RiVAMP – Ecosystems-Based Risk and Vulnerability Assessment in Jamaica

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and Implementation of he National Adaptation Plans

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RiVAMP – Key Takeaways Will Focus on…

- The Why – Context
  - The need for this and similar assessment tools
- The How
  - Details of the methodology
- The What (Outcome)
  - Summary Findings
  - Applicability

Risk and Vulnerability Assessment
Methodology Development Project (RiVAMP)

Linking Ecosystems to Risk and
Vulnerability Reduction

The Case of Jamaica

Results of the Pilot Assessment

UNEP

Why RiVAMP

- Ecosystems underpin economies and social wellbeing of coastal states/islands but yet are often not taken into account adequately in development planning

- Climate change:
  - Increases vulnerabilities of human and natural systems
  - Increases risks which are evolving and unprecedented, esp. to already vulnerable countries, including Jamaica

- Assessments that inform national/sectoral development exists but don't always account for full range of ecosystem products & services

- RiVAMP was developed as one tool to help to address this gap

Why RiVAMP

- RiVAMP – Risk and Vulnerability Assessment Methodology Development Project – was conceived and developed by UN Environment and pilot tested in Negril Jamaica
  - Initial methodology for coastal areas in Small Island Developing States
  - To assess primary and secondary effects of storms
- Outputs of assessment geared towards local and national level decision-makers.
- Tool to help with understanding role of ecosystems in disaster risk reduction
- Conducted between 2009 and 2010

Why RiVAMP

- Site selection: based on local and national level expertise, governance systems at the community level, data availability
  - Negril was selected after applying the criteria

Selection criteria by order of importance	Negril		Treasure Beach		Trelawny to Discovery Bay		Montego Bay		Portland and St. Thomas		Portland Cottage to Portland Bight	
	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score
8. physical vulnerability to natural hazards	2	16	3	24	1	8	1	8	3	24	3	24
7. coastal tourism	3	21	2	14	2	14	3	21	1	7	0	0
6. data availability	3	18	3	18	3	18	3	18	3	18	3	18
5. development pressure	3	15	1	5	3	15	3	15	2	10	0	0
4. ecosystem diversity (based number of different types of ecosystems)	2	8	1	4	3	12	2	8	3	12	3	12
3. socio-economic vulnerability	2	6	2	6	2	6	2	6	3	9	3	9
2. level of degradation	2	4	1	2	3	6	2	4	3	6	3	6
1. willingness of local communities to participate in pilot	3	3	3	3	2	2	3	3	2	2	2	2
Total score	91		76		81		83		88		71	
Ranking	1		5		4		3		2		6	

* Rating: 0 = none; 1 = least; 2 = mid; 3 = most
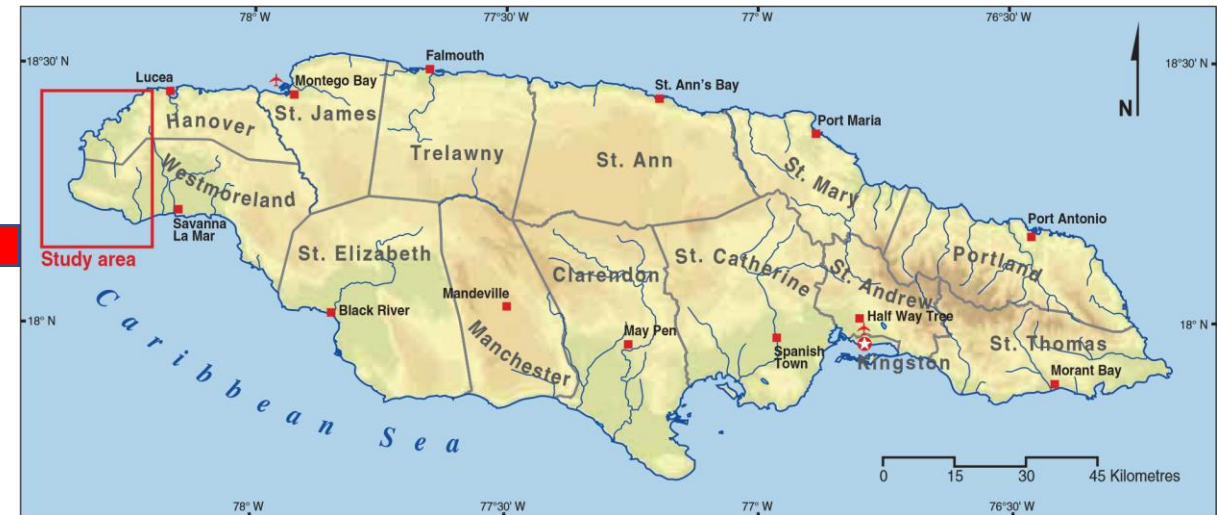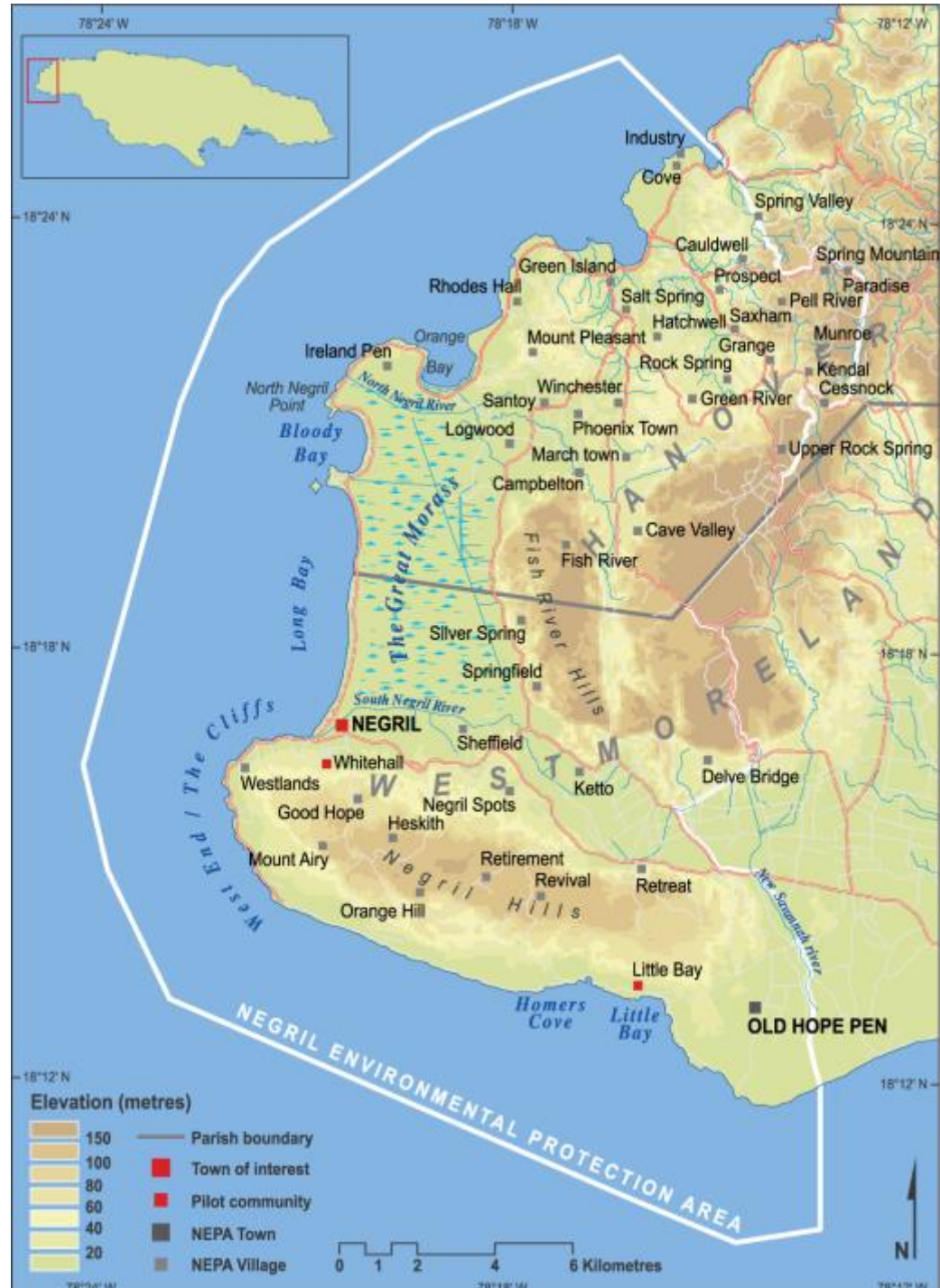
How – the RiVAMP Methodology

