



Building Coastal Resilience in Grenada: Lessons from the Field

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The Nature Conservancy
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A Venn diagram consisting of two overlapping circles. The left circle is blue and labeled "RESILIENT PEOPLE". The right circle is light green and labeled "RESILIENT NATURE". The overlapping area between the two circles is a smaller, semi-transparent teal circle.

**RESILIENT
PEOPLE**

**RESILIENT
NATURE**

GREY Infrastructure



GREEN Infrastructure







At the Water's Edge (AWE):

The
Grenadine
Bank

St. Vincent
And the Grenadines

Grenada

St. Lucia

Barbados

Trinidad
and
Tobago

Venezuela



- 1) How do we model future impacts?**
- 2) How will people and nature be impacted?**
- 3) How will people and nature respond?**

Vulnerability Assessment

EXPOSURE

What is going to be affected by a particular climate hazard?

SENSITIVITY

What characteristics make something more susceptible to harm?

IMPACT

ADAPTIVE CAPACITY

Ability of a community to anticipate, respond, cope, and recover?

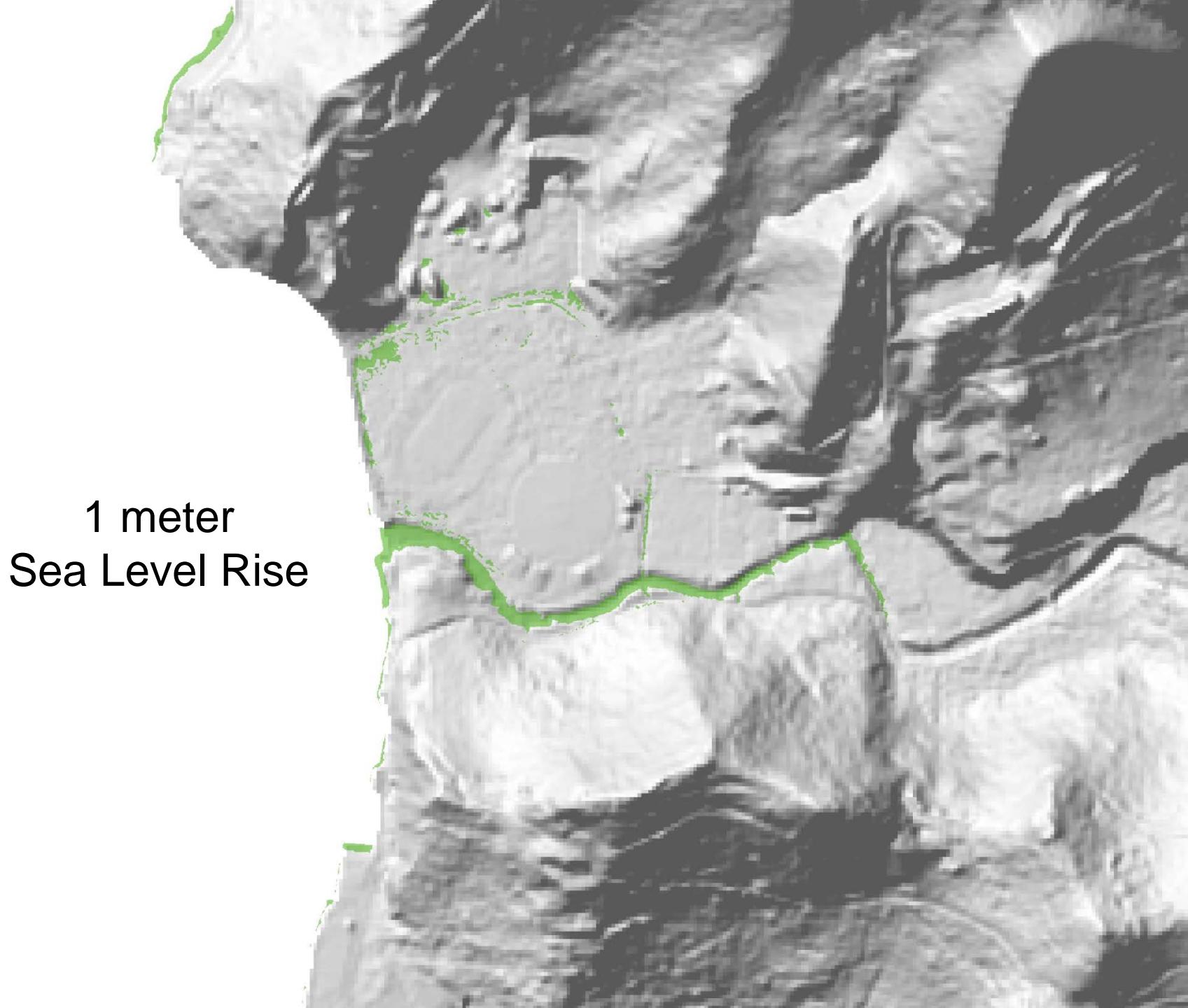




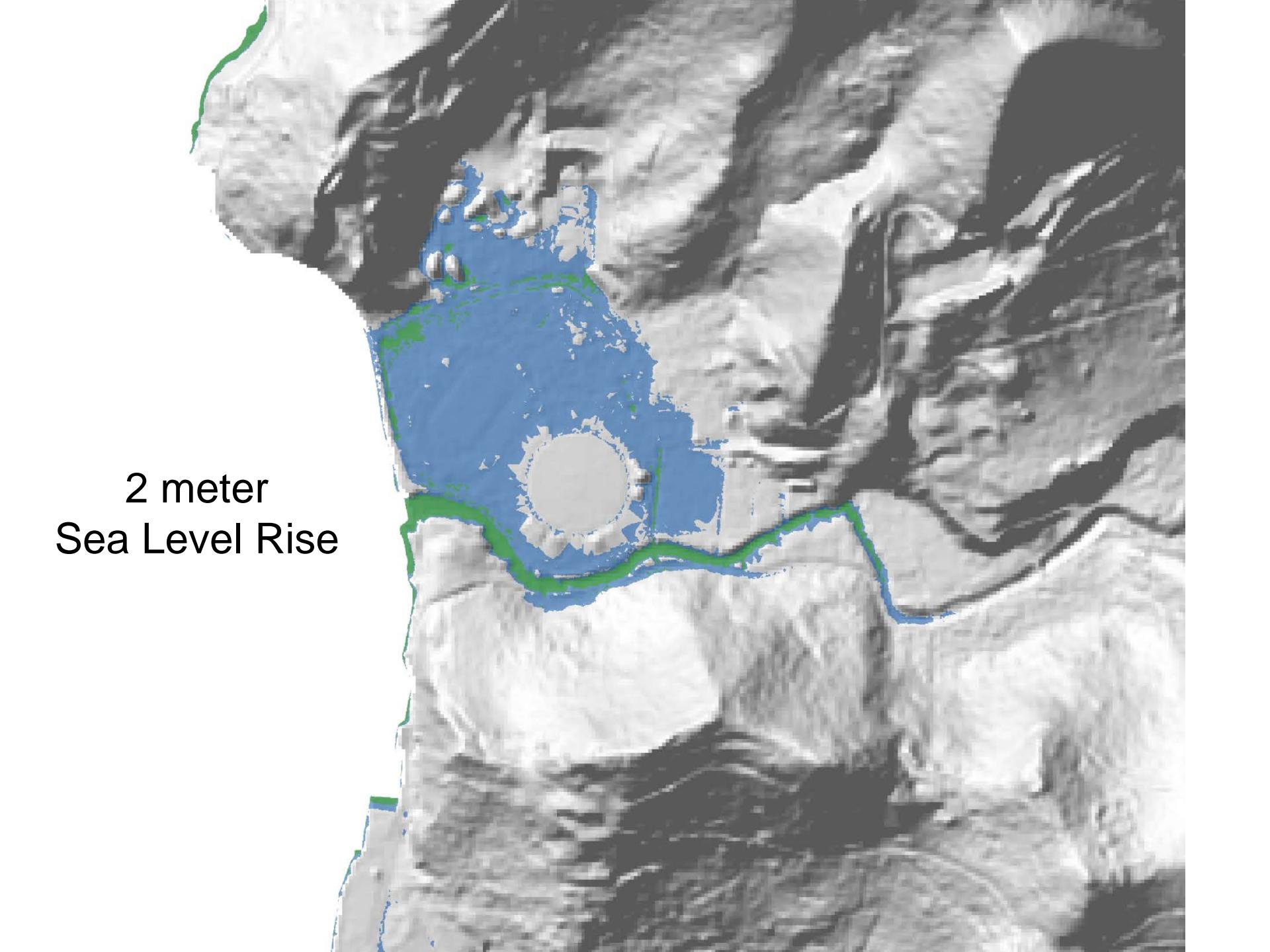
30 meter



1 meter



1 meter
Sea Level Rise



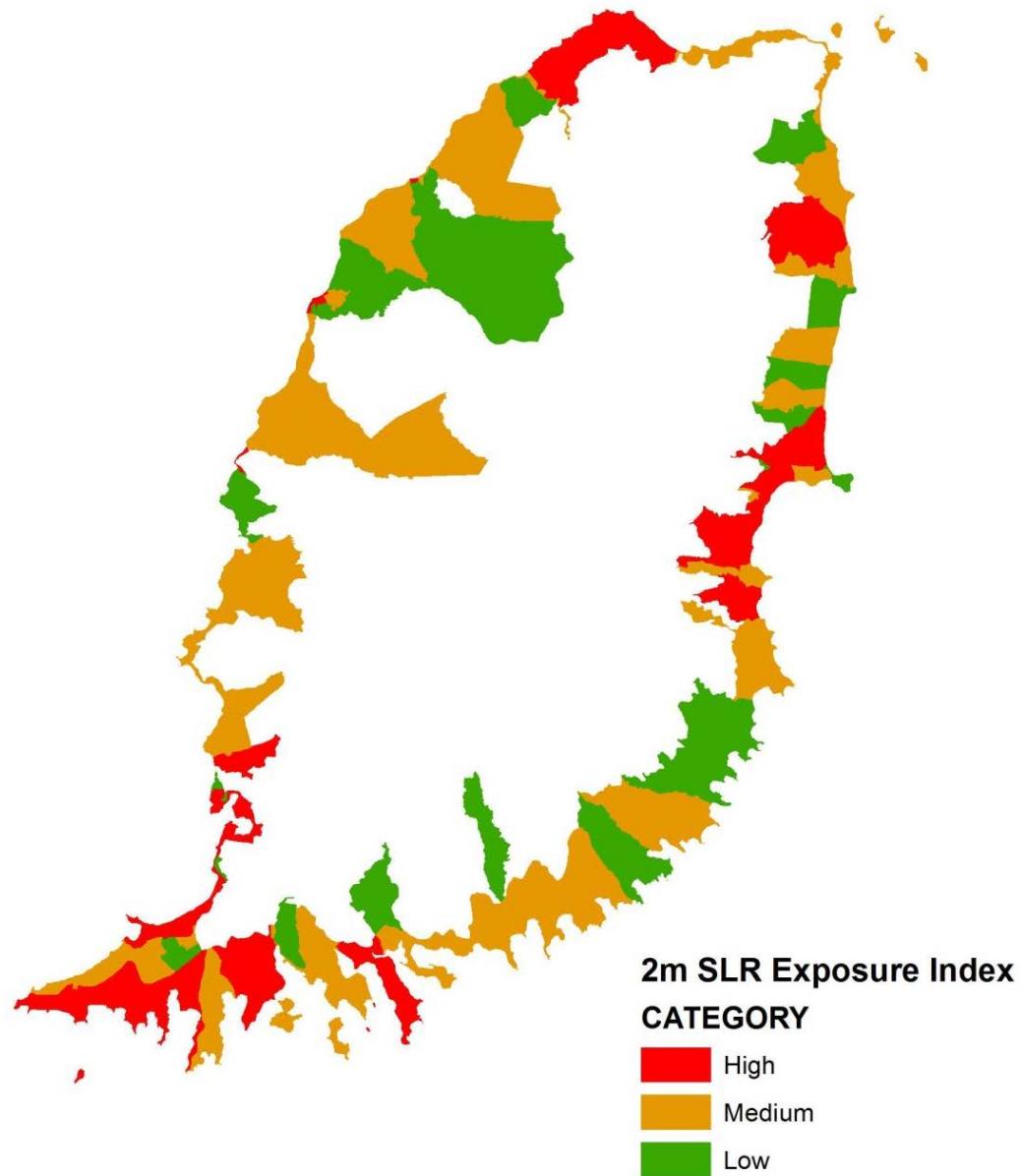
Aerial photograph of coastal areas showing simulated flooding under 2 meters of sea level rise. The image highlights coastal zones in blue and green, indicating different elevation ranges. Major infrastructure like roads and bridges are visible.

2 meter
Sea Level Rise

Exposure Index

What is going to be affected by a particular climate hazard?

