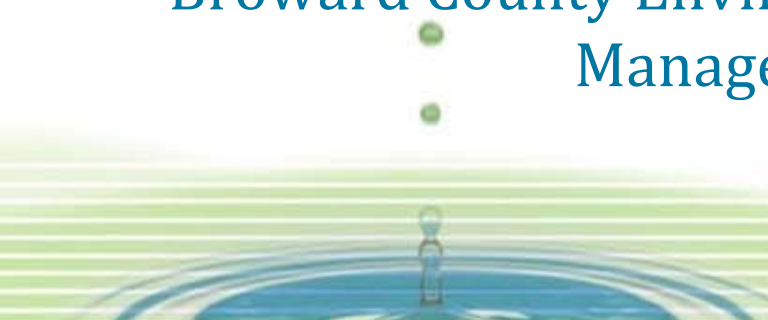


A close-up of a green leaf with a single water droplet hanging from its tip, set against a bright, cloudy sky.

SOUTHEAST FLORIDA PARADISE CHANGING

Nancy J. Gassman, Ph.D.
**Natural Resources Planning
and Management Division**

Broward County Environmental Protection and Growth
Management Department



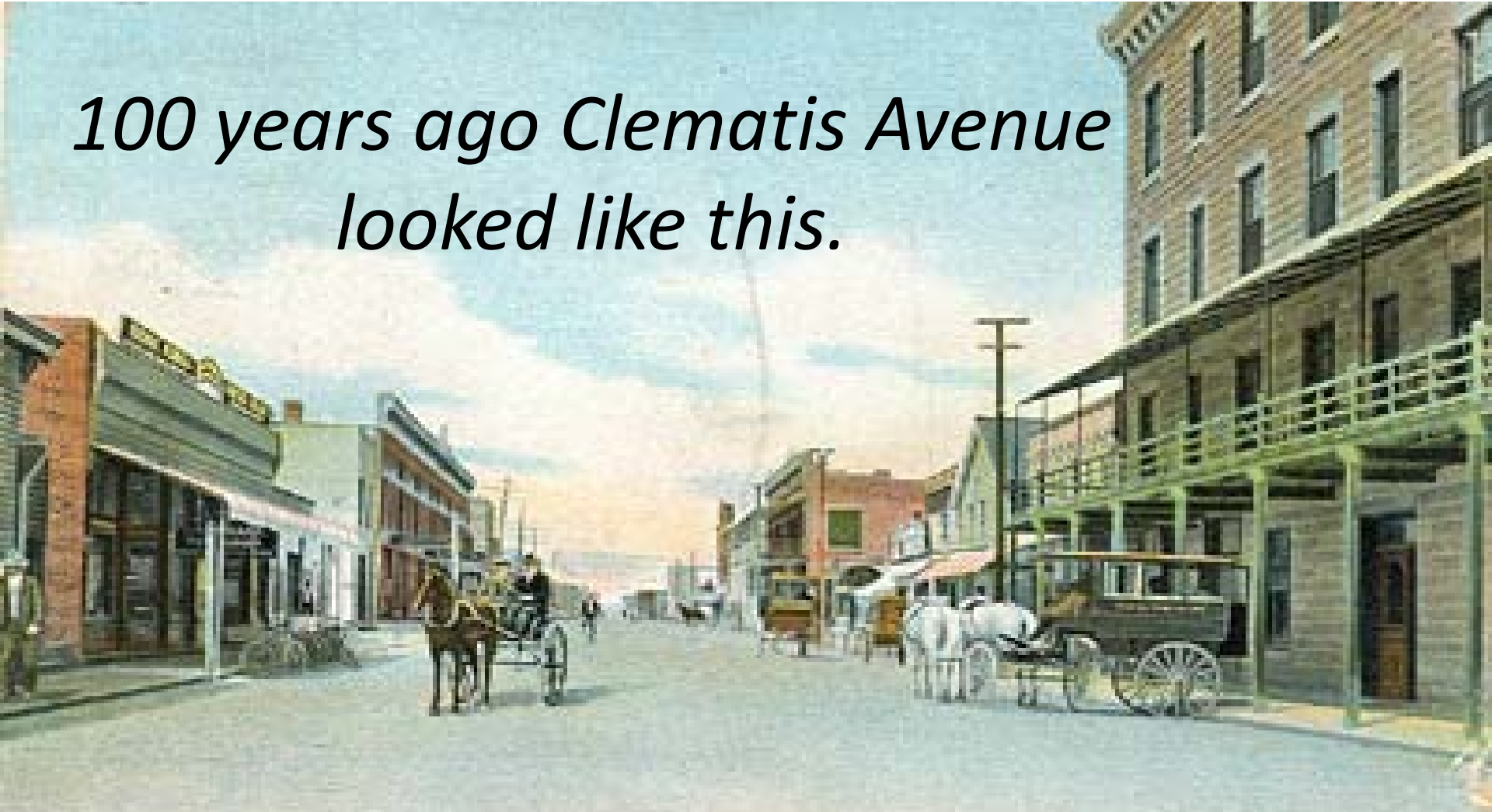


Overview

- **Change is constant**
- **Climate change in Southeast Florida**
- **Assessing the risks from sea level rise**
- **Topics for regional cooperation**

Change is Constant.

*100 years ago Clematis Avenue
looked like this.*



Change is Constant.



