



**Florida Department of Environmental Protection**

# **Utilizing long-term data sets to evaluate local storm impacts to the GTMNERR estuary**

**Shannon Dunnigan and Pamela Marcum**

Nikki Dix, Ph.D. and Silas Tanner

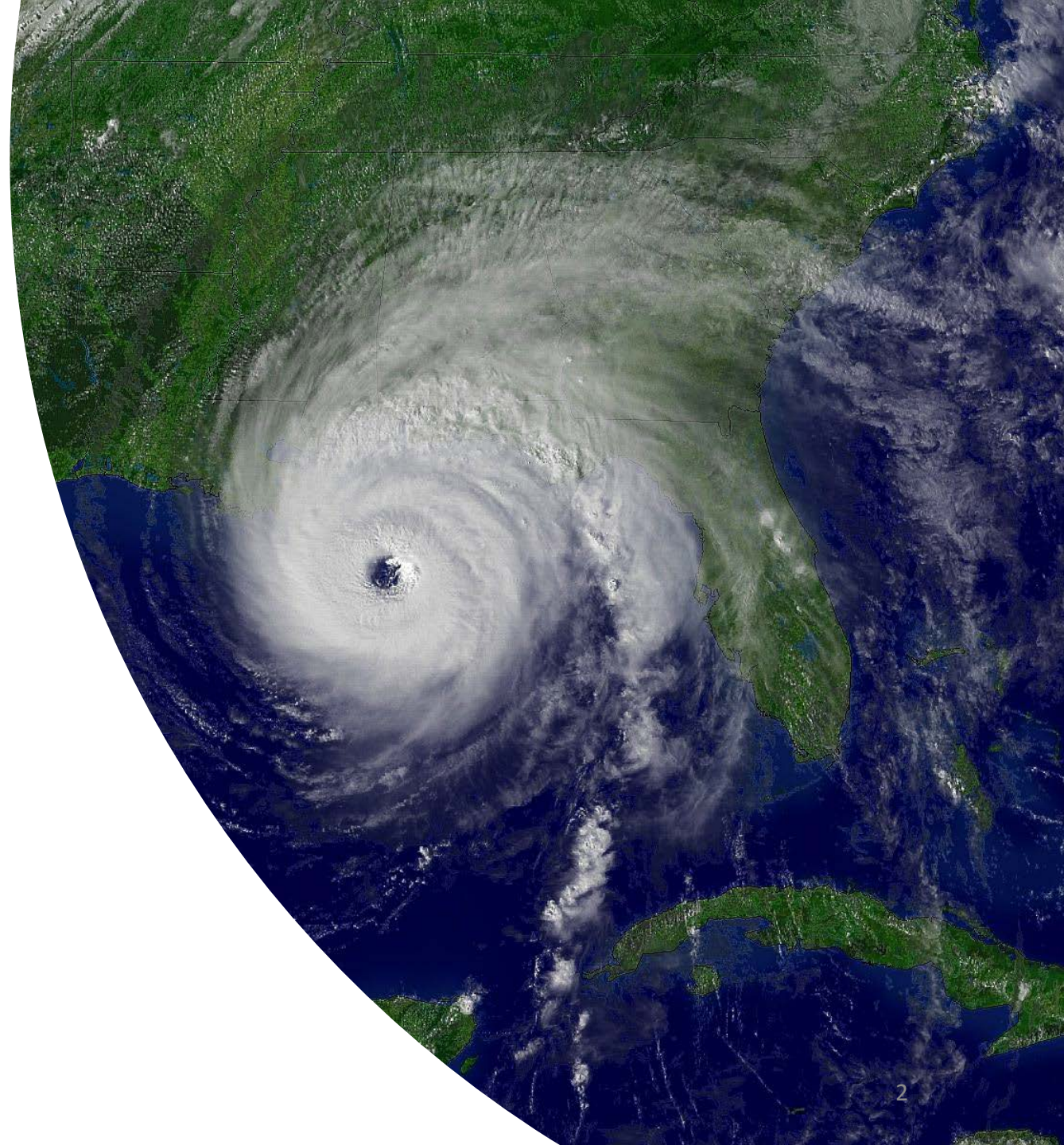
**GTM Research Reserve | State of the Reserve | February 23, 2018**



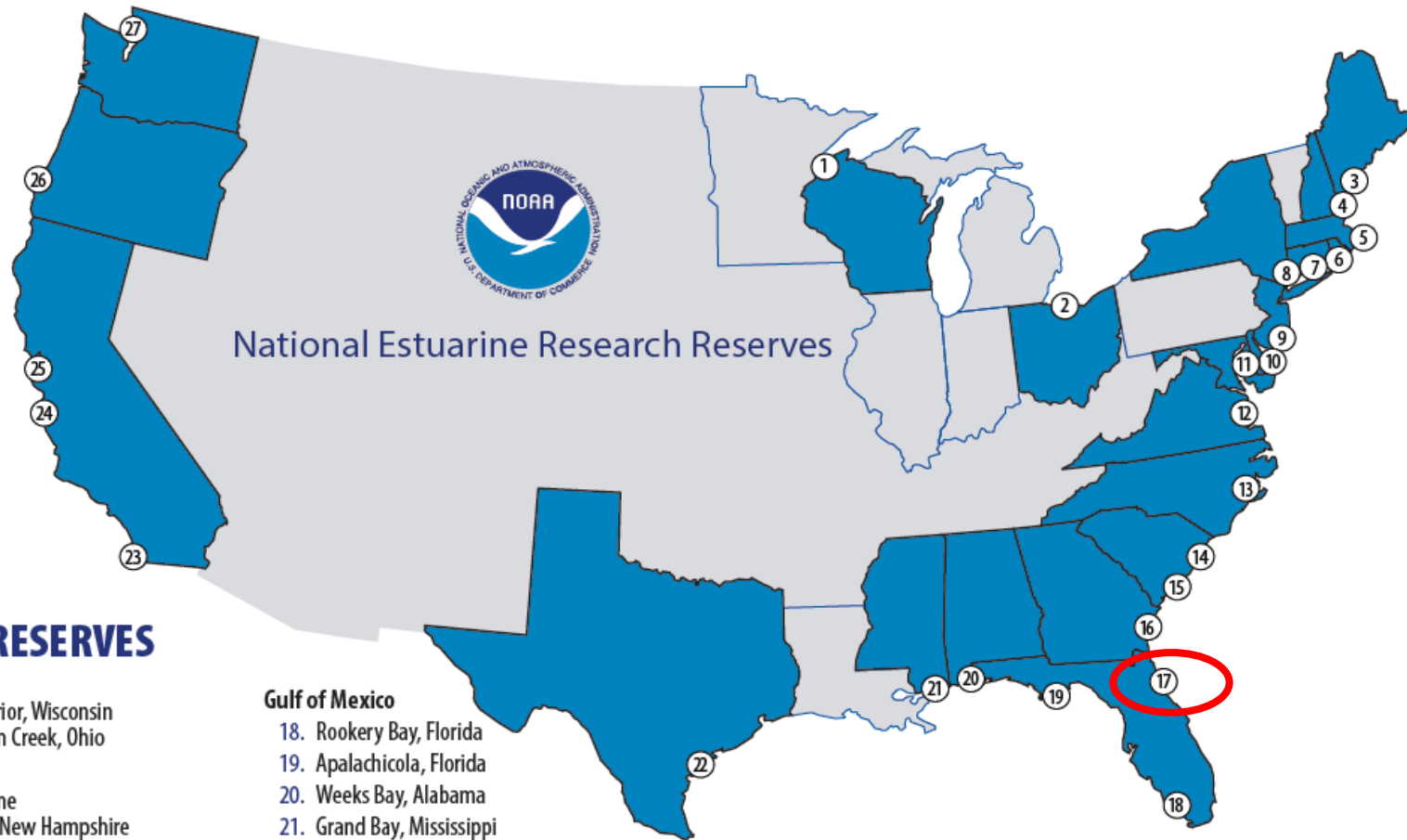
# Environmental Variability

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- Range of spatial and temporal scales
  - Daily cycles
  - Seasonal cycles
  - Long-term trends
  - **Sporadic events**







## LIST OF RESERVES

### Great Lakes

1. Lake Superior, Wisconsin
2. Old Woman Creek, Ohio

### Northeast

3. Wells, Maine
4. Great Bay, New Hampshire
5. Waquoit Bay, Massachusetts
6. Narragansett Bay, Rhode Island
7. Connecticut (*Proposed*)

### Mid-Atlantic

8. Hudson River, New York
9. Jacques Cousteau, New Jersey
10. Delaware
11. Chesapeake Bay, Maryland
12. Chesapeake Bay, Virginia

### Southeast

13. North Carolina
14. North Inlet-Winyah Bay, South Carolina
15. ACE Basin, South Carolina
16. Sapelo Island, Georgia
17. Guana Tolomato Matanzas, Florida

### Gulf of Mexico

18. Rookery Bay, Florida
19. Apalachicola, Florida
20. Weeks Bay, Alabama
21. Grand Bay, Mississippi
22. Mission-Aransas, Texas

### West

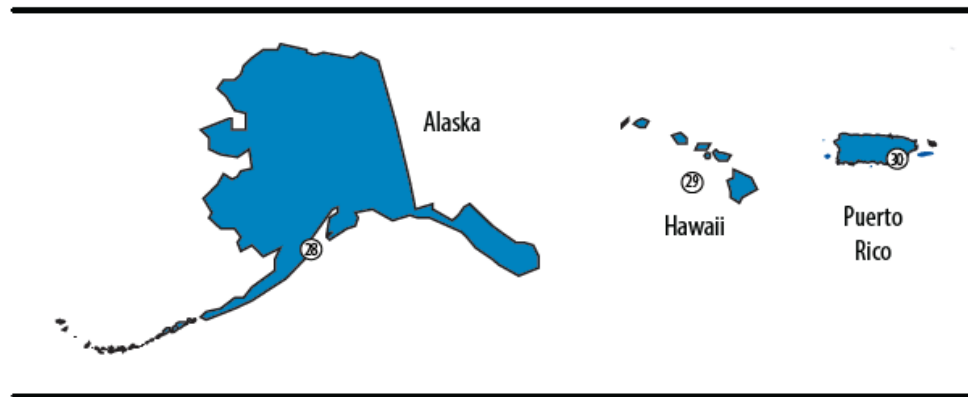
23. Tijuana River, California
24. Elkhorn Slough, California
25. San Francisco Bay, California
26. South Slough, Oregon
27. Padilla Bay, Washington
28. Kachemak Bay, Alaska