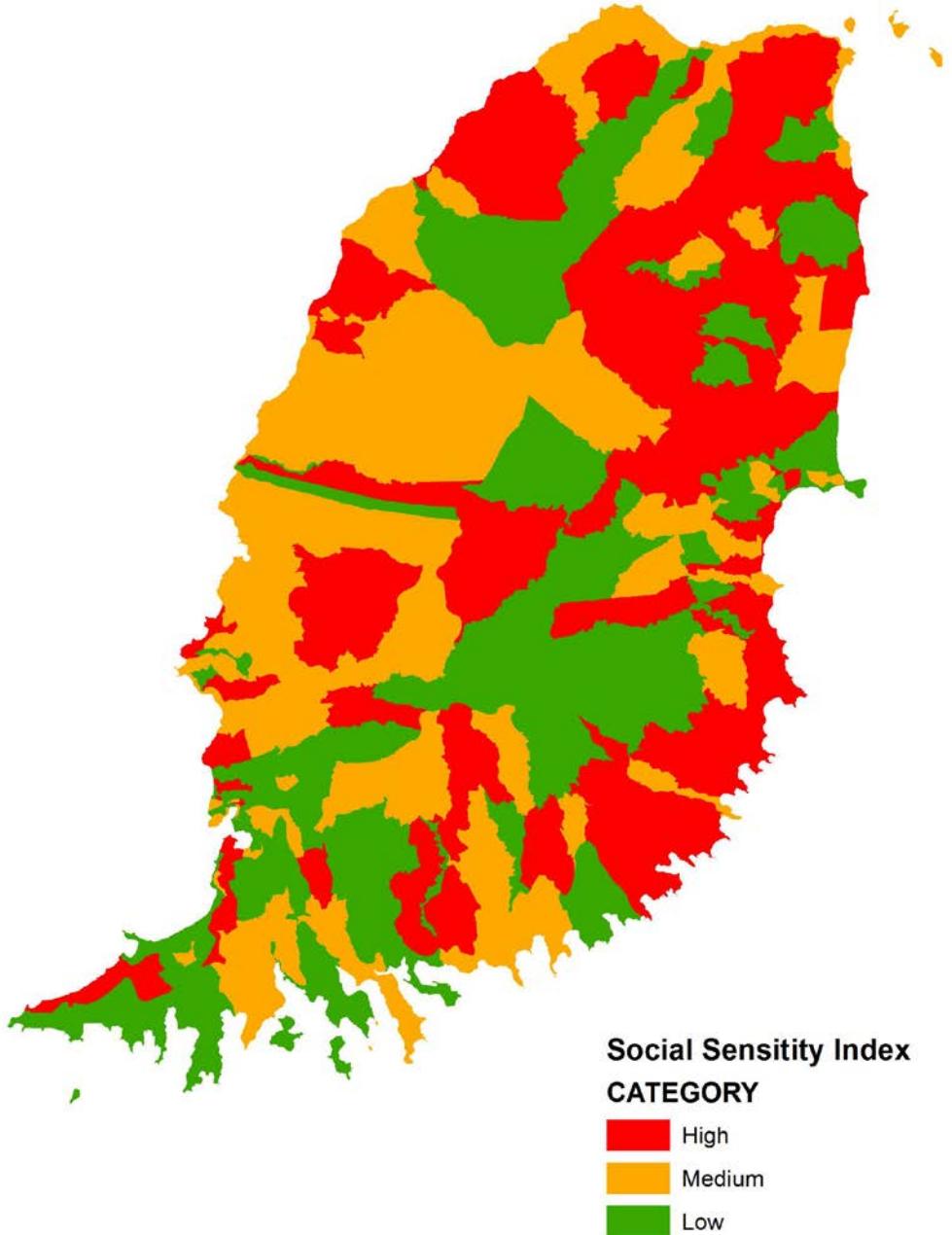
1. Length of road
2. Percent of road
3. Building area
4. Percent of total area
5. Number of buildings
6. Percent of number of buildings



Social Sensitivity Index

What characteristics make something more susceptible to harm?

1. Population
2. Population Density
3. Number of Housing Units
4. Density of Housing Units
5. Age under 5
6. Age over 65
7. Households without Internet
8. Households without Radio
9. Households without Automobile



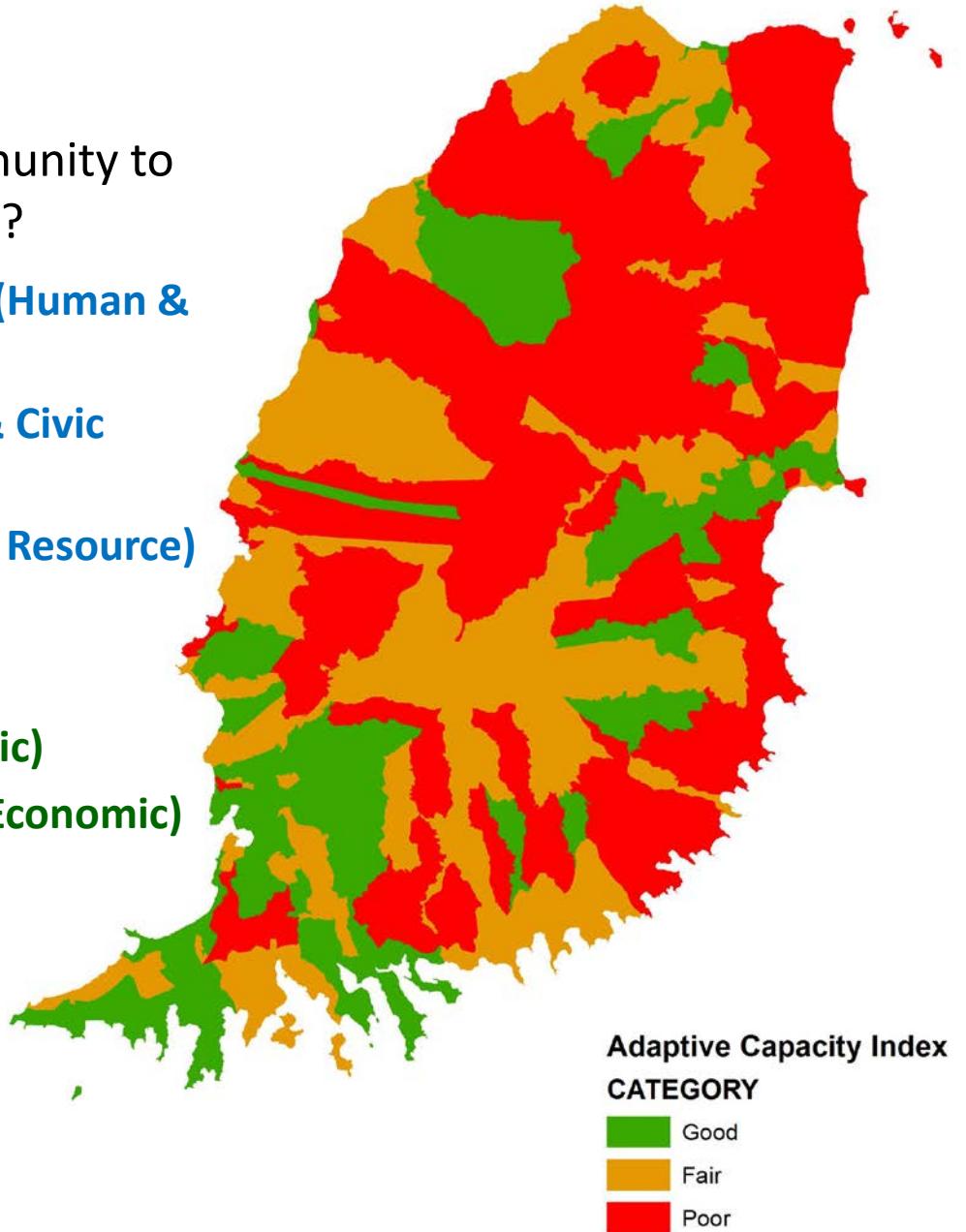
Adaptive Capacity Index

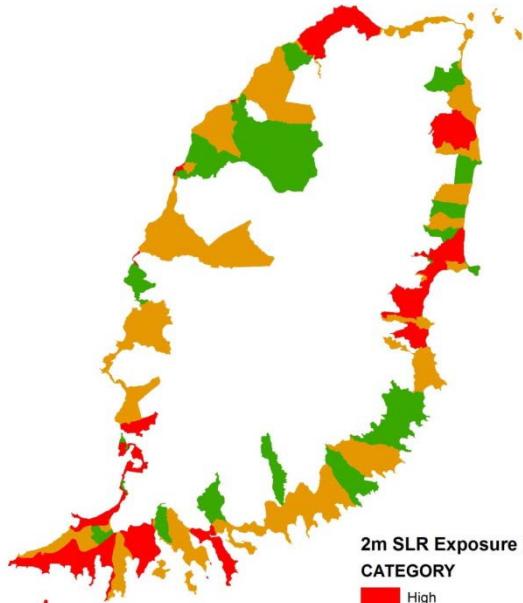
What is the potential ability of a community to anticipate, respond, cope, and recover?

