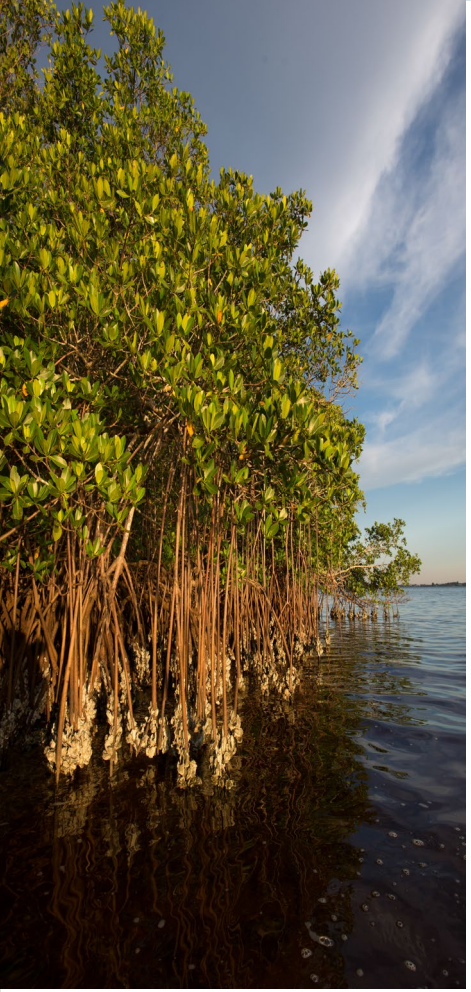
Storm Loss Reduction Value of Florida's Mangroves including Spatially Explicit Benefit-Cost Data to Support Restoration Financing Decisions

Presented by Laura Geselbracht
February 2023

The Nature Conservancy Florida



Project Staff and Partners

Dr. Martha Rogers, Natural Capital Economist (Project Manager)

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Mexico Team: Fernando Secaira, Coastal Risk and Resilience Lead

The Bahamas Lead: Marcia Musgrove

Florida Team: Rod Braun, Climate Program Manager

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Janet Bowman, Senior Policy Advisor

AXA

BUILDERS INITIATIVE

Cinvestav

UC SANTA CRUZ

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TNC Florida's Climate Strategy

- Centered around climate and energy policies to reduce emissions and enhance resilience.
- Leveraging on-the-ground projects to highlight the resilience benefits of nature based solutions (NbS) around the state.
- Promoting climate and adaptation policy at the state-level, and through monthly calls with the nine regional climate collaboratives across the state.

Spring tide flooding, Miami

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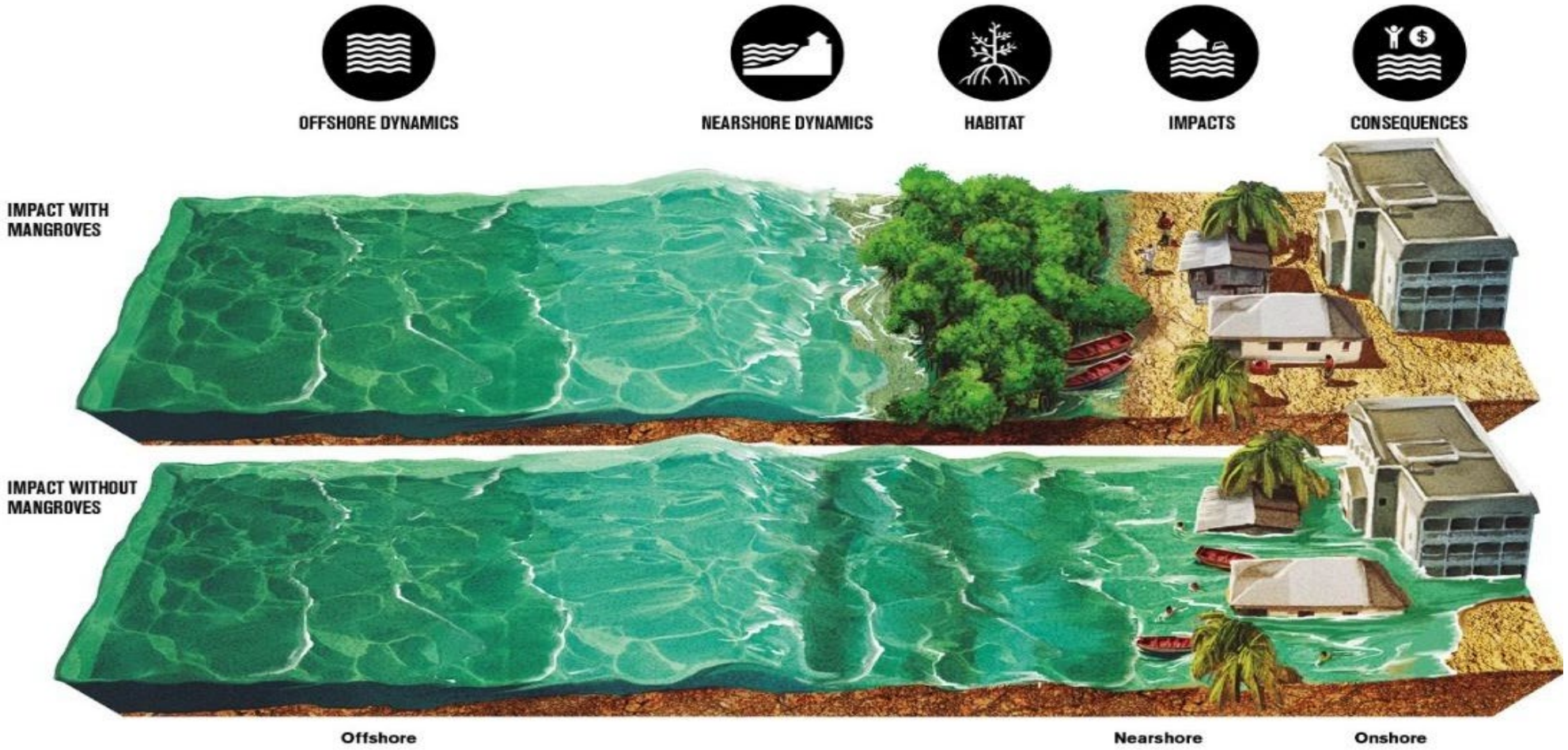
Nature infrastructure protects and provides numerous co-benefits for coastal communities



