The Benefits of a Multiple Habitat Restoration Strategy

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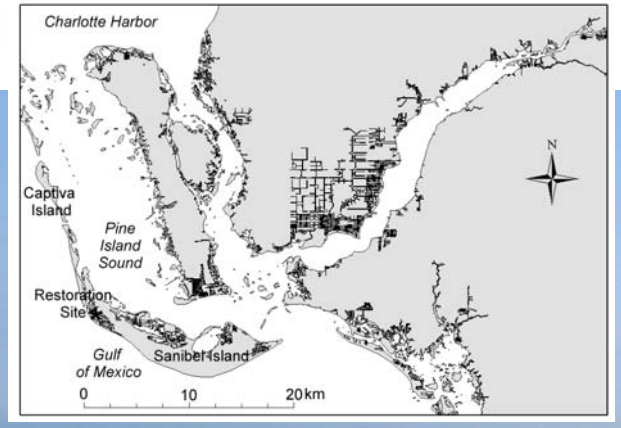
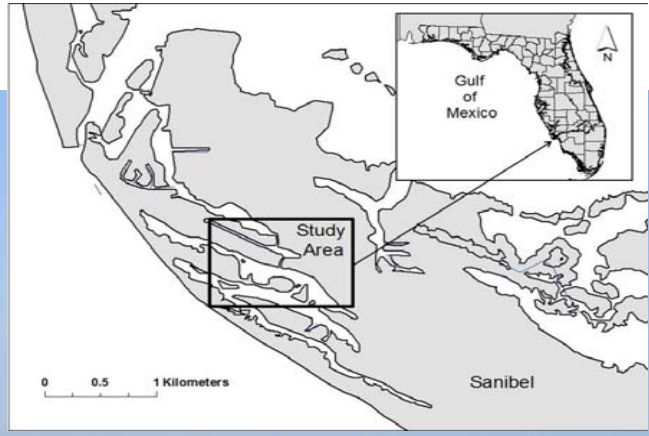
Mangrove & Macrobenthos Meeting (MMM4), St. Augustine, FL

Clam Bayou


Charlotte Harbor
Captiva Island
Pine Island Sound
Restoration Site
Gulf of Mexico
Sanibel Island
0
10
20km
N


Gulf of Mexico
N
Study Area
0
0.5
1 Kilometers
Sanibel

Multi-species dieoff

Valiela et al. Mangrove Forests: One of the World's Threatened Major Tropical Environments. Bioscience

Beck et al. Oyster Reefs at Risk and Recommendations for Conservation, Restoration, and Management Bioscience

2006-2009

#1: Get the hydrology right! (Robin Lewis)

A few years later....

Phase II: speeding recovery

2009-2011 100 yd^3 shell

2009-2011 500K propagules planted

5/24/2006

11/18/2012

5/24/2006

11/18/2012

5/24/2006

11/18/2012

5/24/2006

11/18/2012

5/24/2006

11/18/2012

5/24/2006

11/18/2012

2011

2013

2016

2010

2013

2016

Seagrass colonization (*H. wrightii*) in areas with planting and substrate addition

- **Unexpected benefits**

Seagrass colonization (*H. wrightii*) in areas with propagule planting?

**These need additional mechanistic studies

Ray Grizzle measured uptake of chl a at all restored reefs 3 yrs. post construction

More graphs and data…

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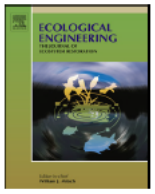

A multiple habitat restoration strategy in a semi-enclosed Florida embayment, combining hydrologic restoration, mangrove propagule plantings and oyster substrate additions

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ABSTRACT

Habitat loss and disturbance are ranked globally as the greatest threats to biodiversity. Development and coastal population growth are the leading causes for habitat losses. Recently, the restoration of marine habitats has increased, especially with the goal of increasing non-consumptive ecosystem services derived from mangrove and submerged aquatic vegetation (SAV) along with biogenic oyster reefs. Habitats reside in landscapes dominated by multiple species. Rather than focusing on a single habitat such as oysters or mangroves or SAV, we took an approach restoring multiple adjacent habitats to accelerate restoration in a Florida embayment that had been significantly degraded prior to the restoration of natural tidally generated flows. After a multiple habitat die-off, a project was initiated in 2006 to reintroduce tidal flushing. The re-introduction of tidal flushing, however, did not result in immediate recovery of mangrove shorelines or oyster-dominated reefs. There was a lack of mangrove propagule production and significant substrate limitation in areas with appropriate salinity, sediment and tidal flows. From 2009–2012, red mangrove (*Rhizophora mangle*) propagules were collected (over