1. Highest Level of Education Attained (Human & Civic Resource)
2. Access to Social Networks (Human & Civic Resource)
3. Available Workforce (Human & Civic Resource)

4. Diversity of Income (Economic)
5. Households with Insurance (Economic)
6. Households with available Savings (Economic)

7. Health Insurance (Health)
8. Education (Health)
9. Birth Rate (Health)

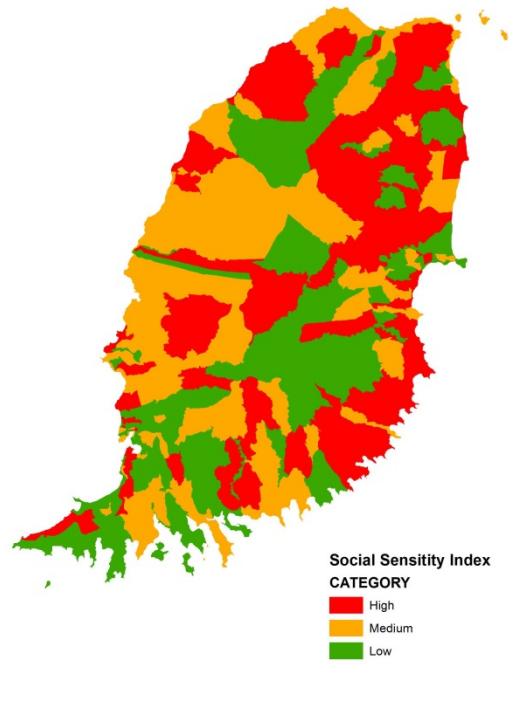




2m SLR Exposure Index
CATEGORY
High
Medium
Low

Exposure Index

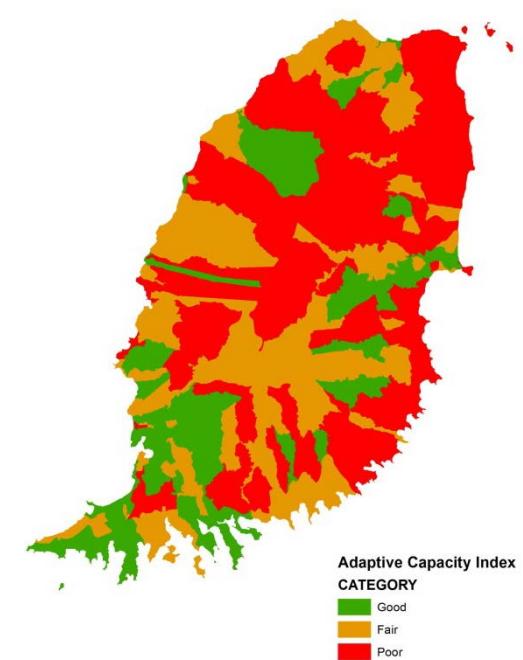
Which enumeration districts are more susceptible to flooding risk based on inundation models using SLR and hurricane storm surge ?



Social Sensitivity Index
CATEGORY
High
Medium
Low

Social Sensitivity Index

Population and housing density, youth and elderly, communication capacity, and transportation access contribute to a communities' overall sensitivity.



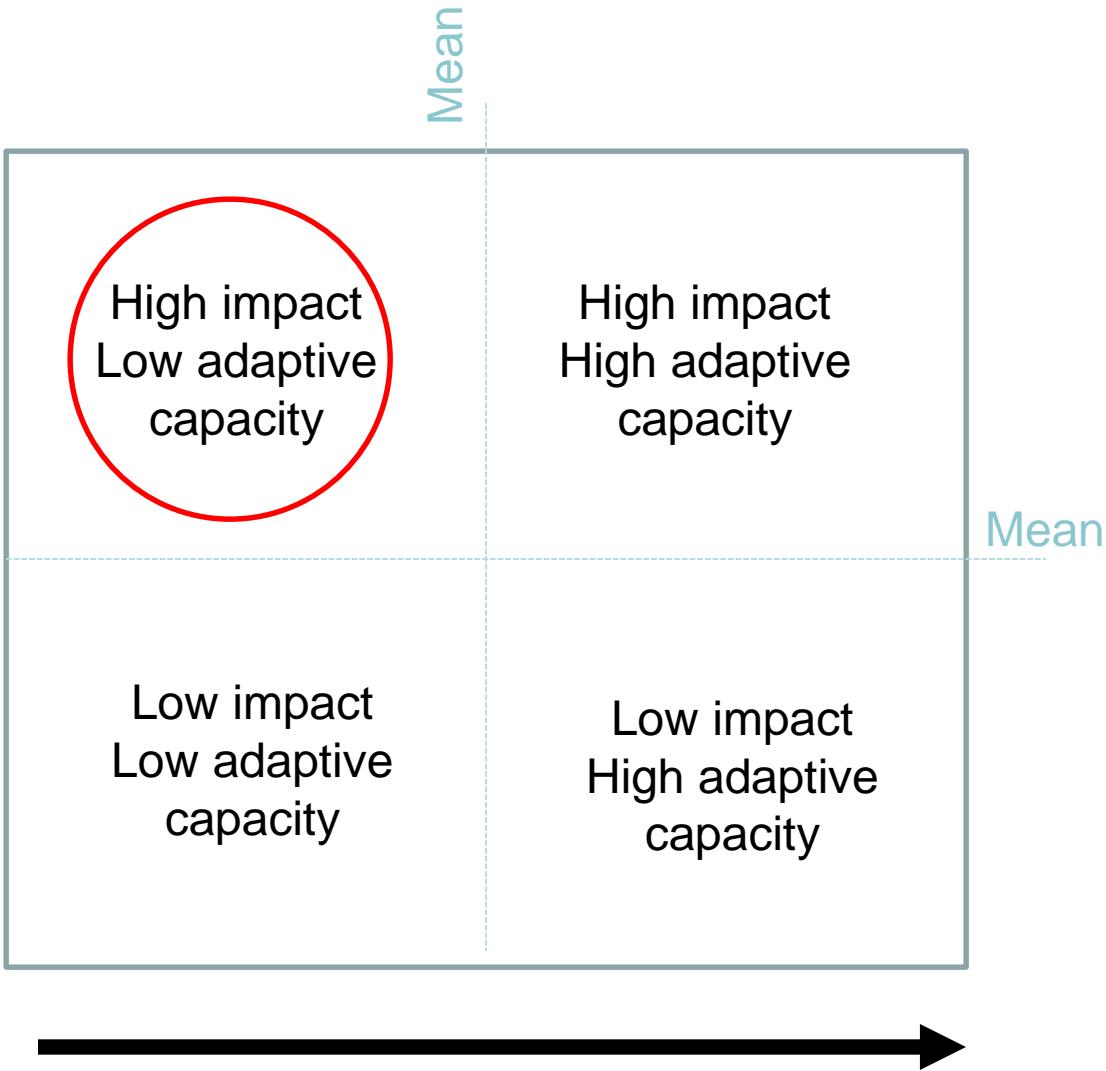
Adaptive Capacity Index
CATEGORY
Good
Fair
Poor

