	4
Freeport Inside R. Mangle Forest	-0.9	-undetected	>-0.9	5
Freeport Rehab location	-0.1	0	-0.1	3
Bogue Road	-1.5	0	-1.5	3
Salt Marsh Rd	-1.4	0	-1.4	2
Rodney Street	0.5	0	0.5	3

# Preliminary results

	Mean In Situ Water Parameters collected with YSI							
Site	Temp (° C)	Conductivity (mg/cm)	Conductivity (mS/cm)	Total Dissolved Solids ( g/L)	Salinity (PSU)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	pH
Portland Cottage 2	29	58	63	38	39	<b>42</b>	<b>3</b>	7
Portland Cottage 1	33	63	72	41	42	79	4	9
Freeport (Bogue site 1)	25	<b>12</b>	<b>12</b>	8	7	<b>21</b>	<b>2</b>	8
Bogue Rd Site 2	28	26	28	17	16	<b>37</b>	<b>3</b>	<b>11</b>
Salt Marsh Road	29	52	56	34	34	64	4	<b>14</b>
Rodney Street Site	31	53	59	104	35	81	5	<b>12</b>

# Soil Characteristics-Grain Sizes

## Preliminary results



### KEY



Salt Marsh  
& Rodney  
Street



Portland  
Cottage



Freeport  
& Bogue  
Rd

Roots & un-degraded  
leaves Composition in soil  
(% weight)  
5-25 %

45-68%

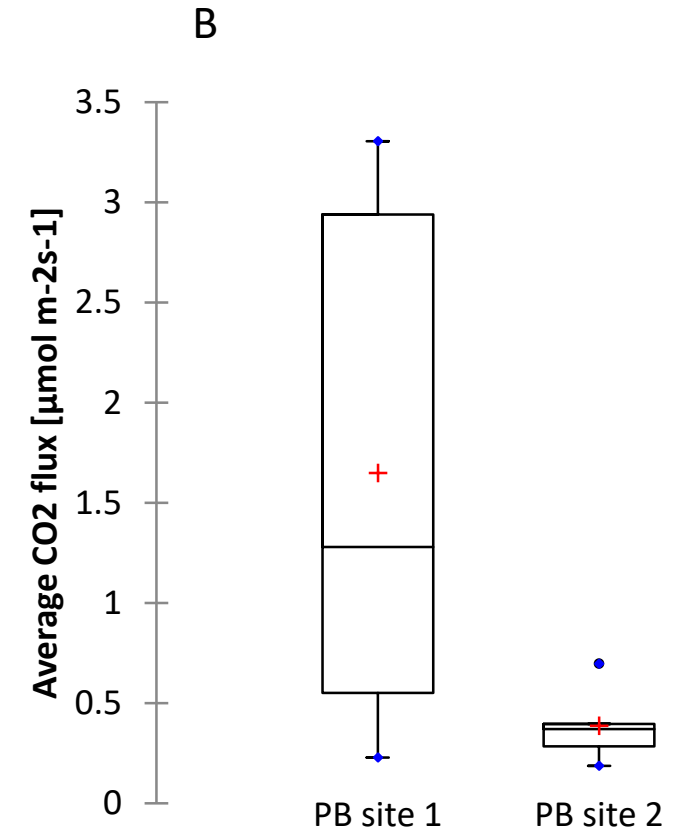
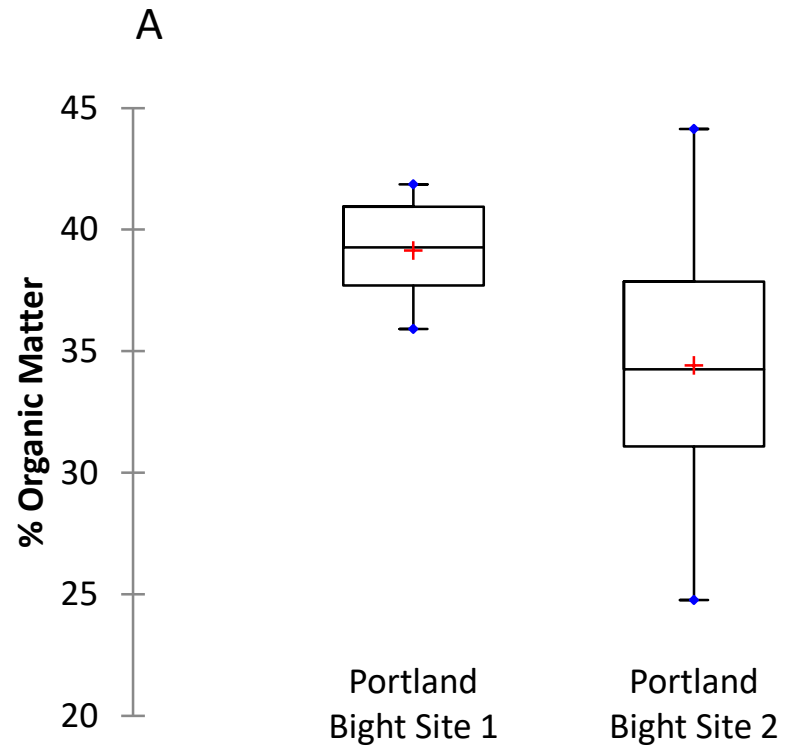
20-45%