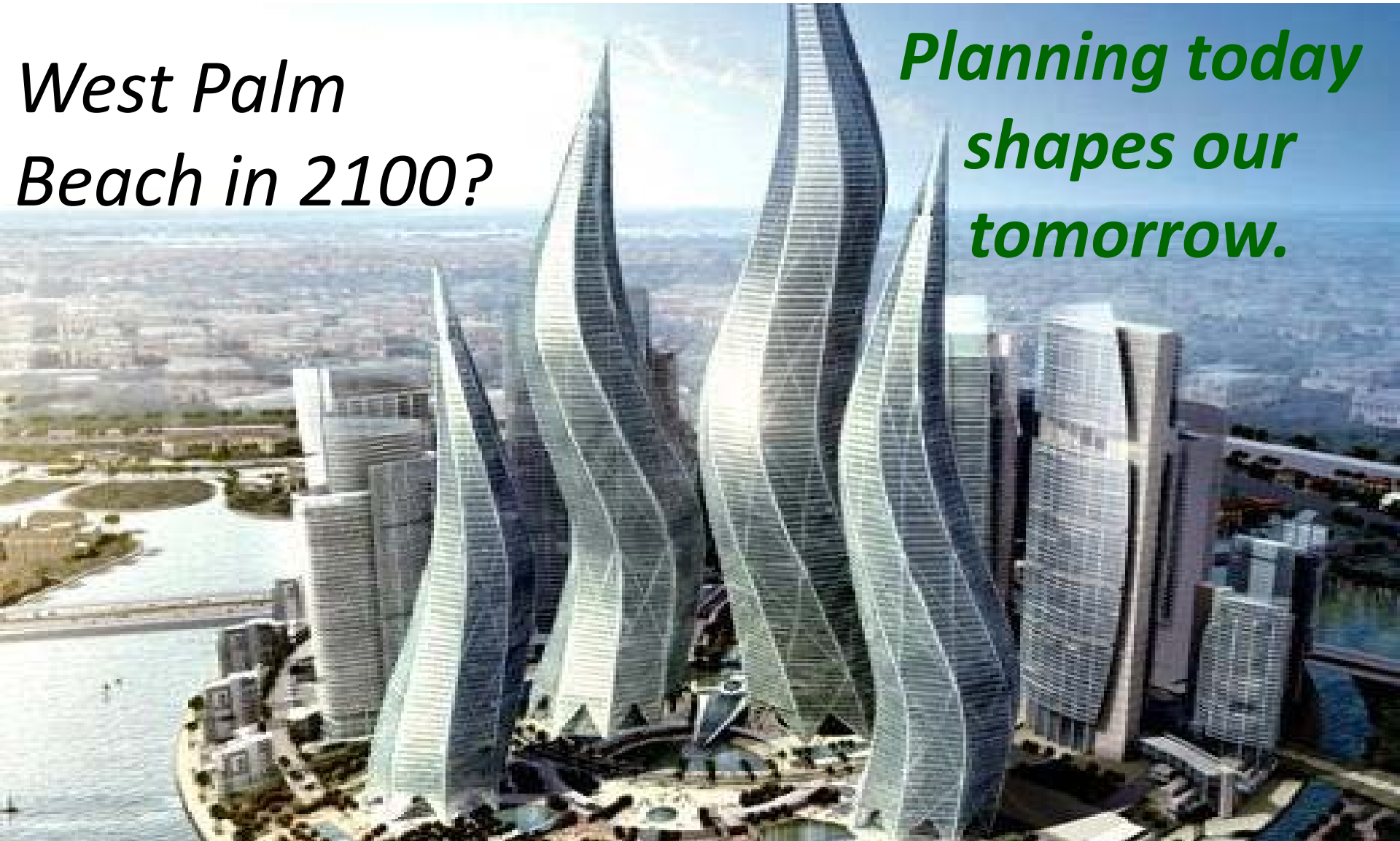
*Clematis Avenue
today*



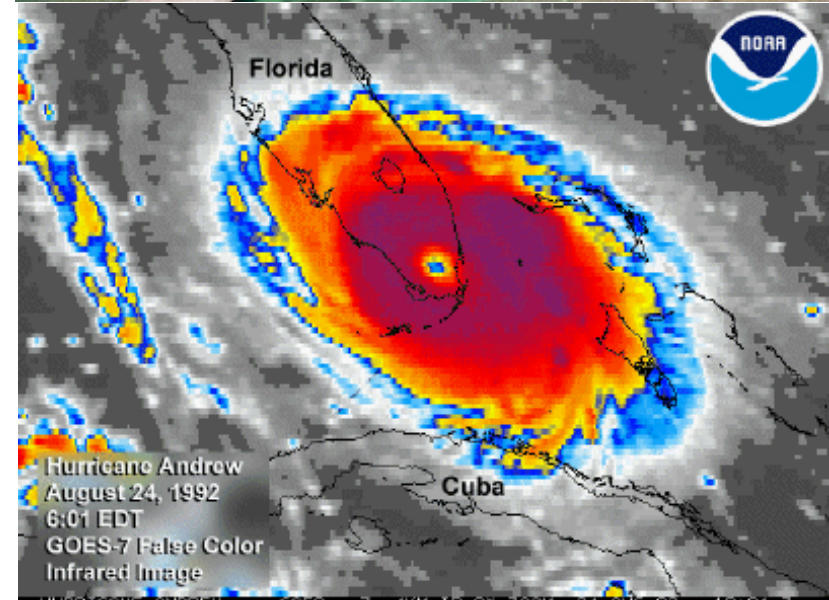
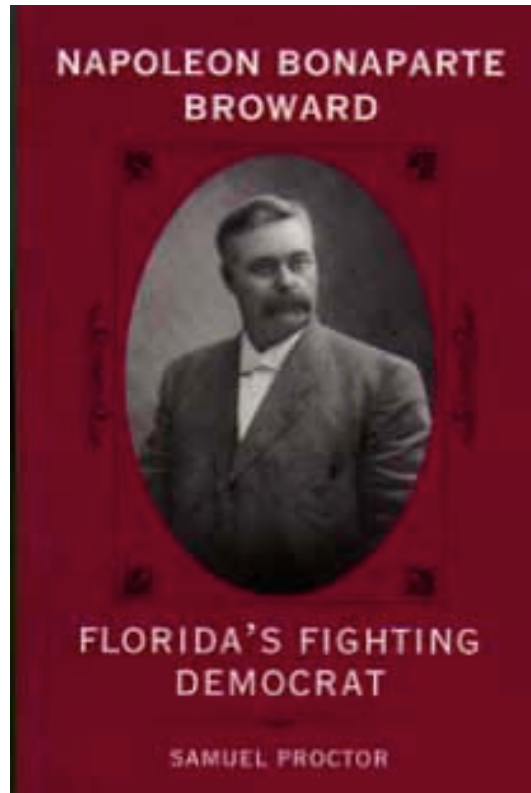
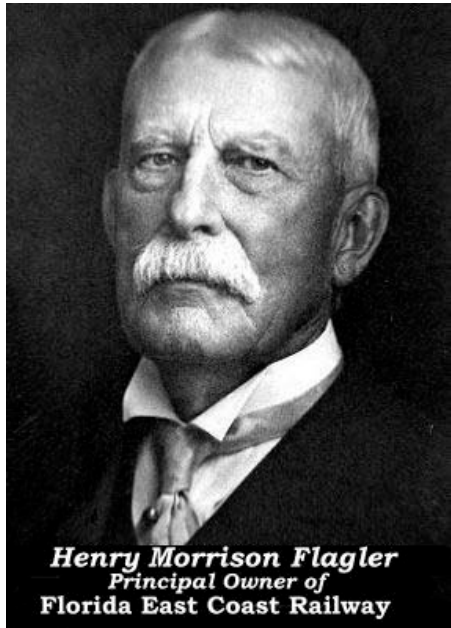
Change is Constant and Inevitable.

*West Palm
Beach in 2100?*

*Planning today
shapes our
tomorrow.*



Past Agents of Change





Looking Forward

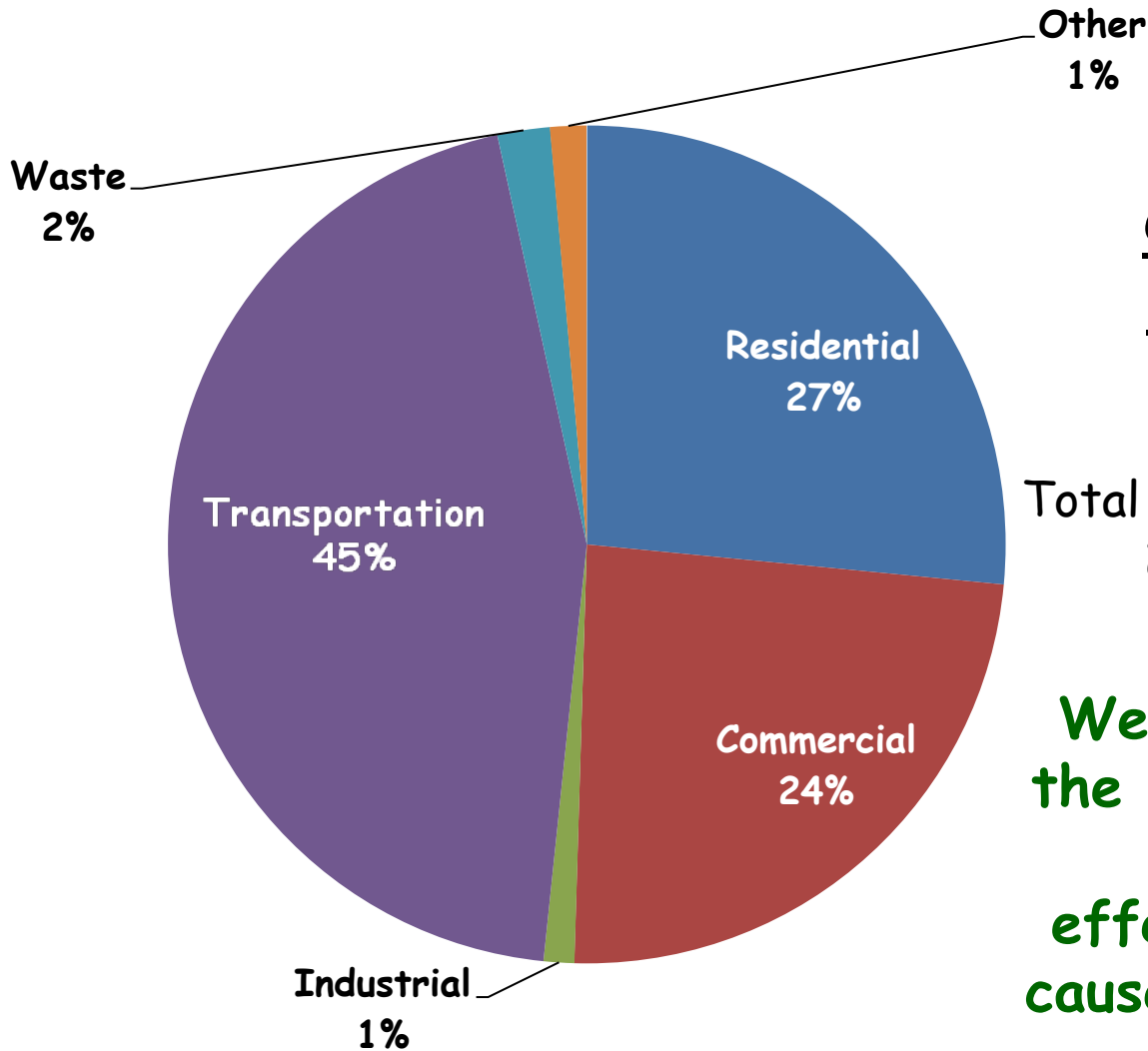
- **Global warming** and its impacts will be a dominant agent of change in SE Florida.
- Our community in 2030, 2050, or 2100 will be very different than that of 2009.
- Action including careful coordinated planning is needed to sustain our economy and to ensure a resilient SE FL community.

Characteristics Across Borders



- **Low lying coastal community**
- **Tourist-based economy**
- **Seagrass to sawgrass ecosystem**
- **Common airshed, a watershed, and a climate.**
- **Regional transportation system**
- **Valued quality of life**

Local Contributors to Climate Change



2007 Broward Community-wide Greenhouse Gas Emissions

Total Community-wide Emissions
22.3 M tonnes eCO₂

We need to understand
the source of greenhouse
gas emissions to
effectively mitigate the
causes of climate change.