Adaptive Capacity Index

Human and civic resources such as level of education, access to retraining programs, and other factors determine coping and adaptive capacity of communities.

IMPACT

(Exposure + Sensitivity)



ADAPTIVE CAPACITY

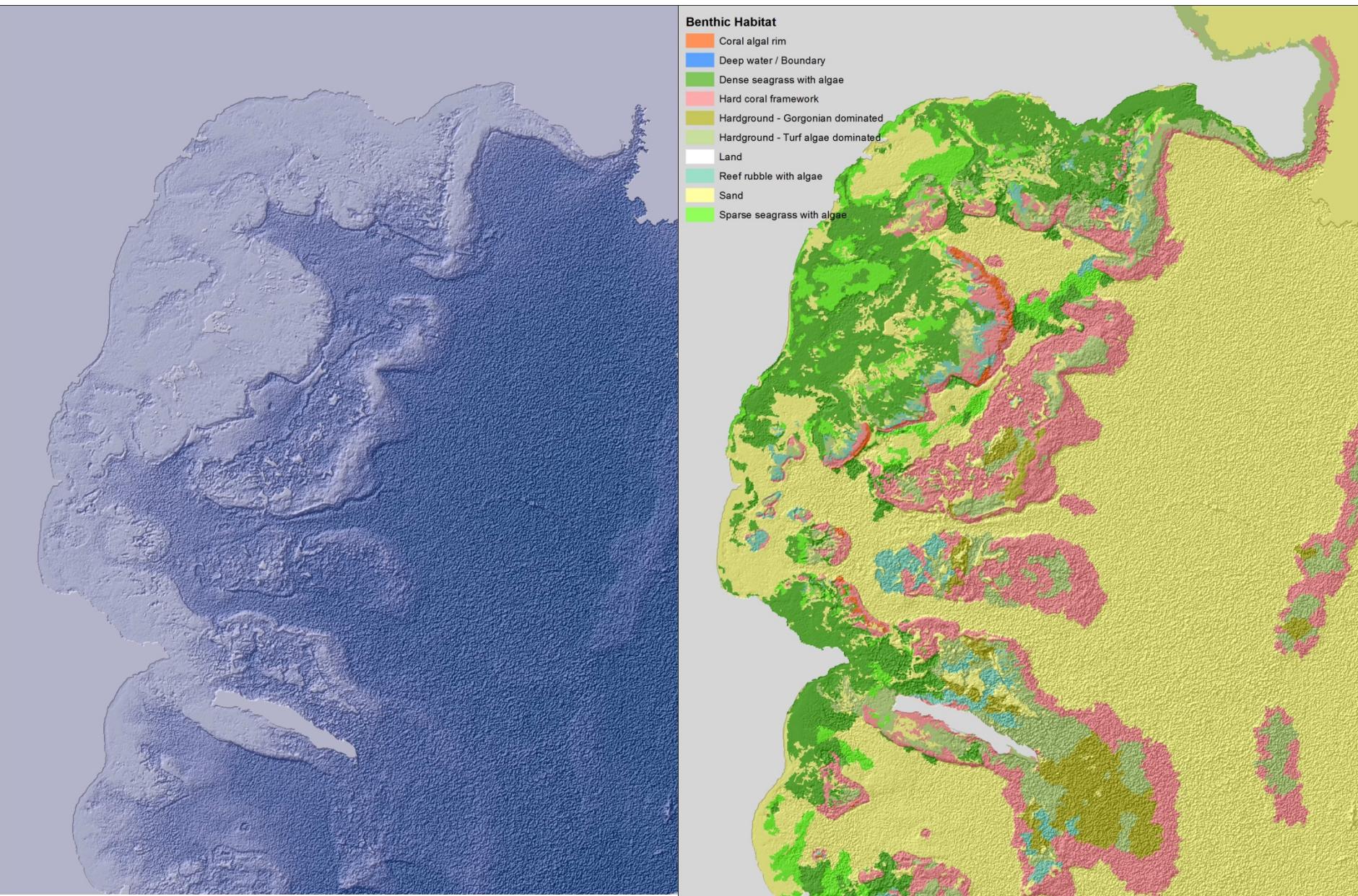
