

# Artificial Warming Increases Adult Mangrove and Salt Marsh Growth Rates and May Enhance Transition to Mangrove Dominance



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Photo Credit:

Samantha Chapman

**2003**



**2013**



## **Range Expansion**

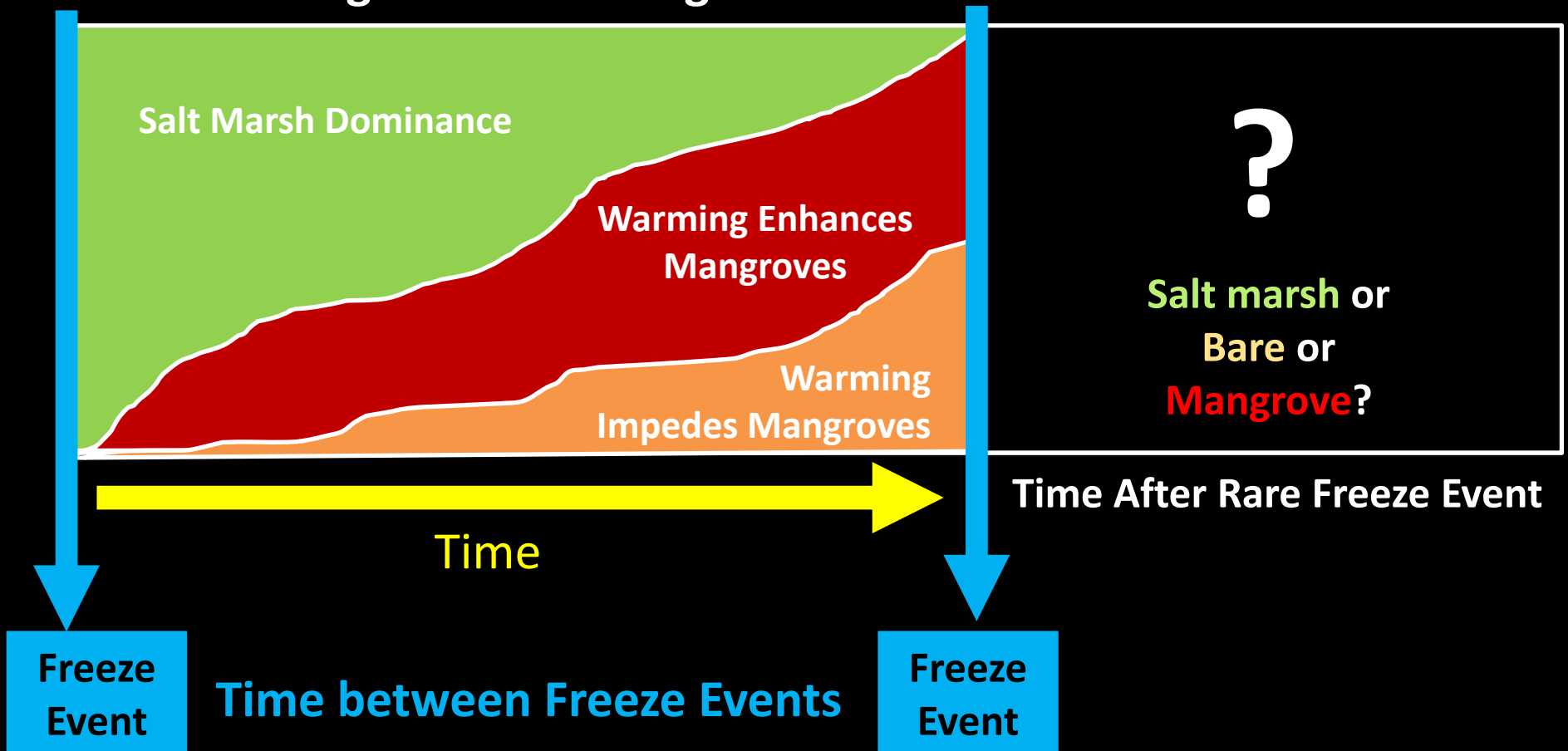
**Reduced freeze frequency  
allows mangrove  
encroachment into new  
habitat**

### **References:**

**Cavanaugh et al. 2014  
Saintilan et al. 2014  
Osland et al. 2013**

# Mangrove Encroachment Under Chronic Warming

## Mangrove Colonizing Site





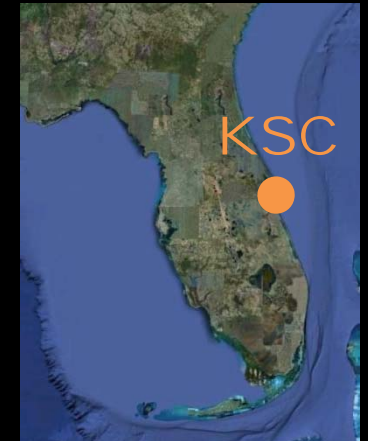
# Cape Canaveral Study Site

## Mangrove

*Laguncularia racemosa*

## Salt Marsh

*Distichlis spicata*





Small Chamber Warming Study  
Mangrove Seedlings & Salt Marsh  
Coldren et al. In Press (Ecology)