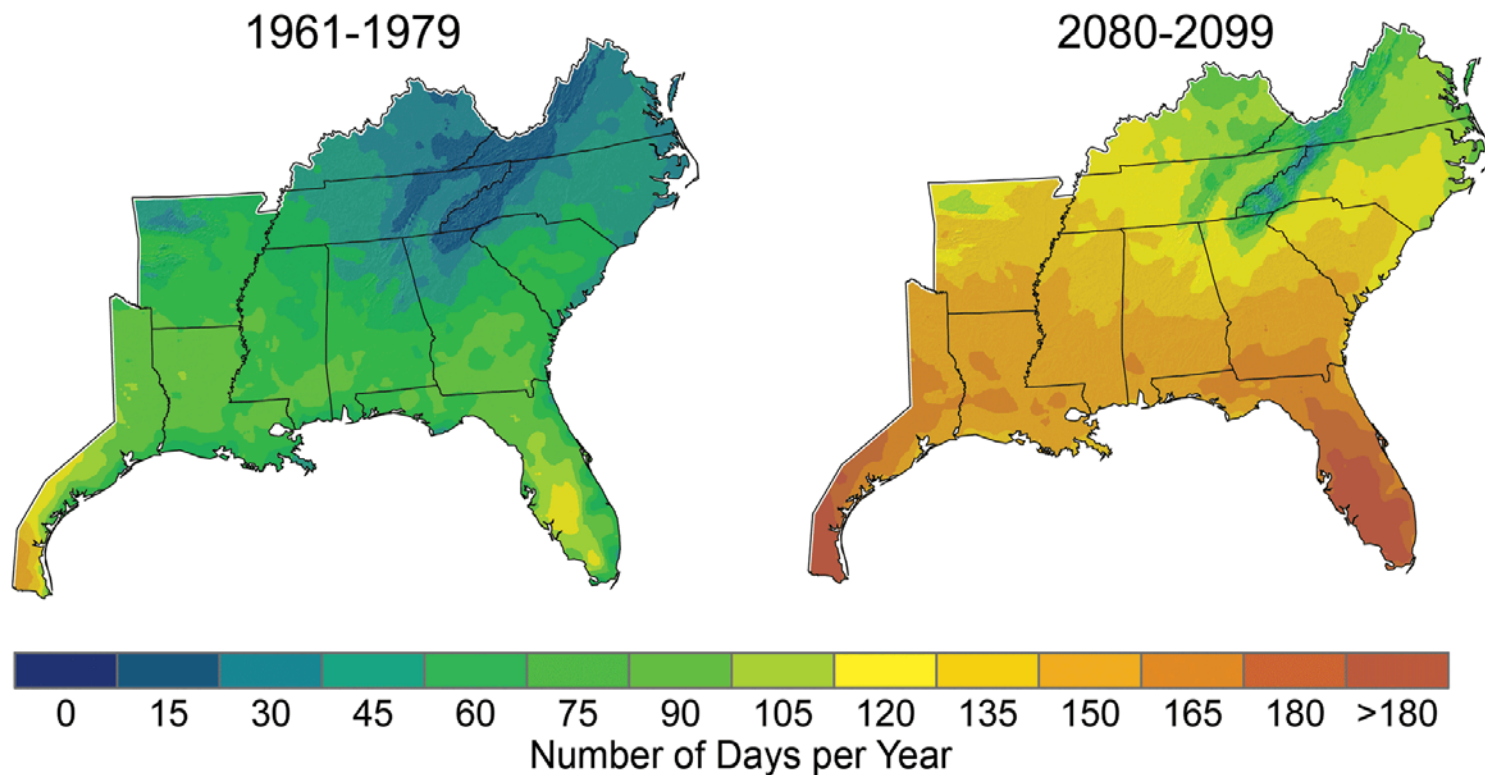


Climate Change Impacts in in Southeast Florida

- *Increasing Temp (2 to 10°F) by 2100*
- *Increasing occurrence of extreme weather*
 - *hotter summers*
 - *drier droughts*
 - *wetter rainy seasons*
- *Change in the growing season*
- *Sea level rise (2-5 feet) by 2100*
- *Potential change in the frequency and intensity of tropical storms*

Local Impacts From Climate Change

From 60 days $>90^{\circ}\text{F}$ in the past to 180 days in the future.



CMIP3-B¹¹⁷

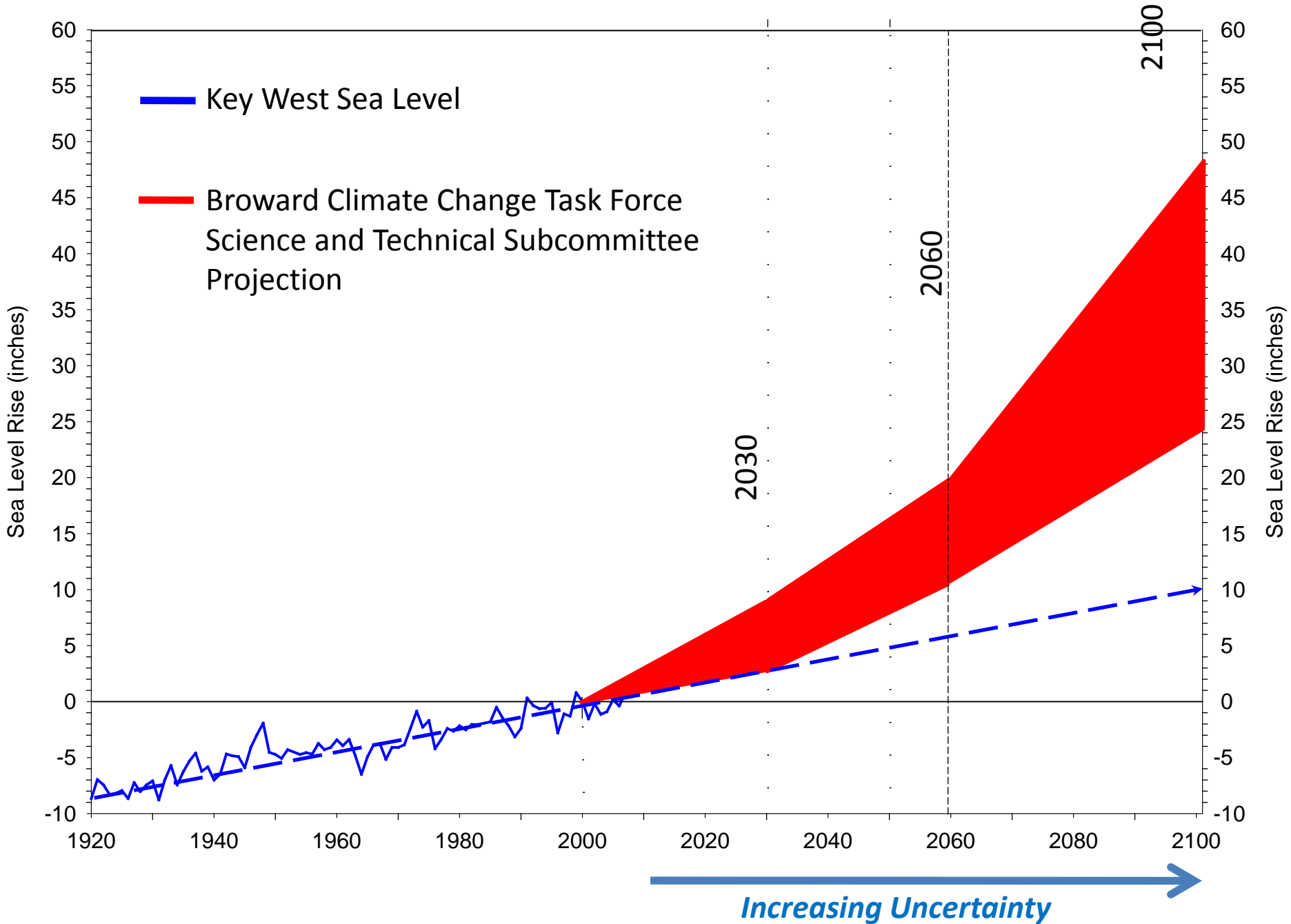
The number of days per year with peak temperature over 90°F is expected to rise significantly, especially under a higher emissions scenario⁹¹ as shown in the map above. By the end of the century, projections indicate that North Florida will have more than 165 days (nearly six months) per year over 90°F , up from roughly 60 days in the 1960s and 1970s. The increase in very hot days will have consequences for human health, drought, and wildfires.