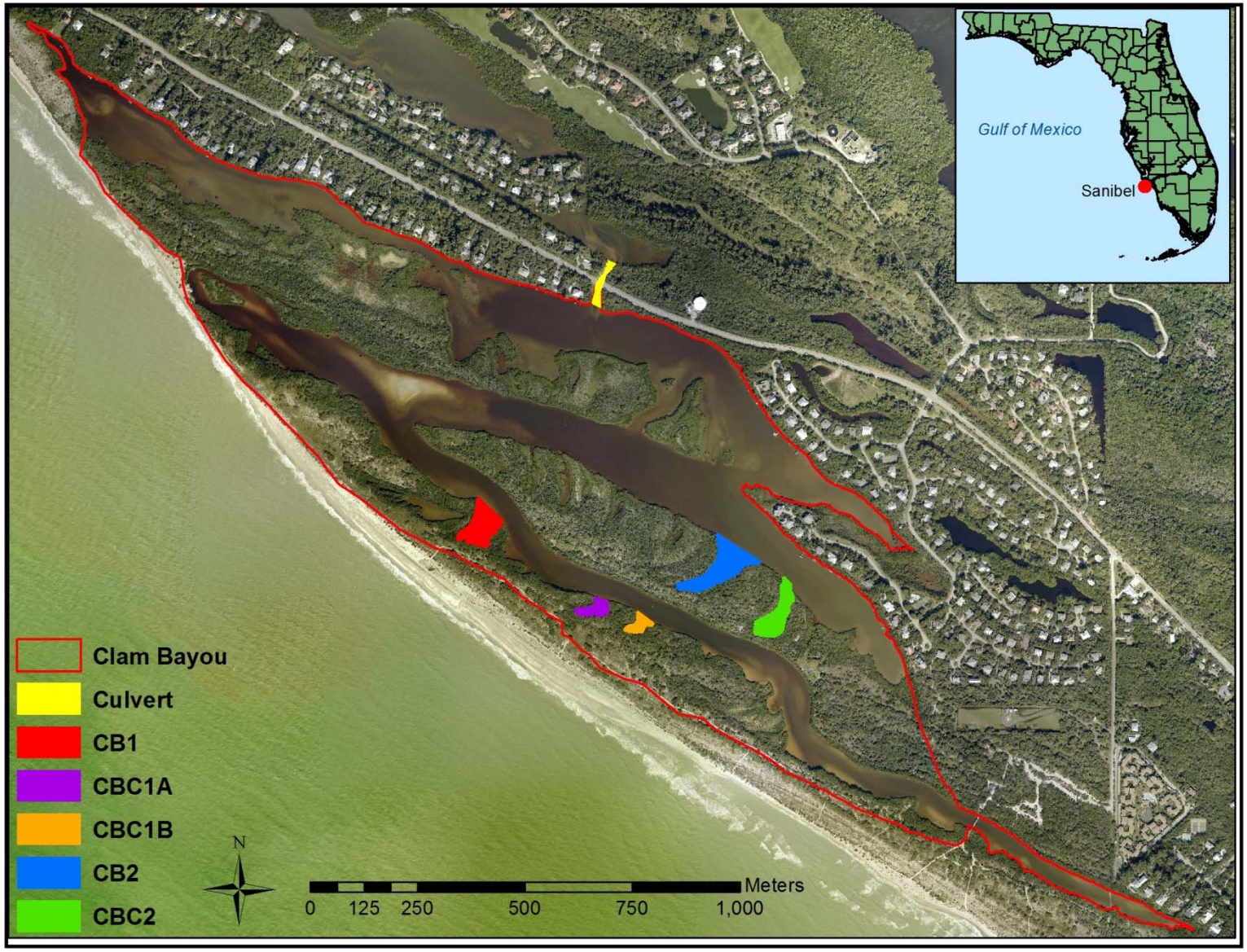
Planted vs. Unplanted