- Four main areas assessed:
  1. Ecosystems and ecosystem services;
  2. Environmental change
  3. Local livelihood and vulnerability
  4. Environmental governance

- The assessment also examined human/environment interactions; driving forces of environmental degradation

- RiVAMP sought to balance science and technical data and analyses with local knowledge and experience

How – the RiVAMP Methodology

- General steps:
  - Identify study area and engage selected stakeholders
    - Use of criterial, scoring sheet; key national experts to guide process
  - Conduct stocktaking and data collection exercise – socio-economic data, ecosystems data, satellite imagery, disaster and hazard data, etc
  - Expand stakeholder engagement – national, parish and community levels
  - Analyse data and info – validate against stakeholder knowledge, experience
    - Used statistical analyses (multiple regressions), hydrodynamic and geomorphological modelling (wave regimes, sea level rise), remote sensing (and other satellite imagery analyses), theoretical modelling (storm and flooding return events), community maps
  - Present results and recommendations to partners, other stakeholders
 - Finalise report

How – the RiVAMP Methodology

- Stocktaking and data collection exercise:
  - Previous studies – incl. hydrodynamic studies, sand budget near and off-shore, etc
  - Satellite imagery
  - Ecosystems (extent, quality, etc)
  - Governance (all levels)
  - Hazard and disaster data
  - Socio-economic data
  - Asset mapping
  - Community experiences:
    - Hazards observed, impact, knowledge and perceptions of governance systems, local coping and adaptation strategies, key issues and proposed solutions, etc
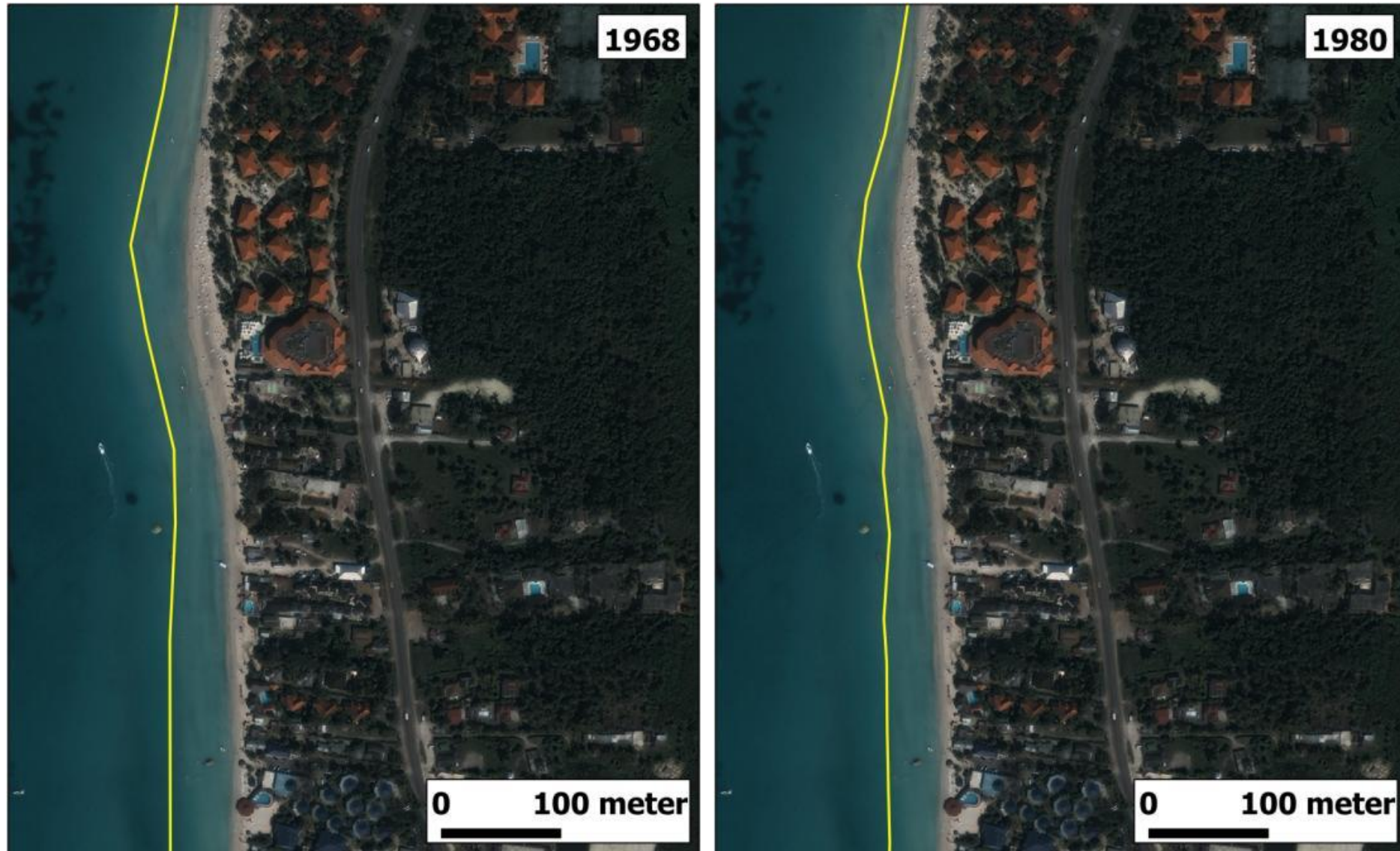
The What – Analyses and Results