**Response to Warming**

**Mangrove Seedlings (*Avicennia*)**

Minimal

**Salt marsh (*Distichlis*)**

Strong positive effect but only in Summer

# Warming Study Experimental Design

## Warming Treatments

August 2014 to June 2016

**Control (Ambient)**

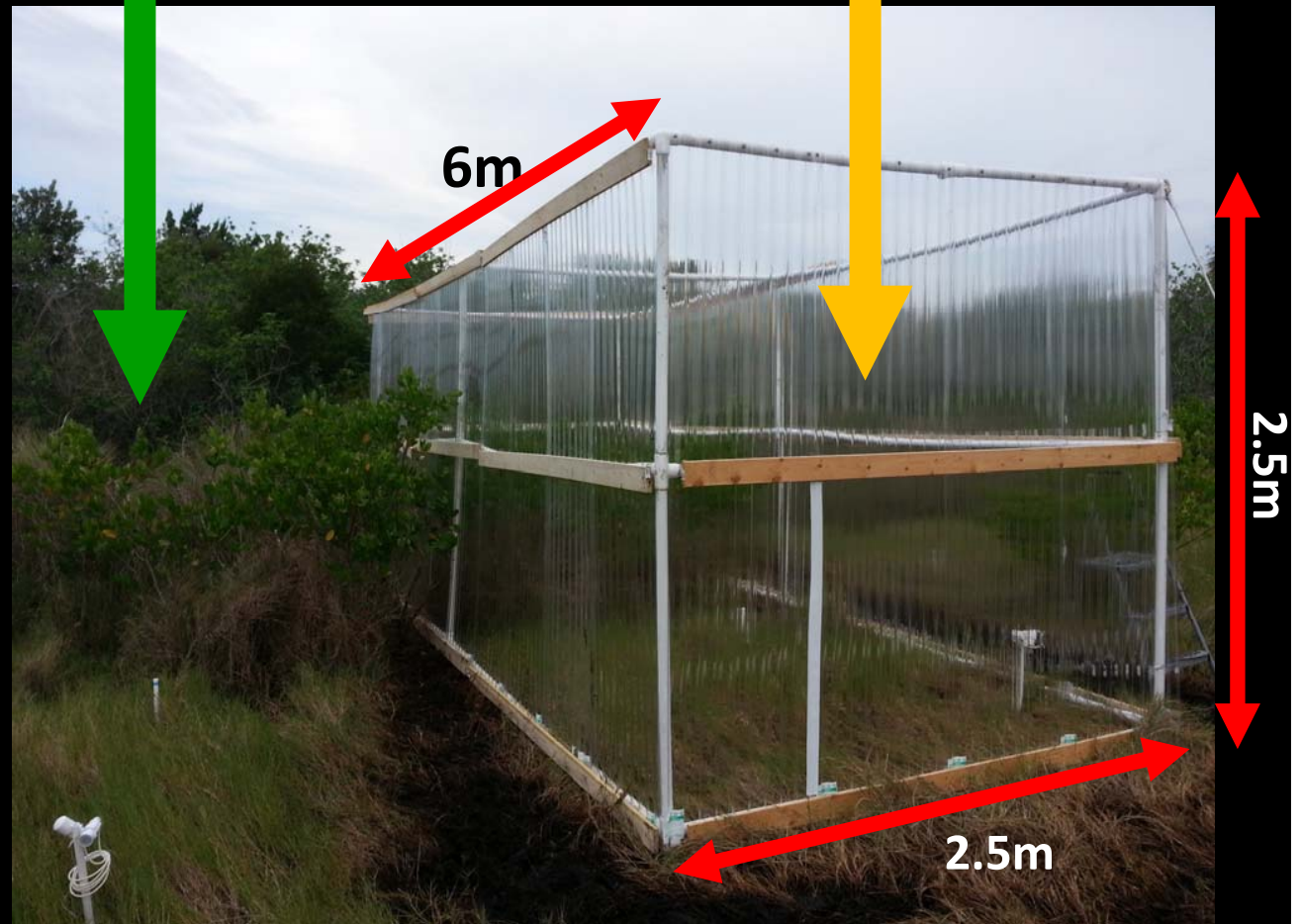