Mangroves offer a multitude of benefits

FISHERIES

WATER PURIFICATION

FLOOD PROTECTION

TOURISM

CARBON STORAGE

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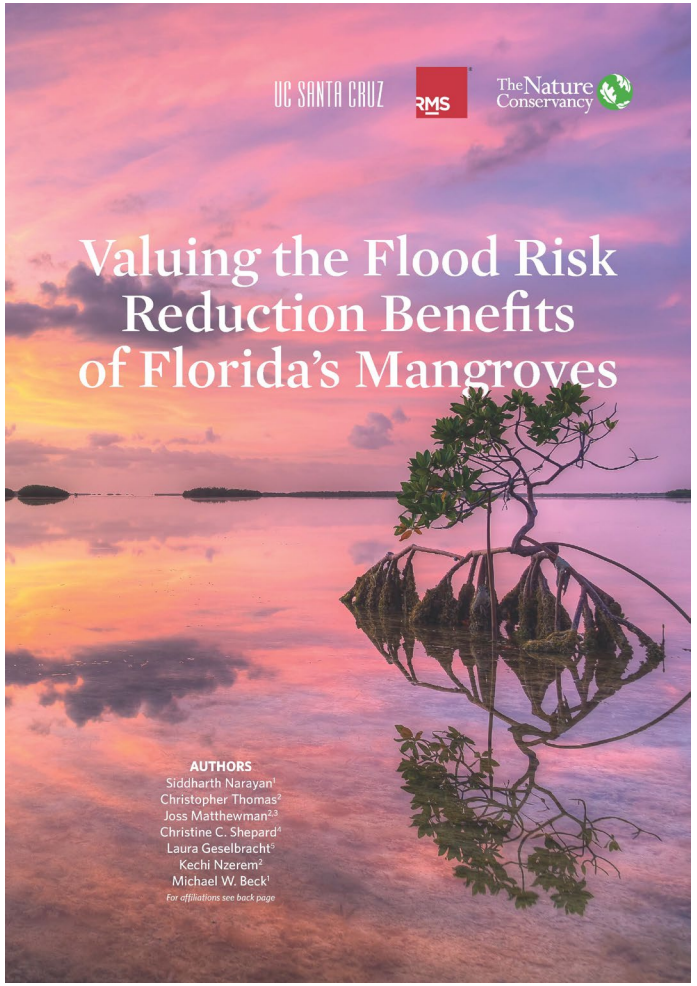
Florida has approx. 228,700 ha of mangrove forest (Radabaugh *et al.* 2017), now expanding north.

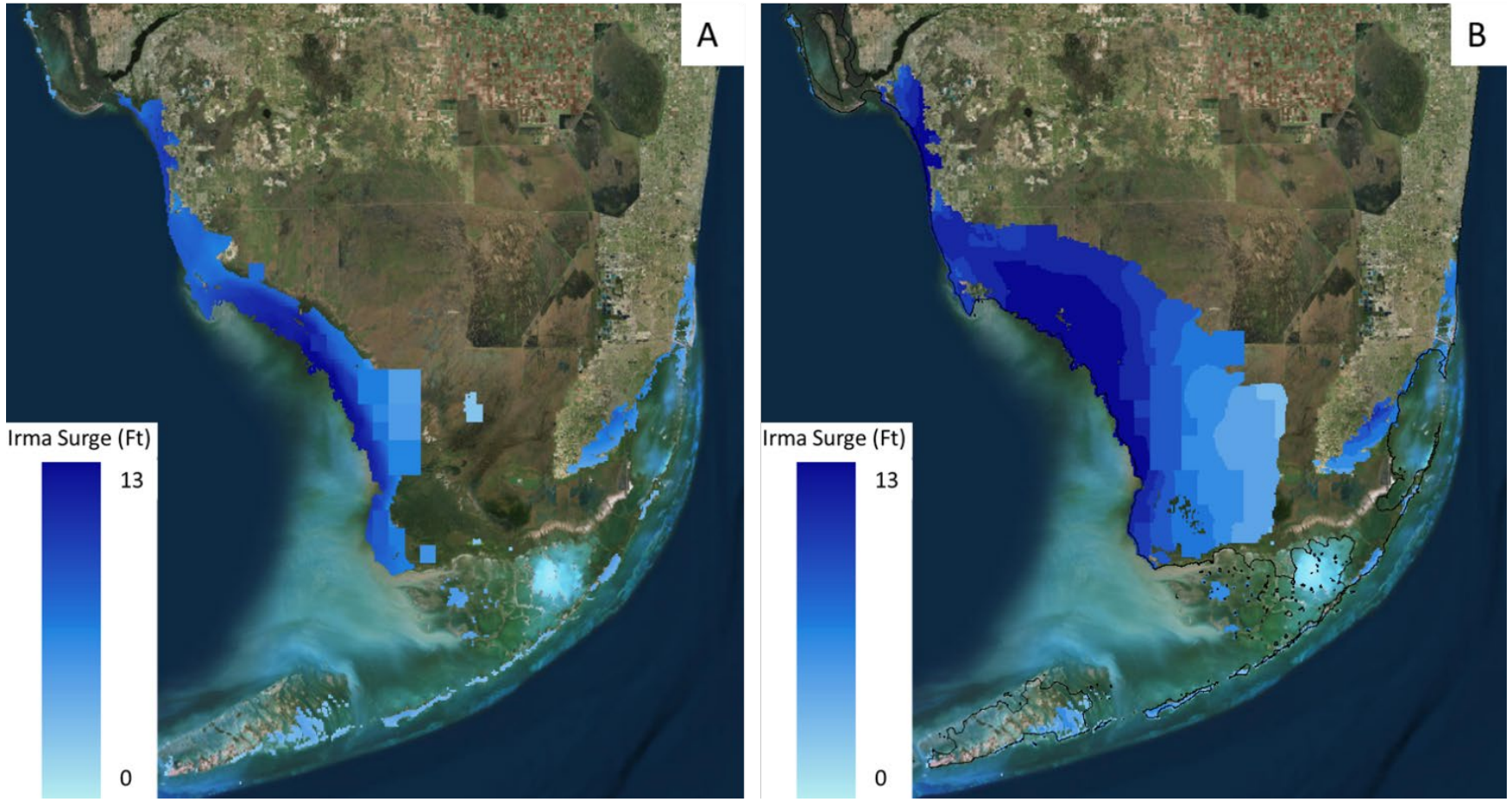
Their mean annual ecosystem service value based on a world-wide meta-analysis has been estimated at $33,258 ha/year (Su *et al.* 2021).

This is a **conservative** value for Florida is therefore $7.6 billion annually.

