Energy partitioning and sensitivity to low temperature events of Everglades wetlands

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Wetlands Have a Great Potential for Carbon Sequestration

Ocean
(40,000 Gt C)

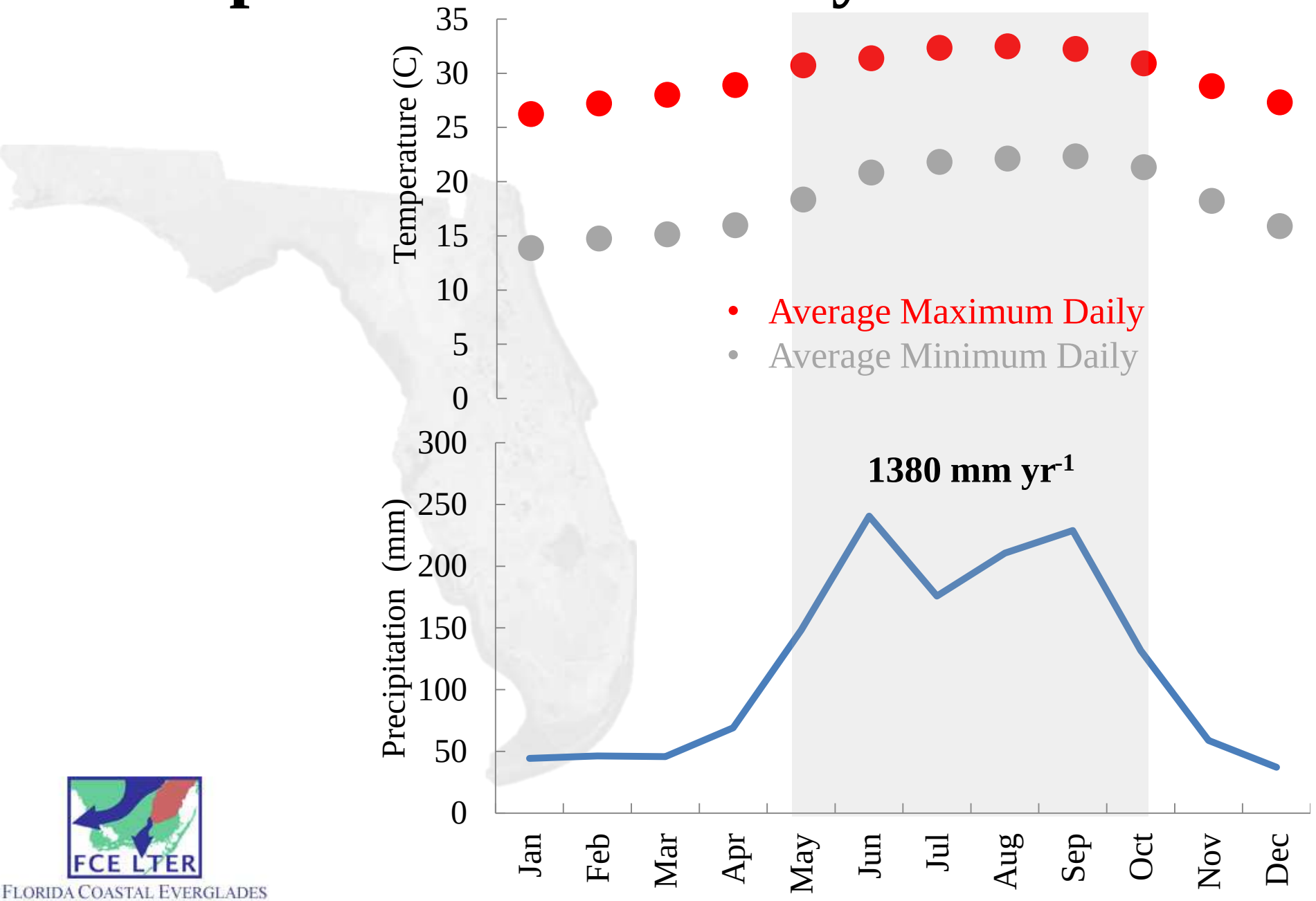
Fossil Fuels
(6,000 Gt C)

Land/ Plants/ Soil
(2,200 Gt C)

Atmosphere
(800 Gt C)

- Slow decomposition and C accumulates over long time periods
- Representing just 5-8% land cover, wetlands contain ~68% soil C
- The stability of this large C pool is uncertain due to human influence and climate change