Grenville Bay, Grenada



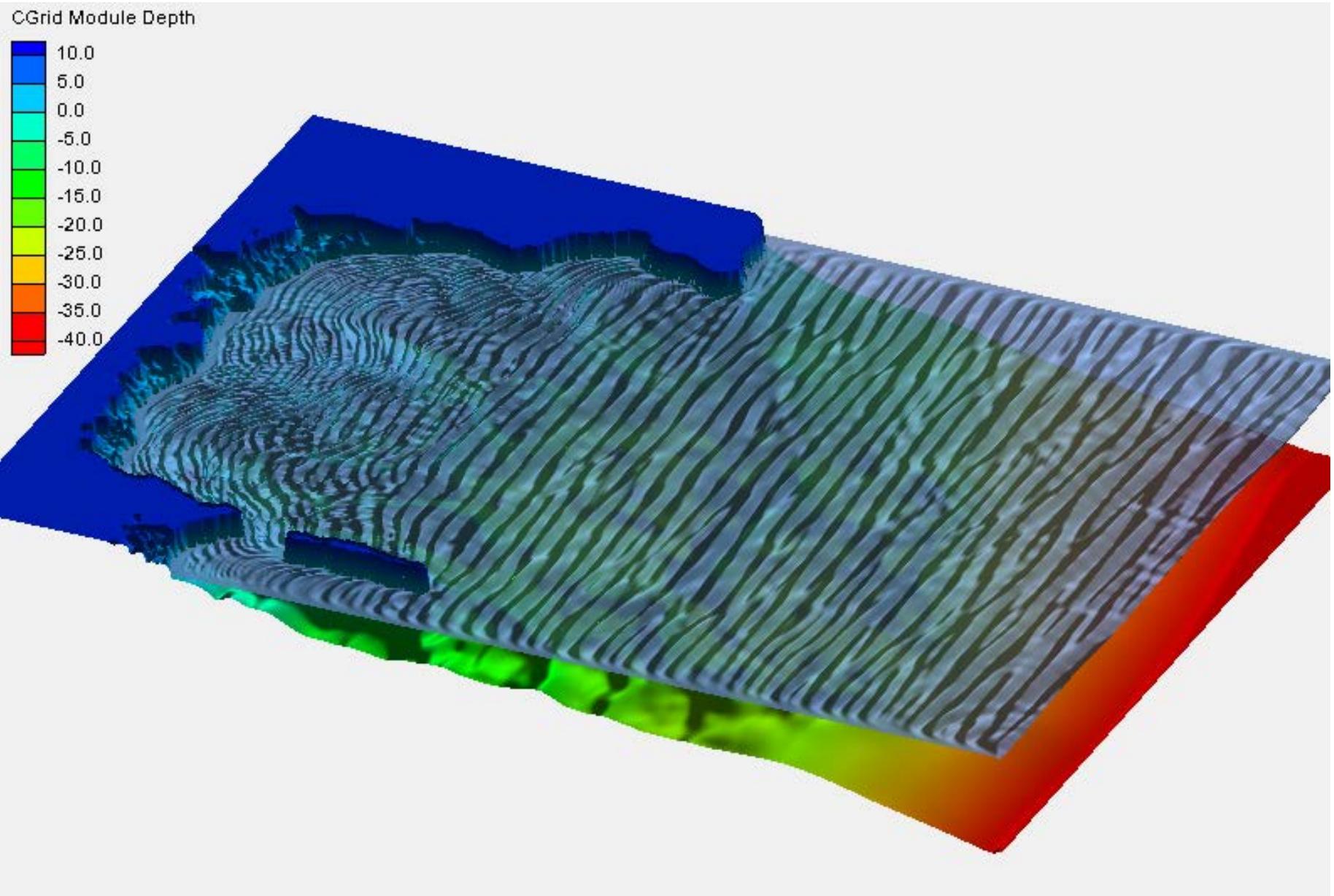
High Exposure/Sensitivity and Low Adaptive Capacity



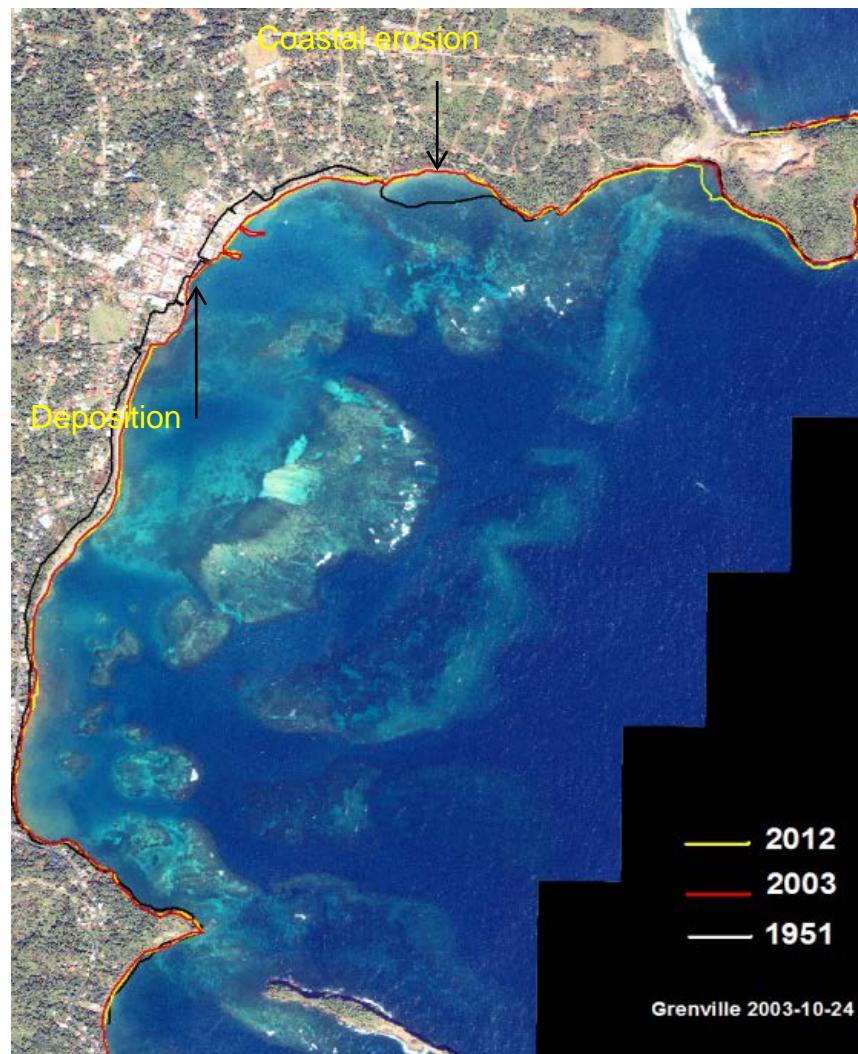
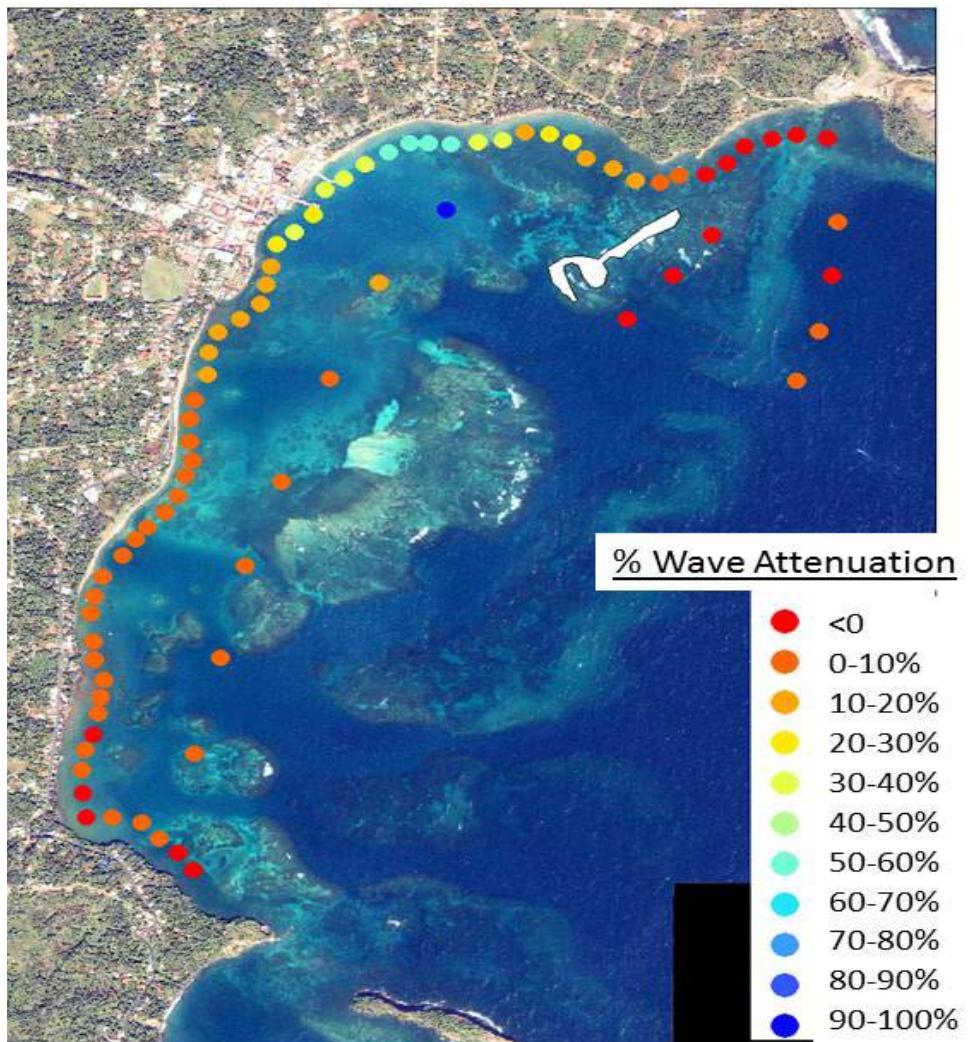
WorldView-2 Satellite Image
Sep 1, 2012