Value of Mangroves Storm Loss Reduction – Post Hurricane Irma Assessment

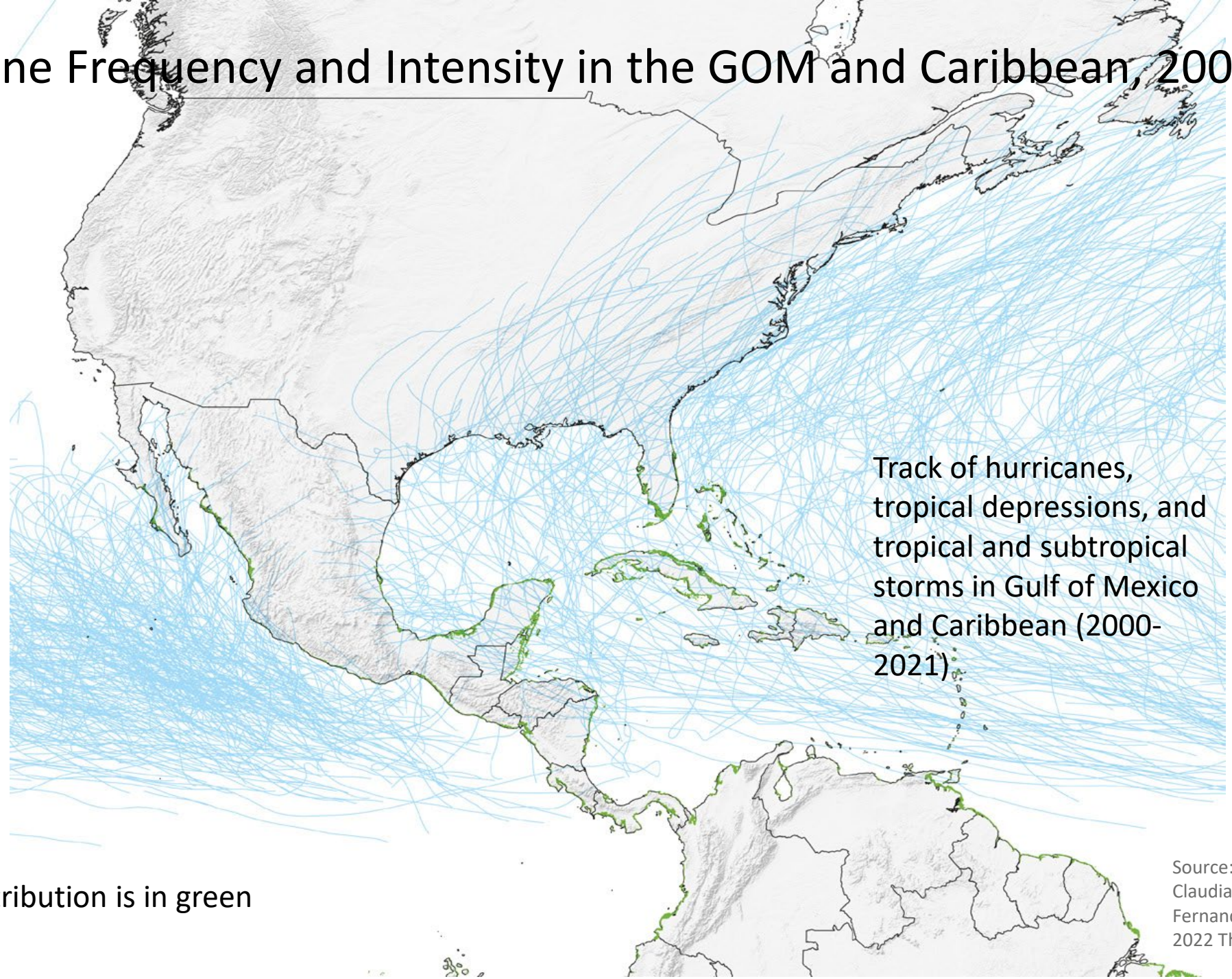


Modeled flood extents during Hurricane Irma – A: With Mangroves, B: Without Mangroves.



Narayan, S., C. Thomas, J. Matthewman, C. C. Shepard, A. Birch, L. Geselbracht, M. W. Beck. 2019. The Flood Risk Reduction Benefits of Florida's Mangroves During Hurricane Irma And Beyond. The Nature Conservancy, Washington, DC.

Hurricane Frequency and Intensity in the GOM and Caribbean, 2000 - 2021



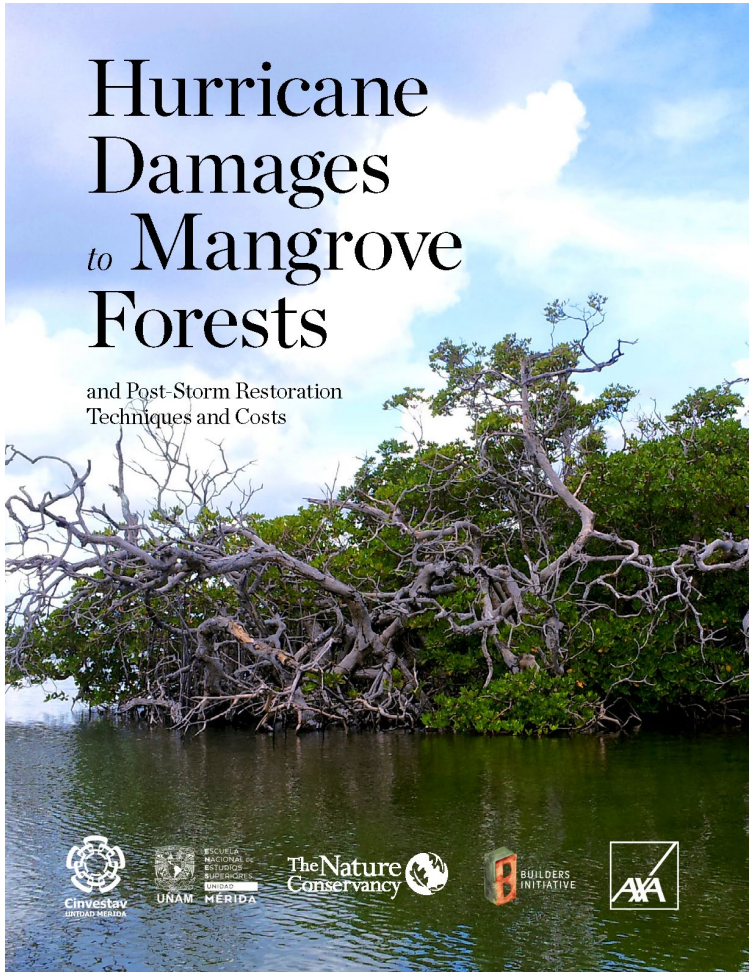
Track of hurricanes, tropical depressions, and tropical and subtropical storms in Gulf of Mexico and Caribbean (2000-2021)