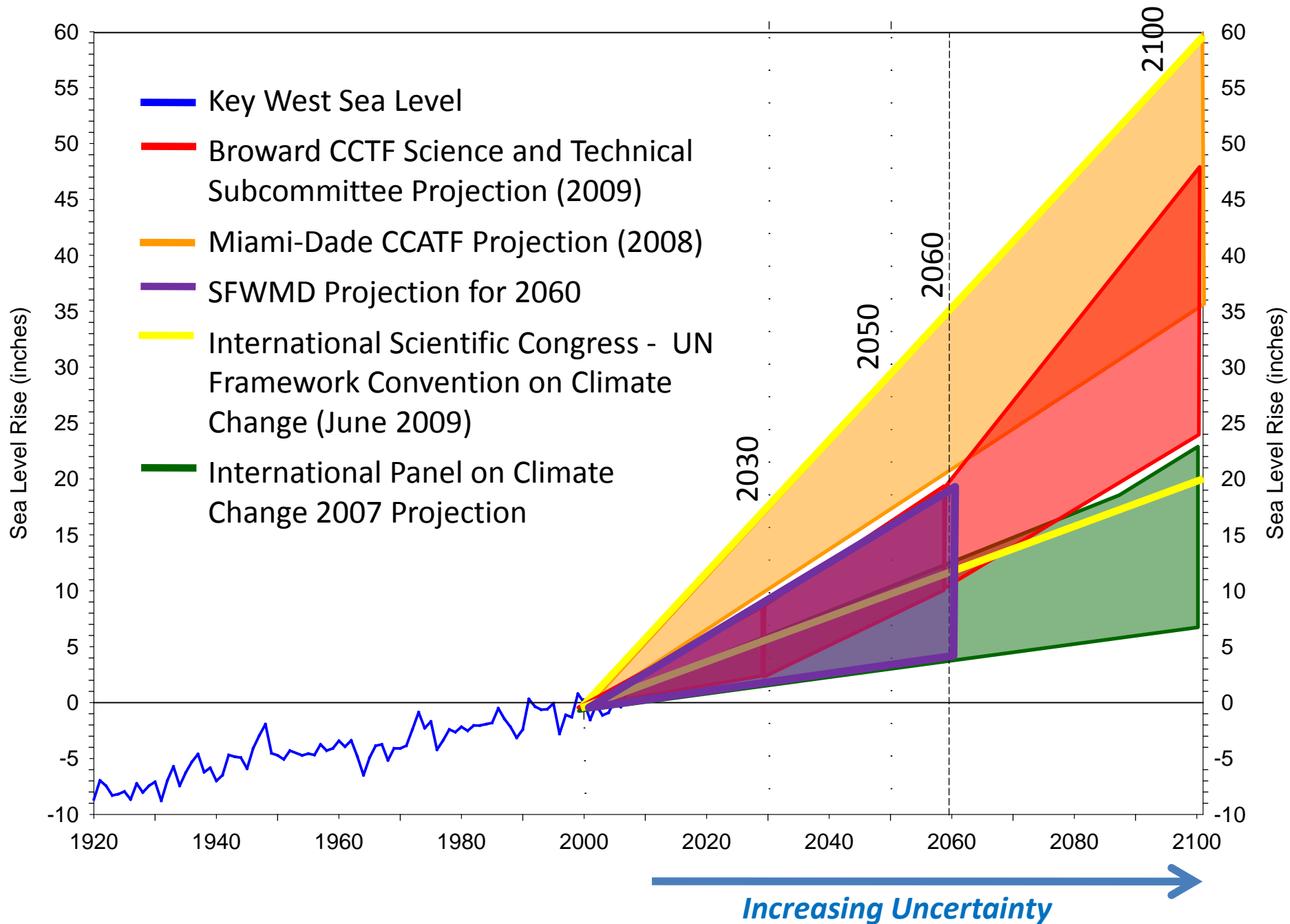
Local Impacts From Climate Change

Sea Level Rise Implications for SE Florida

- Saltwater intrusion into our aquifer
- Drainage and flood control compromised
- Impacts to public and private infrastructure
- Beach erosion
- Impacts to coral reefs
- Impacts to Everglades

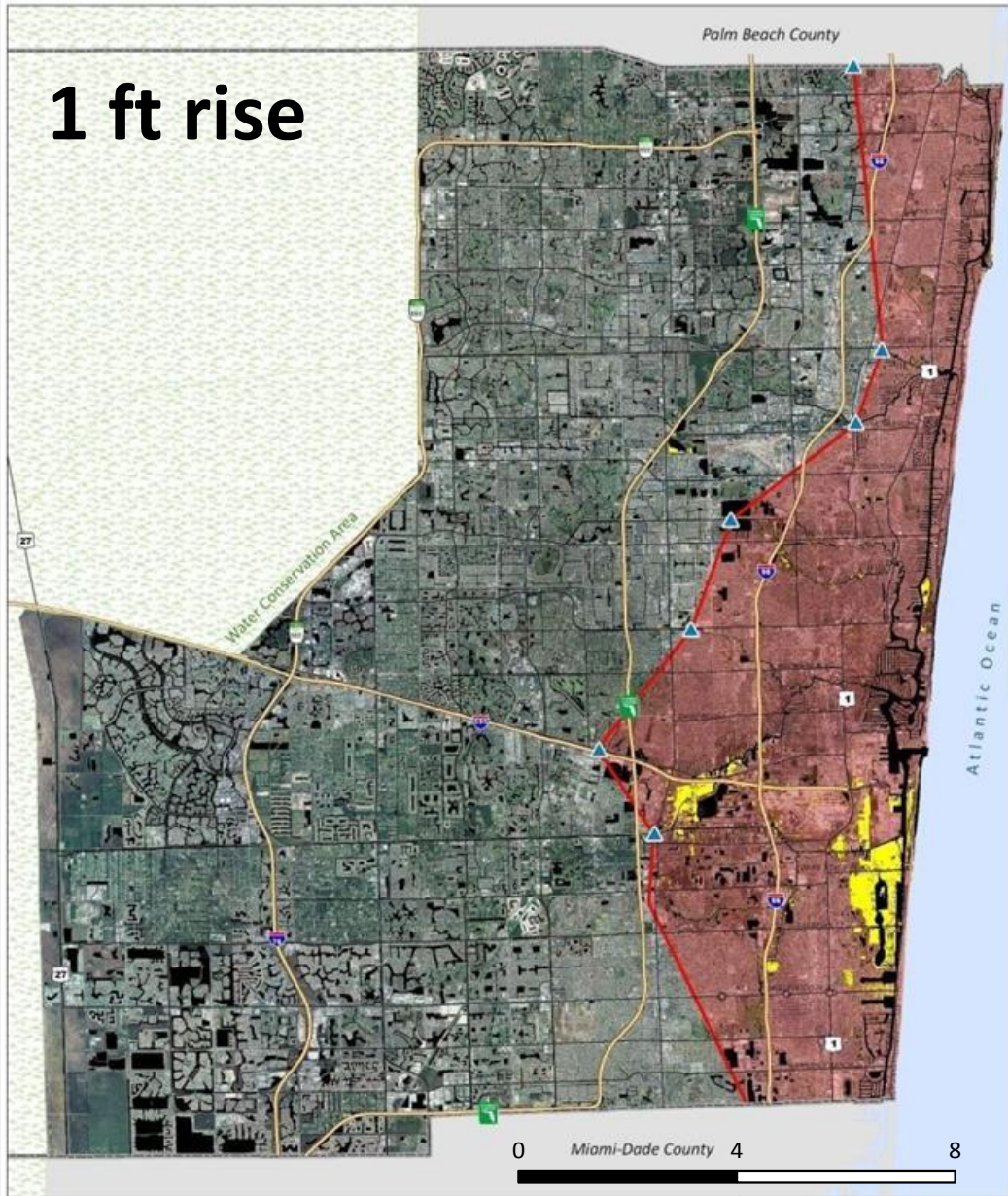






AREAS AT RISK OF TIDAL FLOODING DUE TO SEA LEVEL RISE (1 FOOT)

1 ft rise



UNDERSTANDING OUR VULNERABILITIES

At Risk in Broward:

- 1934 households
(4151 residents)
- 182 business
(1812 employees)
- Property worth ~ \$469M
- Library/park/natural area
- 4 major roads including:
Hollywood Blvd
Ocean Dr / A1A
Dania Beach Blvd
Sheridan St

LEGEND



Broward County Salinity Control Structures



General area directly affected by tides



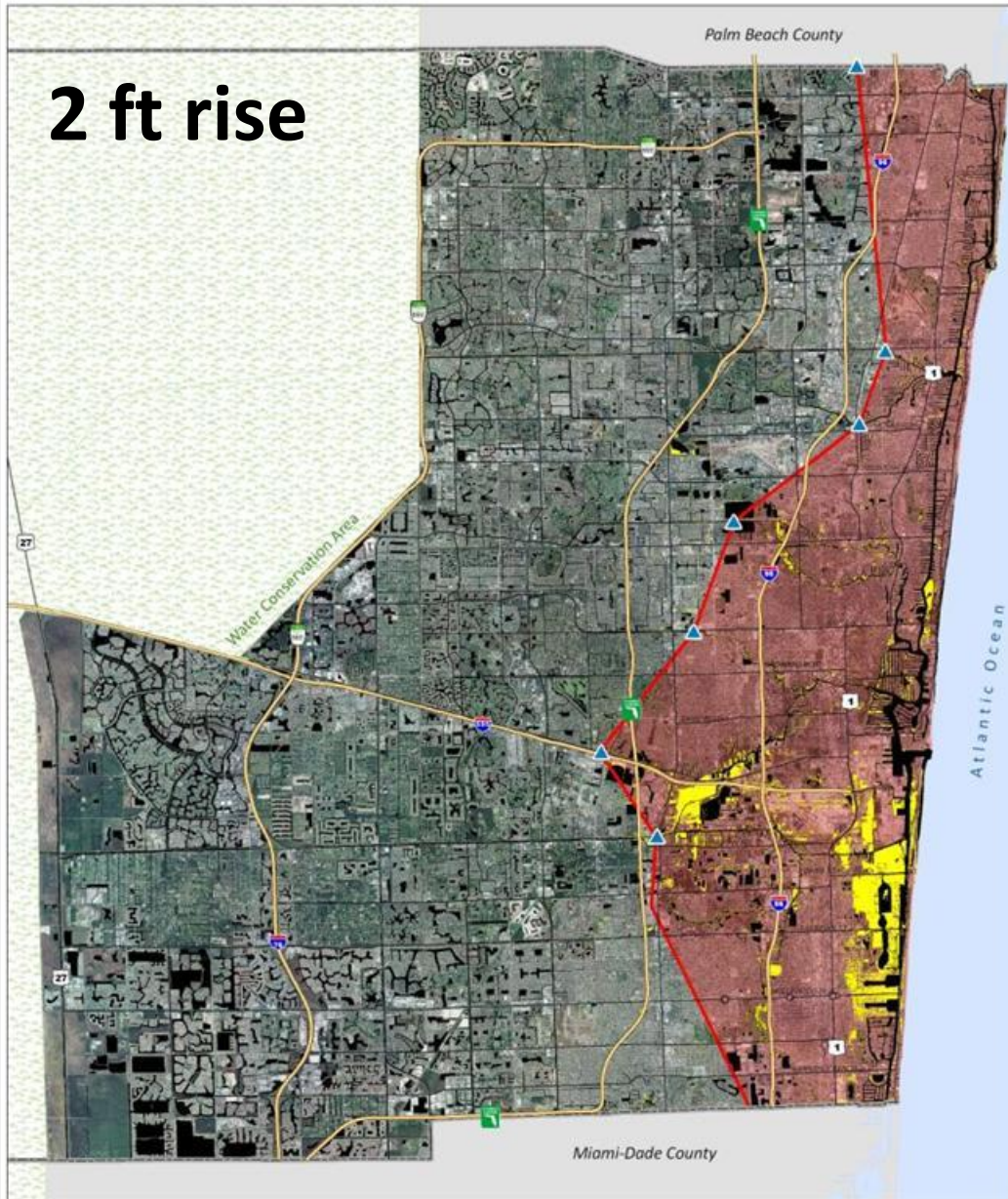
Area at Risk

DRAFT




emagraw August 2009

AREAS AT RISK OF TIDAL FLOODING DUE TO SEA LEVEL RISE (2 FOOT)

2 ft rise



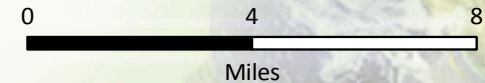
LEGEND

-  Broward County Salinity Control Structures
-  General area directly affected by tides
-  Area at Risk

Sea level rise is based on additional water above the mean higher-high water (MHHW) value. MHHW is defined as the average of the higher high water height of each tidal day. MHHW was calculated from tidal station data along the coast of Broward County during the 1983-2001 epoch and represents approximately 6 inches of elevation on the LiDAR. This value was provided by NOAA Tide and Currents.