### Pacific

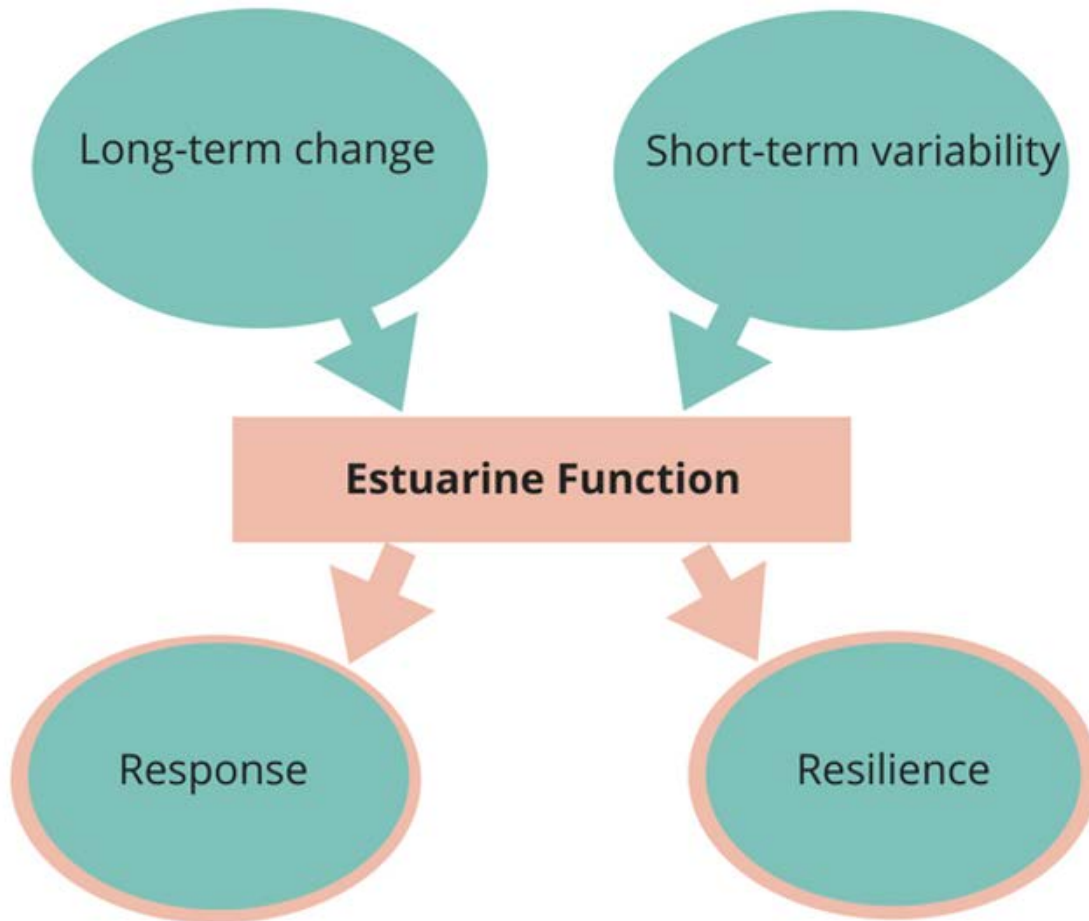
29. Hawaii

### Caribbean

30. Jobos Bay, Puerto Rico



# Long-term monitoring: **SWMP** **S**ystem-**W**ide **M**onitoring **P**rogram



- Abiotic Monitoring
- Biotic Monitoring
- Mapping
- Data Analysis & Interpretation
- Translation & Education

# SWMP Abiotic Monitoring

## Water Quality

- Nitrogen
- Phosphorus
- Phytoplankton biomass
- Salinity
- Temperature
- Oxygen
- pH
- Turbidity
- Water depth

## Weather

- Temperature
- Barometric pressure
- Wind speed/direction
- Relative humidity
- Rainfall
- Photosynthetically active radiation





# SWMP Biotic Monitoring

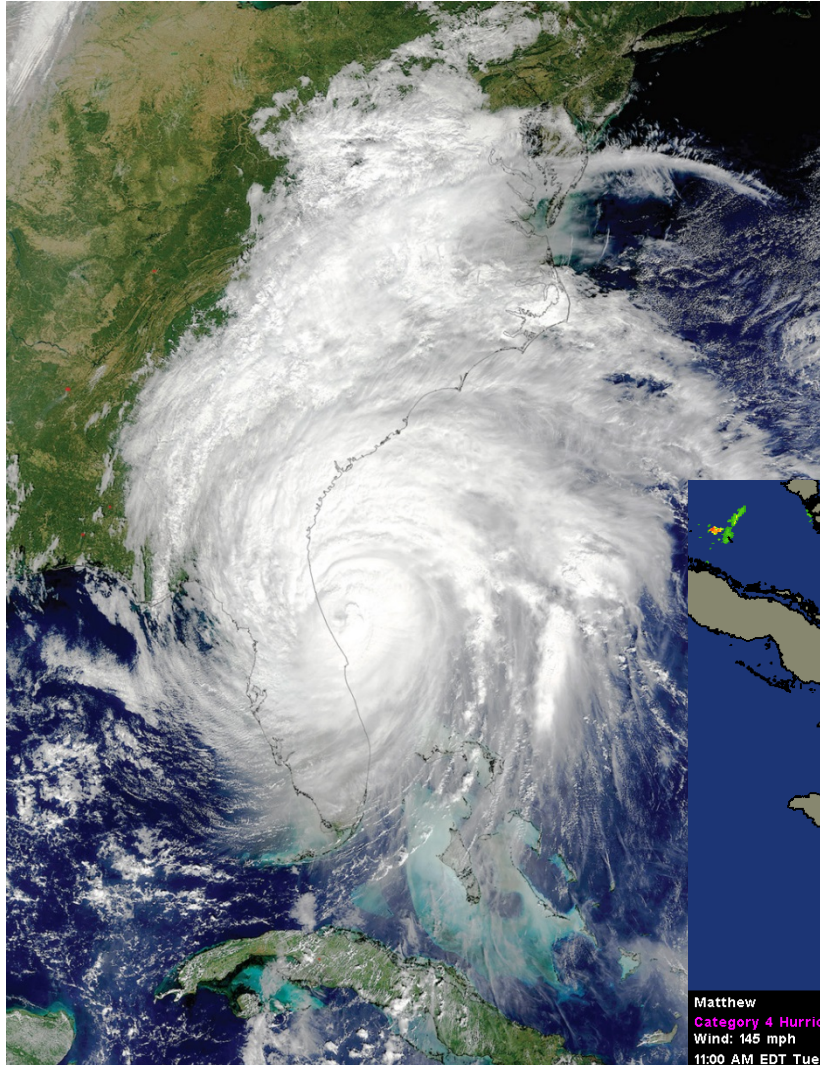
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- Oyster Monitoring
- Phytoplankton Monitoring
- Mangrove Monitoring
- Salt Marsh Monitoring
  - Vegetation
  - Surface Elevation



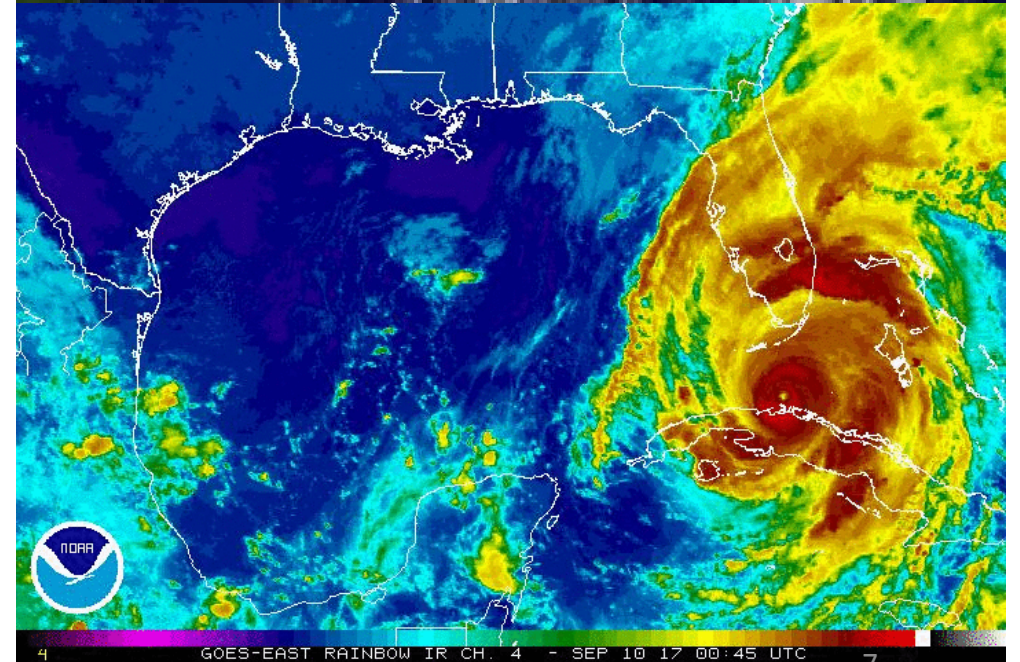
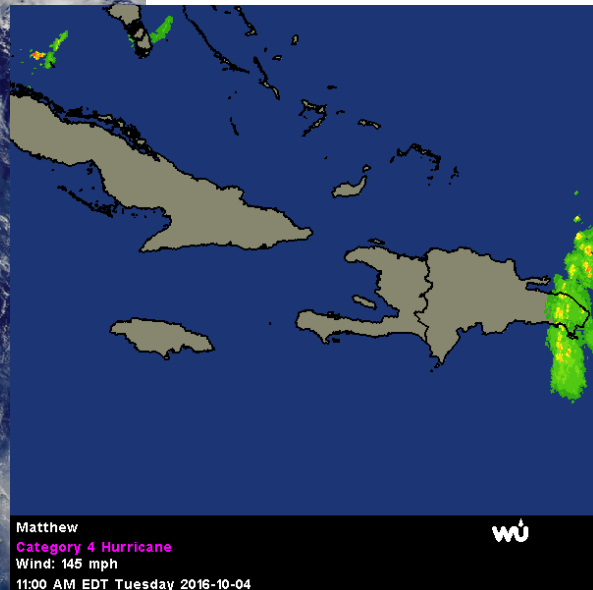