**Warming Chambers**

### Size and Coverage:

Mangroves  
Salt Marsh

### Physical Characteristics:

Air Temperature  
Soil Temperature  
Humidity  
Salinity



3 Replicates

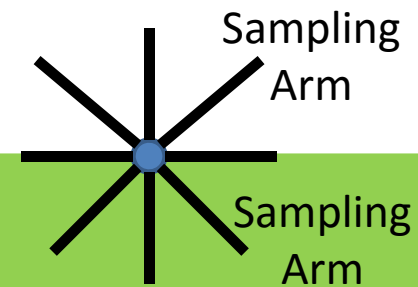


# Sediment Elevation Table (SET)



**SET Position**

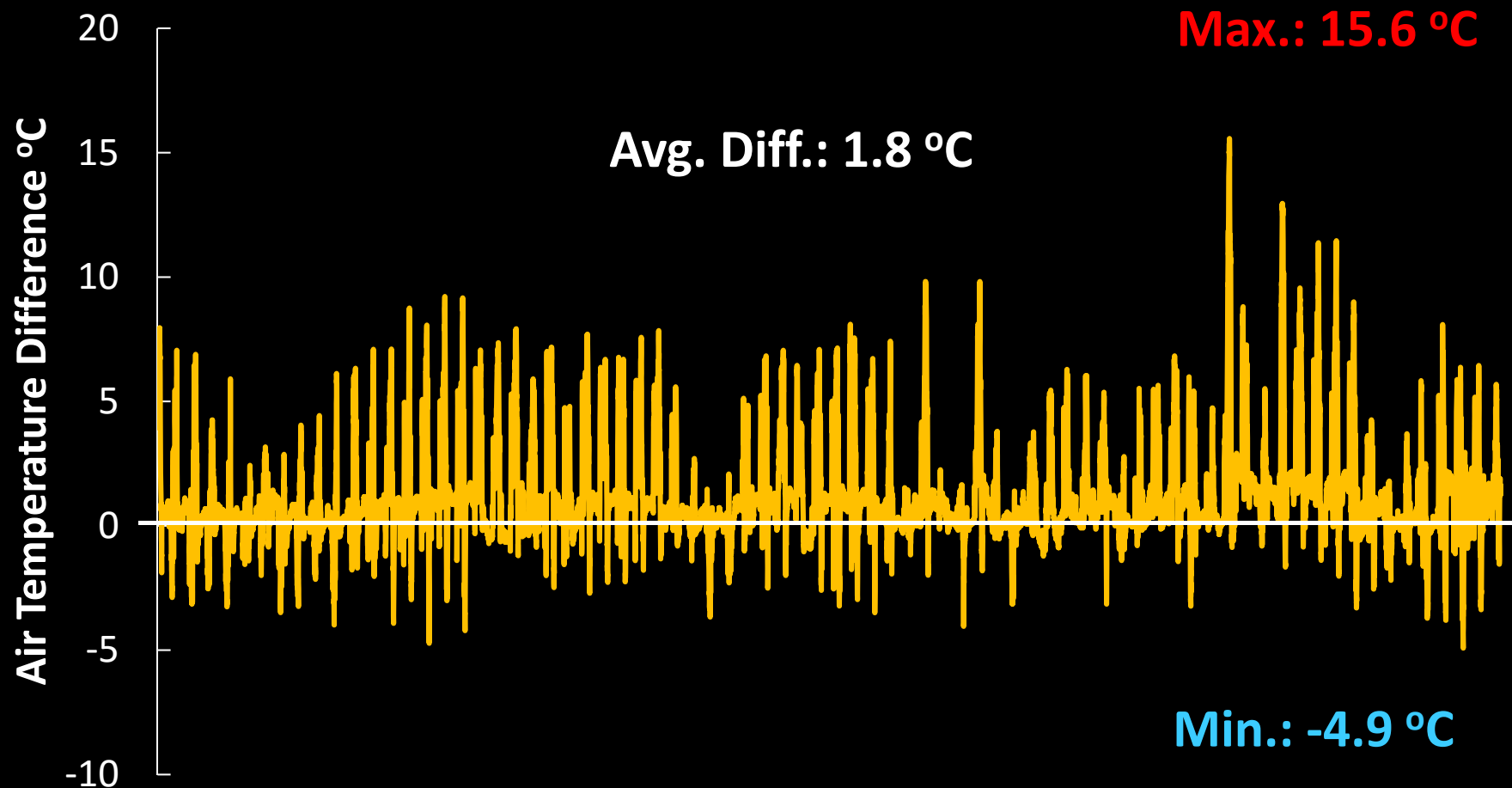
**Mangrove Dominated Zone**



**Salt Marsh Dominated Zone**

# Warming Chamber Effect on Air Temperature

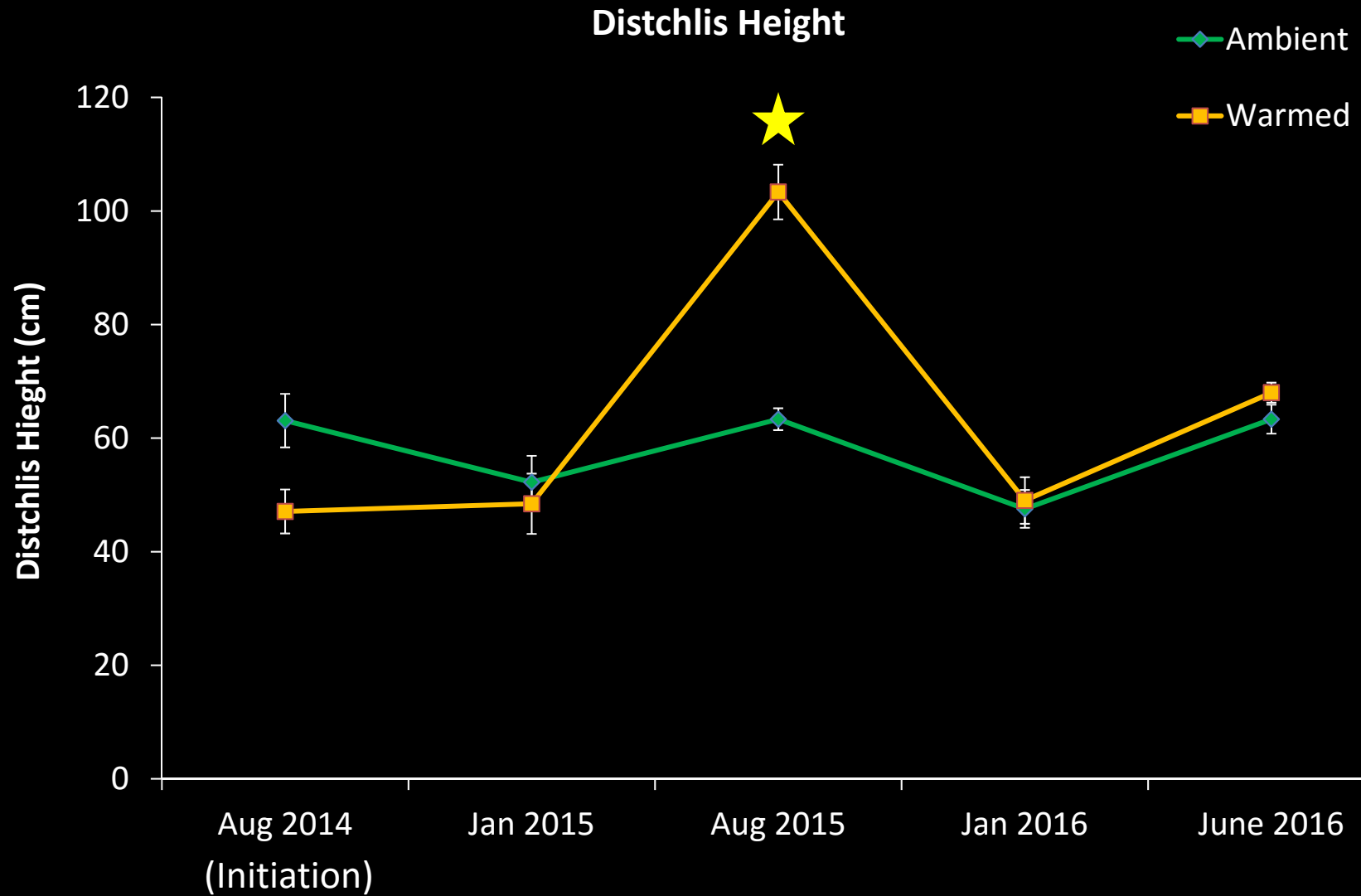
Other Physical Characterizes: No significant Effects