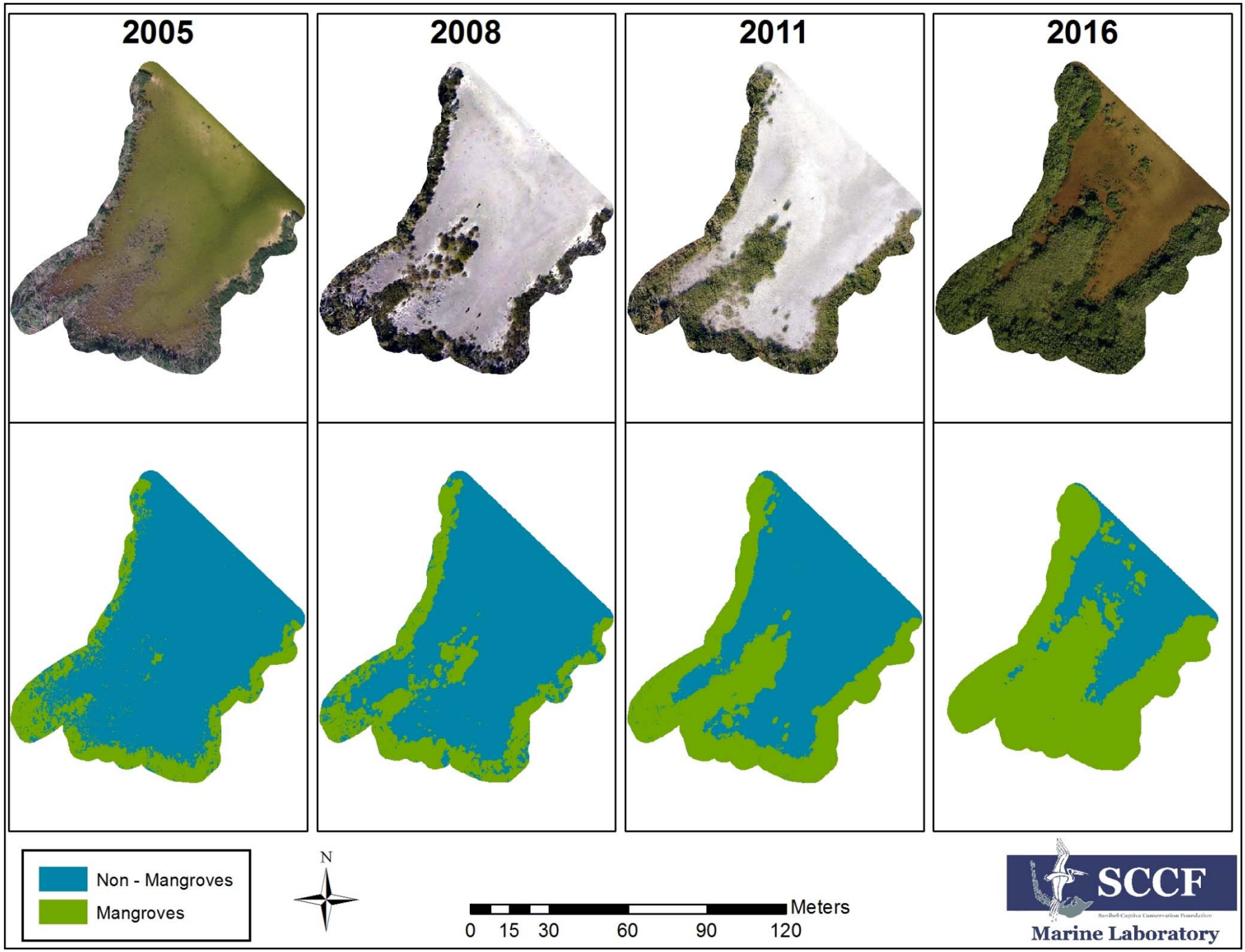
Comparisons of planted versus unplanted sites*