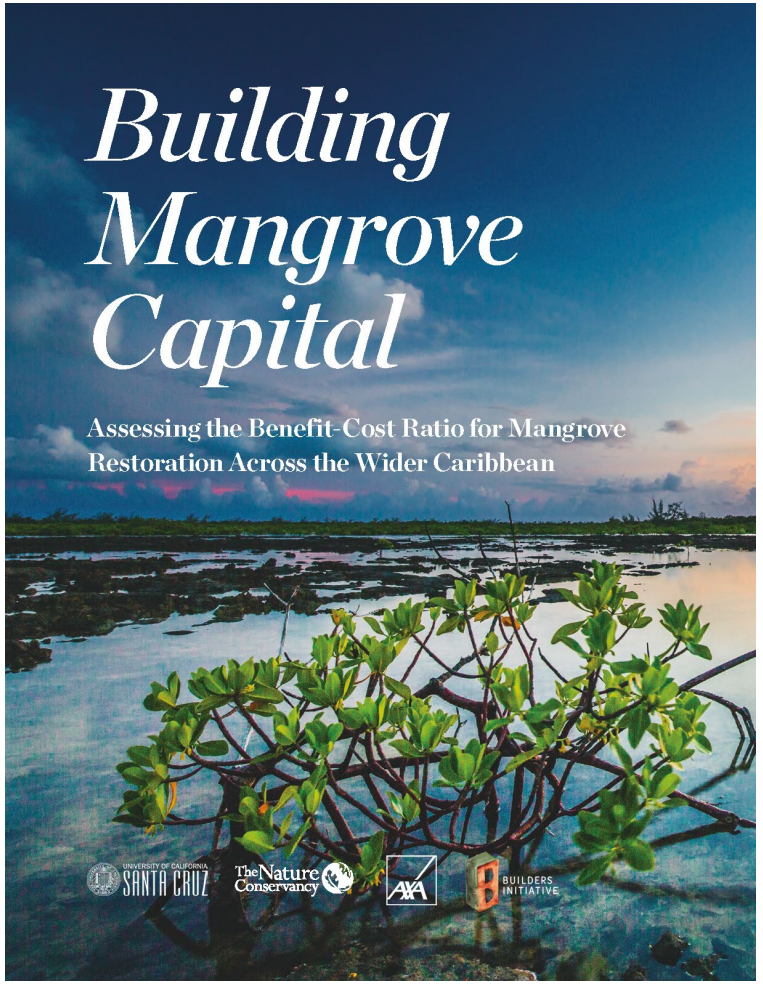
Mangrove distribution is in green

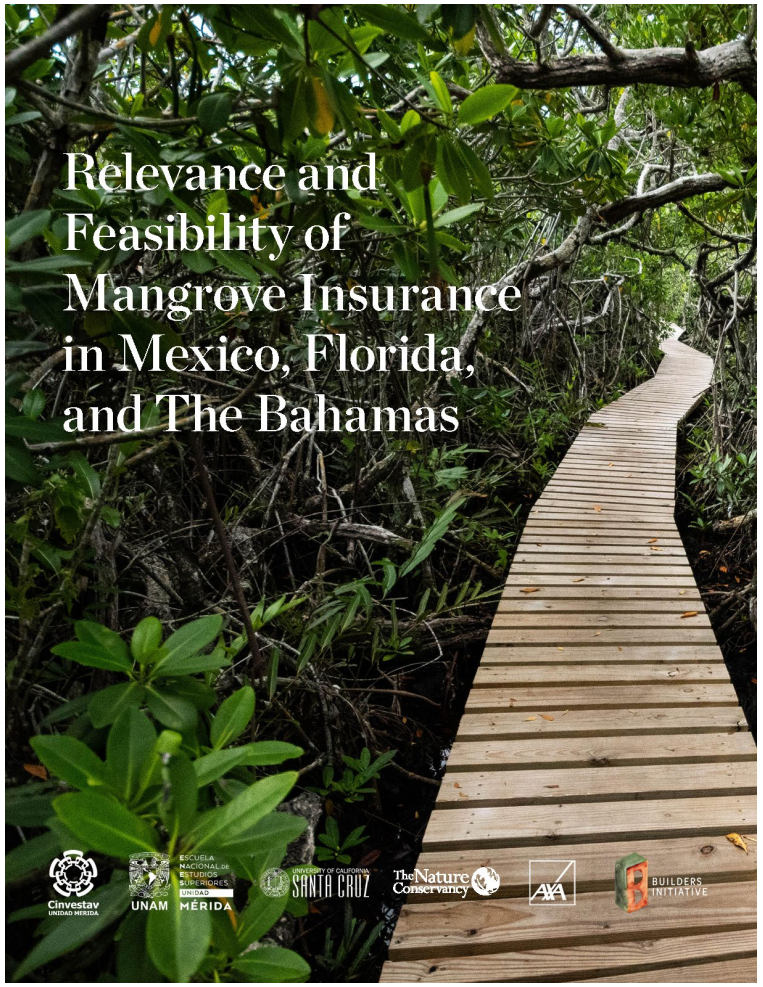
Source: Jorge A. Herrera Silveira
Claudia Teutli Hernandez,
Fernando Secaira Fajardo, et al
2022 The Nature Conservancy

Three-Part Study that Rigorously Examines Where to Focus Mangrove Restoration Efforts based Valuation of Flood Loss Reduction and Costs of Restoration

(completed early September 2022)







Report 1 - Types of and severity of damages & restoration techniques

MINIMUM

1. Slight defoliation
2. Breakage of small branches
3. Suspended particles in water column

MODERATE

1. Small and medium branch breakage
2. Moderate flooding (up to 2.5 meters)
3. Moderate channel sedimentation

EXTENSIVE

1. Breakage of large branches
2. Large volumes of fallen woody material
3. Extensive flooding (2.7 to 3.6 meters)
4. Hydrological flow disruption
5. Sediment salinization

EXTREME

1. Large trees downed/uprooted
2. Change in structure and composition (height and size)
3. Extreme flooding (3.9 to 5.5 meters)
4. Sea water intrusion
5. Opening of inlets through barrier islands or dune systems

CATASTROPHIC

1. No presence of seedlings or juveniles
2. Large trees downed/uprooted
3. Decrease in density and complexity
4. Catastrophic and prolonged flooding (higher than 5.5 meters)
5. Sediment salinization
6. Opening of inlets through barrier islands and dune systems

Adapted from Krauss and Osland, 2020.

Hydrological rehabilitation

Removal of sediment, creation and maintenance of channels for water flow recovery.



Topographic rehabilitation

Modification of ground level according to sea level.