# “Storms are like snowflakes”



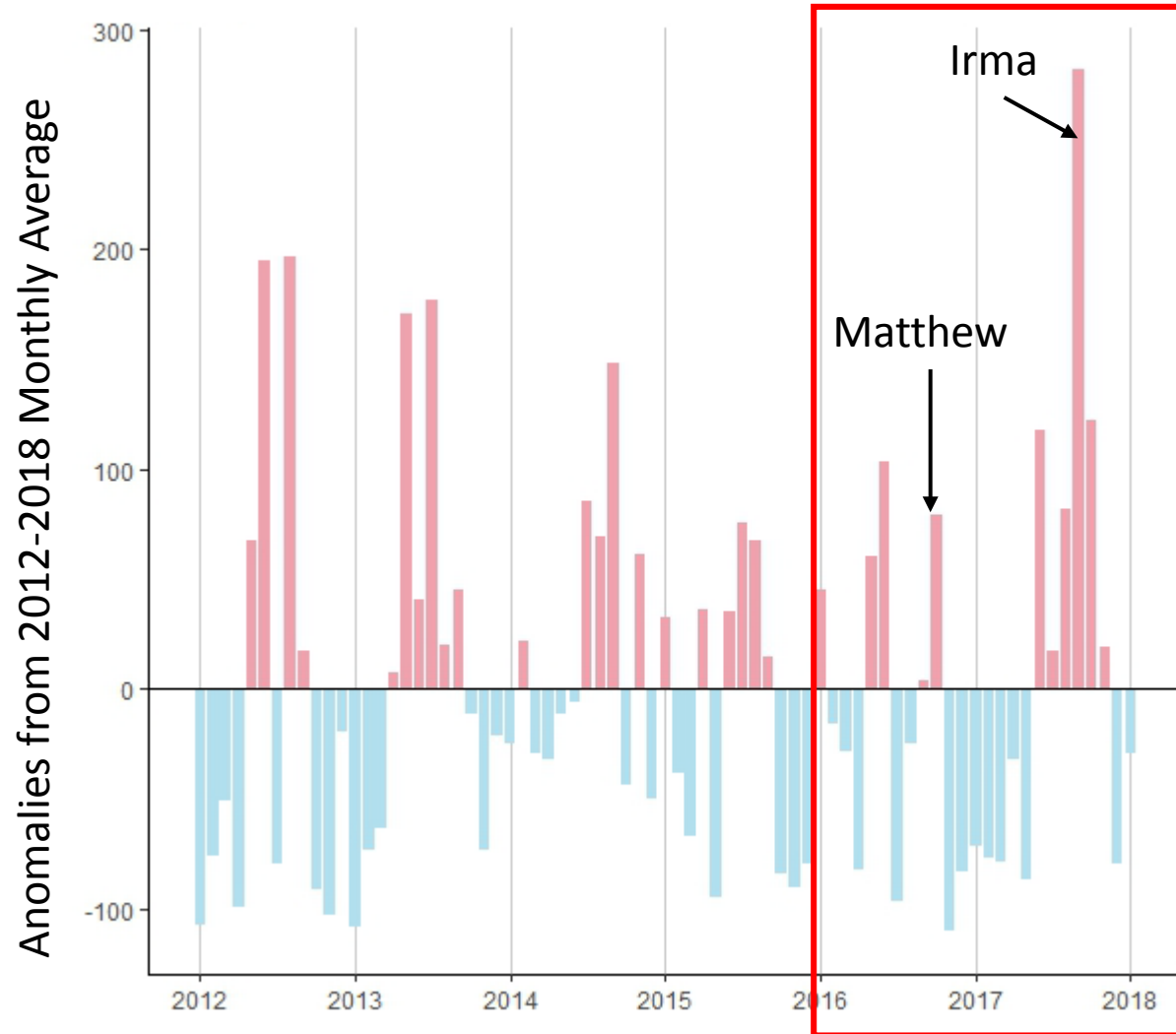
Hurricane Irma (right)  
2017

2016  
Hurricane Matthew (left)





# Monthly Rainfall

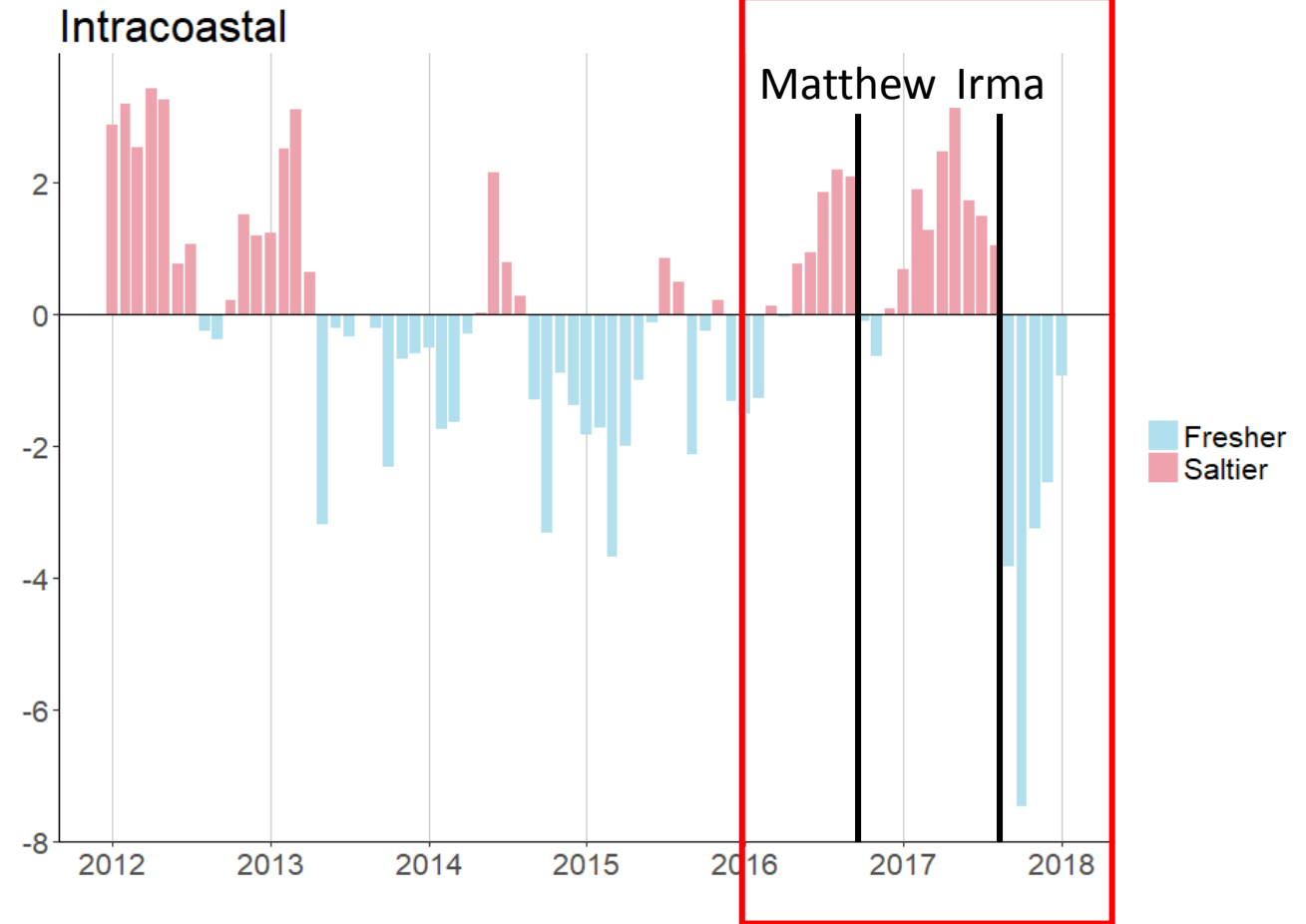
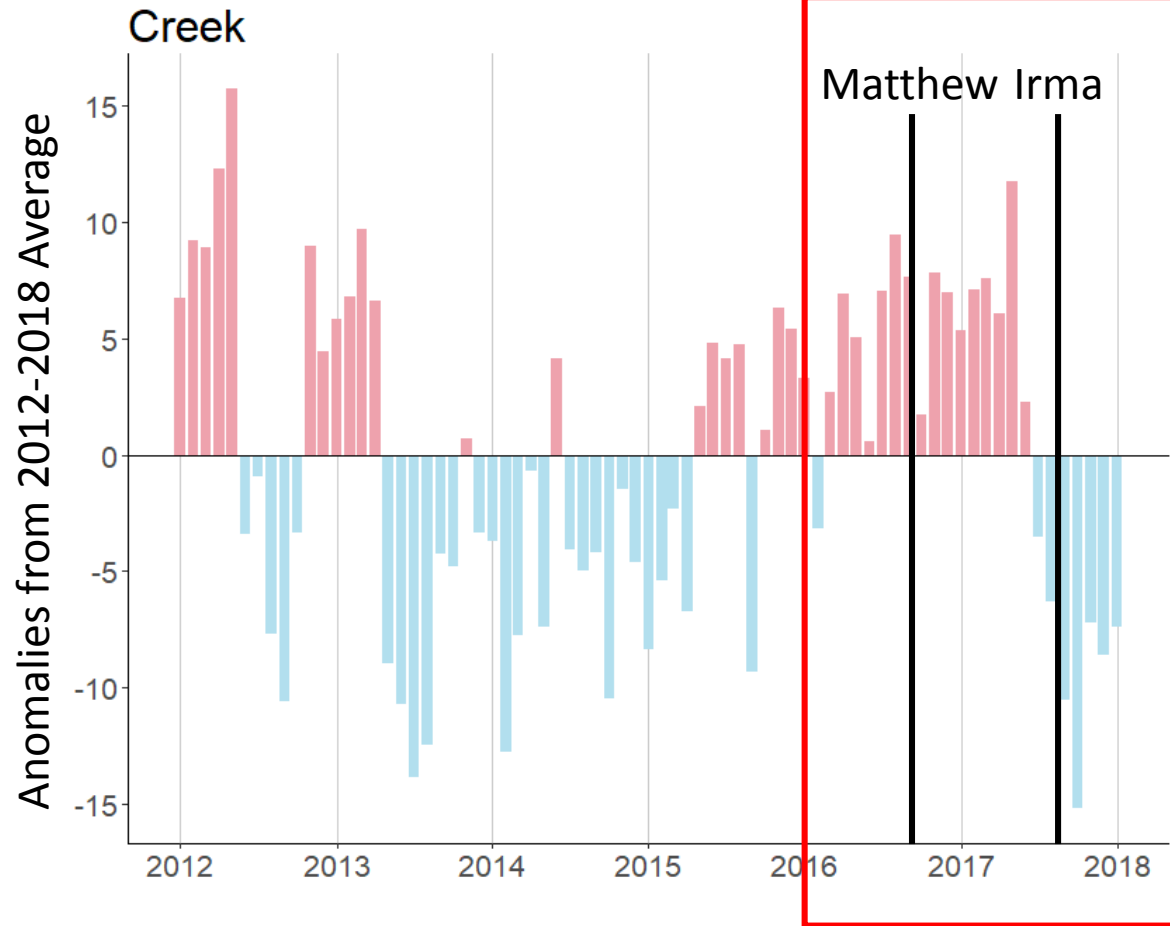