GRENVILLE BAY: Bathymetry and benthic habitats derived from 2m Worldview-2 imagery

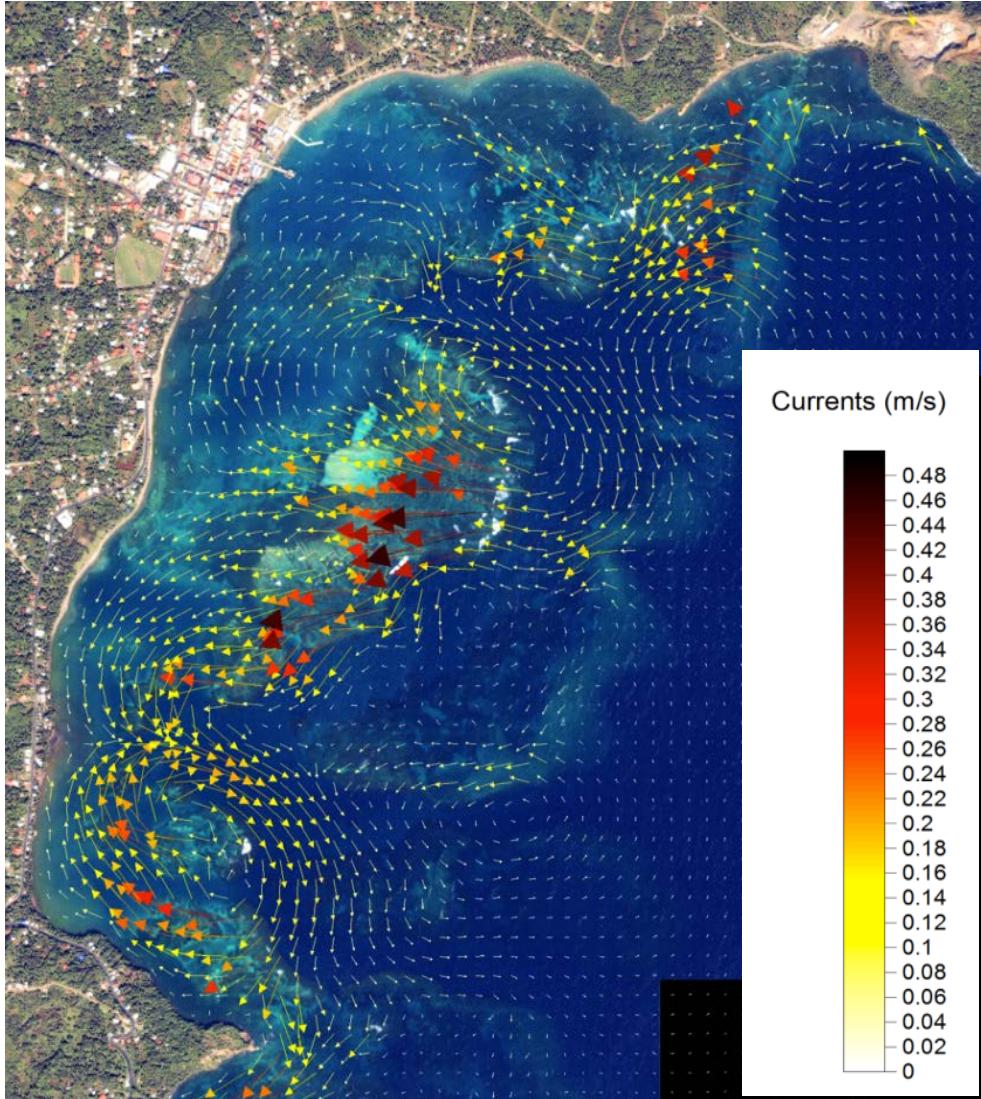


(Reguero et al 2014)

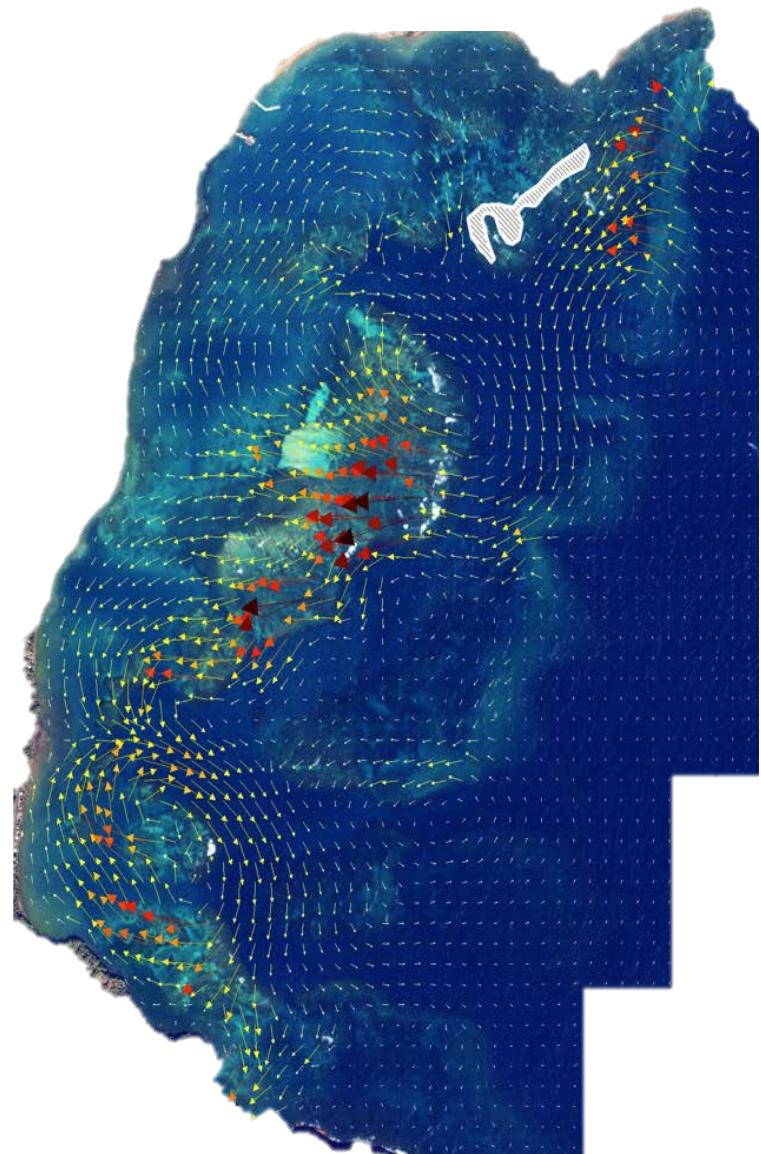


(Reguero et al 2014)