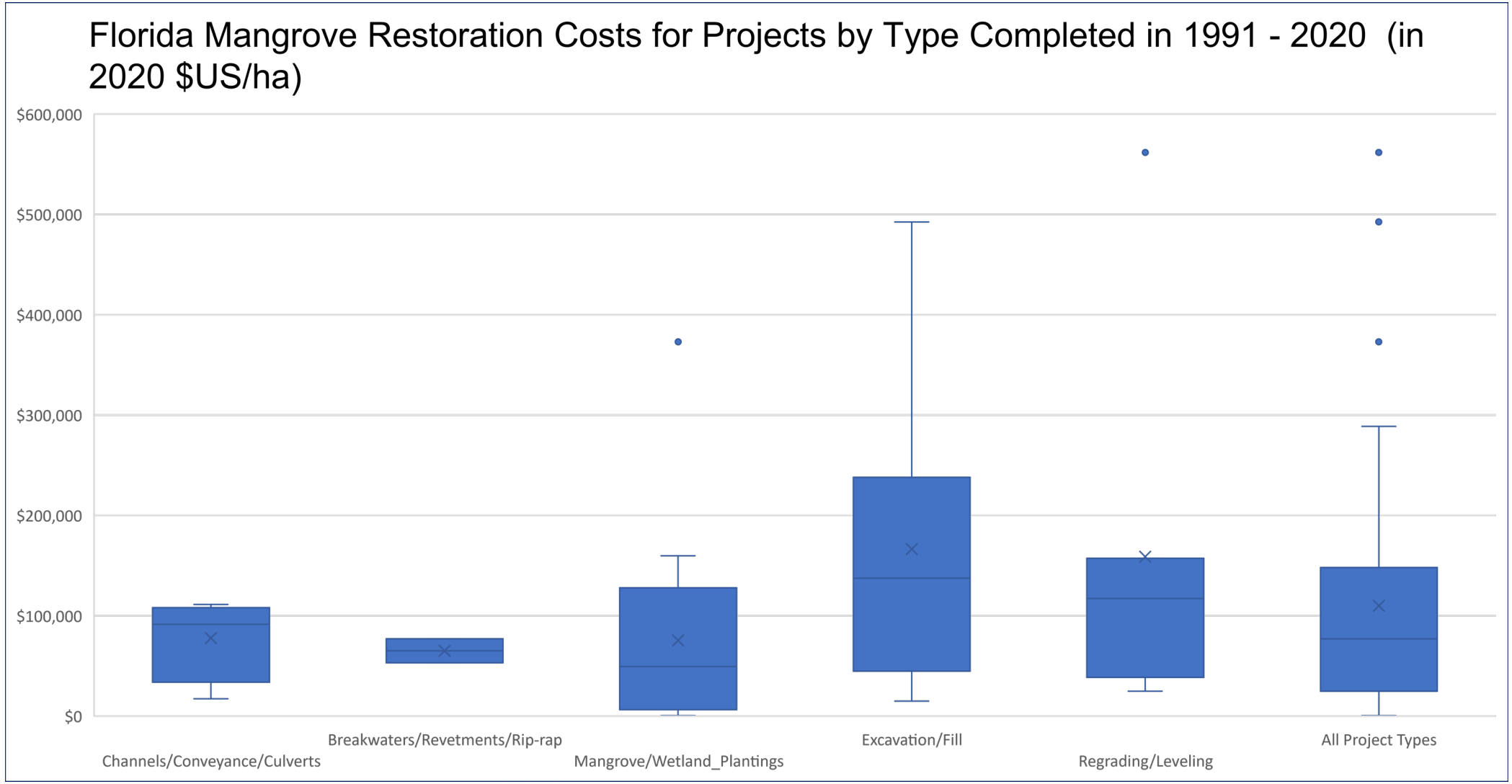


Reforestation

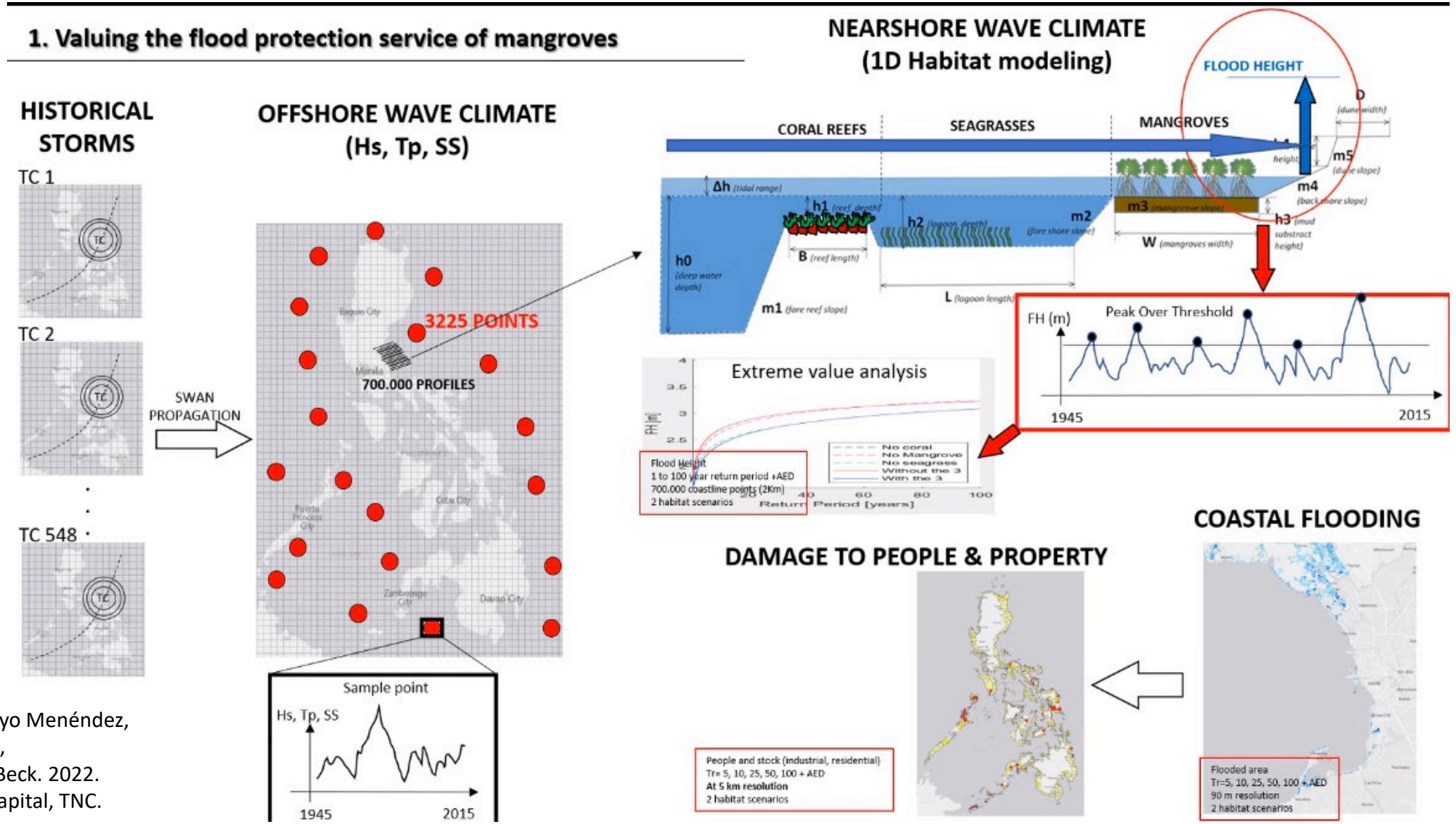
Planting mangrove seedlings. Recommended only when hydrological and topographic conditions are suitable for mangrove growth.



Report 1 - Cost of Restoration by Intervention Type

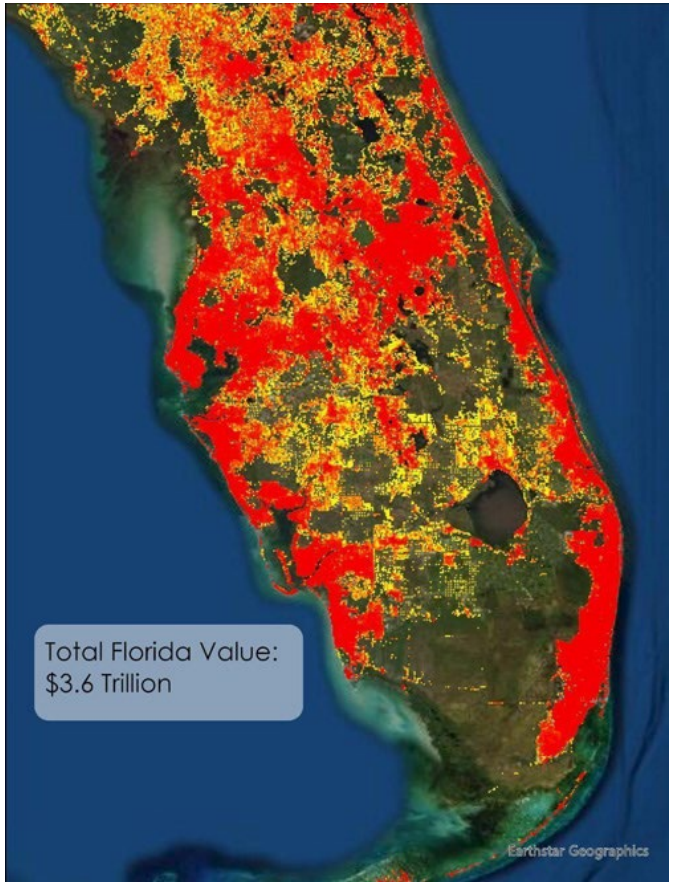


Report 2 – Assessing the Spatially-Explicit Benefit-Cost Ratio of Mangrove Restoration



Source: Pelayo Menéndez, Chris Lowrie, Michael W. Beck. 2022. Mangrove Capital, TNC.