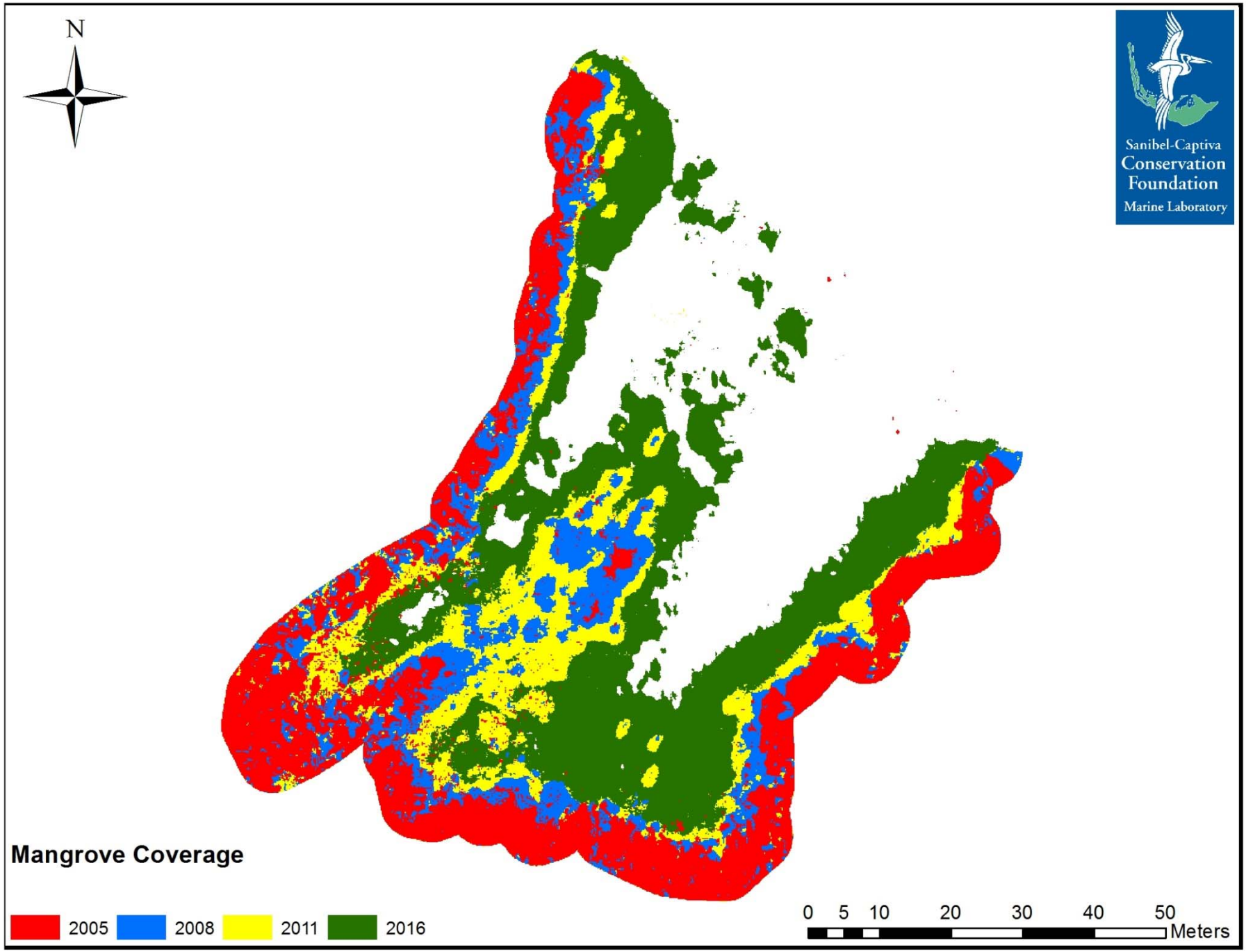
Category	Sample size	2005-2008	2010-2013	2013-2016
Planted (hectares)	9 sites	$4.4X10^{-4}$	$4.8\ X10^{-4}$	$7.6X10^{-4}$
Unplanted (hectares)	6 sites	$2.7X10^{-4}$	$1.7X10^{-4}$	$3.2X10^{-4}$

*Aerial interpretation

New Analysis for MMM4-Special Issue?




2005
2008
2011
2016
Non - Mangroves
Mangroves
N
0 15 30 60 90 120
Meters
SCCF
Sanibel-Captiva Conservation Foundation
Marine Laboratory


N
Sanibel-Captiva
Conservation
Foundation
Marine Laboratory
Mangrove Coverage
2005
2008
2011
2016
0 5 10 20 30 40 50
Meters