Drier  
Wetter

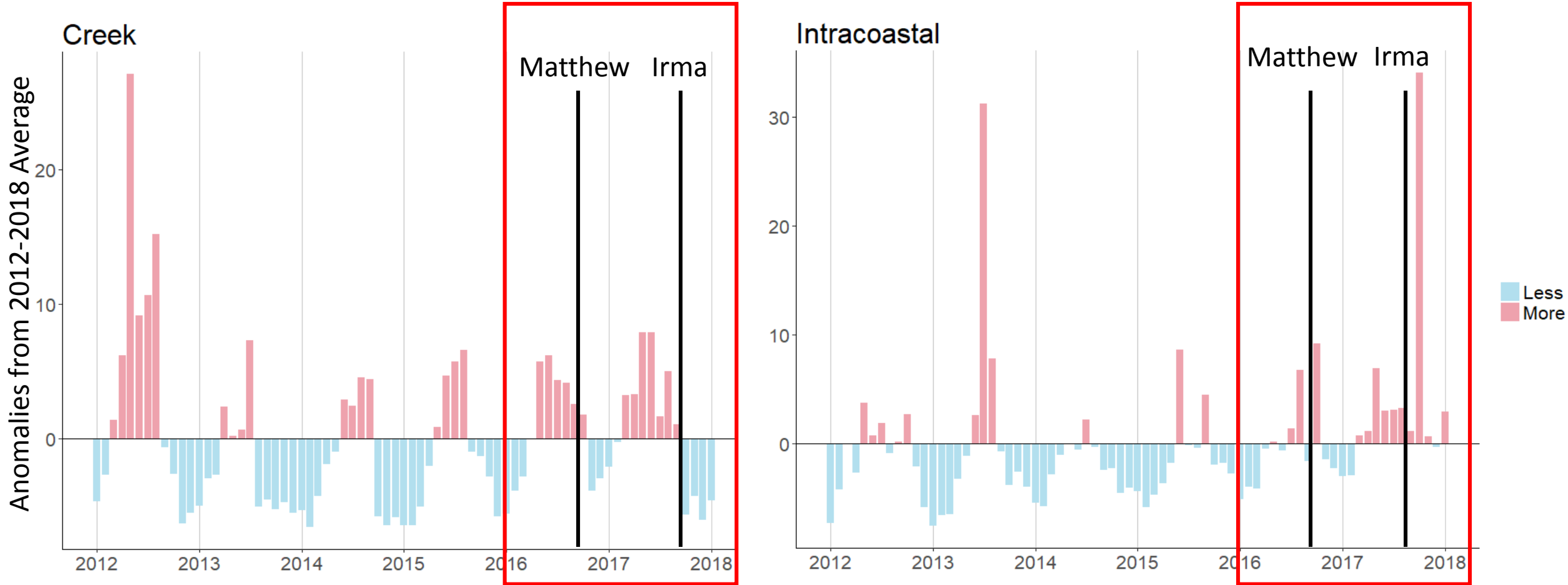




# Salinity (*saltiness of water*)

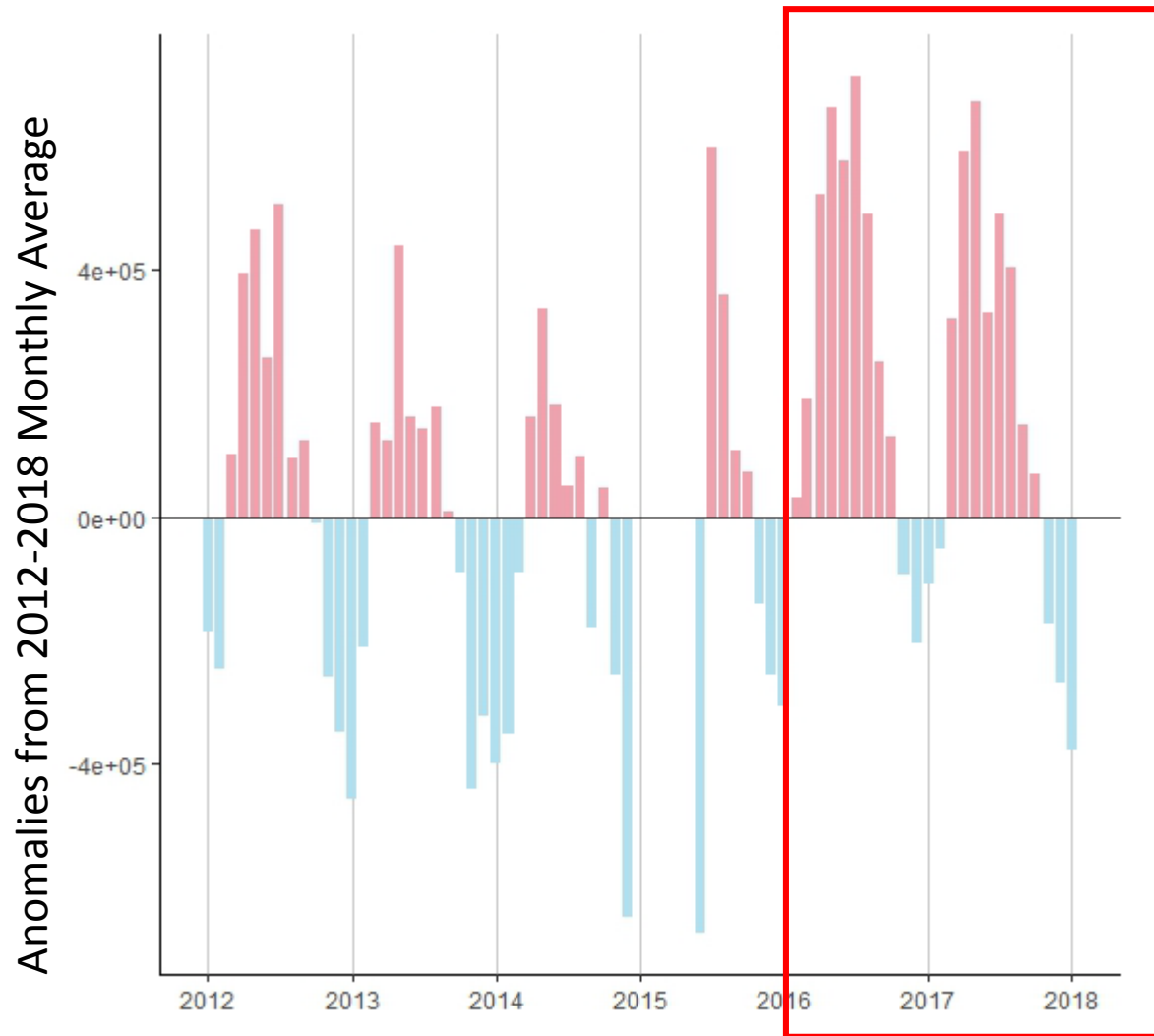


# Turbidity (*cloudiness of water*)



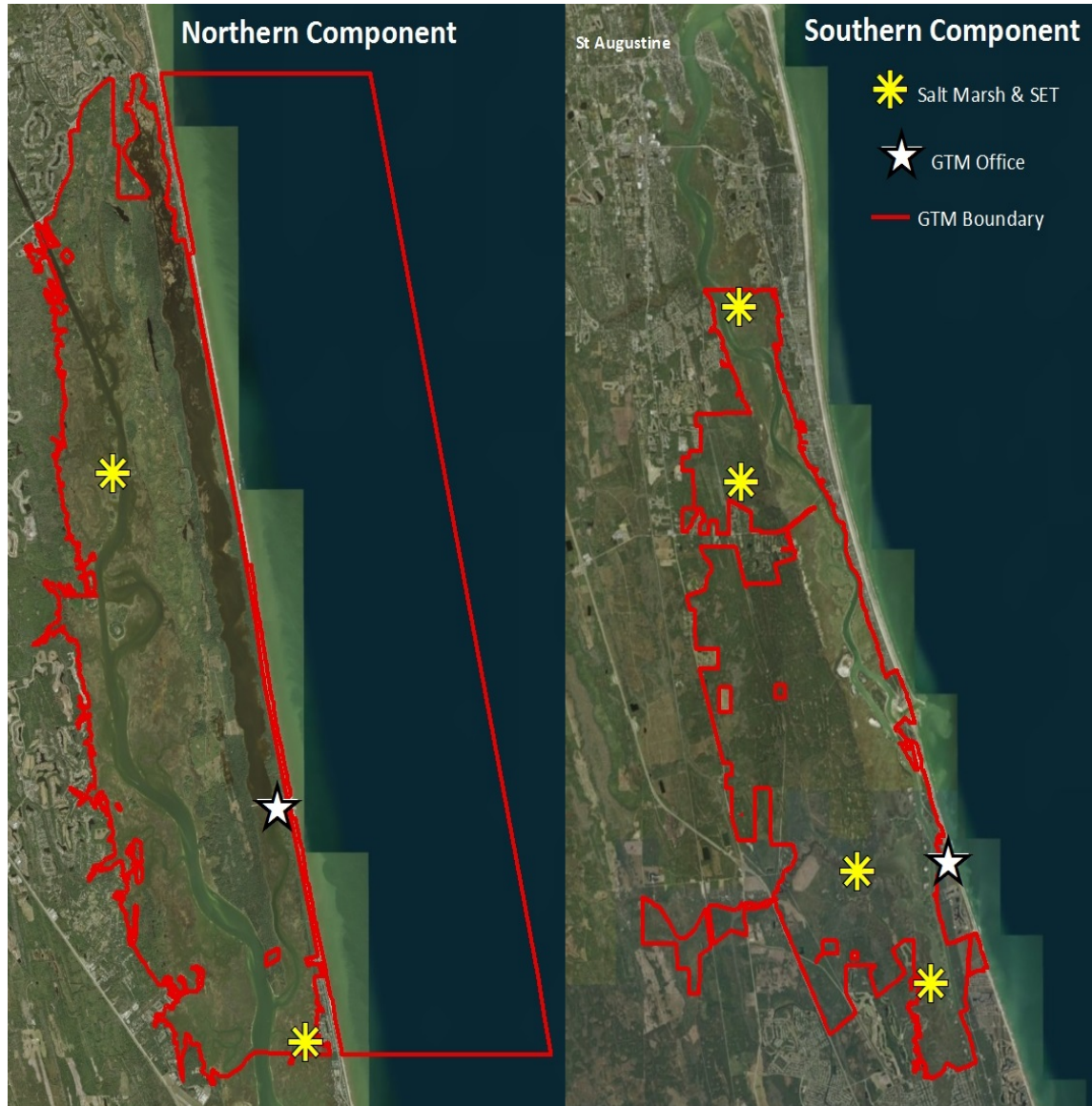


# Monthly Photosynthetically Active Radiation



Apogee Images: [www.apogeeinstruments.com](http://www.apogeeinstruments.com)

# Salt Marsh Monitoring

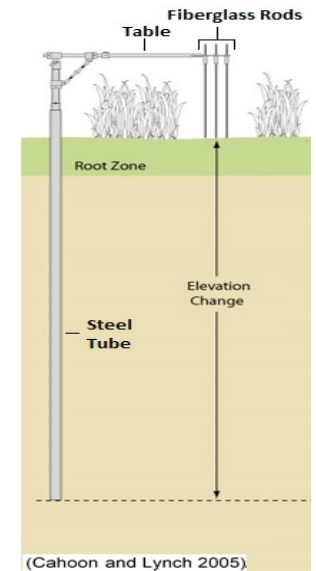


- **Vegetation**

- Stem Density
- Canopy Height
- Cover



- **Surface Elevation**



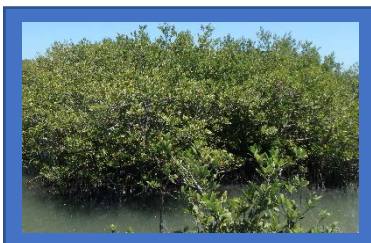
- **Sediment Accretion**



# Vegetation Patterns



*Spartina alterniflora*  
"Smooth Cordgrass"



*Avicennia germinans*  
"Black Mangrove"



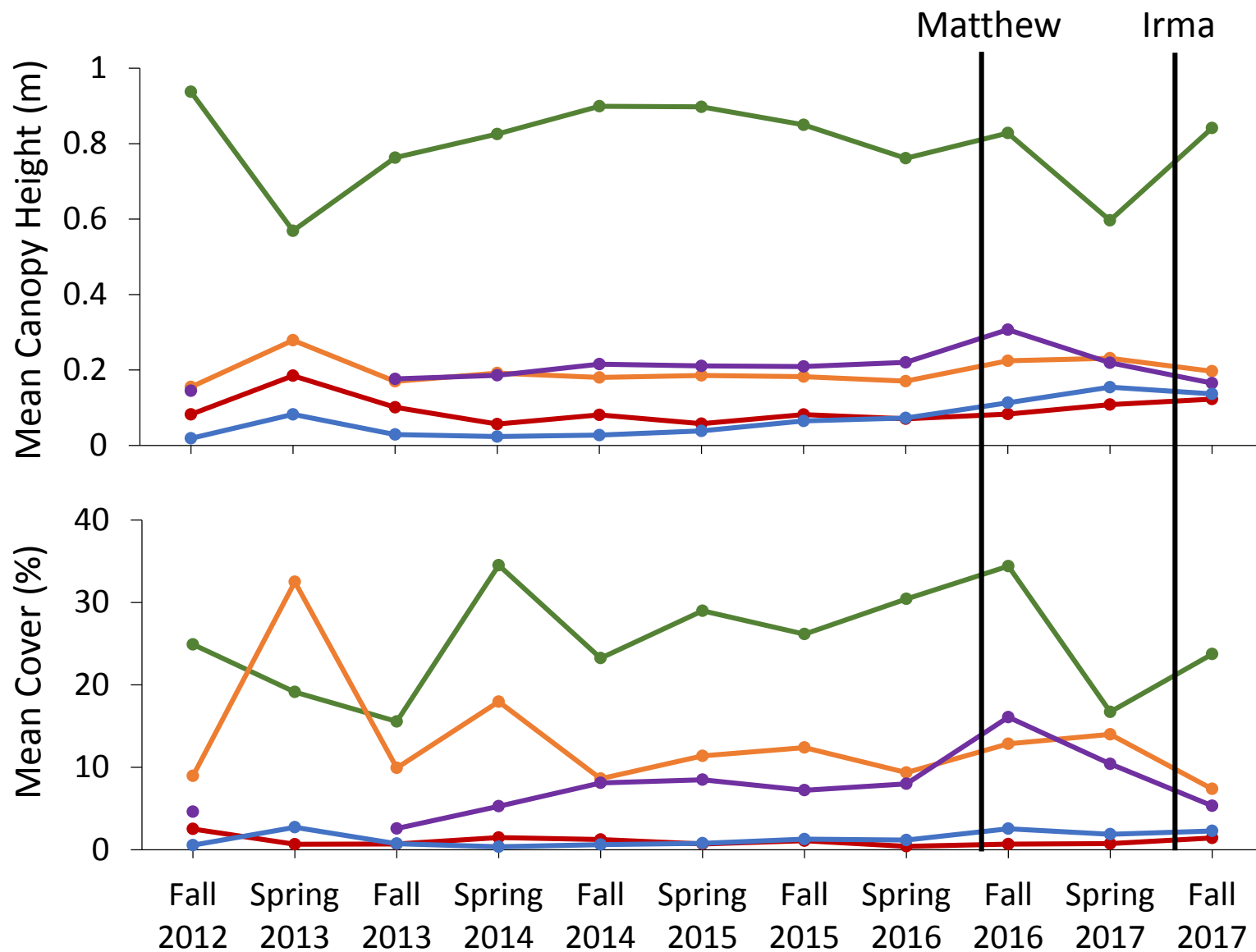
*Juncus roemerianus*  
"Black Needlerush"