- Satellite imagery analysis
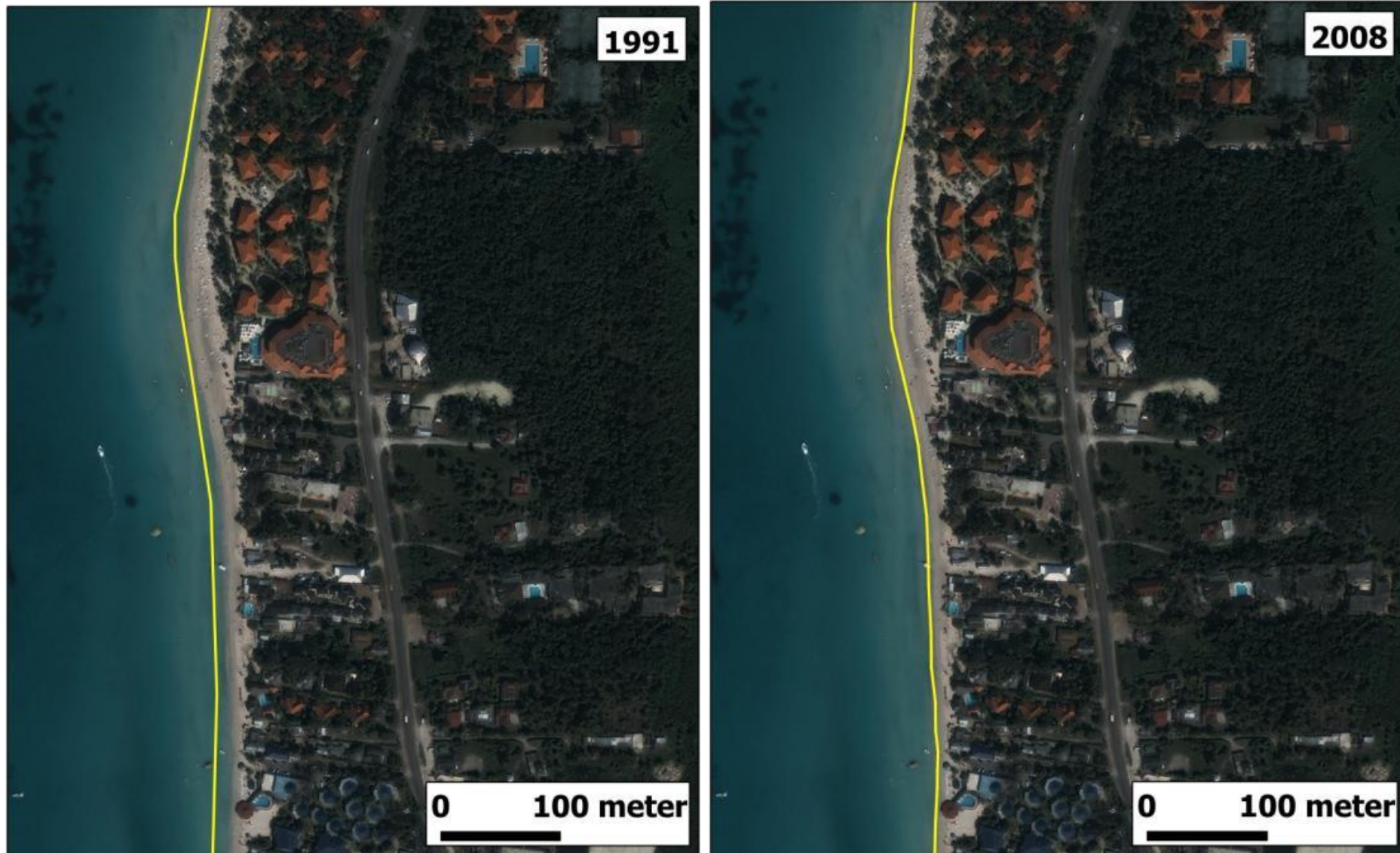 - incl. remote sensing
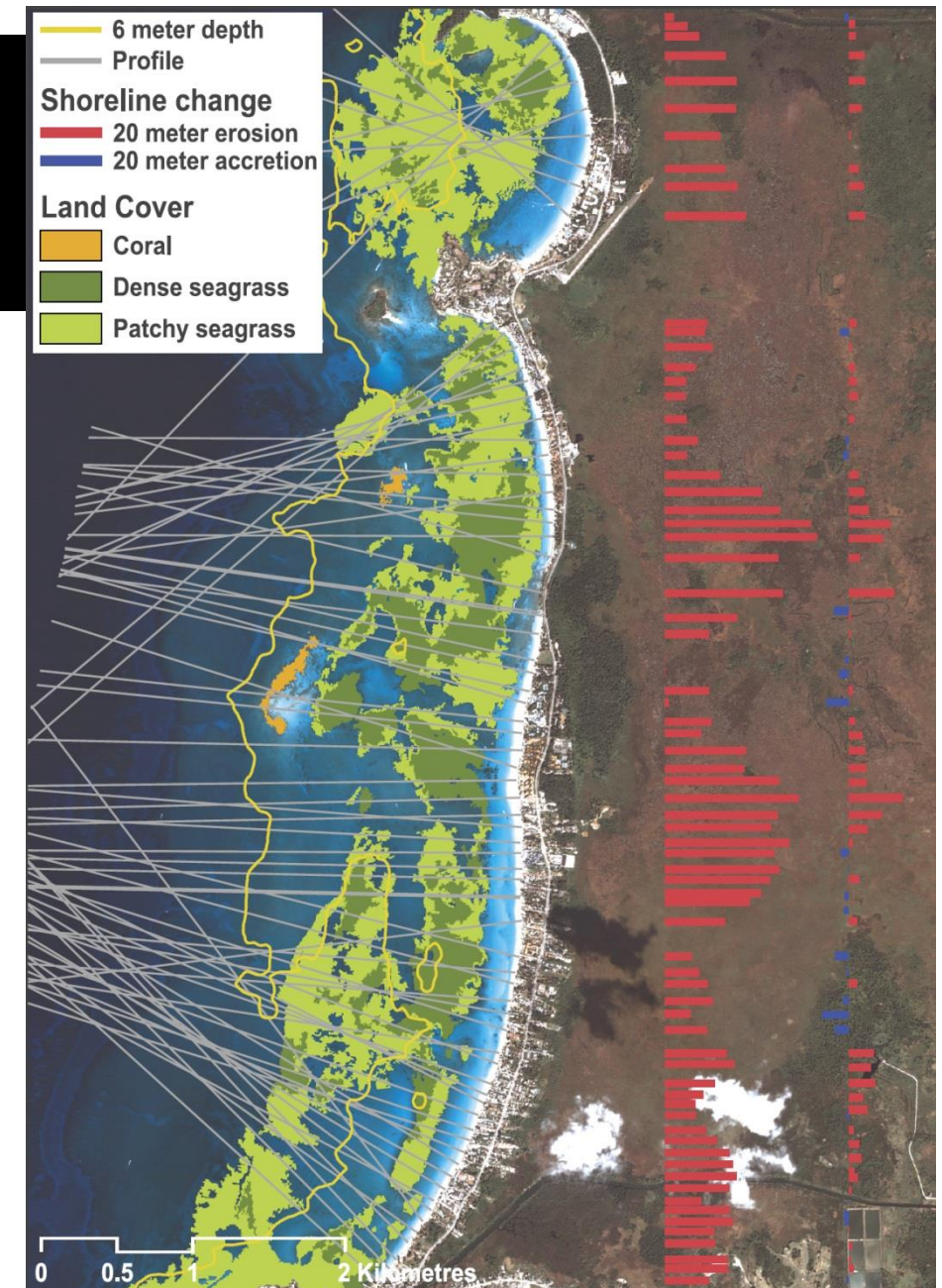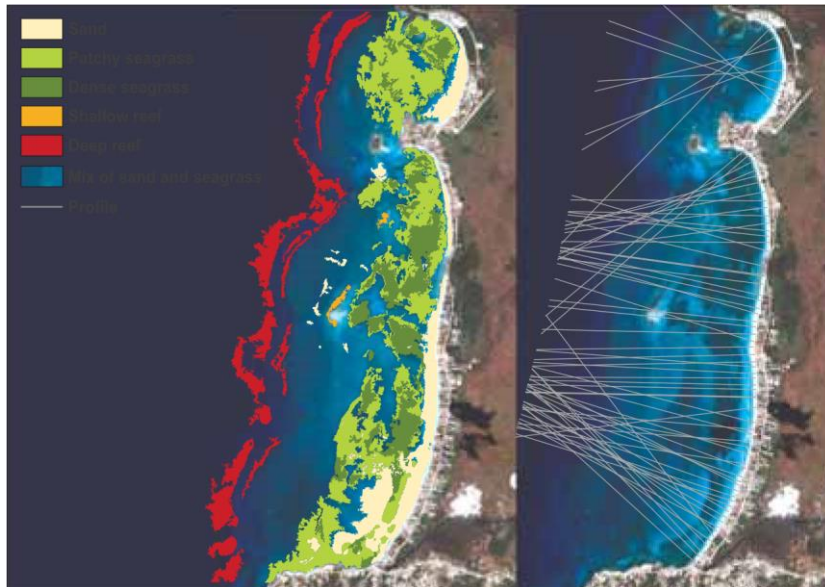
Negril's Beach Retreat using satellite imagery