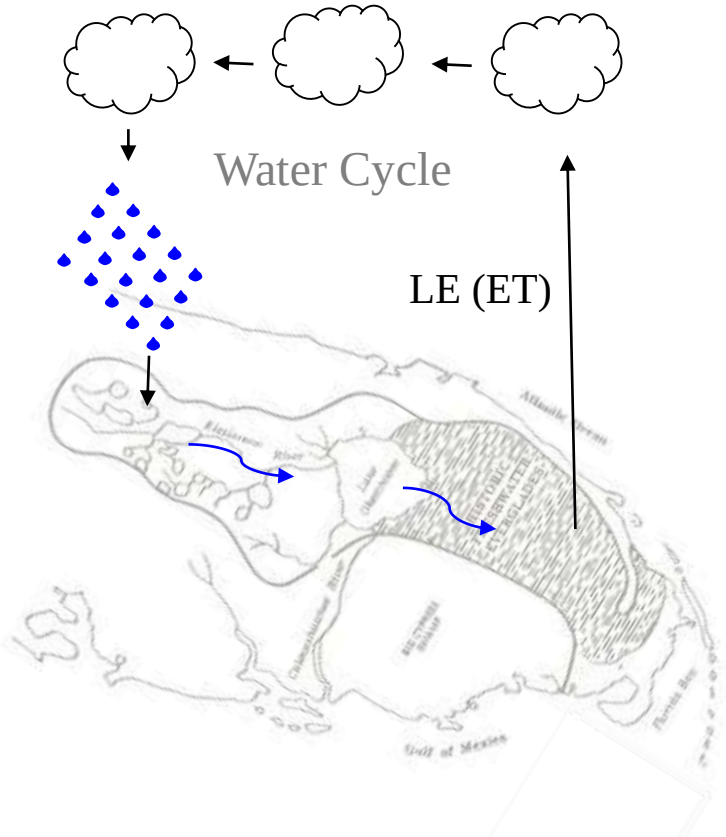
Subtropical Wetland Ecosystem



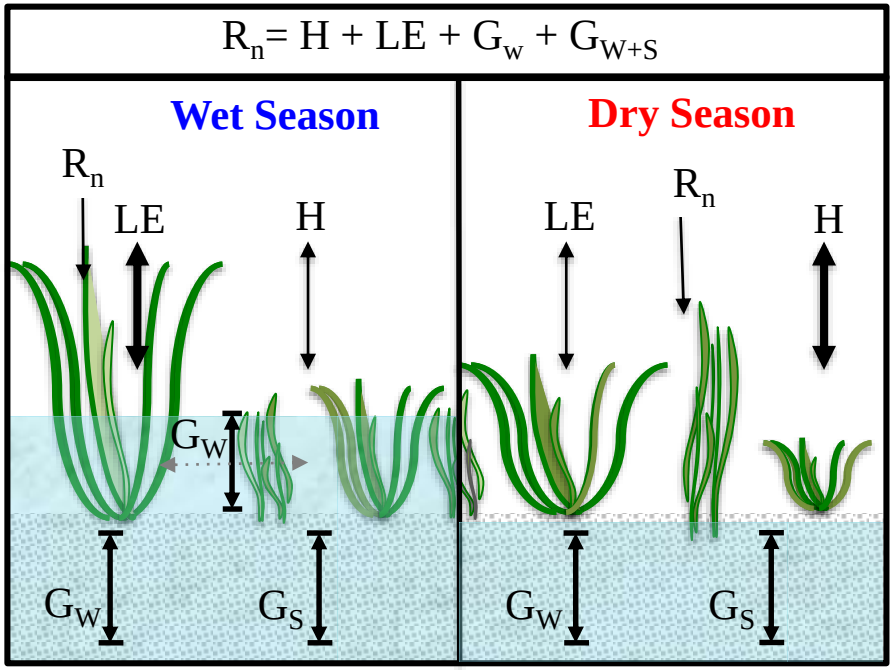
FCE LTER

FLORIDA COASTAL EVERGLADES
LONG TERM ECOLOGICAL RESEARCH