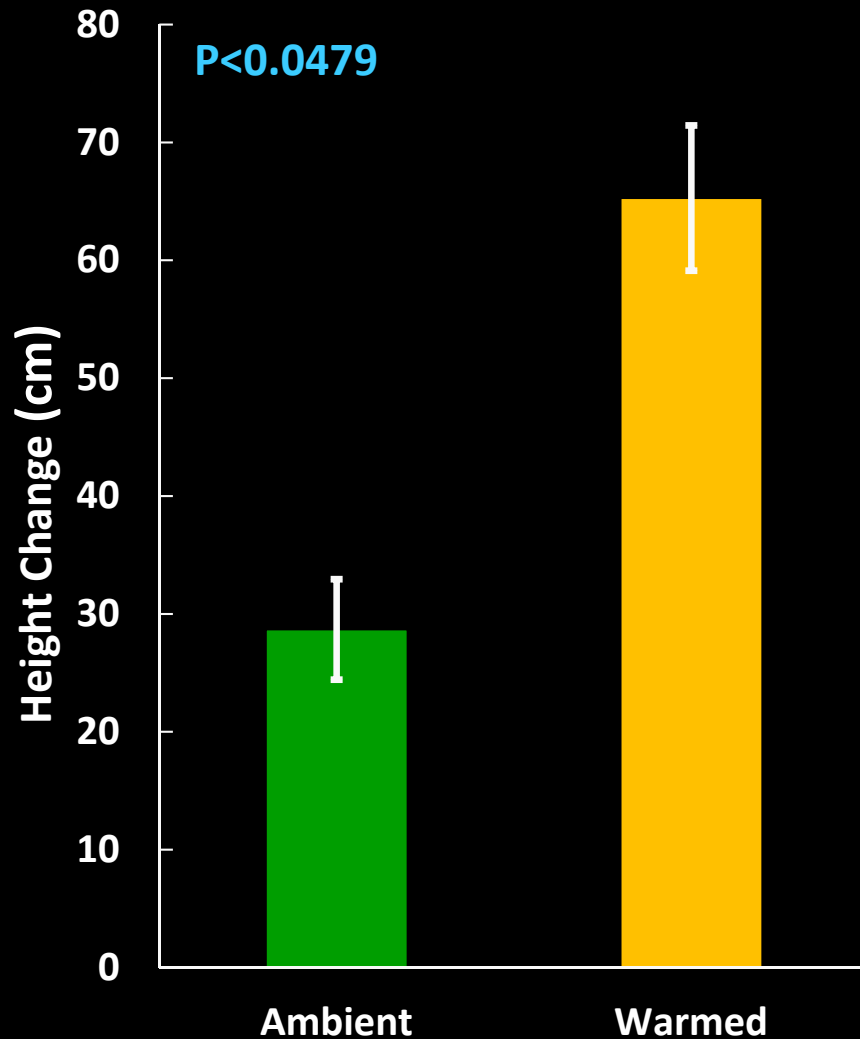
# Distchlis Over Time



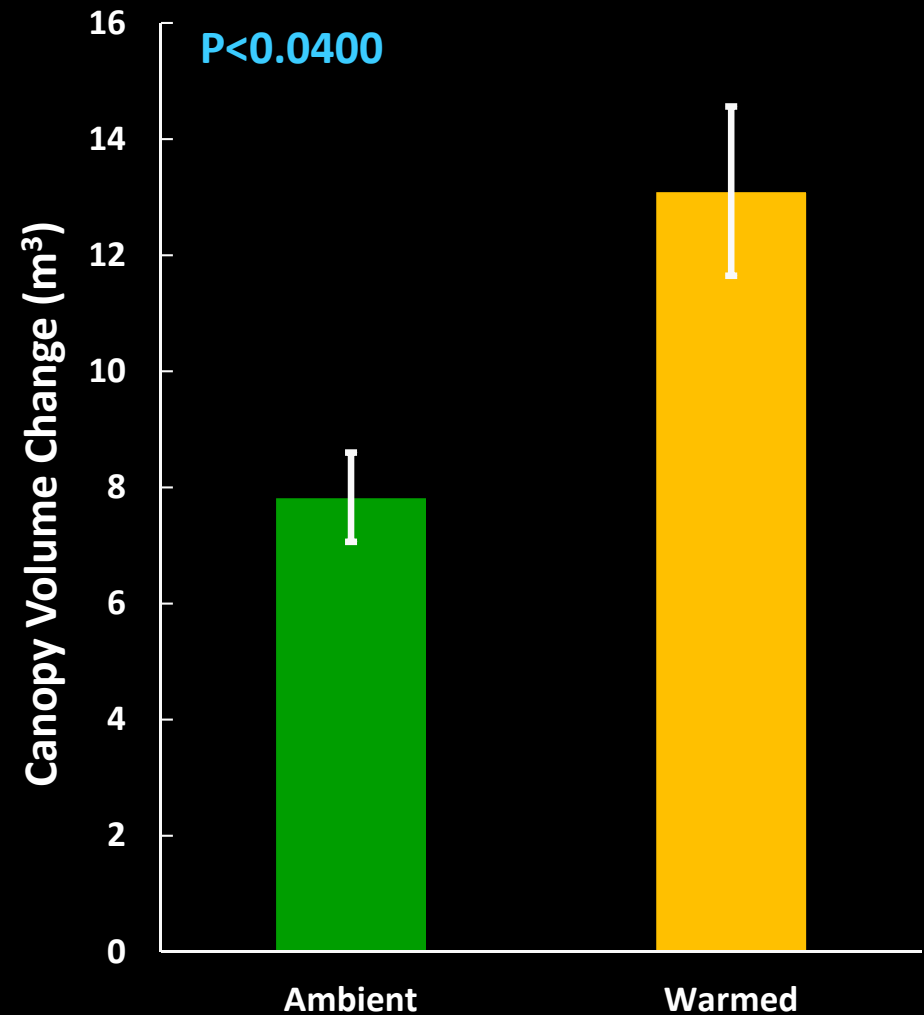
# Change in *Laguncularia* Size (22 Months)