Asset Value of the Built Environment



National Structure Inventory (NSI)

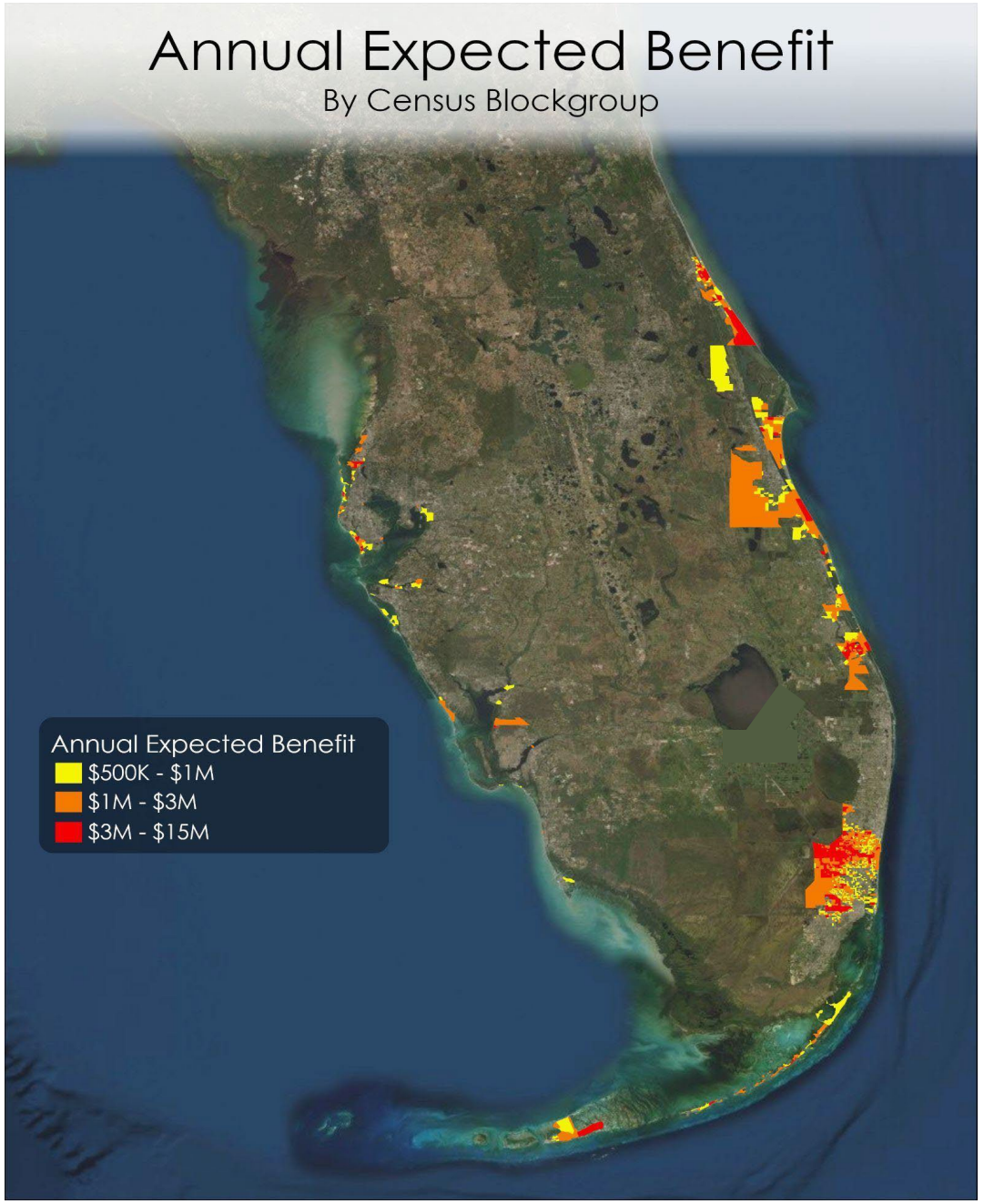
- Used FEMA's Flood Assessment Structure Tool (FAST) along with the NSI to evaluate expected building and content value loss as a function of flood depth.
- FAST uses depth-damage functions from USACE that are structure-specific and widely accepted.

Report 2 Results

Annual Expected Value and Present Value of Mangroves

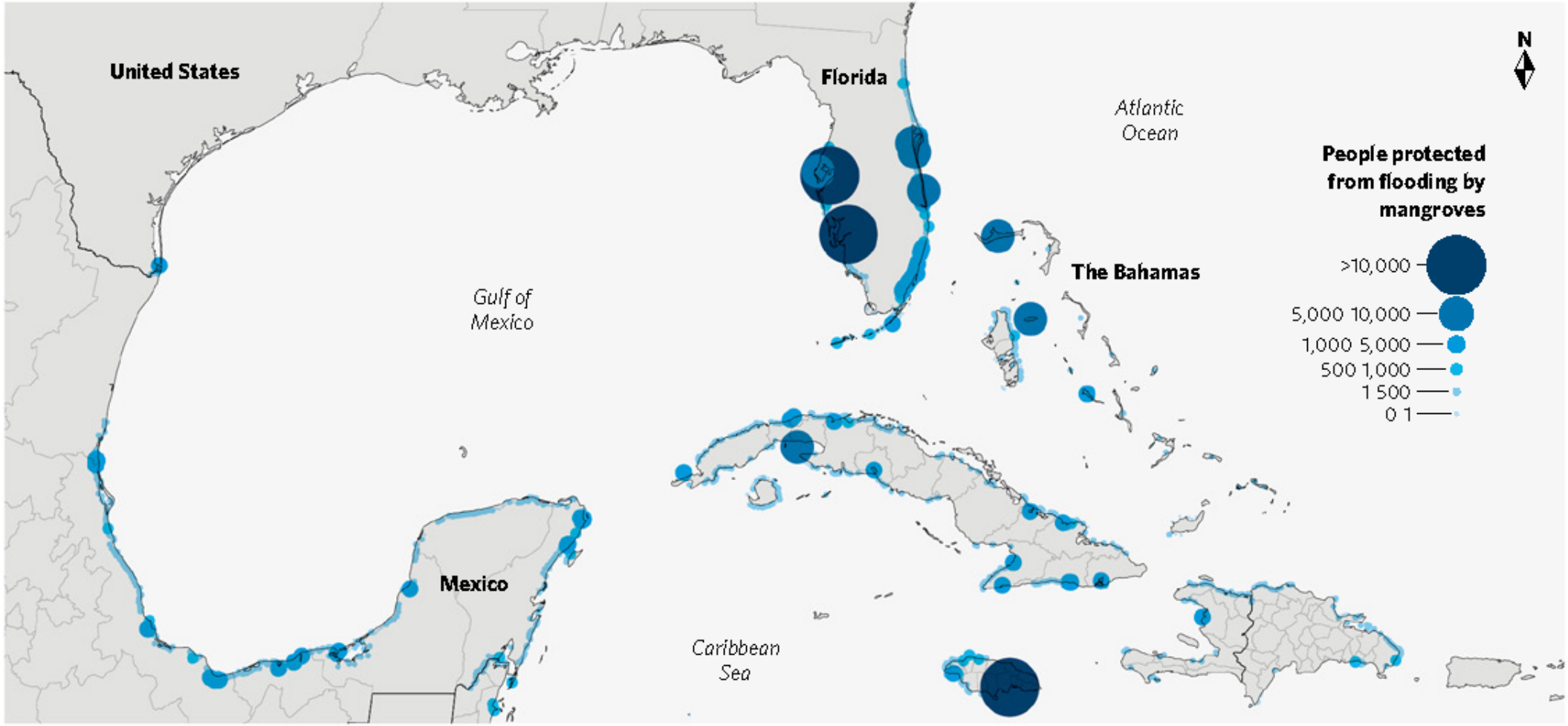
Annual Expected Benefits of mangroves for flood reduction to property by Census Block Group using NSI data and USACE depth-damage curves with the FEMA FAST tool. Total = $2.7 billion/year statewide.

Present Value: Applying discount rates of 4% and 7% for a 30-year period, NSI yields a statewide Present Value of mangrove benefits at $50 billion and $37 billion, respectively.