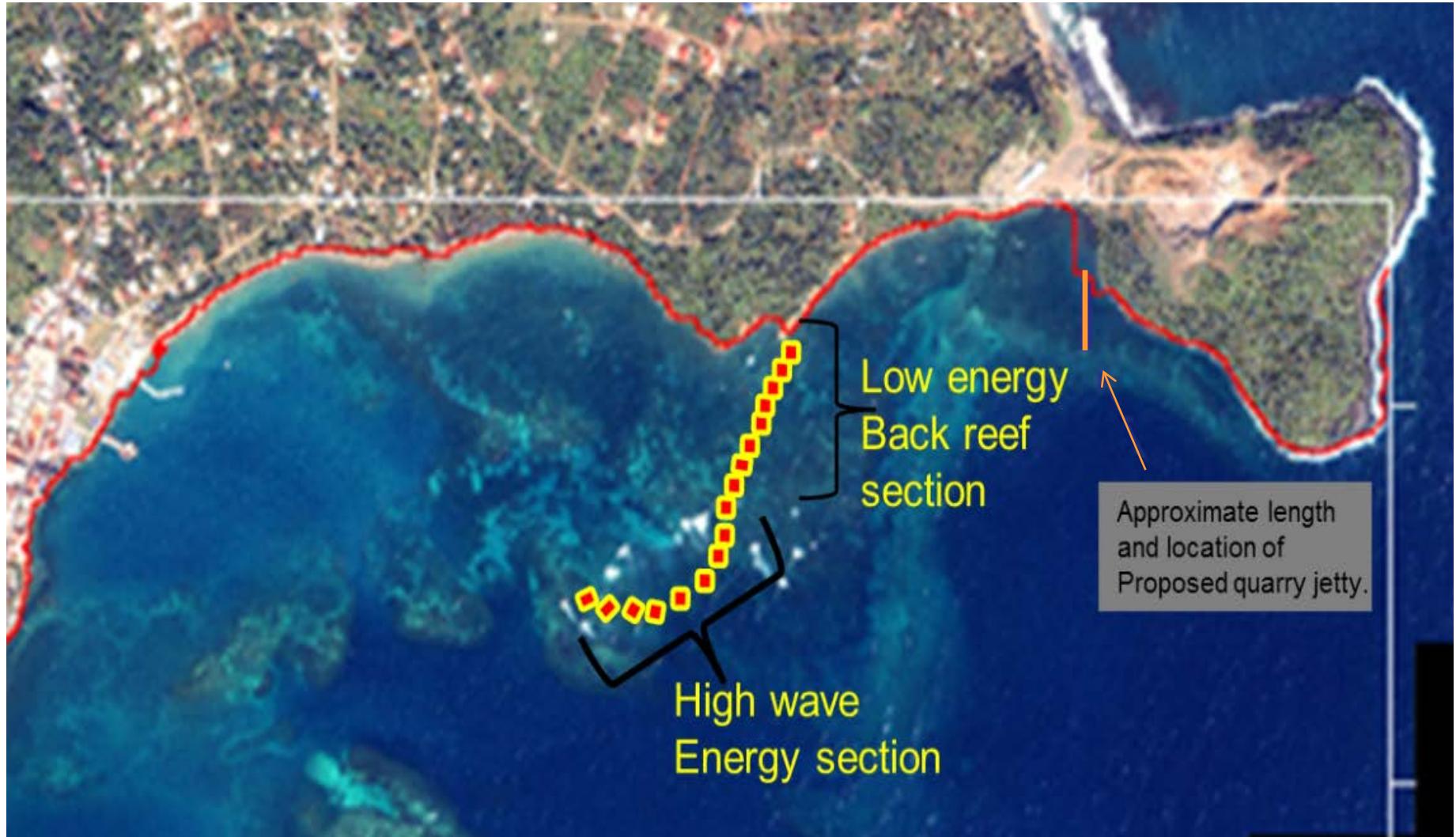
Present



Reef Restored



(Reguero et al 2014)



(Reguero et al 2014)

A number of baskets were coated with coal tar epoxy paint to examine how it will influence rates of corrosion and biological colonization on the pilot structures.



01/25/2015



01/14/2015

Attaching the structure to reef substrate using fiberglass rebar pins to further prevent any horizontal movement of the submerged breakwater



01/20/2015

A completed 2-tier pilot submerged breakwater structure (this one with blocks) with corals from the nursery placed along their sides.



01/22/2015

Grenville Reef Pilot Project

By The Numbers

- Total length of pilot submerged breakwater built: ~30 meters (100 feet)
- Number of diver community man hours for pilot: 1,500
- Quarry stone mined and placed in structures: 70 tons
- Concrete building blocks placed in structures: 2,400
- Amount of 5/8th rebar steel: 44,000 feet
- Number of welds for all gabion baskets: 41,000
- Average live coral cover currently on Grenville reef flat ~1%
- Corals relocated: ~1,250 (~ 240 of these were re-planted on structures)
- Cost per meter (~ \$7,000 US). 1/3rd the cost of a traditional breakwater

01/16/2015

How will you know if it works?

We will be evaluating 1) wave attenuation; 2) structural integrity; 3) biological colonization; 4) local community/fisherman opinion.

Won't the steel "rot"?

5/8th inch steel will last at least 30 years - the placement and shape of structures is designed to maximize coral growth over time. Also testing different steel protective coatings on the welds as part of this pilot.

If it works, what will you do next?

If the structures are successful, a full scale submerged breakwater spanning a length of over 250 meters will be built. However, watershed threats and overfishing need to be addressed for corals to reestablish.

Closing perspectives

- One of the first examples of a soft structural intervention on a urban coral reef specifically designed to reduce the impacts of sea level rise and promote natural benefits.
- Demonstrates that building a submerged breakwater using non traditional community-based approach is a feasible alternative
- EBA is new for many countries and needs further testing, but should be part of broader adaptation and development strategies
- Each location is different so approaches need to be customized, involving a broad range of stakeholders throughout the process
- A key goal of this project is to empower coastal communities. The commitment and interest by the Telescope community in this project was high throughout and punctuated by a beach party or “lime” on the last day with over 100 persons.