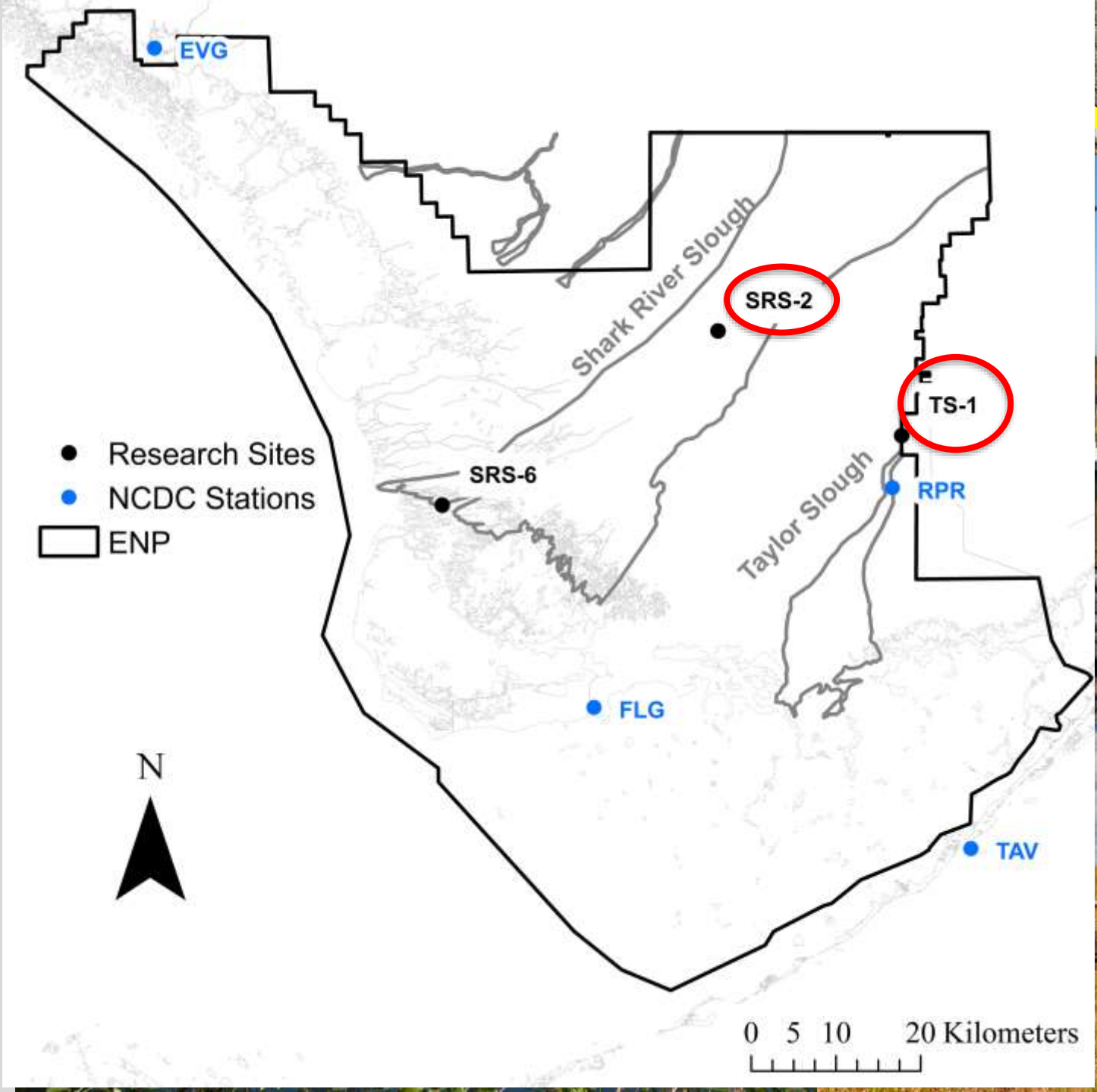
Hydrology is the most important factor for wetland structure and function, including **energy partitioning**.