The yellow line represents the shoreline at the stated year

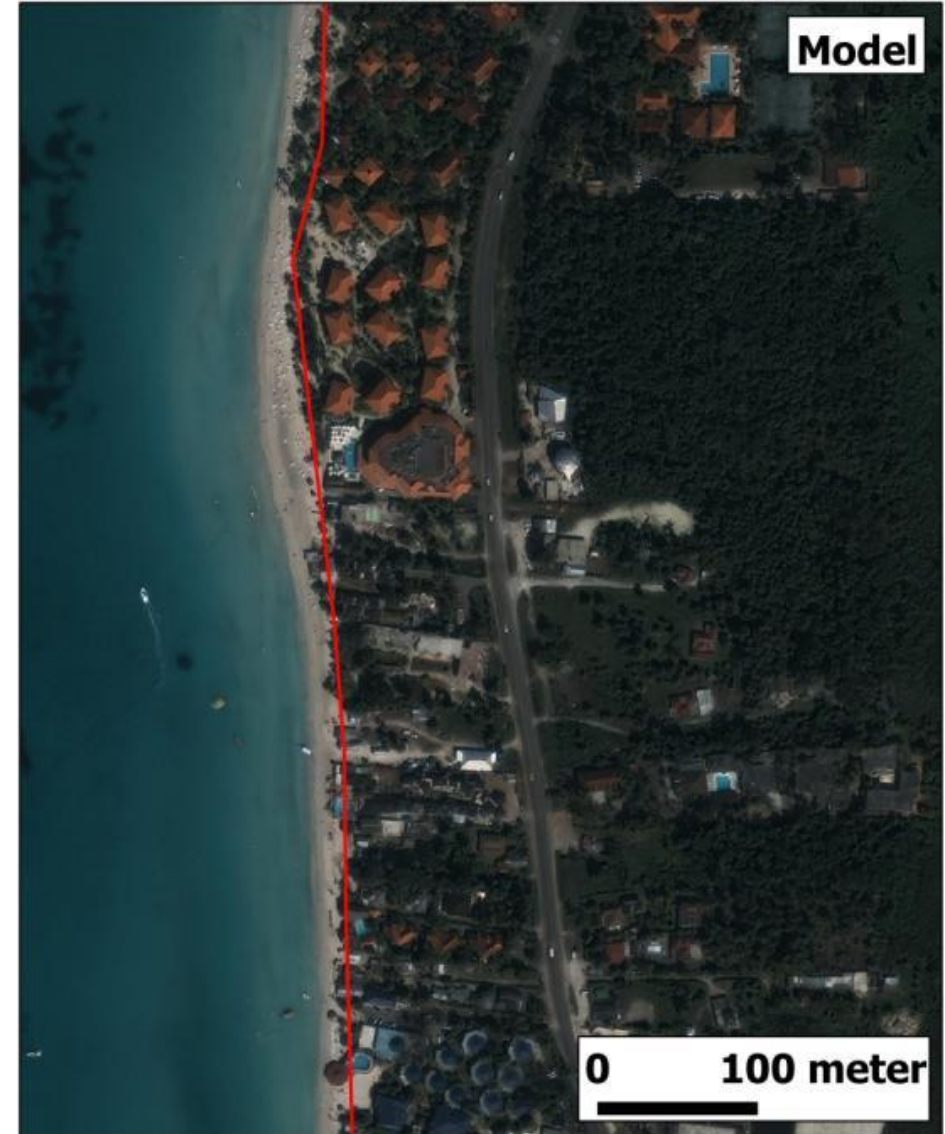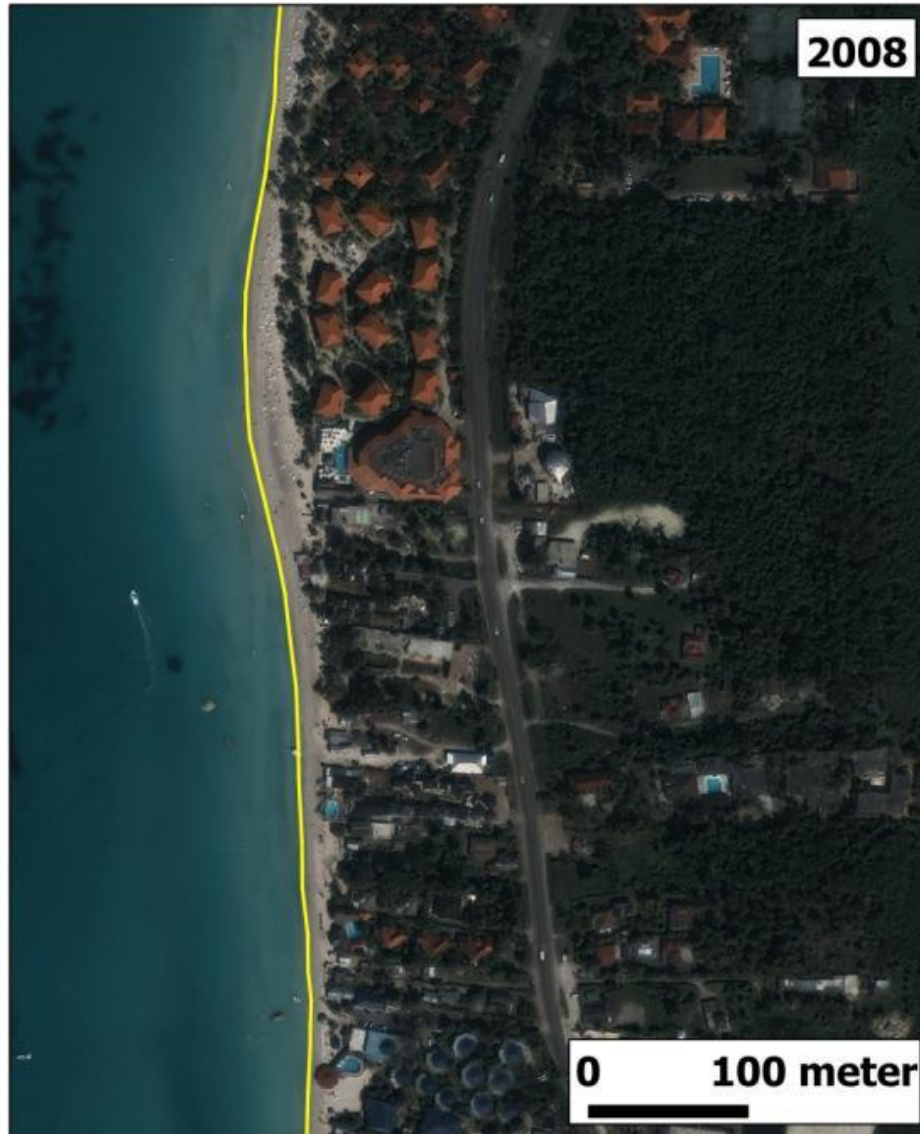# Negril's Beach Retreat using satellite imagery