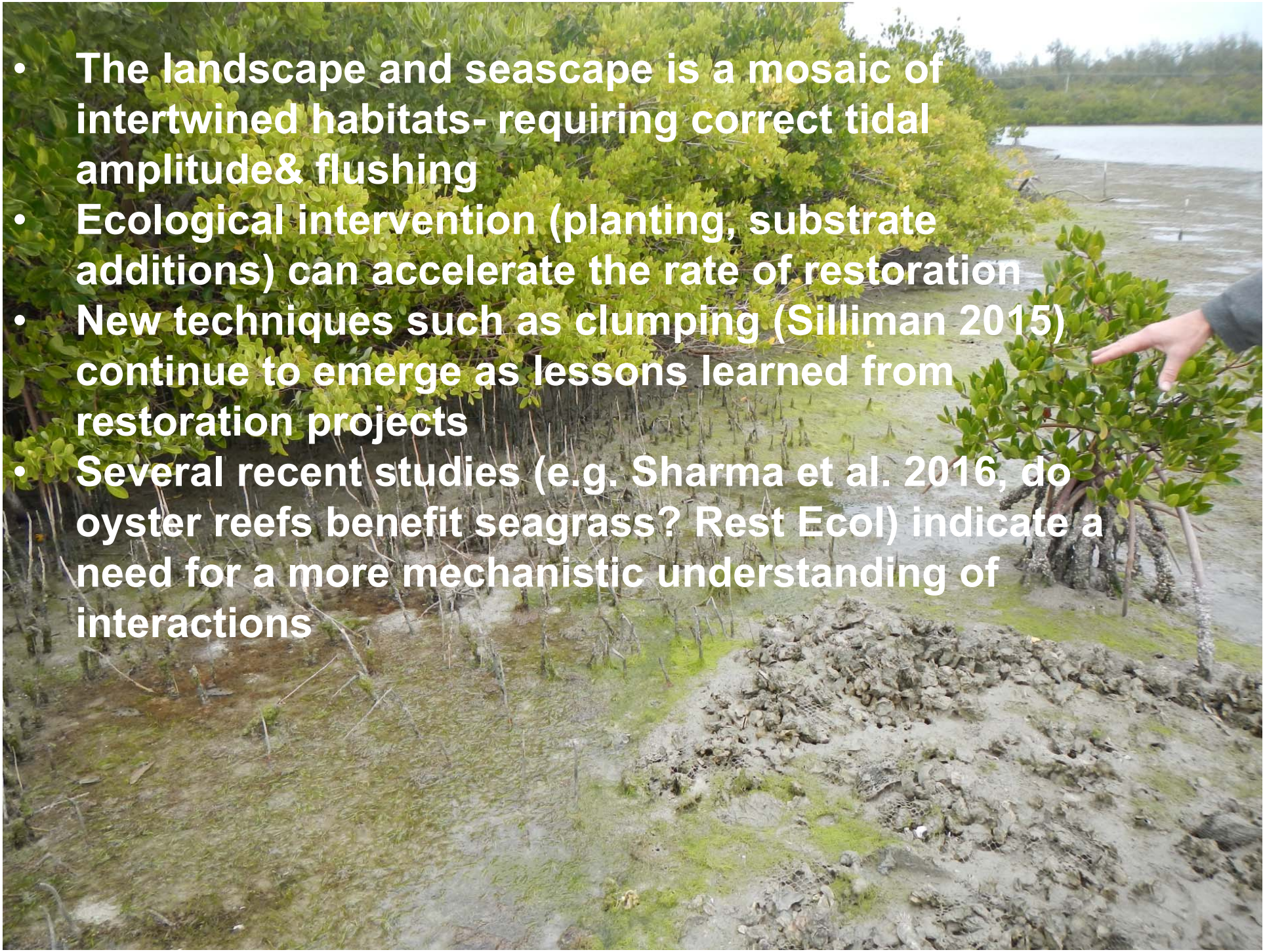
Rapid expansion of the Mangrove Shoreline

	Mangrove Area (m2)	Percent change since 2005
Planted Area 1		
2005	1,411	-
2008	1,851	31
2011	2,811	99
2016	4,730	235
Unplanted 1 (Control)		
2005	956	-
2008	1028	7
2011	1147	20
2016	1434	50

Supervised Classification: Maximum Likelihood Classification (ArcGIS v. 10.2)

Mangrove Shoreline

	Mangrove Area (m2)	Percent change since 2005
Planted Area 2		
2005	2132	-
2008	1841	-14
2011	2229	5
2016	3488	64
Unplanted 2 (Control)		
2005	1610	
2008	1486	-8
2011	1858	15
2016	2601	50



- The landscape and seascape is a mosaic of intertwined habitats- requiring correct tidal amplitude& flushing
- Ecological intervention (planting, substrate additions) can accelerate the rate of restoration
- New techniques such as clumping (Silliman 2015) continue to emerge as lessons learned from restoration projects
- Several recent studies (e.g. Sharma et al. 2016, do oyster reefs benefit seagrass? Rest Ecol) indicate a need for a more mechanistic understanding of interactions

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