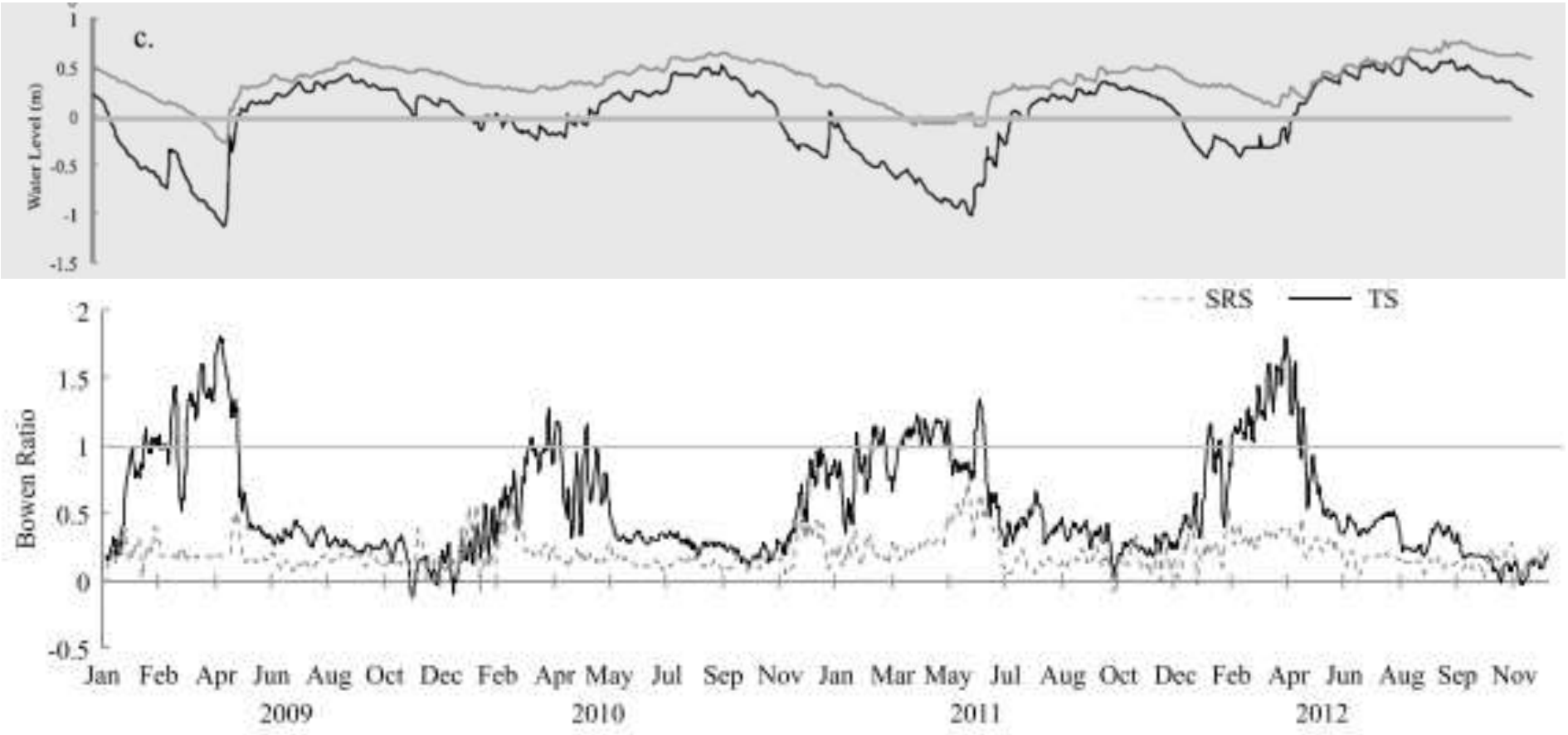
R_n: Net Radiation
H: Sensible Heat
LE: Latent Energy
G_W: Energy stored in water
G_S: Energy Stored in the soil column