The yellow line represents the shoreline at the stated year

Negril's Beach Retreat using satellite imagery

The yellow line represents current shoreline. The red line is a projection of shoreline change
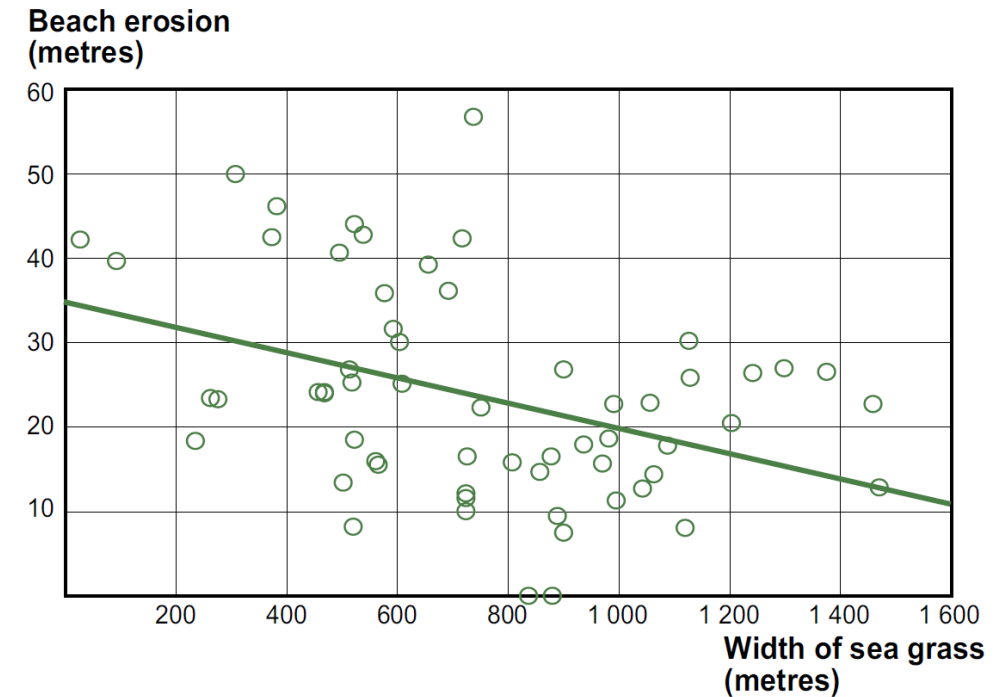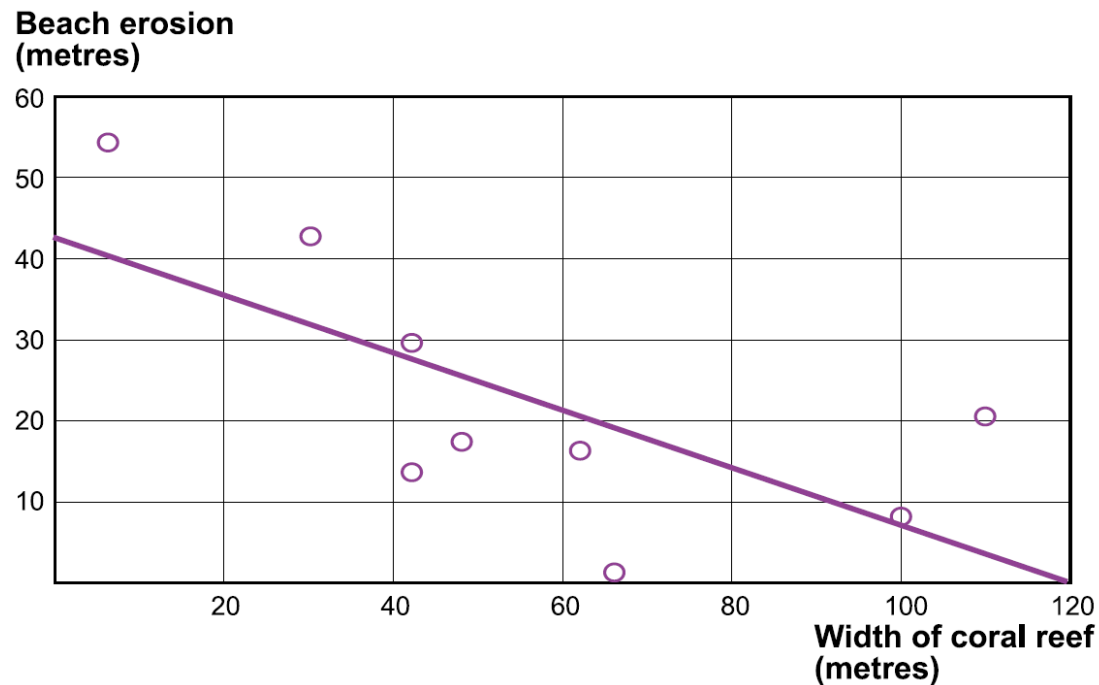
The What – Analyses and Results