LiDAR point elevation error: +/- 0.21 feet (2.52 inches)
 LiDAR flown: 2007 - 2008
 H: North American Datum 1983 HARN Feet
 V: North American Vertical Datum 1988 (NAVD88) Feet

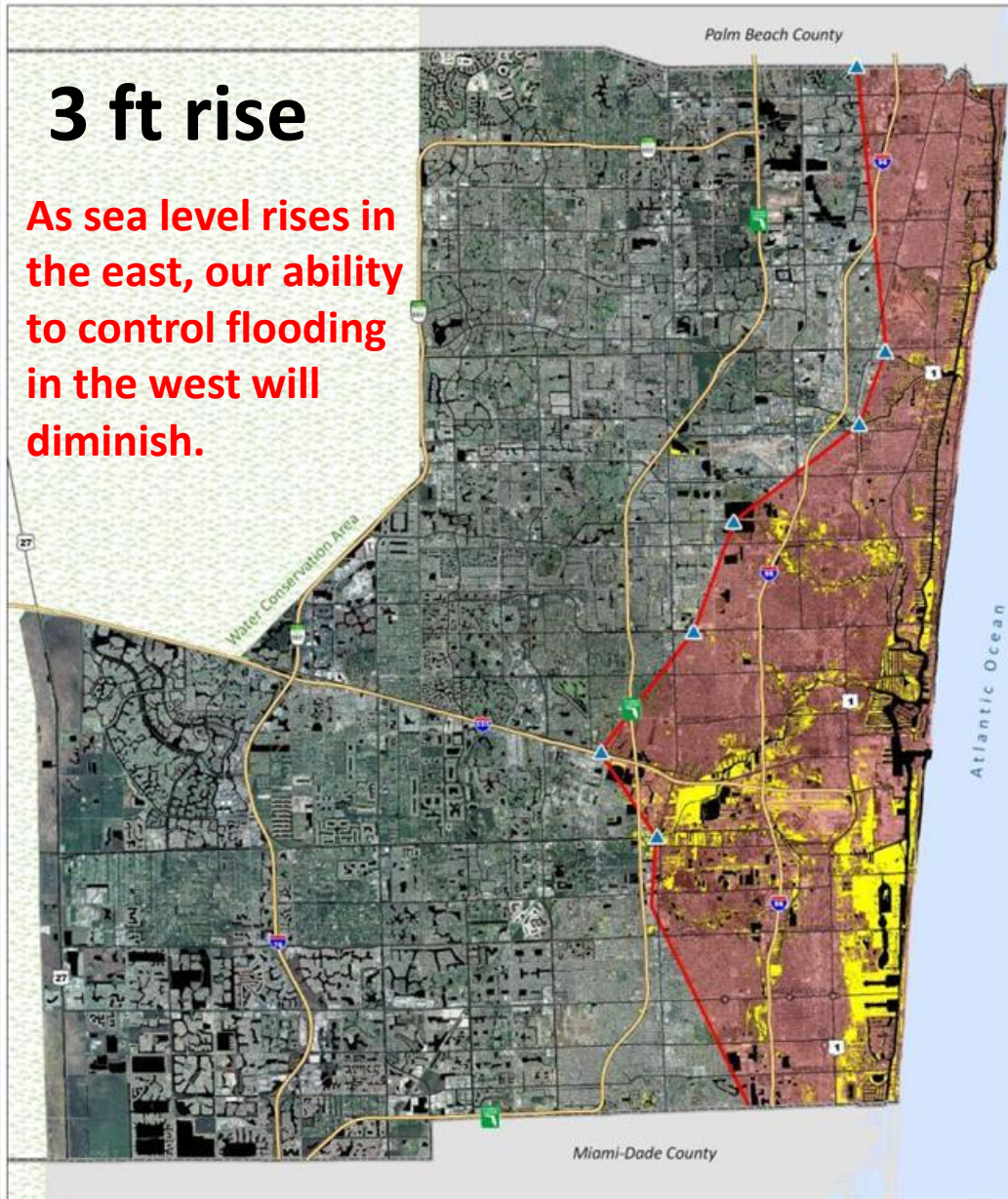
LiDAR point elevations provided by:
 Florida Division of Emergency Management






AREAS AT RISK OF TIDAL FLOODING DUE TO SEA LEVEL RISE (3 FOOT)

3 ft rise

As sea level rises in the east, our ability to control flooding in the west will diminish.



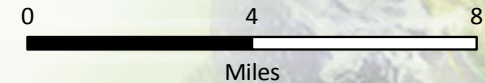
LEGEND

-  Broward County Salinity Control Structures
-  General area directly affected by tides
-  Area at Risk

Sea level rise is based on additional water above the mean higher-high water (MHHW) value. MHHW is defined as the average of the higher high water height of each tidal day. MHHW was calculated from tidal station data along the coast of Broward County during the 1983-2001 epoch and represents approximately 6 inches of elevation on the LiDAR. This value was provided by NOAA Tide and Currents.

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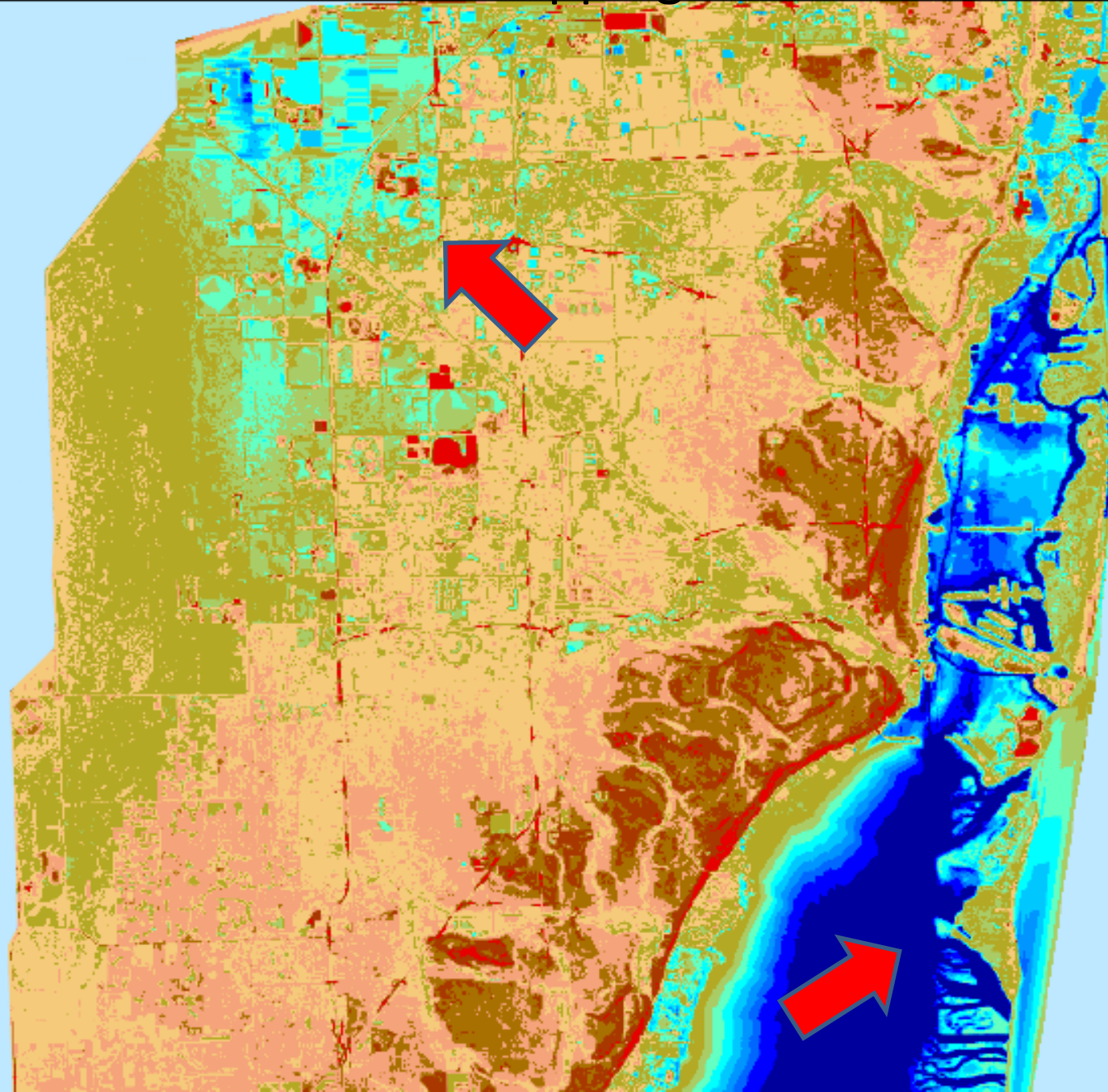