Freshwater Marsh



Bowen Ratio (β): sensible heat / latent heat

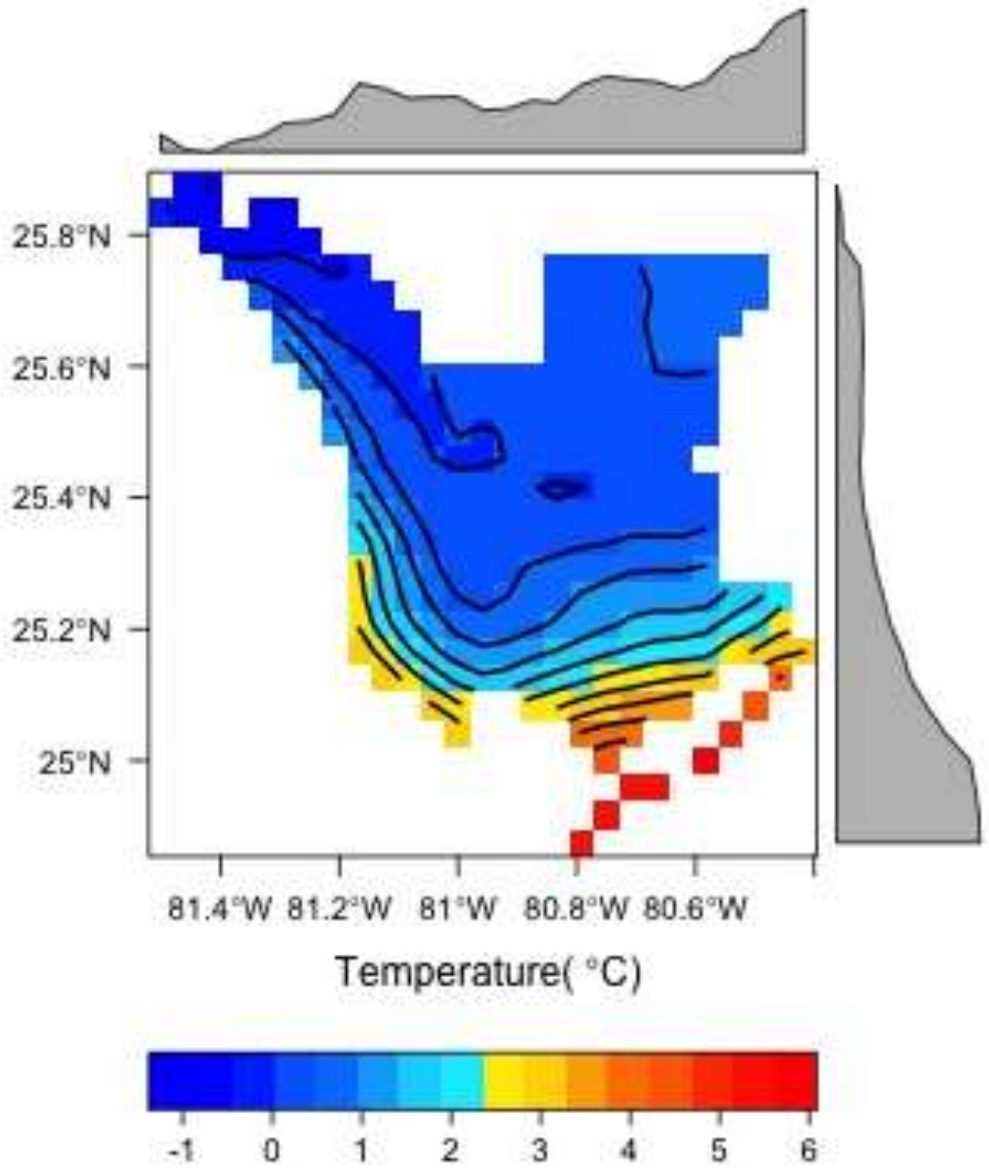


- β seasonality increases with variation in hydroperiod.
- The β was higher during the dry season when the amount of energy partitioned to the H flux increased.

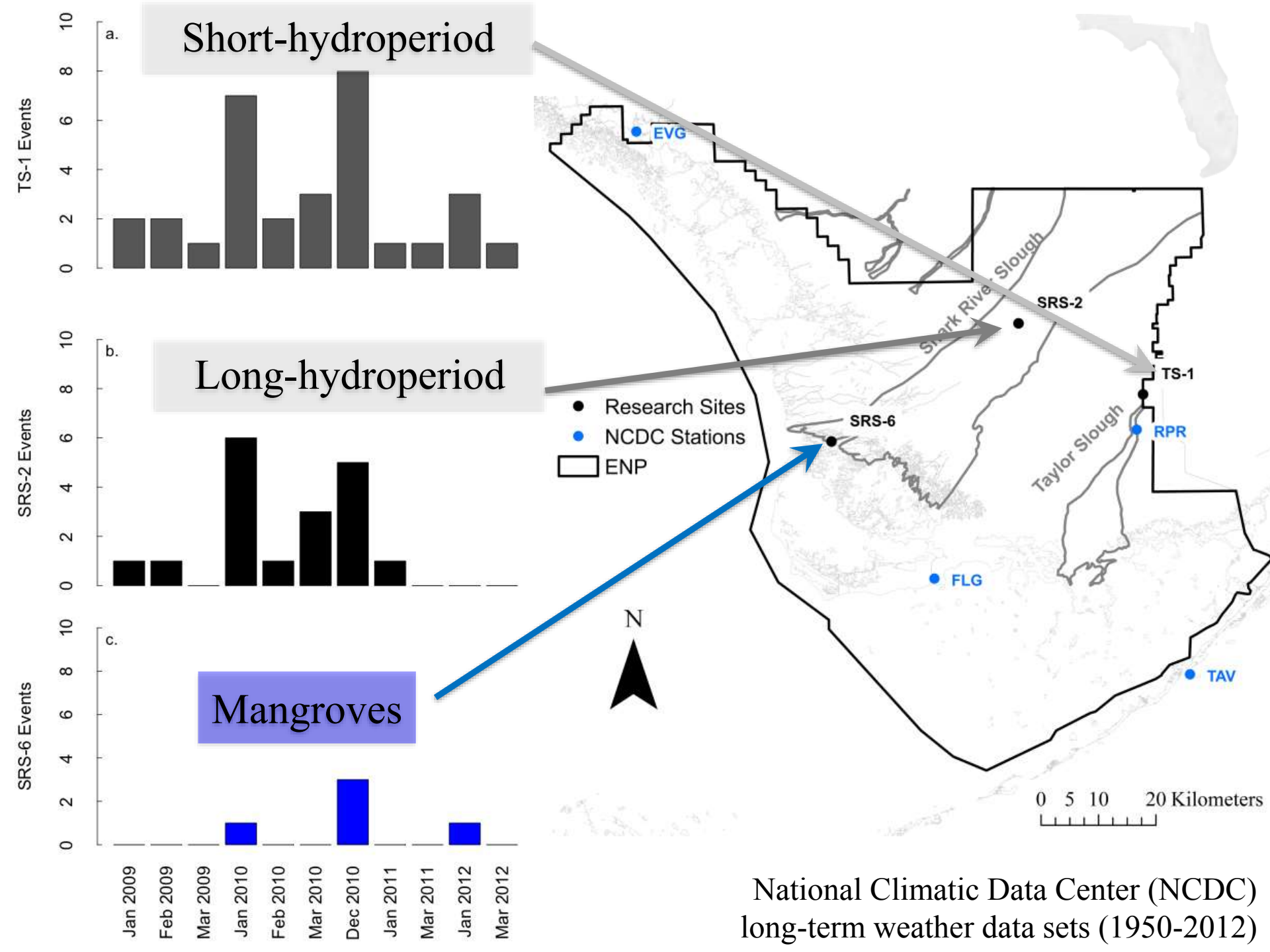
Historical frequency (days) of low-temperature events (< 5 °C) in Everglades National Park (1950–2012).