Social Impacts of Flooding - Annual Expected Benefits to People

In Florida, 191,820 people receive direct flood protection from mangroves every year

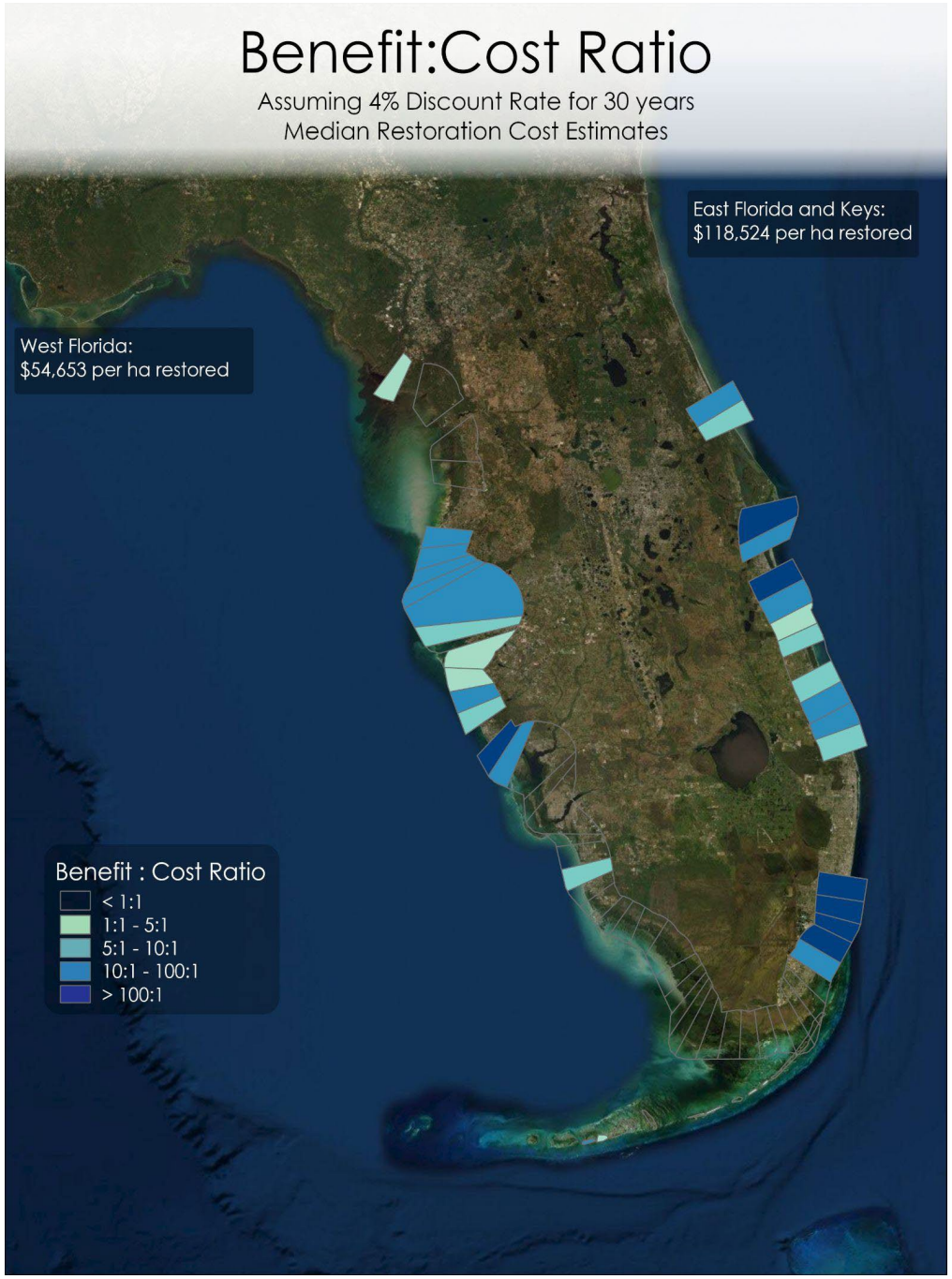


Report 2 Results, cont'd

Benefit to Cost Ratio for Restoring Mangroves

Used Project Cost and National Structure Inventory Data

Median project costs estimated at
$54,653 per hectare in western Florida
$118,524 per hectare in eastern Florida

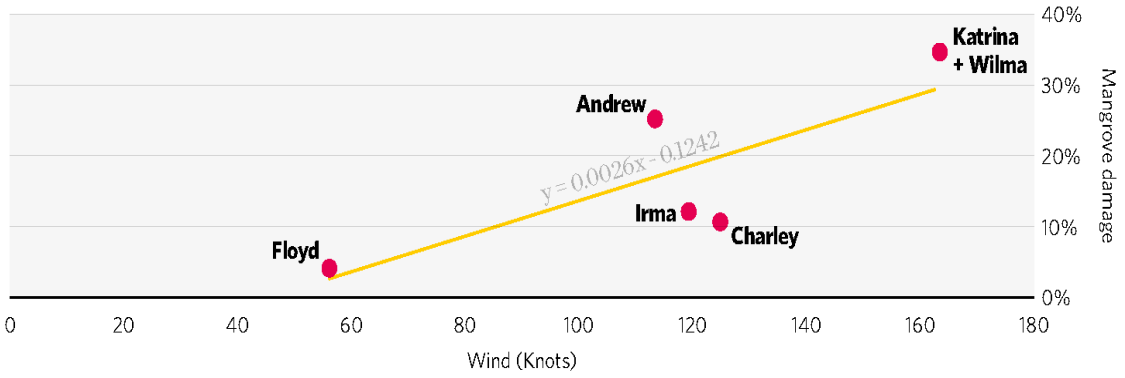


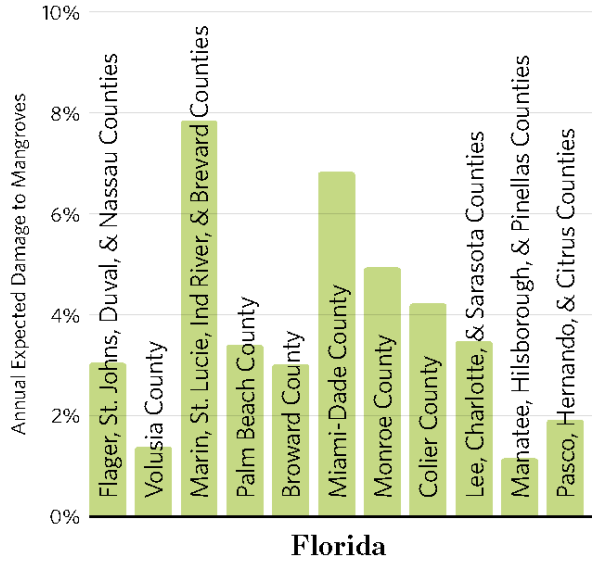
Report 2 Results, cont'd:

Mangrove Fragility Curve to assess the likelihood of mangrove loss to storms

- Developed a regression analysis based on Han et al (2018) mangrove damage values.
- Found positive correlation between wind speed and percent loss of mangroves.
- Calculated annual expected damages of mangroves in Florida is 3.75%
- Substantial variation across the state.