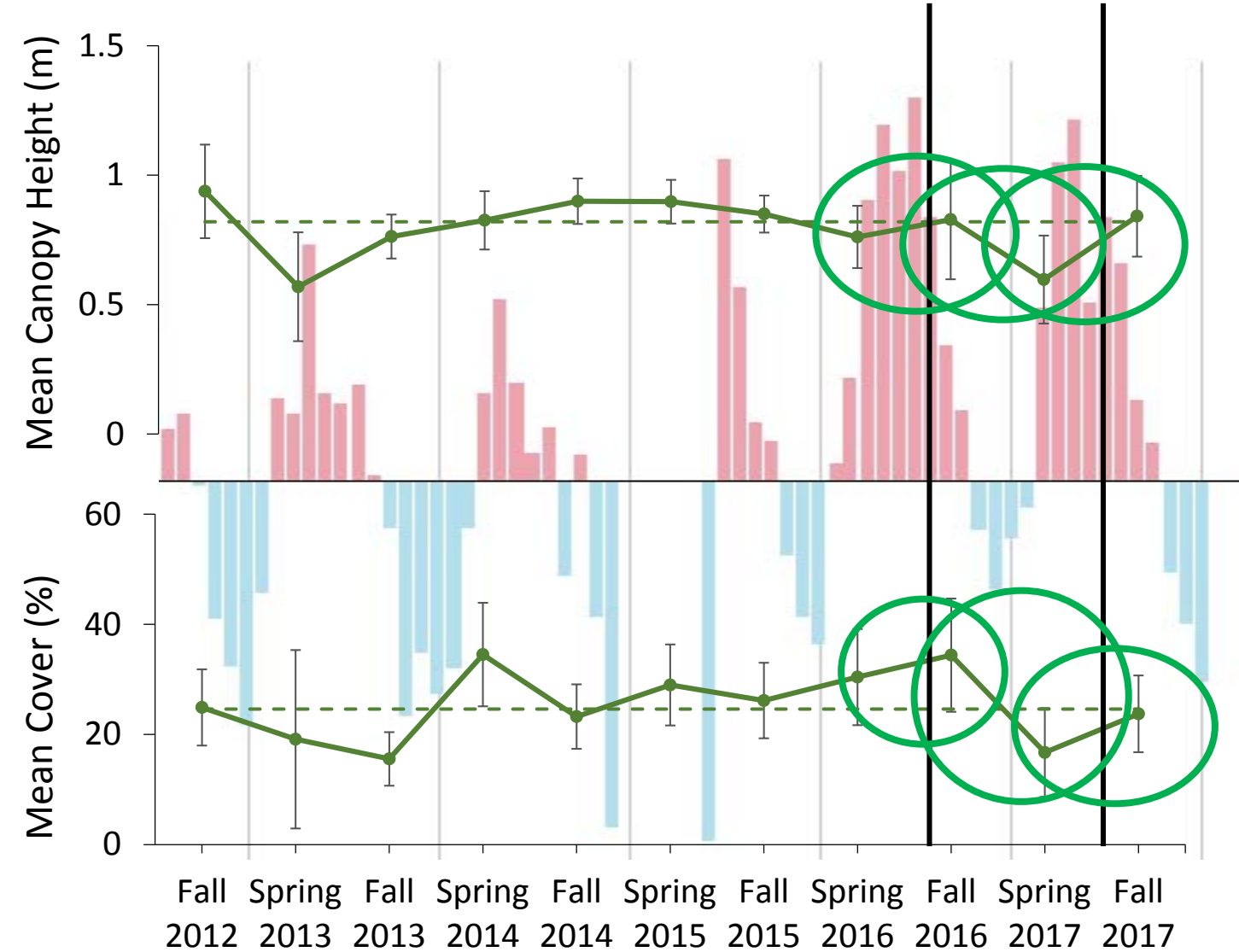
*Batis maritima*  
"Sea Pickle"



*Sarcocornia perennis*  
"Chickenclaws"

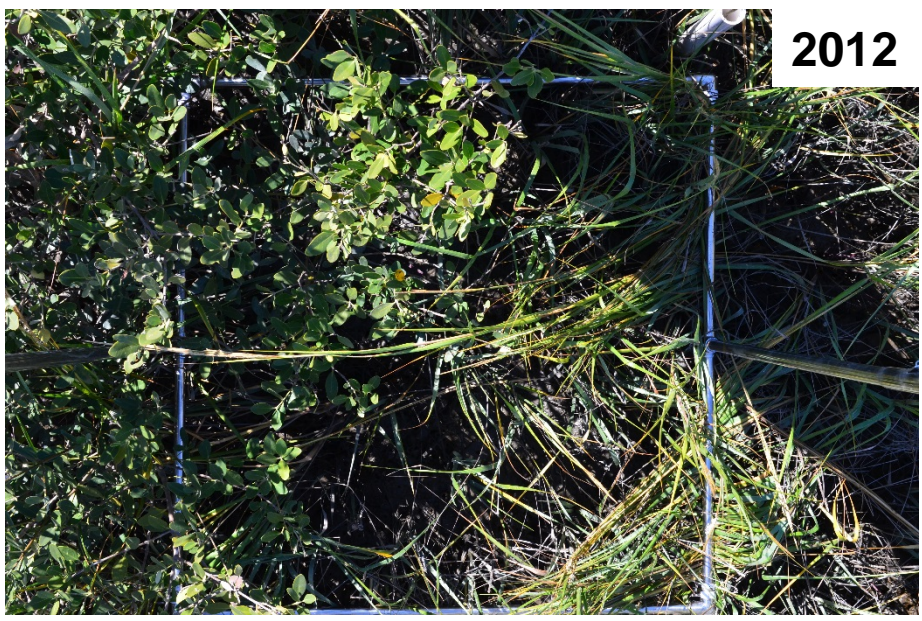
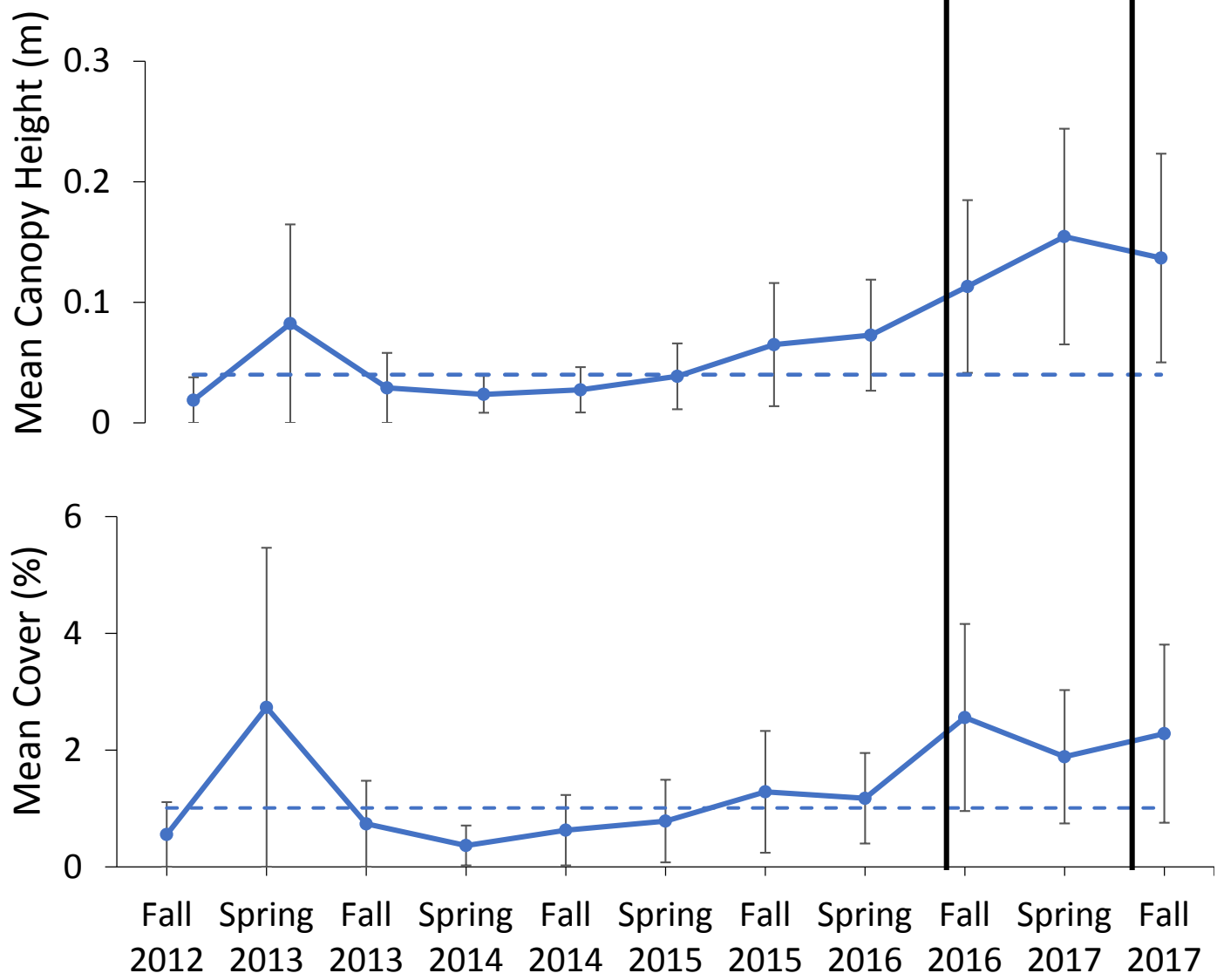