- ## Numerical modelling
  - ### Wave heights
  - ### Sea levels

Numerical model results for wave heights (a) and wave-induced currents (b) at the Negril coast. Conditions: Offshore wave height (Hrms) = 2.8 m, Tp=8.7 s. Waves approach from the northwest. Note the diminishing wave heights and changed nearshore flow patterns at the lee of the shallow coral reefs
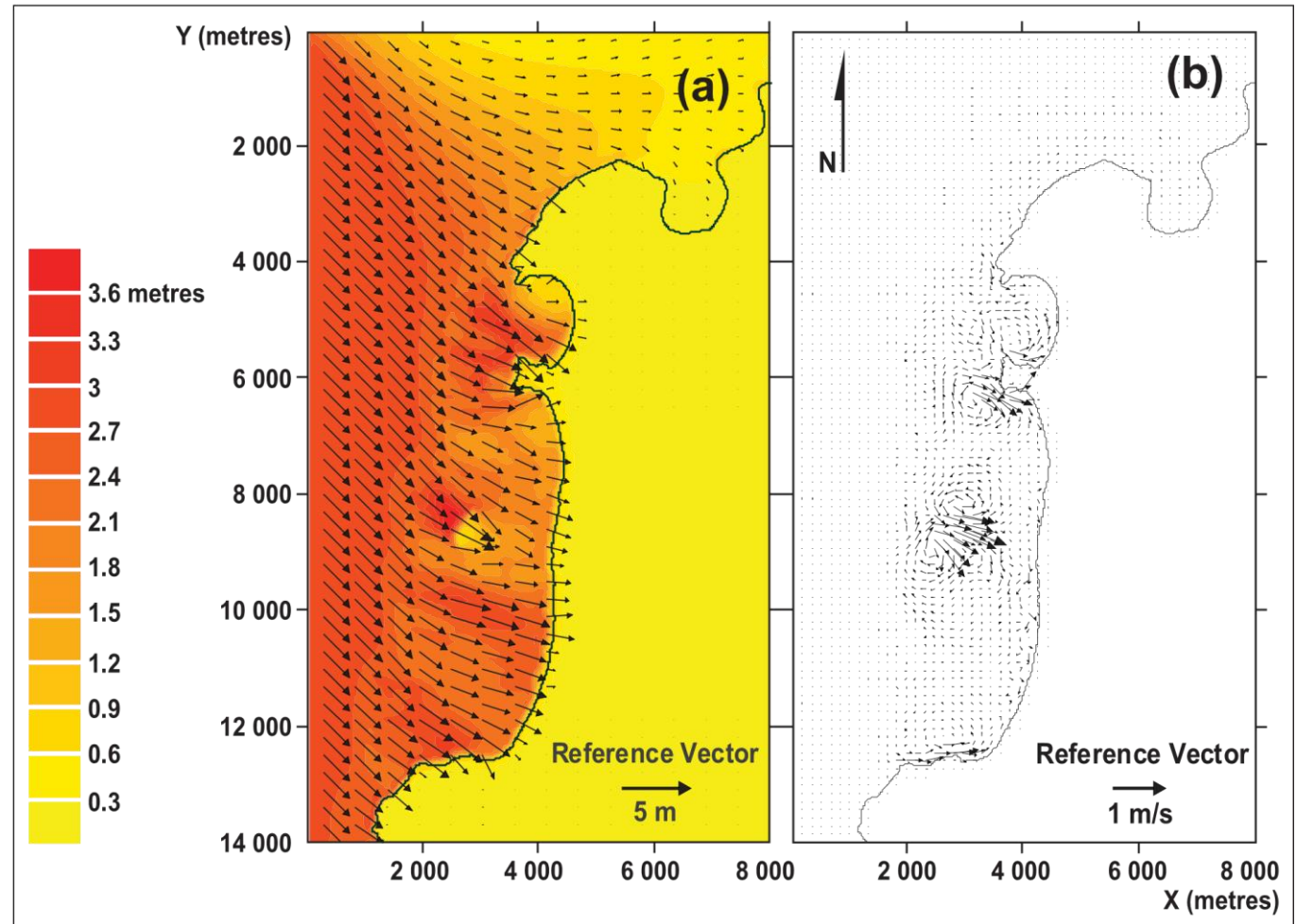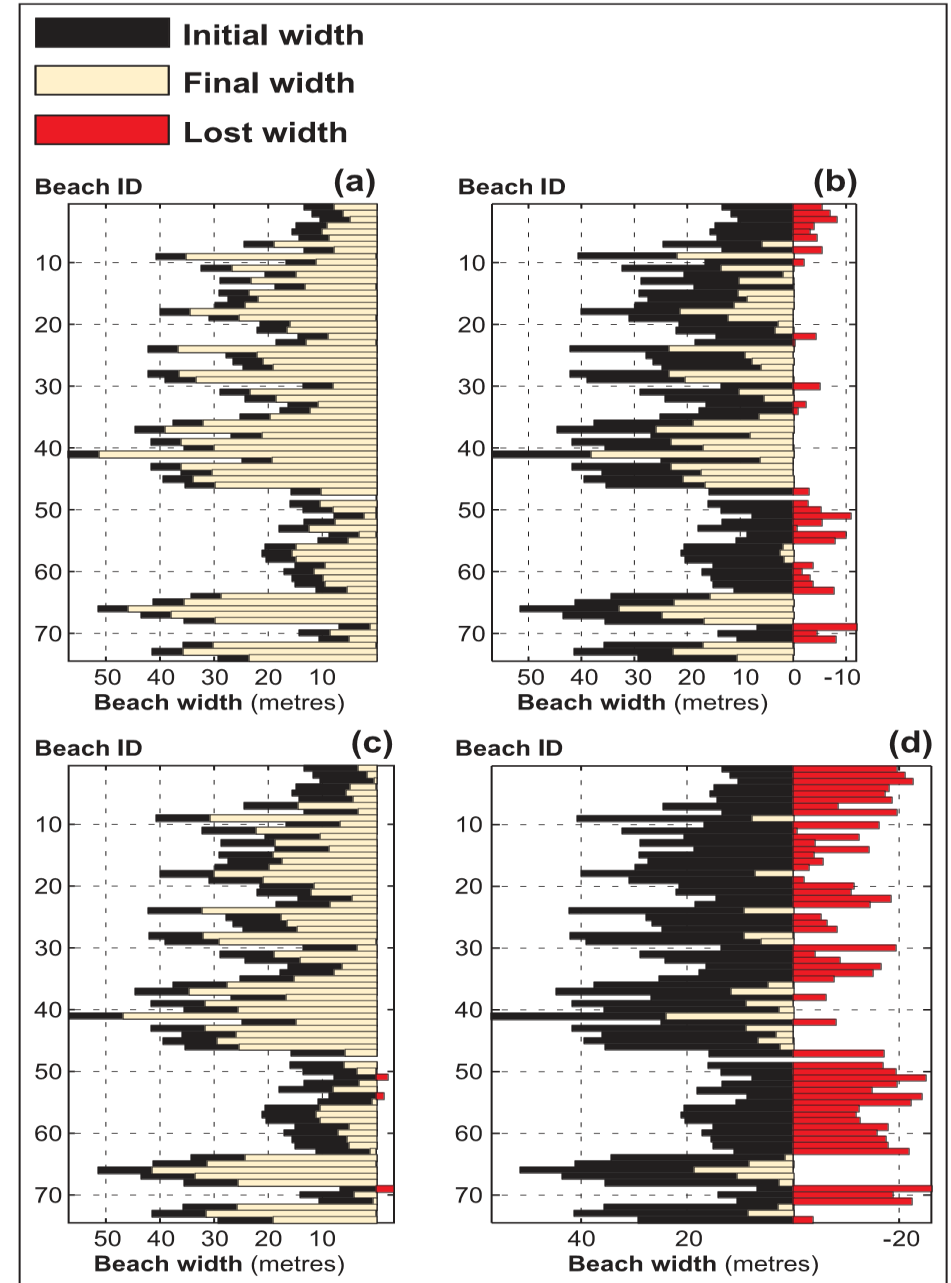
The What – Analyses and Results

- Multiple regression analysis: Ecosystems loss play a key role in beach erosion

The What – Analyses and Results

- Morphodynamic modelling
  - To show possible extent of erosion
 - Compares two levels of SLR

Minimum and maximum retreats of
the Negril beaches at the location of the 74 profiles (for profile location, see Map 4.3).
(a) and (b) minimum and maximum retreats for 0.52 m sea level increase (tidal effects
and lowest predicted rise in 2060). (c) and (d) minimum and maximum retreats for
1.05 m sea level increase (tidal effects and highest predicted rise in 2060, see
Rahmstorf, 2007). Final width values < 0 show sections of the beach which will be
entirely lost. Beach ID progresses from north to south, with the first 8 profiles being
located in Bloody Bay