Name	Year	Wind (knots)	Category	Km² Pre-storm	Km² Post-storm	Damage (%)
Floyd	1987	57	1	1,300	1,240	4.6%
Andrew	1992	114	4	1,360	1,020	25.0%
Charley	2004	125	4	1,390	1,240	10.8%
Katrina Wilma	2005	66 95	1 3	1,240	800	35.5%
Irma	2017	120	4	1,480	1,300	12.2%

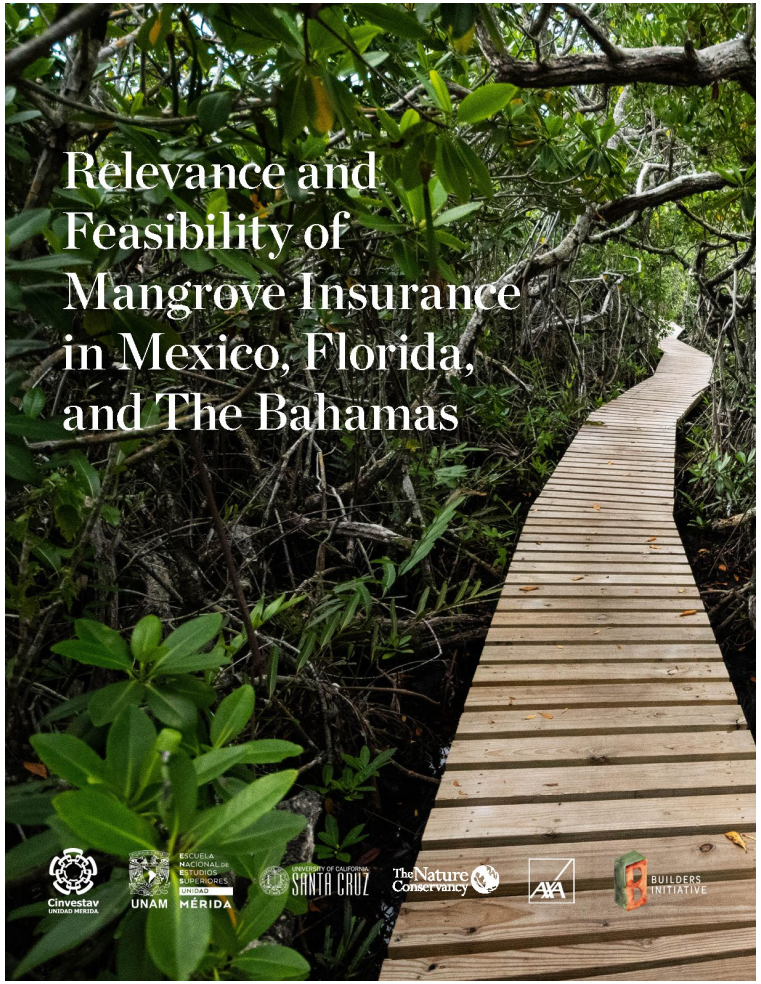




Report 3 – specific locations where restoration interventions are likely to be cost-effective

- Information from the first two reports is aggregated
- Specific areas are identified where a mangrove insurance policy would be most cost-effective.
- Summarizes the efforts of our market analysis in Mexico, Florida, and The Bahamas,
- Identifies specific locations where a mangrove insurance policy could be piloted.

All reports available next week



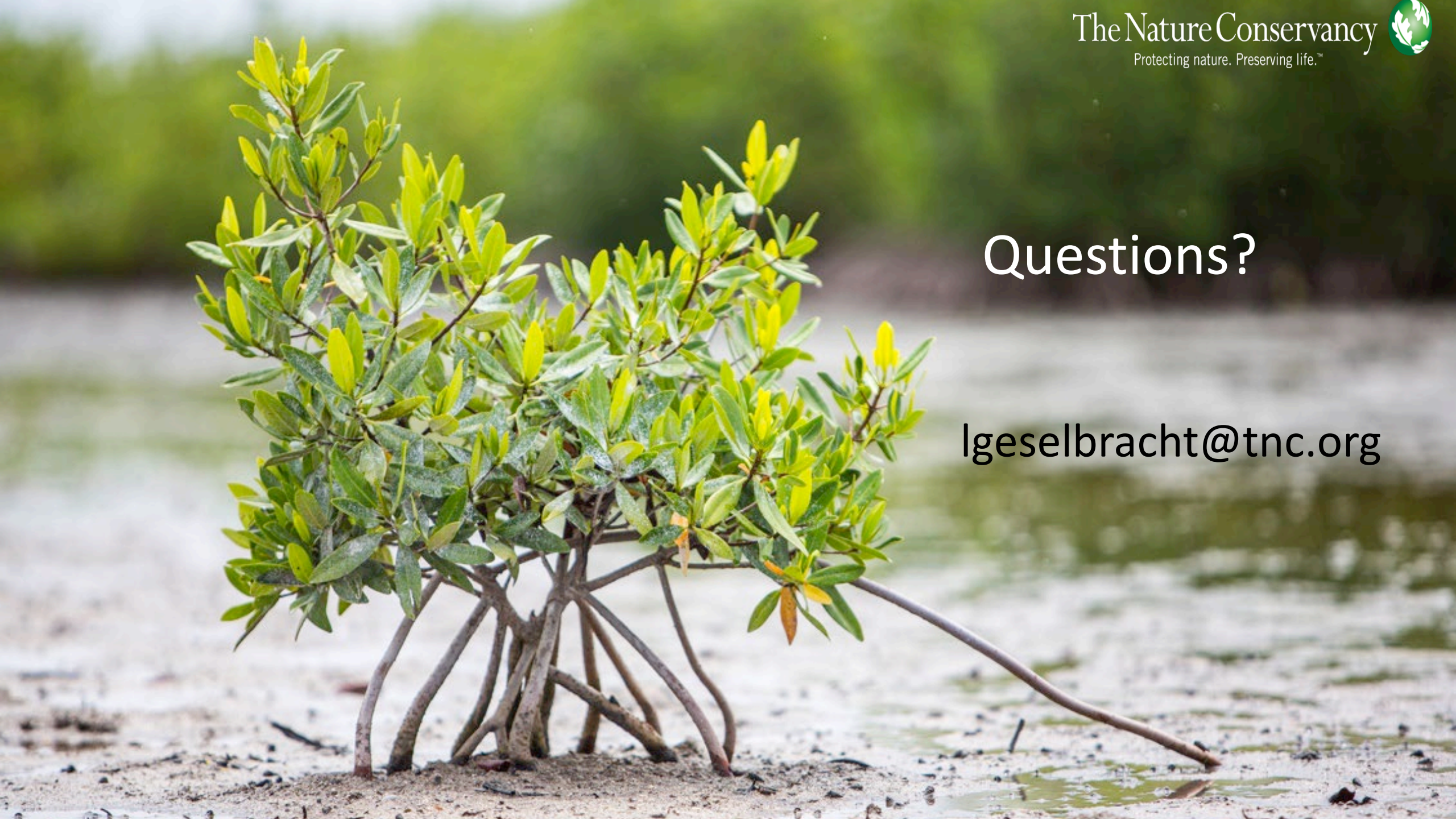
How to Use the Information in Study Reports

- Include natural assets in economic accounting
- Rethink infrastructure investments
- Allocate disaster recovery funds to repair natural defenses*

* Where feasible

SUMMARY

- Coastal habitats benefit lives & livelihoods
- These benefits can be rigorously valued
- Mangroves are cost effective for flood risk reduction
- More financing of mangrove conservation and restoration equals better outcomes for people and nature.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Questions?
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