# *Spartina alterniflora*

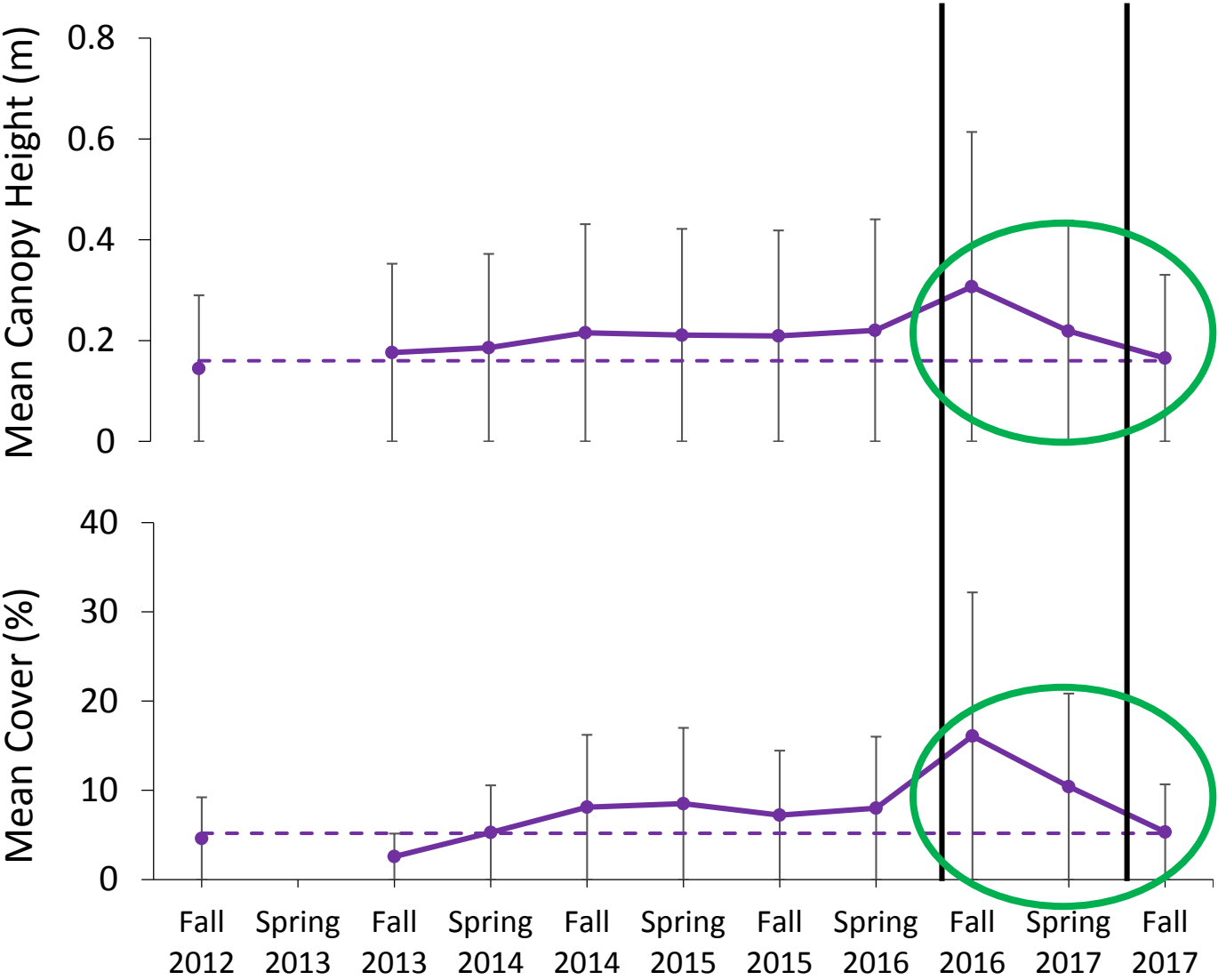




# *Avicennia germinans*

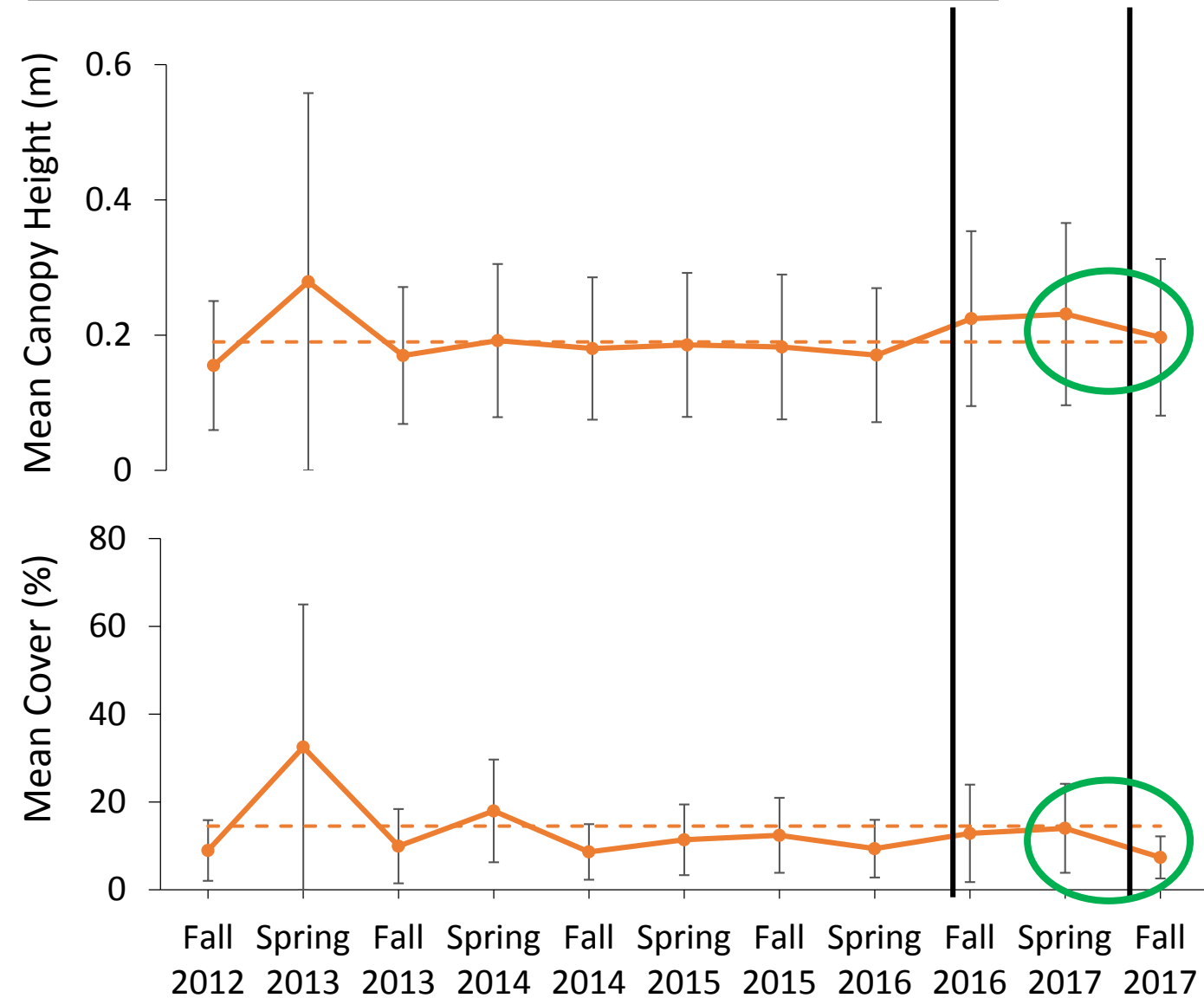


# *Juncus roemerianus*

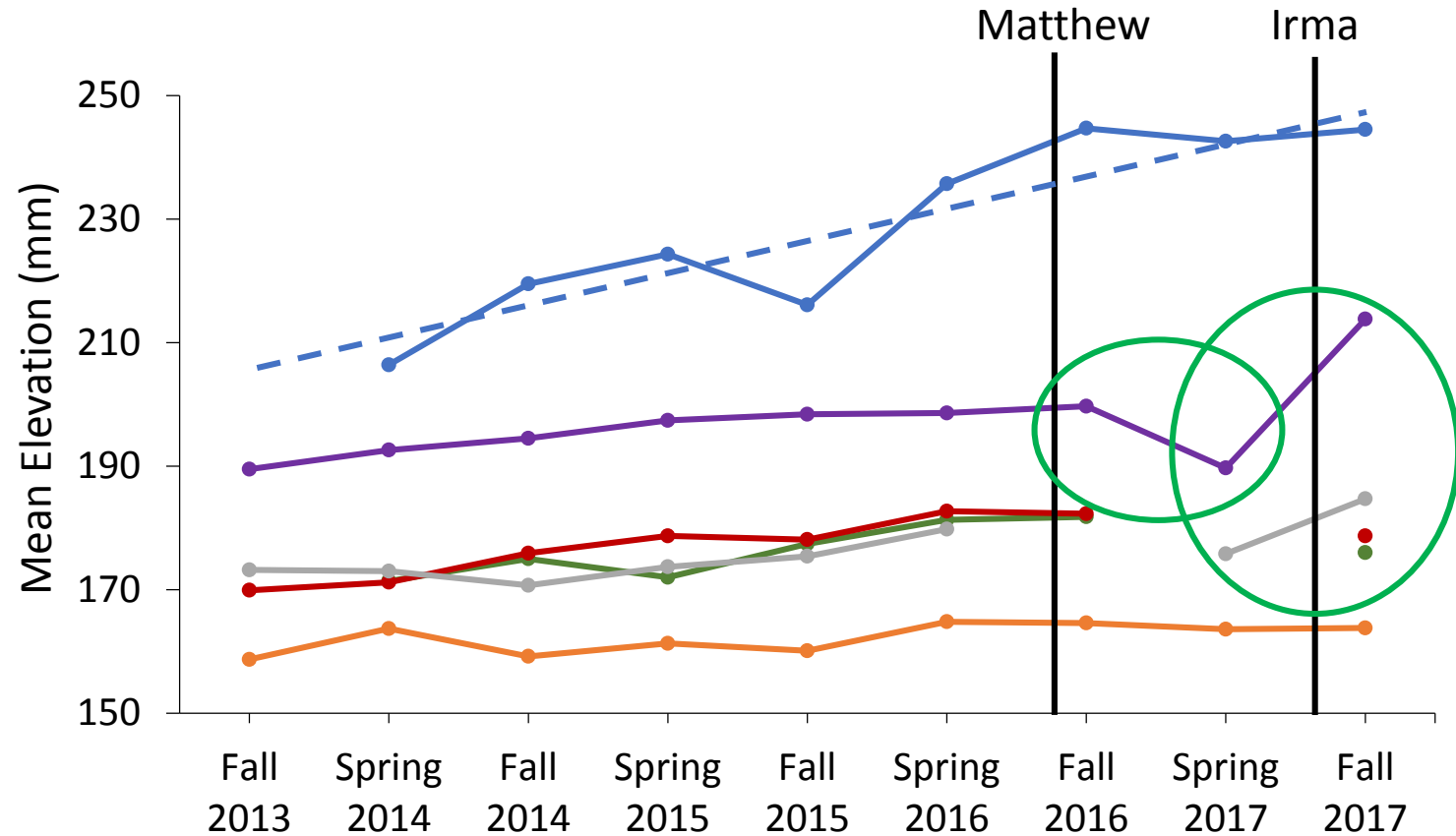
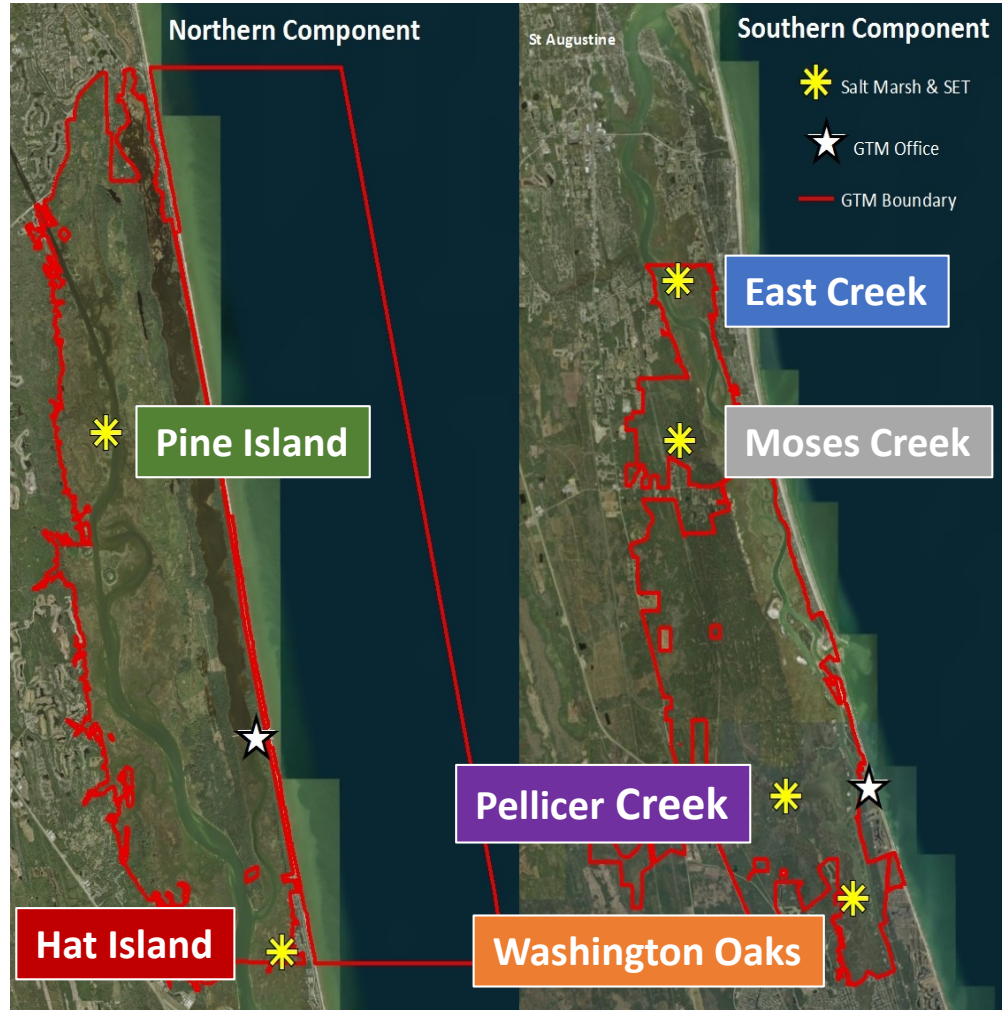