Station	Event frequency	Mean annual frequency
Everglades (EVG)	476	7.8
Royal Palms Ranger Station (RPR)	404	8.4
Flamingo (FLG)	333	5.5
Tavernier (TAV)	37	1.8
Average	***313***	***5.9***

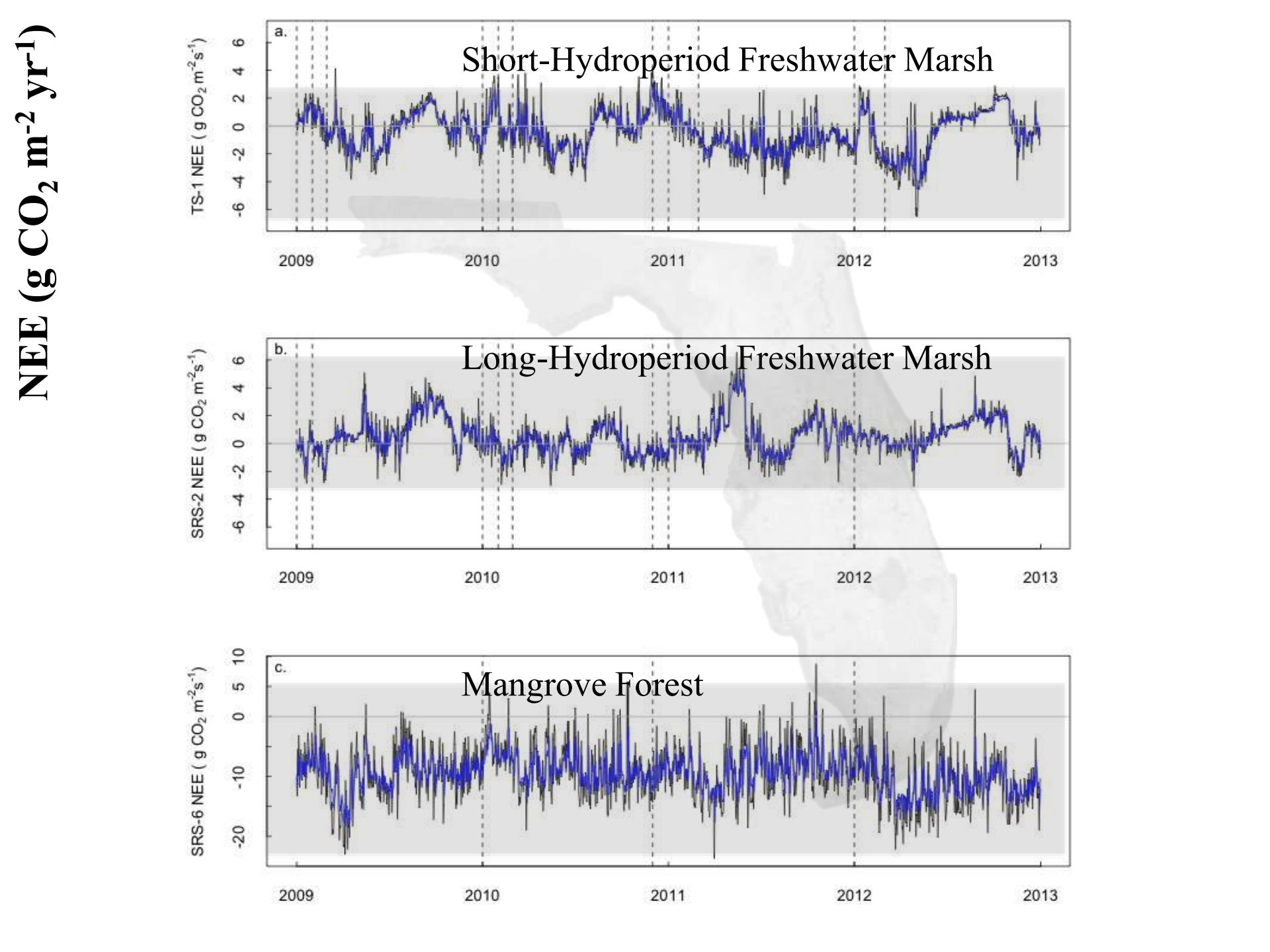
Average temperature during the low temperature days in 2010