Miami-Dade DERM – Inundation Mapping Scenarios – 0 ft

Legend

Current Sea level

IN FEET NAVD 88





Miami-Dade DERM – Inundation Mapping Scenarios – 1 ft

Legend

STATIC SEA LEVEL RISE

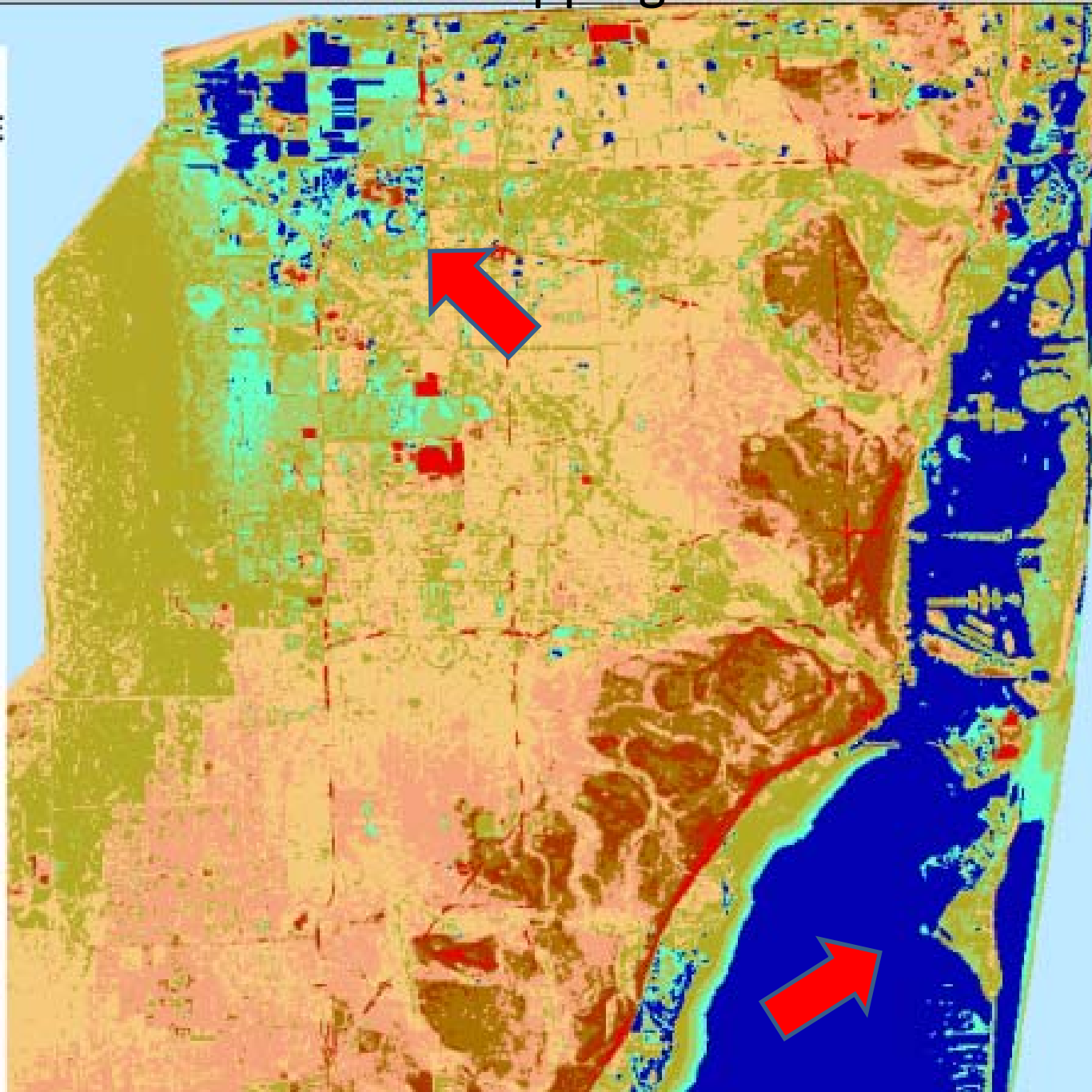
1 Foot Scenario

-  WATER
-  DRY - UNSHADED

ELEVATIONS

IN FEET NAVD 88

-  LESS THAN -5
-  -5 - -3
-  -3 - -2
-  -2 - -1
-  -1 - 0
-  0 - 1
-  1 - 2
-  2 - 3
-  3 - 5
-  5 - 7
-  7 - 9
-  9 - 11
-  11 - 15
-  MORE THAN 15





Miami-Dade DERM – Inundation Mapping Scenarios – 2 ft

Legend












STATIC SEA LEVEL RISE

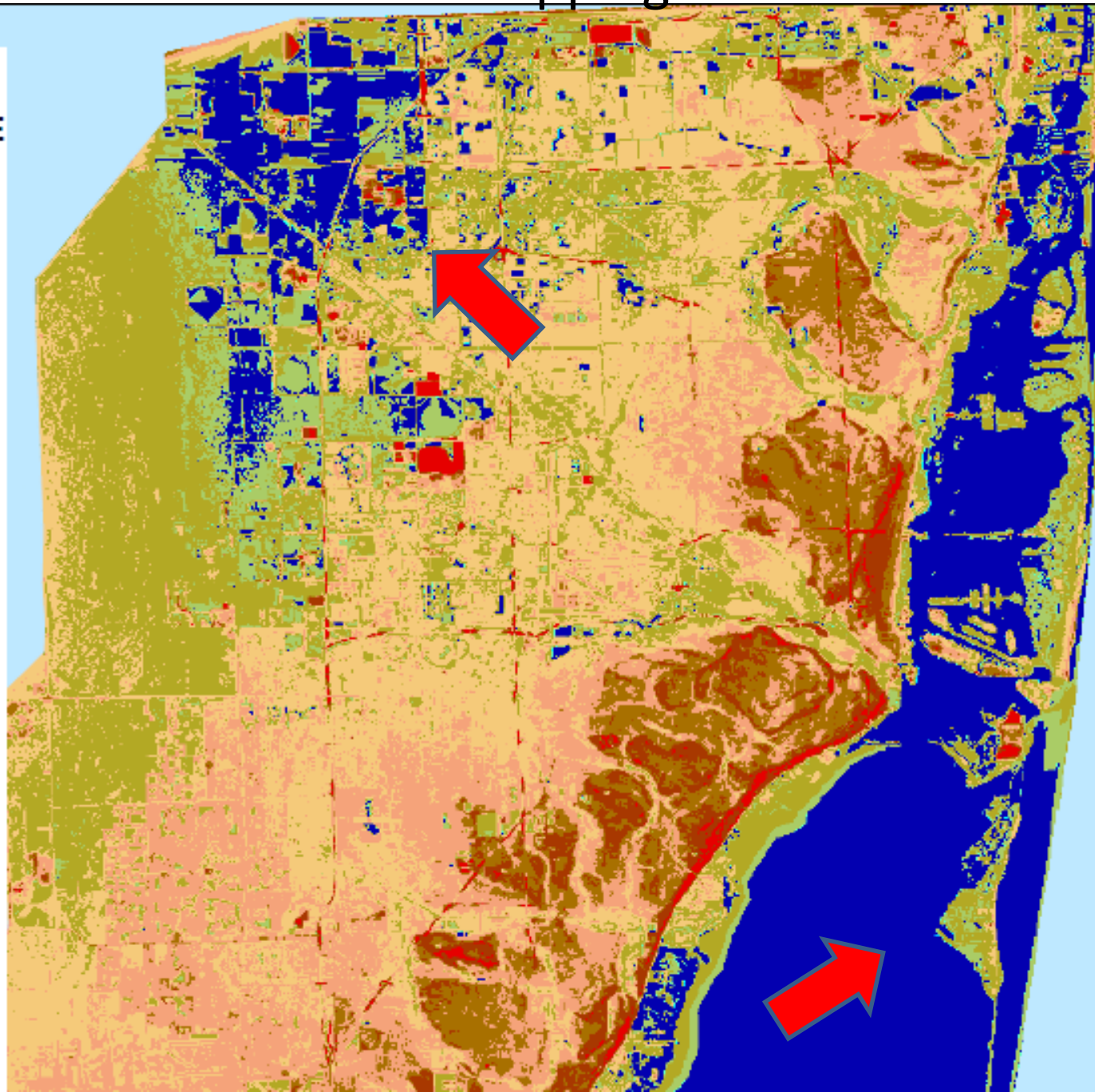
2 Foot Scenario

-  WATER
-  DRY-UNSHADED

ELEVATIONS

IN FEET NAVD 88

-  LESS THAN -5
-  -5 - -3
-  -3 - -2
-  -2 - -1
-  -1 - 0
-  0 - 1
-  1 - 2
-  2 - 3
-  3 - 5
-  5 - 7
-  7 - 9
-  9 - 11
-  11 - 15
-  MORE THAN 15