The What – Analyses and Results

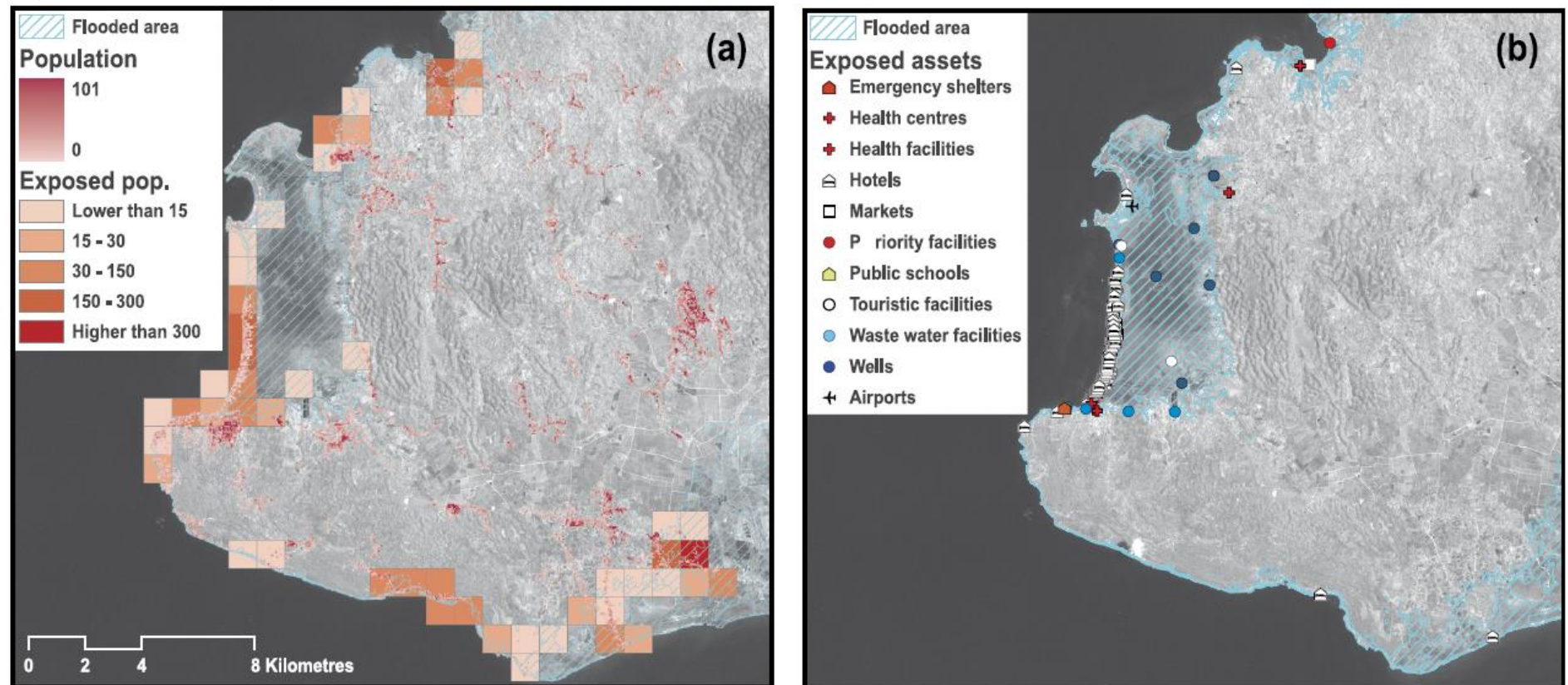- Tropical Cyclone Exposure Models – 10 years
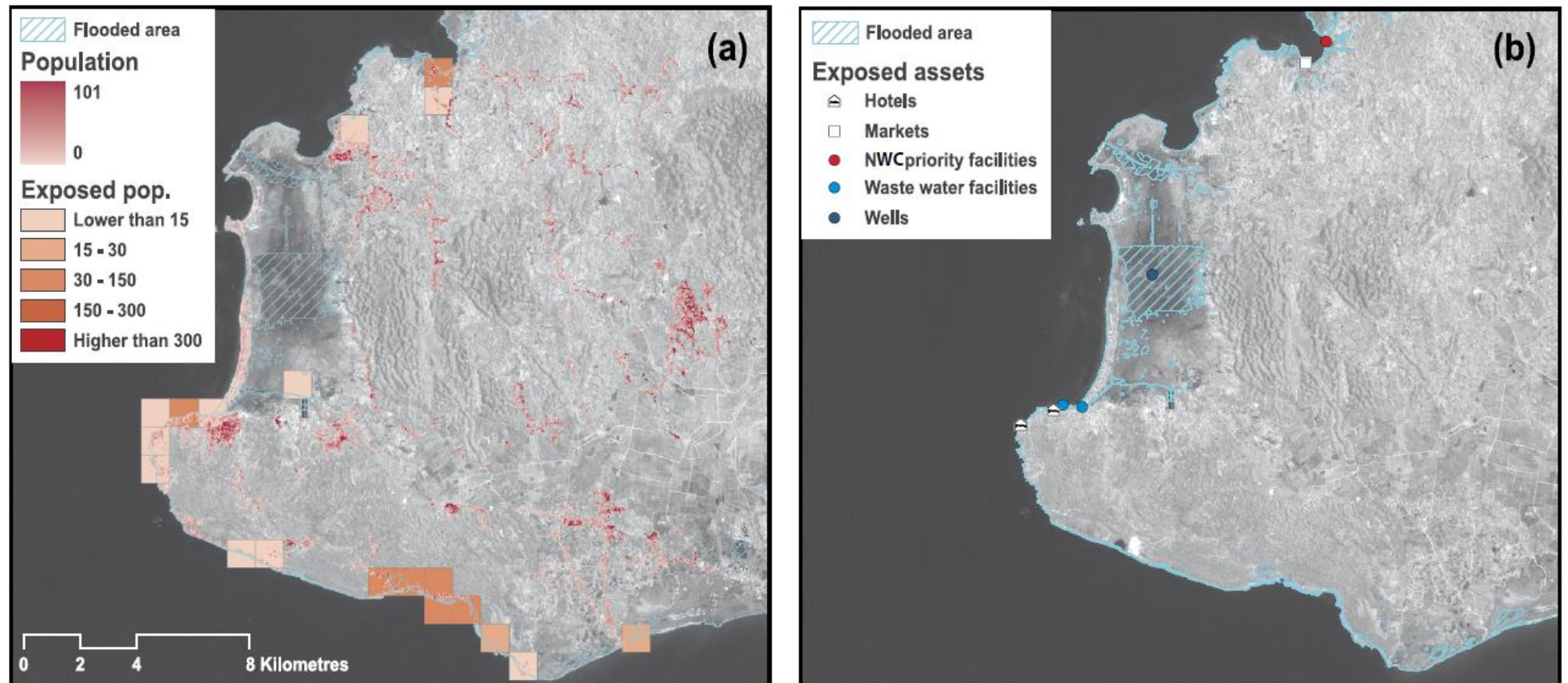
10-year storm exposure of a) population, b) assets. Some 478 persons would be affected by flooding; at least 2 hotels, 2 wastewater facilities, 1 market, 1 well and 1 NWC facility will be flooded.

Note: Population does not include guests/occupancy in hotels.

The What – Analyses and Results

- Tropical Cyclone Exposure Models – 50- Year

50-year storm exposure of a) population, b) assets. About 2,487 persons would be affected by flooding; at least 63 hotels, 3 health centres, 8 wastewater facilities, 1 market, 9 wells and 1 NWC facility will be flooded.

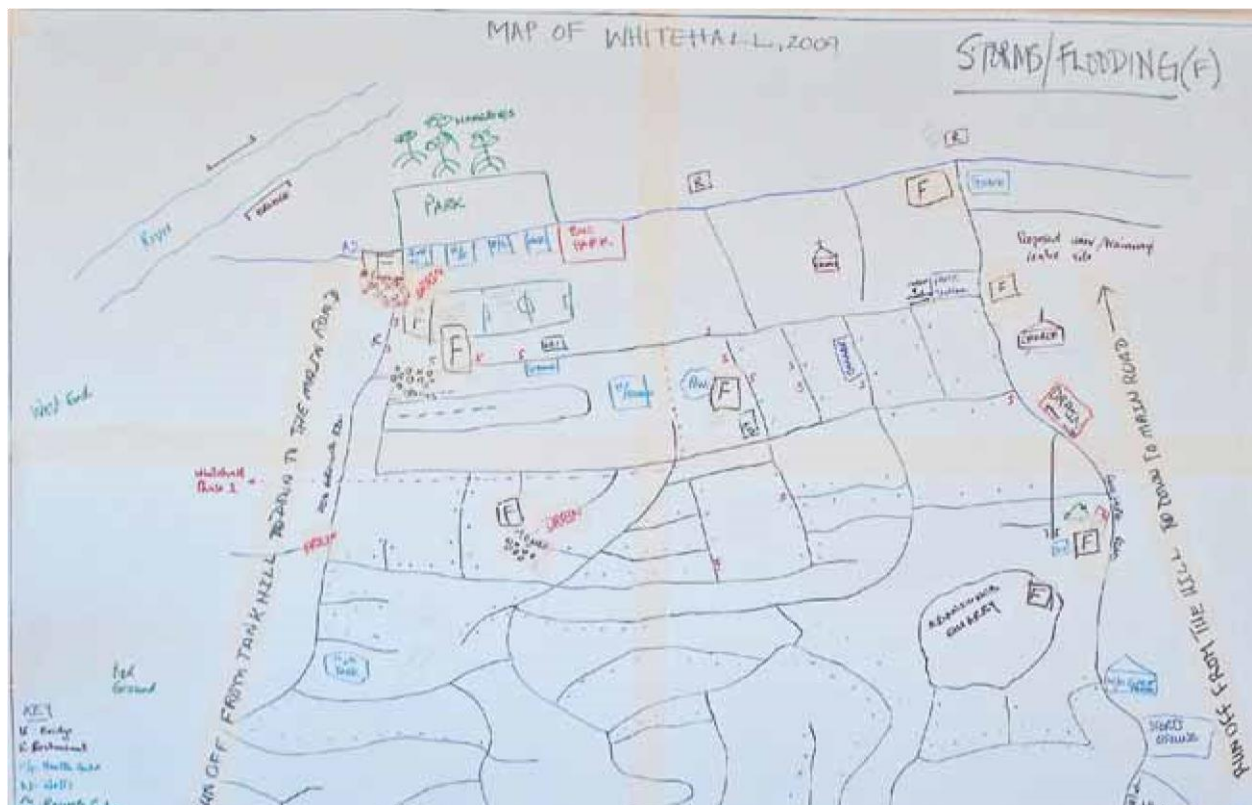Note: Population does not include guests/occupancy in hotels