PRISM

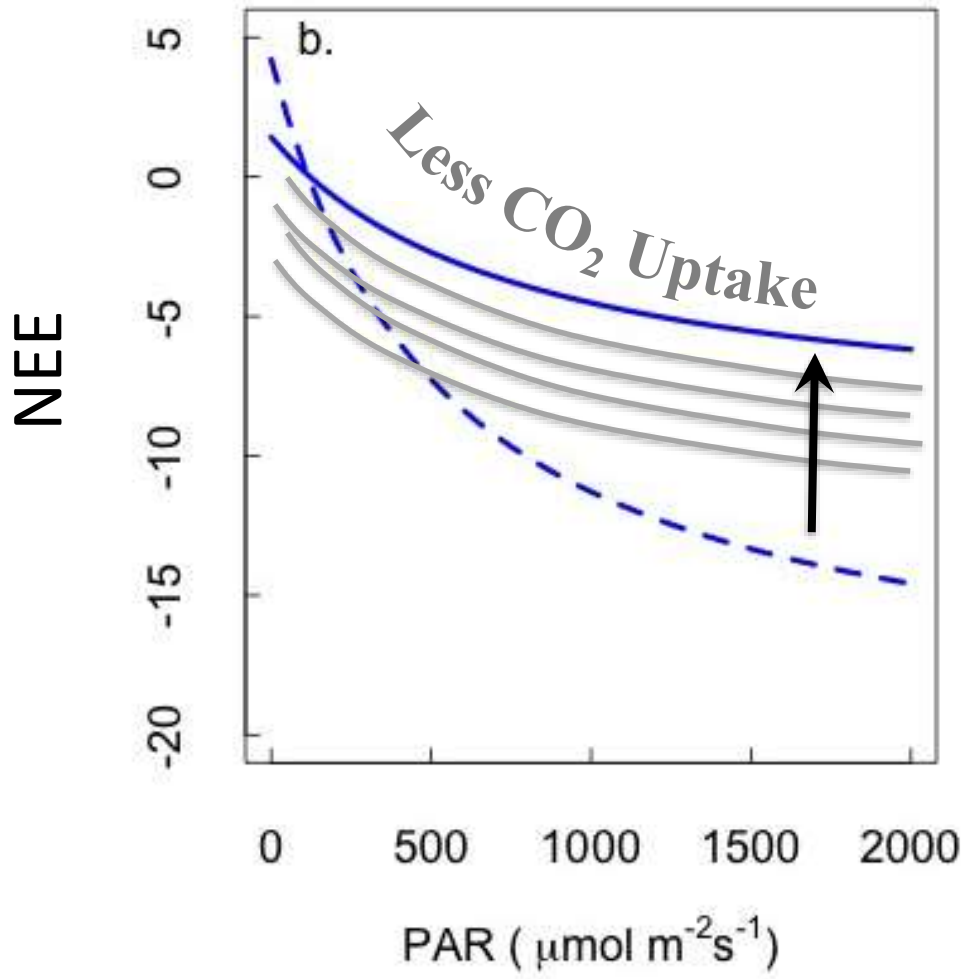


National Climatic Data Center (NCDC) long-term weather data sets (1950-2012)