Miami-Dade DERM – Inundation Mapping Scenarios – 4 ft

Legend

STATIC SEA LEVEL RISE


4 Foot Scenario

 WATER - SHADED BLUE

 DRY - UNSHADED

ELEVATIONS

IN FEET NAVD 88

 LESS THAN -5

 -5 - -3


 -3 - -2

 -2 - -1

 -1 - 0

 0 - 1

 1 - 2


 2 - 3


 3 - 5

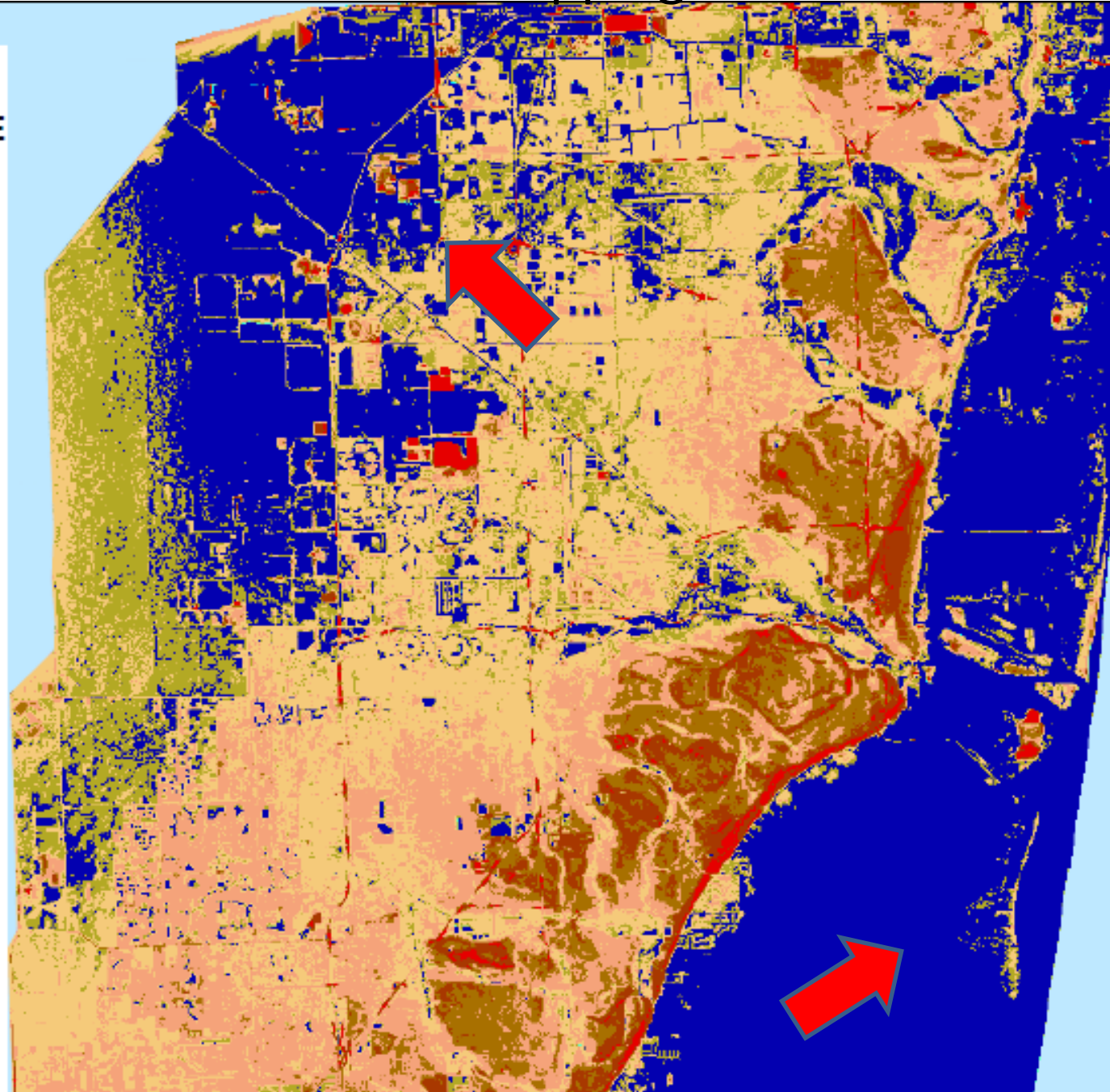
 5 - 7

 7 - 9

 9 - 11

 11 - 15

 MORE THAN 15



Sea Level Rise Scenarios

Big Pine Key

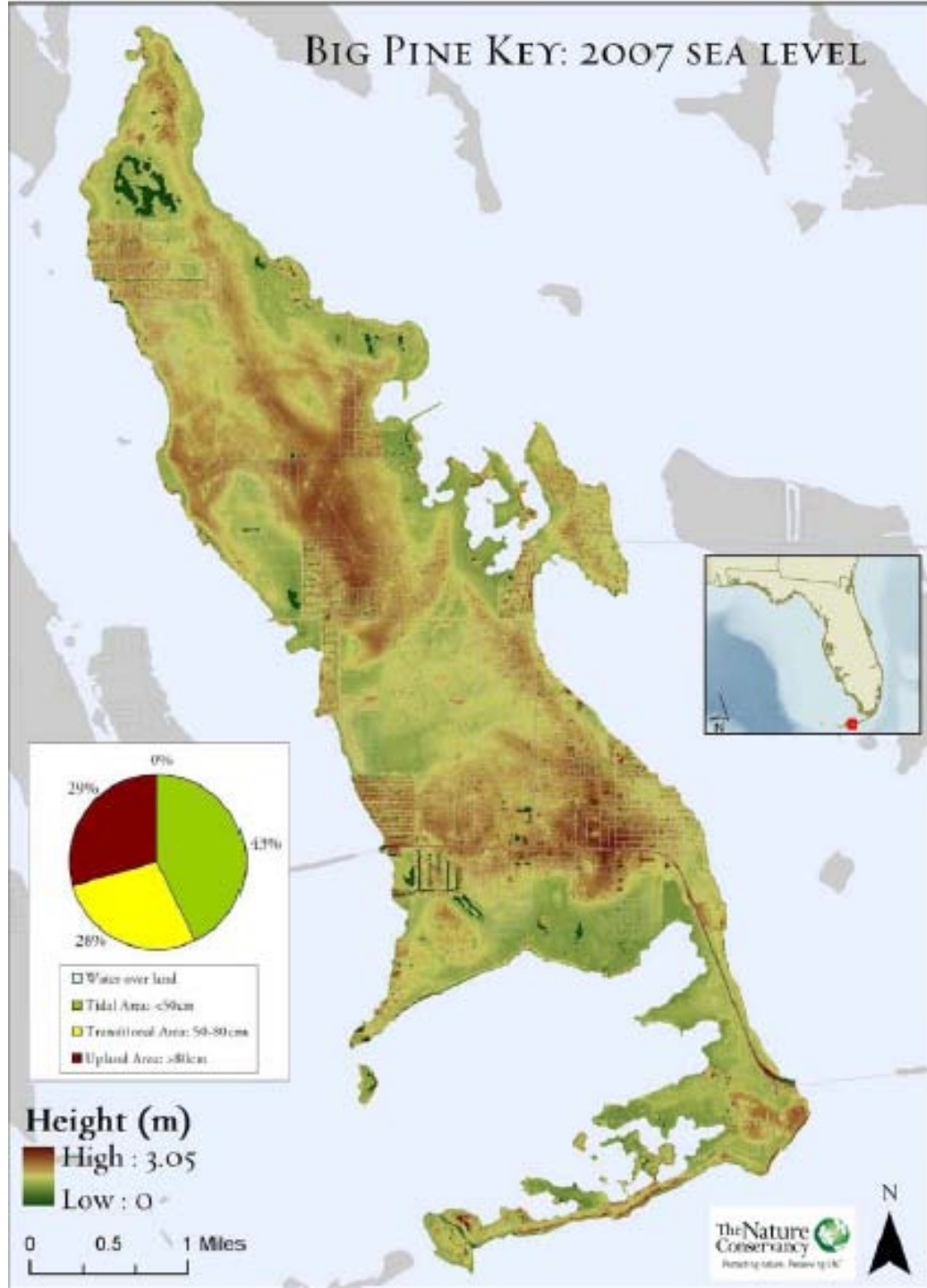
2007 Sea Level

Full report at Florida Keys Reef Resilience Program

frrp.org



Protecting nature. Preserving life.™



Sea Level Rise Scenarios

Big Pine Key

0.6 feet

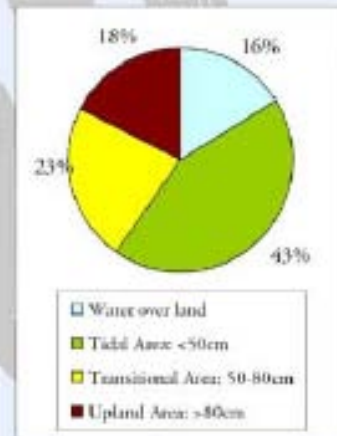
Full report at Florida Keys Reef Resilience Program

frrp.org

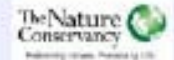


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BIG PINE KEY SCENARIO 1: +18 CM (7 IN.) 2100
BEST OF THE BEST CASE IPCC SCENARIO (B1)
+18 CM (7 IN.) TO +38 CM (15 IN.)