# *Batis maritima*

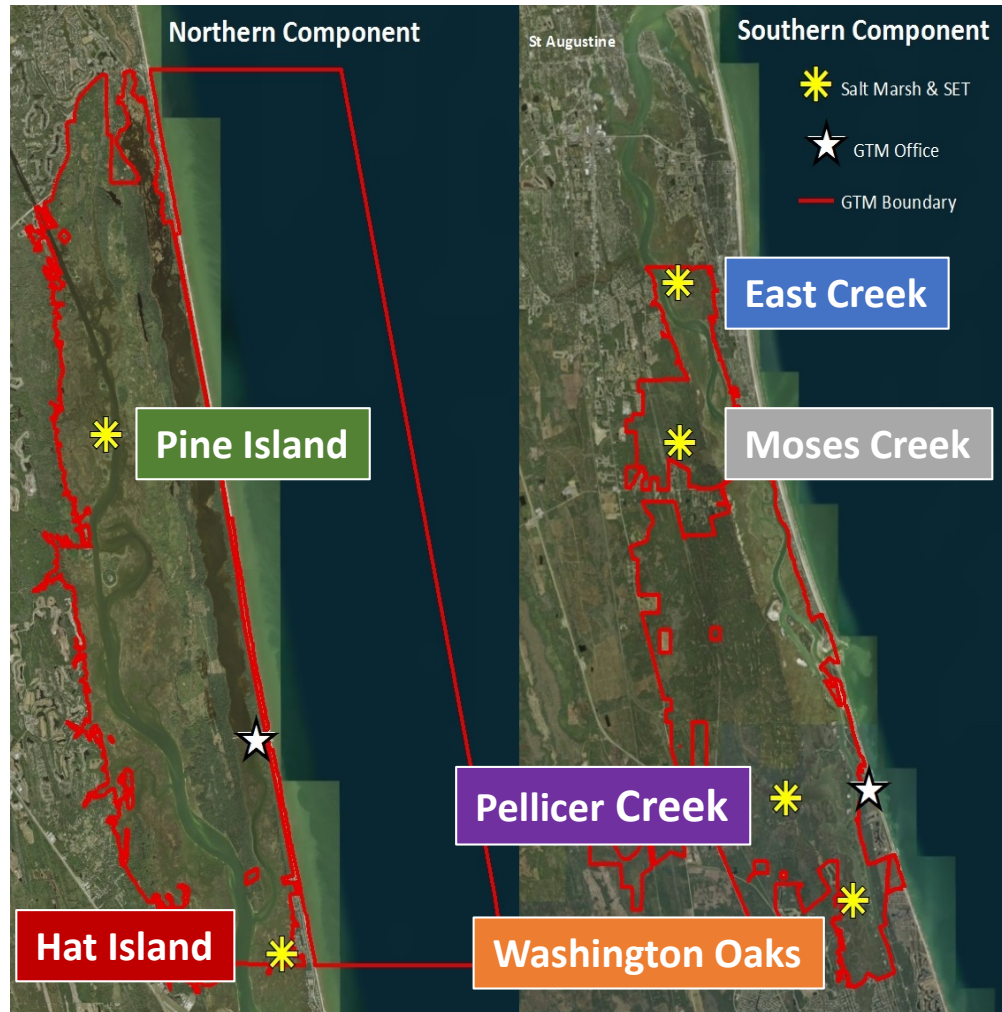


# Surface Elevation Patterns





# Surface Elevation Patterns





# Conclusions

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- How's the water? **It's fine.**
- Abundance of **available light** for photosynthesis
  - 2016 and 2017
- Fairly **stable** vegetation patterns
- Some species showed more of an effect from storms
  - *Spartina* and *Batis*

## Main storm impacts

- Localized erosion
- Prolonged periods of high water/flooding
- Swelling marshes





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Biological Scientist

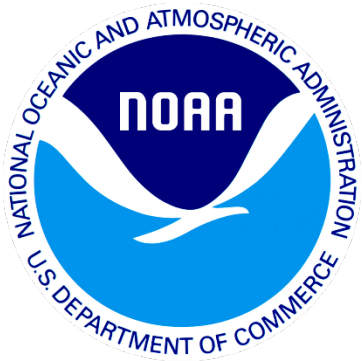
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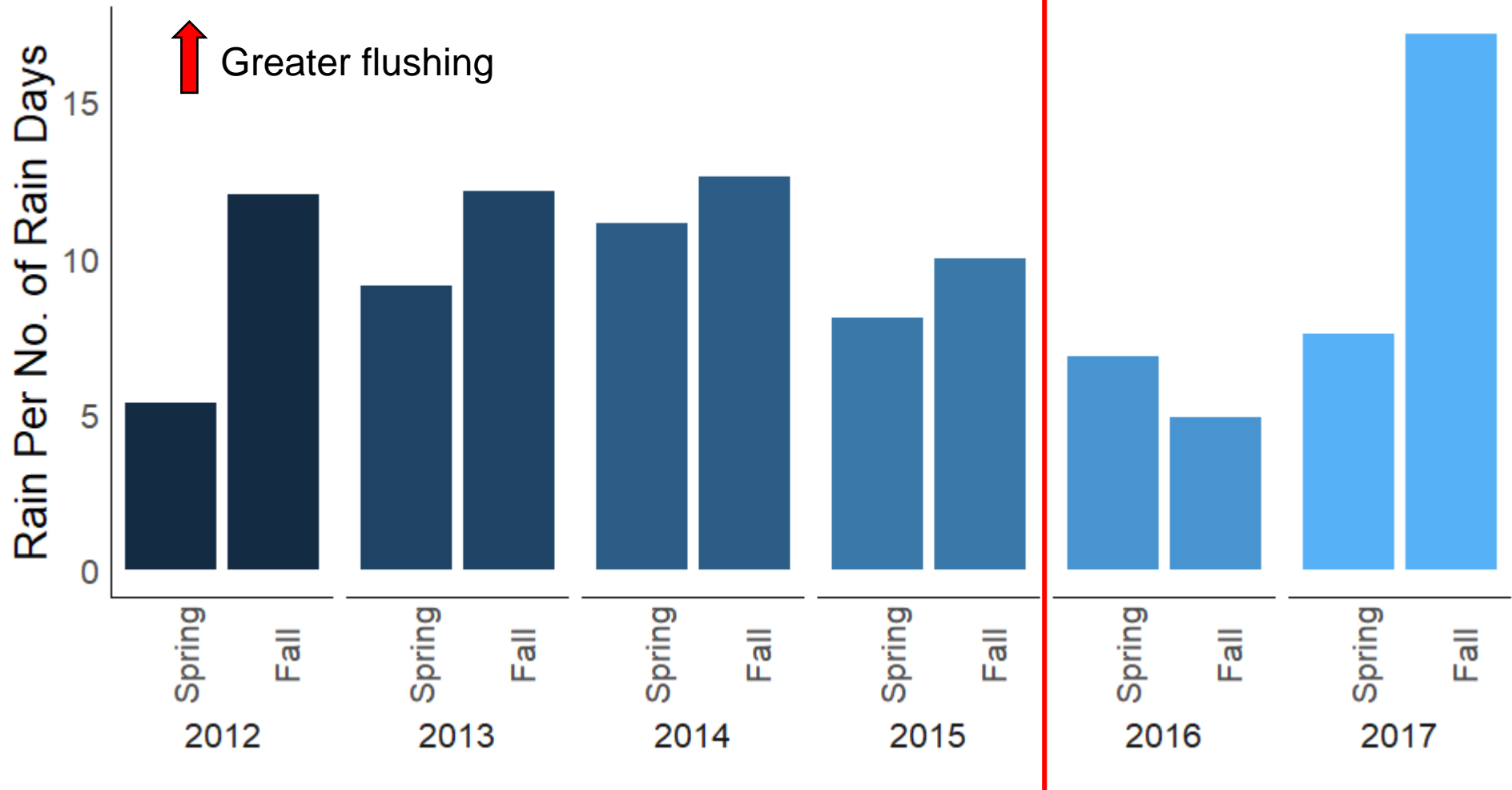