## Wind Parameters

Site	Mean Wind Speed (m/s)			Reduction in Wind Speed	
	Within Mangrove Forest	Outsides mangrove Forest	Wading Depth (Open Coast)	Wind Speed Reduced	Correction for resistive forces
Portland Cottage 2	2.4	5.1	5.7	58%	52%
Portland Cottage 1	2.5	5.8	5.9	58%	57%
Freeport (Bogue site 1)	2.9	4.3	4.5	46%	42%
Bogue Rd Site 2	3.1	5.3	5.7	36%	34%
Salt Marsh Road	4.1	6.1	6.9	41%	36%
Rodney Street Site	3.4	6.8	7.5	55%	50%

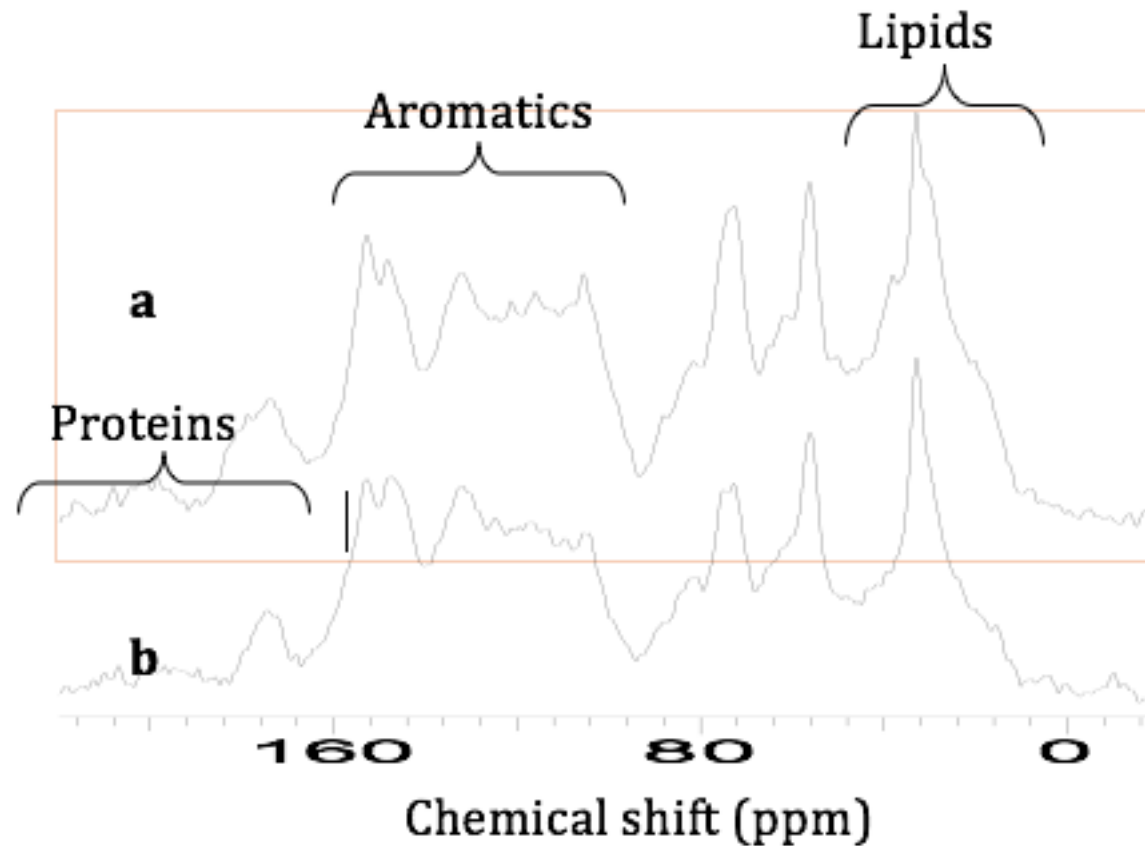
# Soil Parameters

Preliminary results





# Preliminary results



Macromolecular structure of soil organic matter from Portland Cottage localities (a) site 1 and (b) site 2. Samples dominated by aromatic components from vascular plants. Such organic structures are difficult to degrade.

# Thank You