0 0.5 1 Miles



Sea Level Rise Scenarios

Big Pine Key

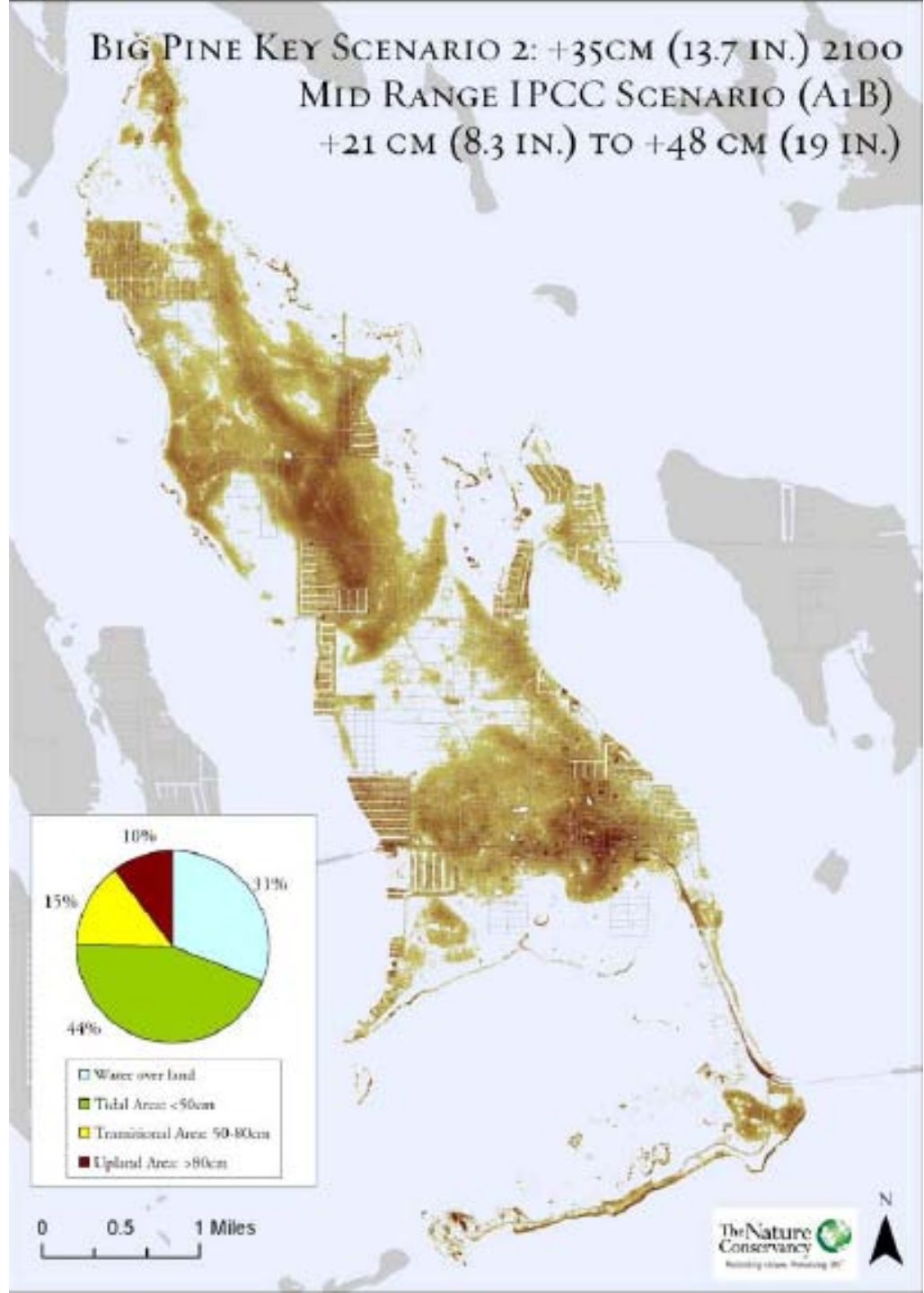
1.15 feet

Full report at Florida Keys Reef Resilience Program

frrp.org



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Sea Level Rise Scenarios

Big Pine Key

1.93 feet

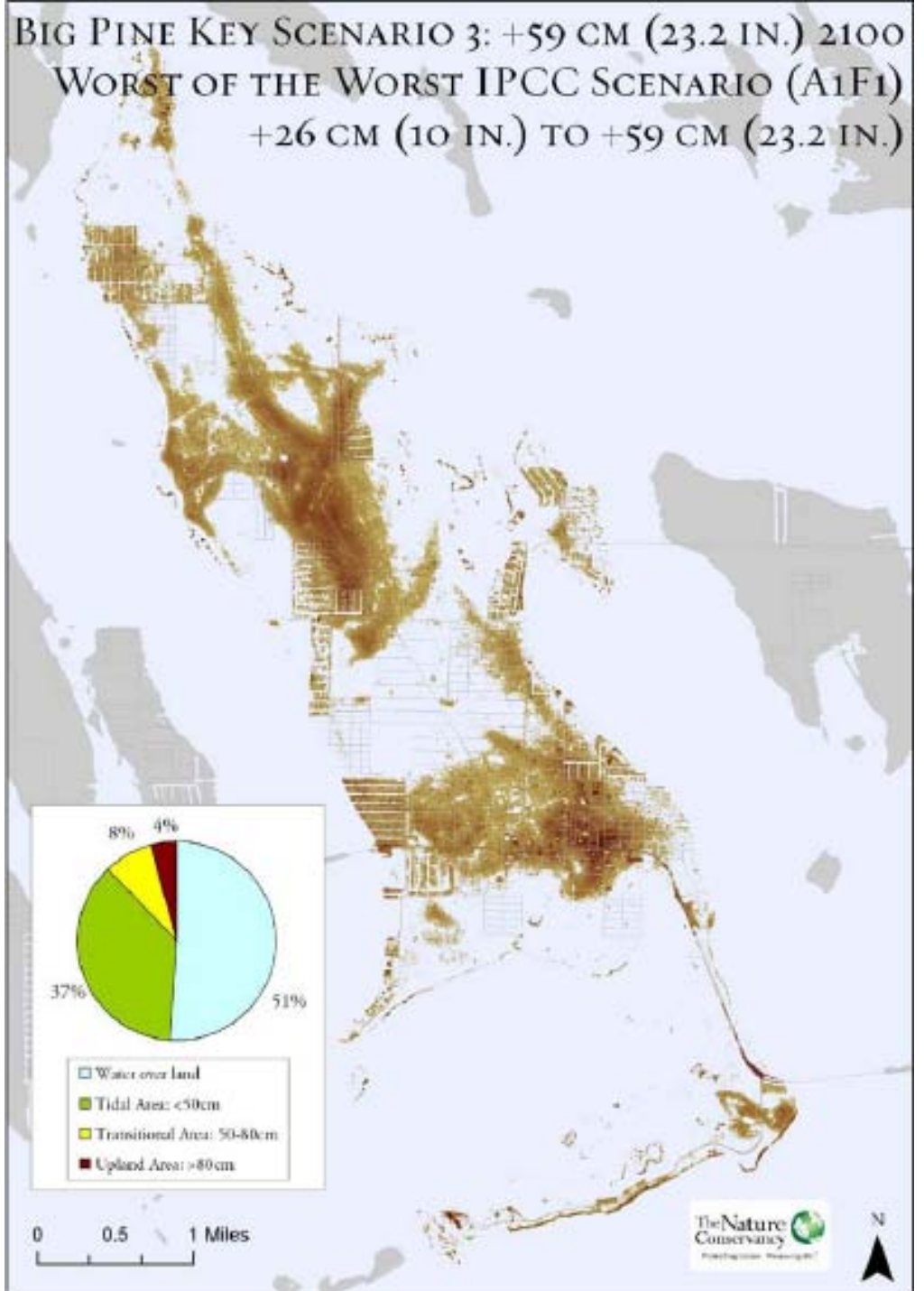
Full report at Florida Keys Reef Resilience Program

frrp.org



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BIG PINE KEY SCENARIO 3: +59 CM (23.2 IN.) 2100
WORST OF THE WORST IPCC SCENARIO (A1F1)
+26 CM (10 IN.) TO +59 CM (23.2 IN.)



Sea Level Rise Scenarios

Big Pine Key

3.28 feet

Full report at Florida Keys Reef Resilience Program

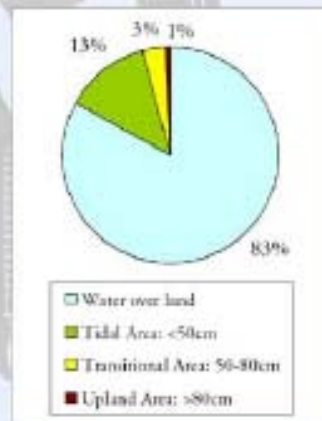
frfp.org



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BIG PINE KEY SCENARIO 4: +100 CM (39.3 IN) 2100
MID RANGE RAHMSTORF ET AL. 2007
+50 CM (19.7 IN.) TO +140 CM (55 IN.)

-\$993,000,000
-4980 acres



0 0.5 1 Miles

The Nature Conservancy
Protecting nature. Preserving life.™





Areas of Regional Coordination

- Coordinate to develop common sea level rise projections and other planning parameters
- Develop a uniform strategy and methodology for assessing sea level rise risk & vulnerability
- Influence national policy and secure funding for climate change adaptation
- Develop a regional strategy that addresses shared mitigation and adaptation goals



Cooperative planning for adaptation must start today

High Tide on
9/17/09

8 inches
higher than
normal

The tide
breached the
seawall on
Las Olas Isles