The What – Analyses and Results

- Flood modelling
  - For storm surge flooding
  - 10-year and 50-year return periods
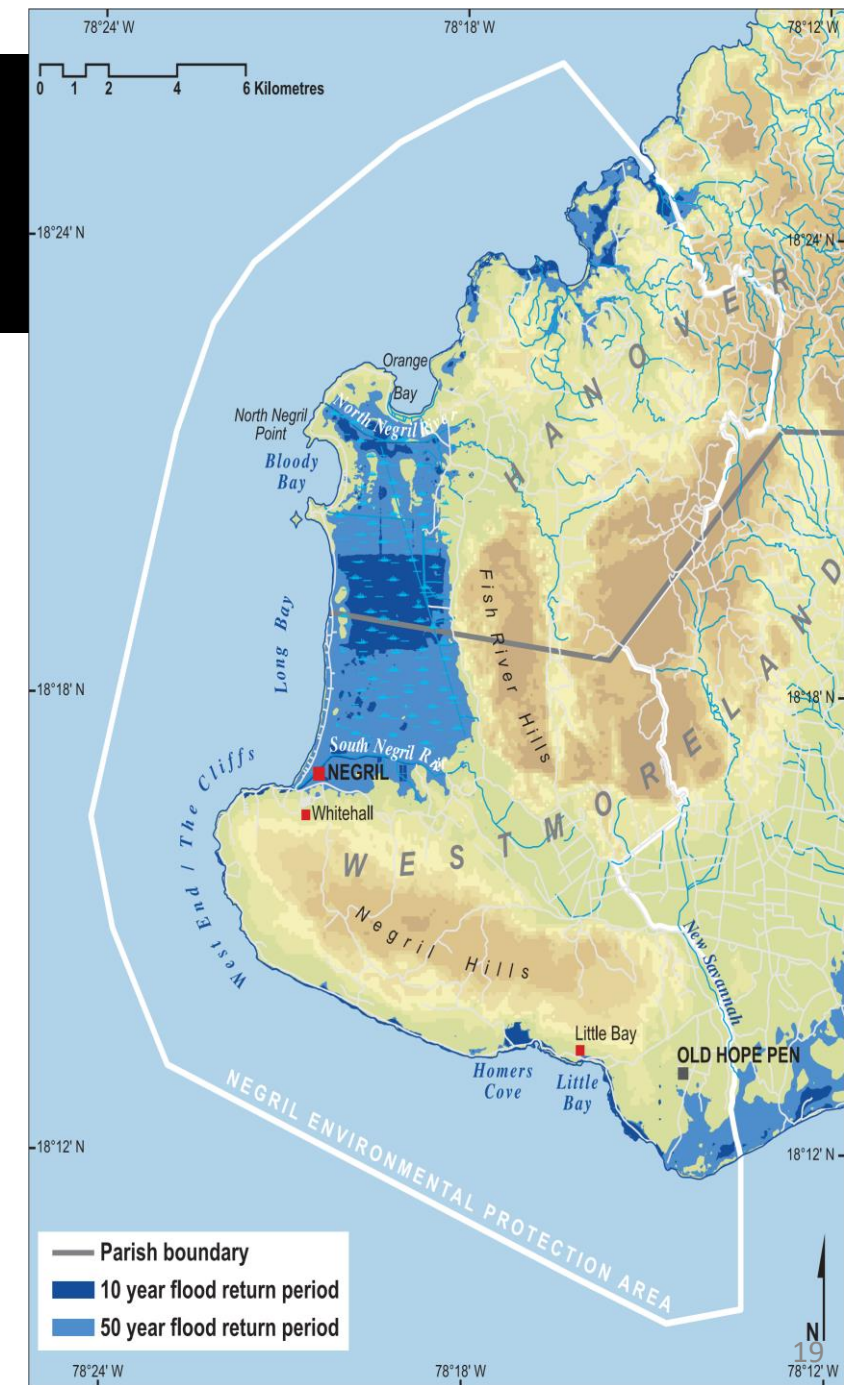
The What – Key Findings

- Livelihoods in Negril are dependent on the state of the ecosystems
  - Tourism, fishing, farming, fuel-wood production
  - In many instances, traditional livelihoods unable to provide adequate income
    - Little Bay reported declining fish stocks, esp. after storms
- Communities in study have experienced disaster from hazards
  - Incl. flooding, storms, etc
  - Residents have developed coping skills - social networks, stockpiling food and other items ahead of hazard, etc
  - Water supply not always reliable after hazard
  - Climate change may intensify hazards; will it exceed current coping strategies?

FYI: Information from community residents helped to validate and quantify data used in models. Eg, distance of storm surge run-up

The What – Key Findings

- The extent and quality of coastal ecosystems in Negril were in a state of decline due to human and natural sources
  - Natural: increasing storm and storm surge activities, accelerated sea level rise, increased sea surface temperatures, invasive species
  - Human: pollution from agriculture and development
- Deforestation, development activities including construction, illegal sand mining, removal of seagrass beds and unsustainable use of coastal resources etc played a role in ecosystem decline and consequent increase in flooding

The What – Key Findings

- 40 years prior to study, Negril's beaches experienced significant and irreversible erosion
  - Trends likely to continue with accelerated sea level rise
- The **main coastal ecosystems** in Negril, namely coral reefs and seagrass beds, are **essential to protecting and sustaining the beach**
  - This includes attenuation and dissipation of wave energy, supply of sand
  - Loss of ecosystems therefore results in loss of these functions, increase vulnerability to climate hazards

The What – Key Findings

- Pressures from climate change and other activities will make the situation worse:
  - Eg, Beach will retreat in response to SLR (more permanent) and storm surge (can be temporary) in "business as usual" scenario
  - Natural recovery is not likely in the short to medium term; human intervention is therefore necessary to keep area functioning well
- Business as usual is not an option given what is at stake!
  - Governance systems – national, local – must take into account ecosystem services more deliberately

Additional Information in RiVAMP Report

- Partners

- Timelines

- Jamaica's natural hazard profile (including geological hazards)

- Further details on the analyses conducted and results

- Livelihood information at community level
  - Incl. perceived benefits and threats to ecosystems

- Environmental governance

- *FYI: RiVAMP training made use of open source software; material available online.*

Conclusion

- RiVAMP provided scientific evidence of the **role of ecosystems** in maintaining and sustaining the beach → risk reduction
  - Showed loss of ecosystems contributed significantly to beach erosion
  - Natural and human factors are among reasons for the decline
- It made the case for **ecosystems-based adaptation** to be implemented
- The report showed the value of **environmental and climate data** to decision-making processes
- It underscored the **need for greater capacity** for similar assessments in SIDS.

Thank you!