■ Ambient ■ Warmed

## Height



## Canopy Volume



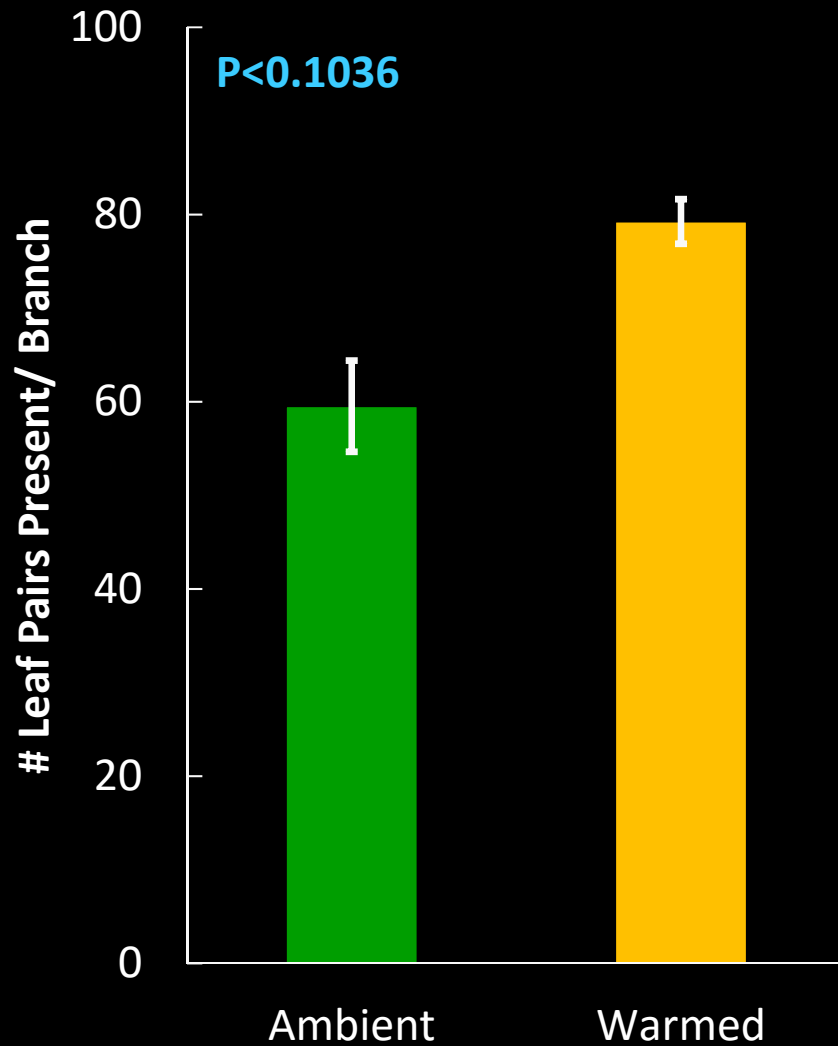




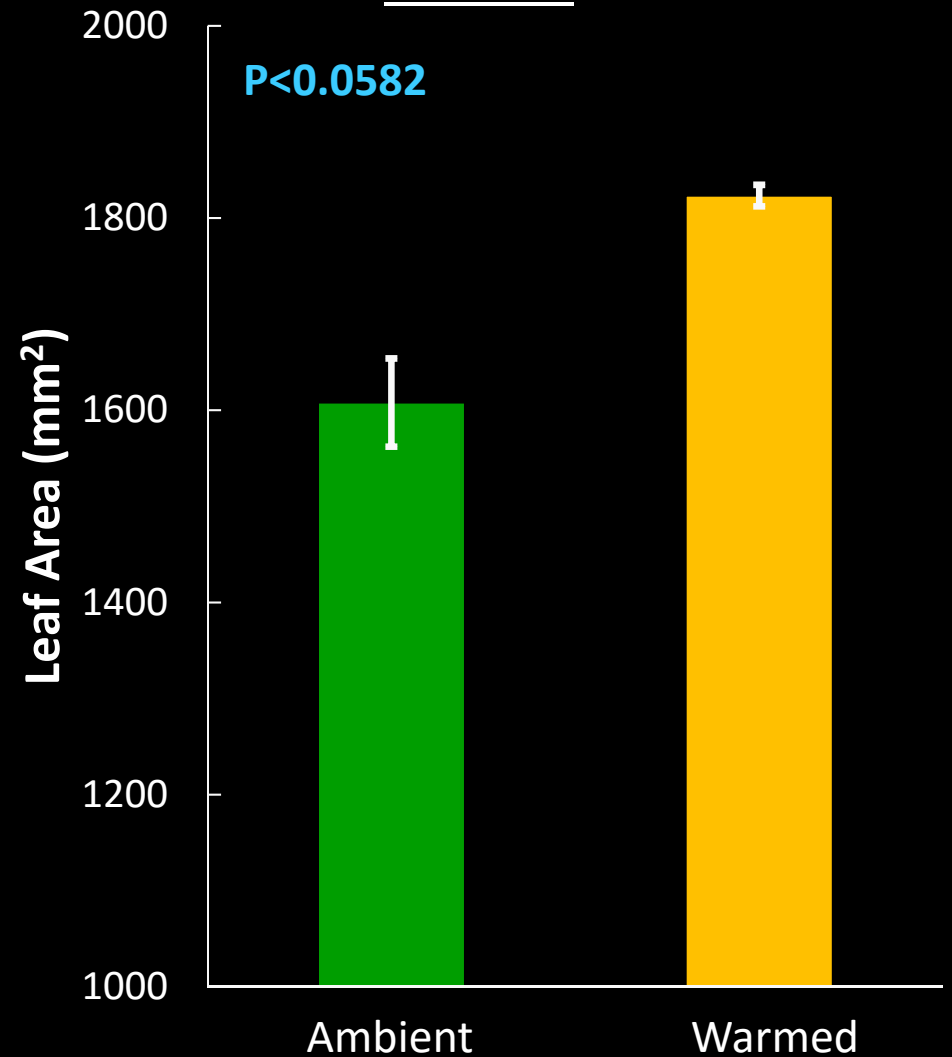
## *Laguncularia* Leaves (After 22 months warming)