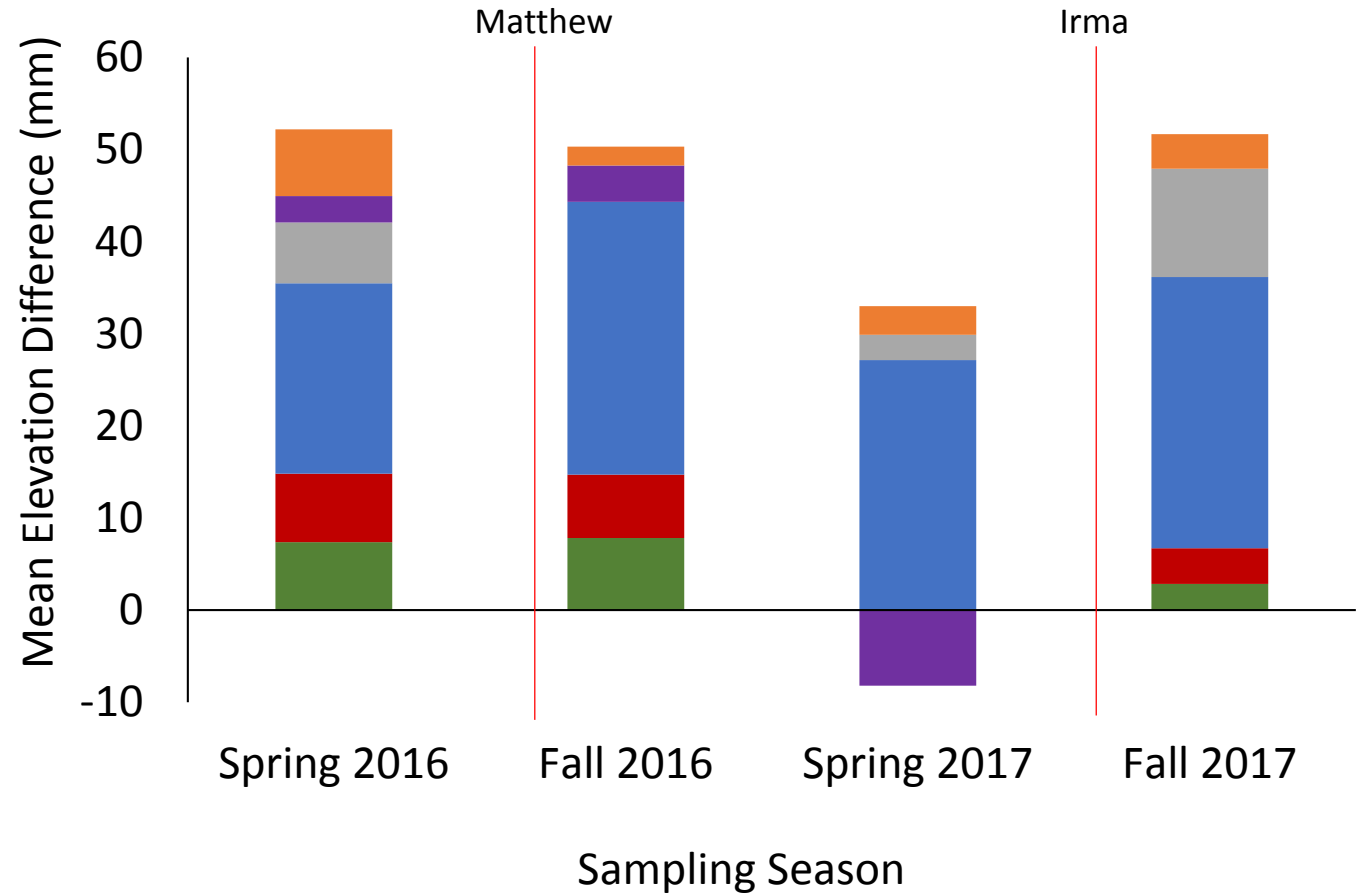
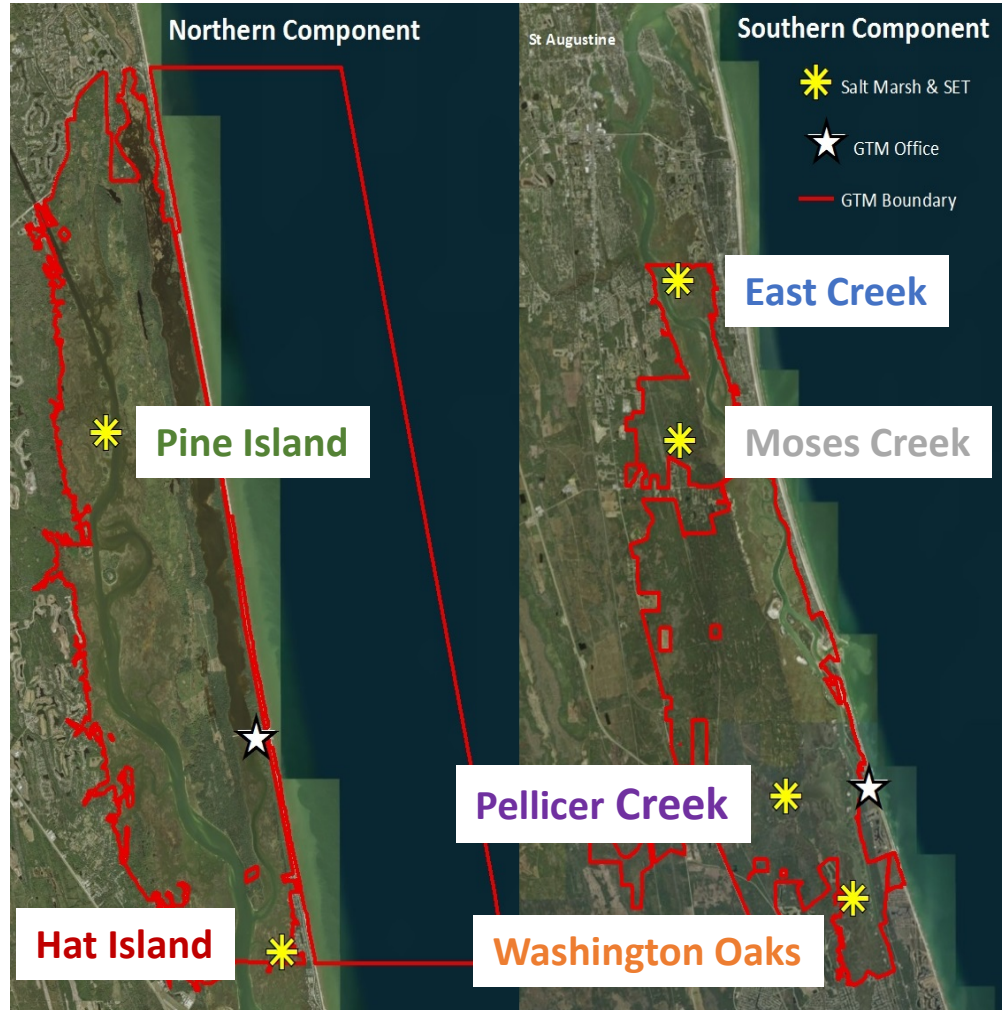


# Rainfall: Acute rainfall index

$$\text{Acute rainfall index} = \frac{\text{Total amount of rain}}{\text{Number of days with rain}}$$

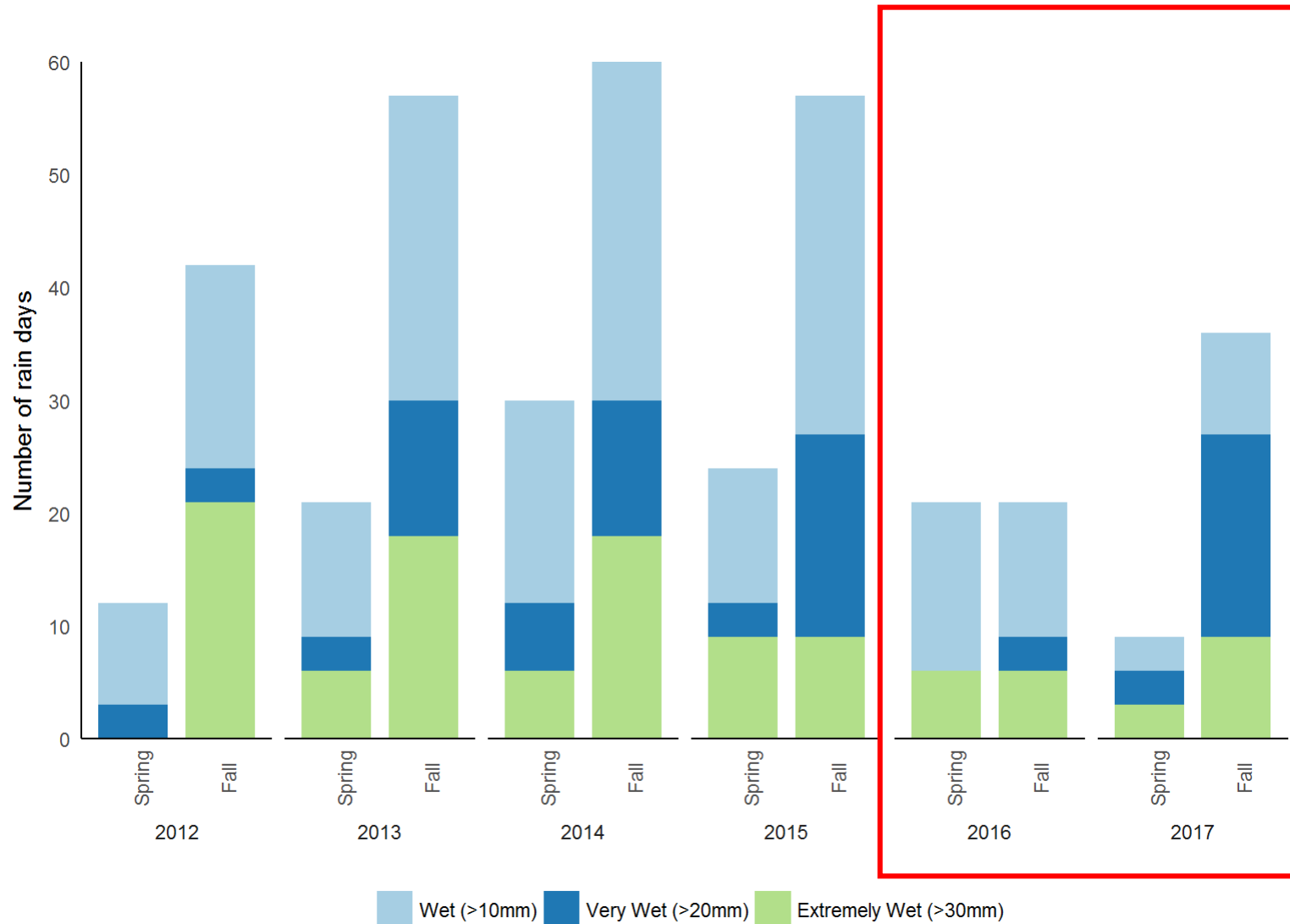


# Surface Elevation Patterns





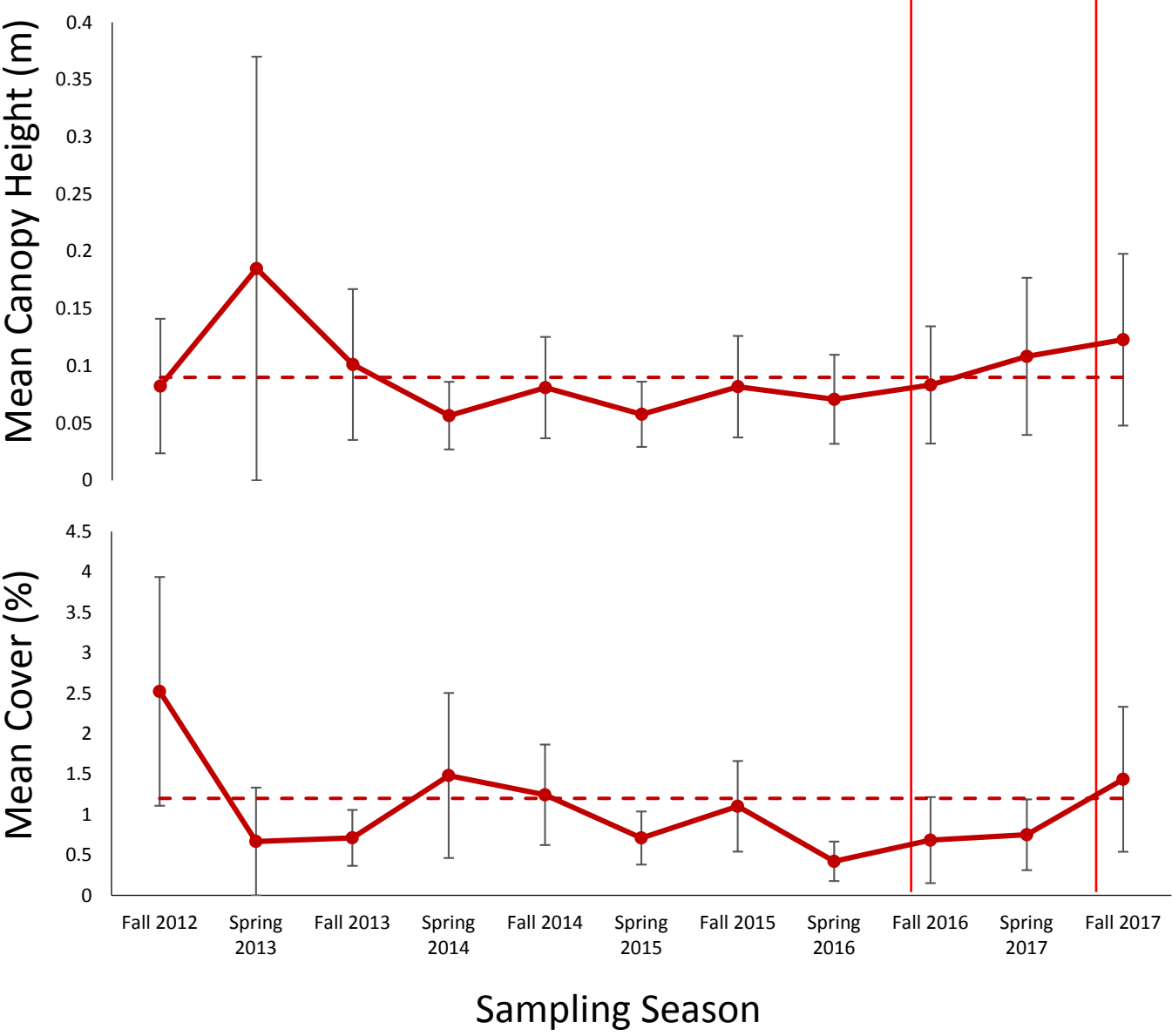
# Rainfall: number of rain days



- Fewer days of rain in the hurricane years
- More rain days during Irma than Matthew



# *Sarcocornia perennis*





<https://coast.noaa.gov/hurricanes/>