■ Ambient ■ Warmed

### Leaf Abundance



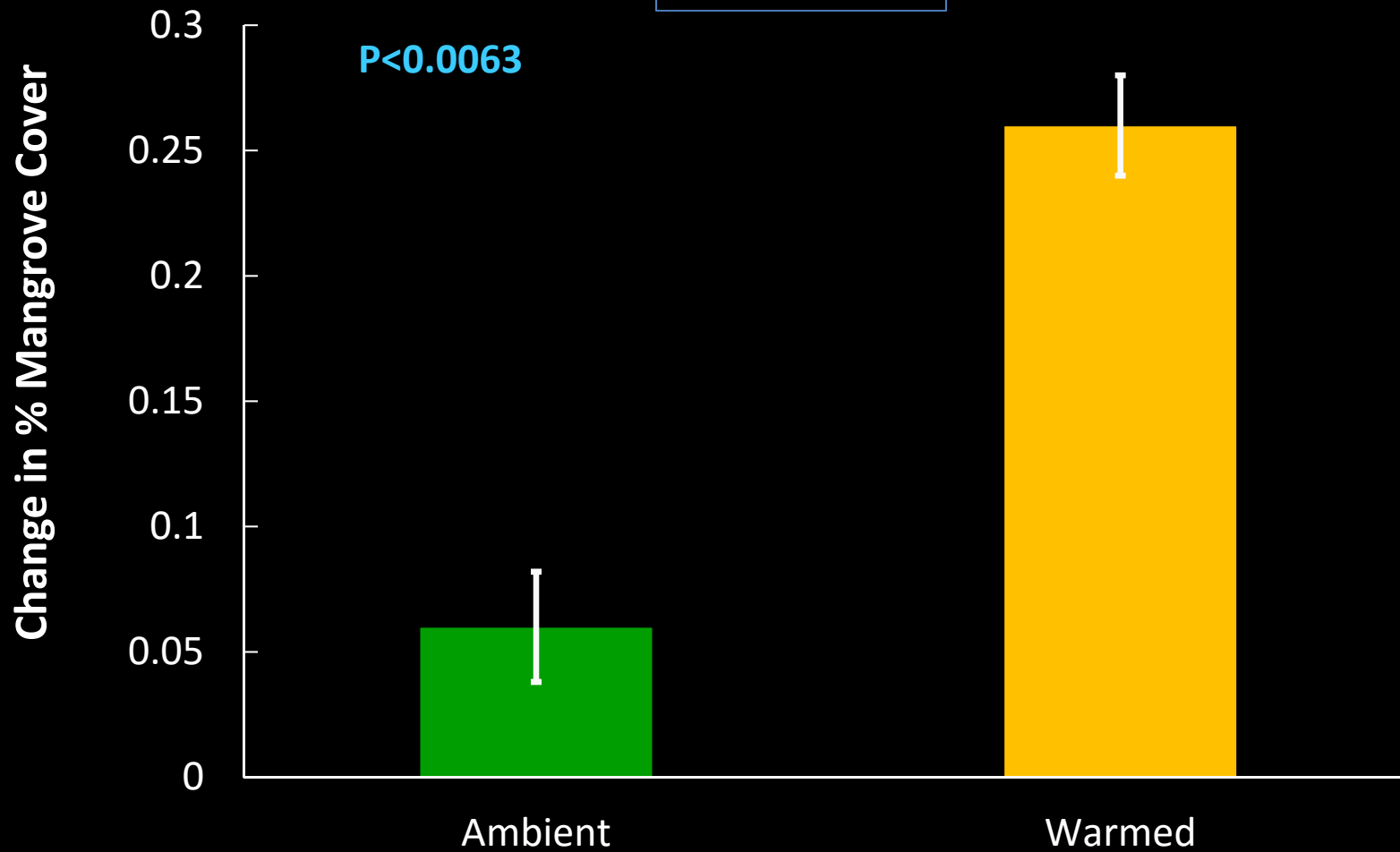
### Leaf Size



# *Laguncularia* Transition (22 Months)

■ Ambient ■ Warmed

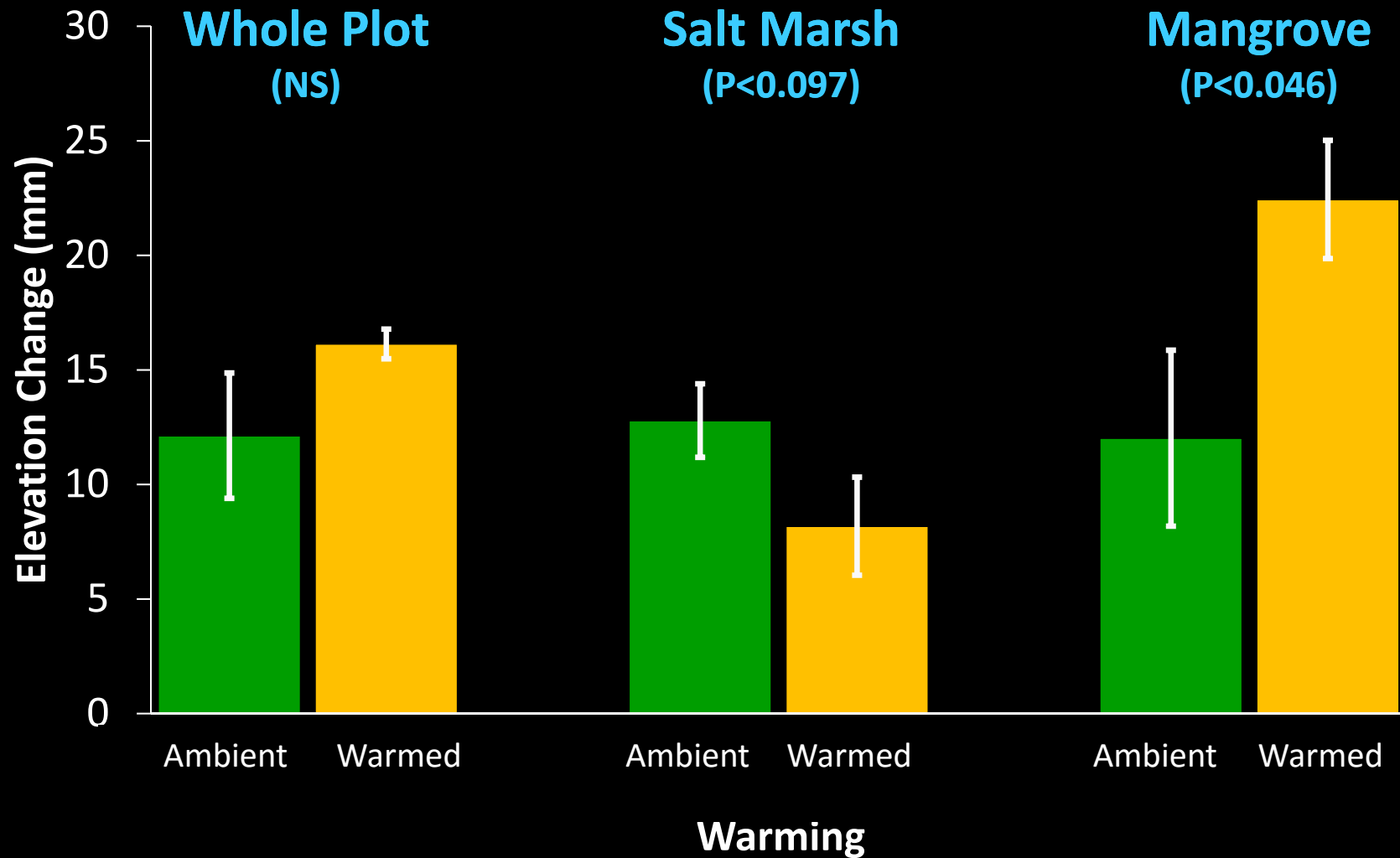
Recruitment  
~3-4 Seedlings  
0 Saplings





# Sediment Elevation Change (22 Months)

■ Ambient ■ Warmed



# Conclusion

## Under chronic warming

- Adult mangroves responded strongly
  - Increased size and leaf characteristics
    - Previous Work: *Avicennia* seedlings showed minimal responses
- Salt marsh only responded in summer
  - Previous Work: Same response
- Enhanced transition to mangrove dominance
  - A result of increased canopy expansion
- Sediment Elevation Gain:
  - Mangrove areas increased
  - Salt marsh areas decreased



# Acknowledgements



## Funding

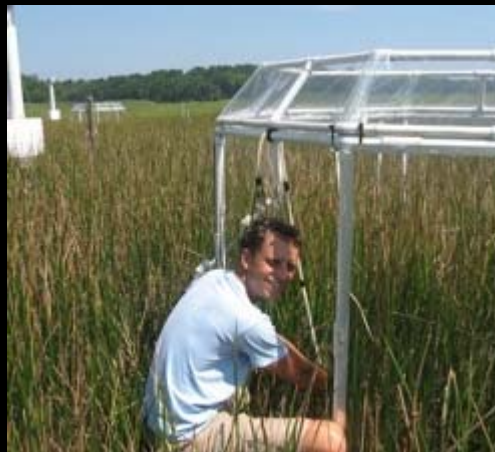
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- NASA-CASI (Climate Adaptation Science Investigator)

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**Samantha Chapman**



**Adam Langley**



**Candy Feller**

# Questions?