NEE (g CO2 m-2 yr-1)
a.
Short-Hydroperiod Freshwater Marsh
TS-1 NEE (g CO2 m-2s-1)
-6 -4 -2 0 2 4 6
2009
2010
2011
2012
2013
b.
Long-Hydroperiod Freshwater Marsh
SRS-2 NEE (g CO2 m-2s-1)
-6 -4 -2 0 2 4 6
2009
2010
2011
2012
2013
c.
Mangrove Forest
SRS-6 NEE (g CO2 m-2s-1)
-20 -10 0 5 10
2009
2010
2011
2012
2013

Sensitivity

- A reduction in CO_2 exchange rates

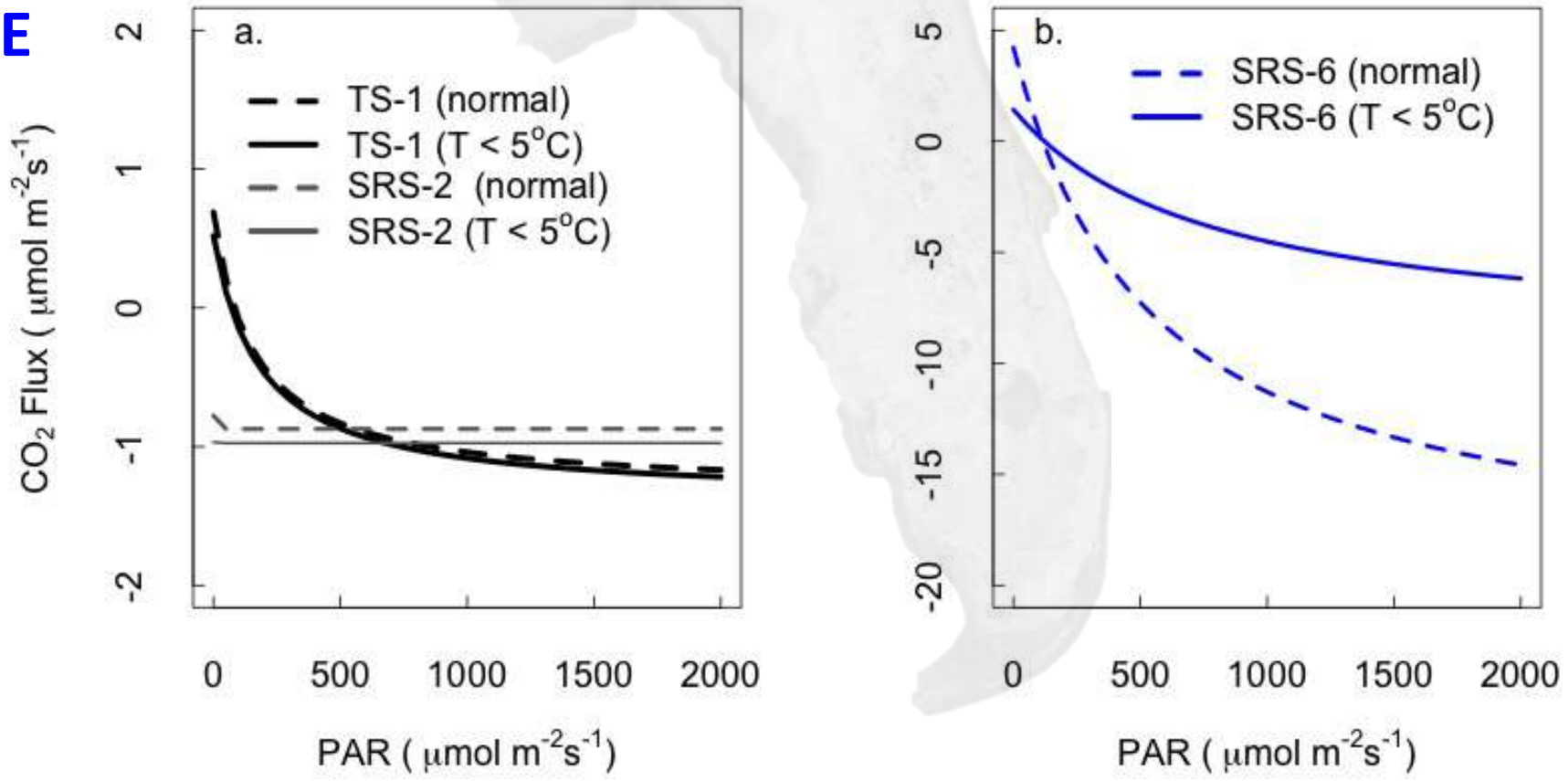


Different sensitivities of CO_2 fluxes to low-temperature events

Short- and long-hydropreriod marsh

Mangroves

NEE



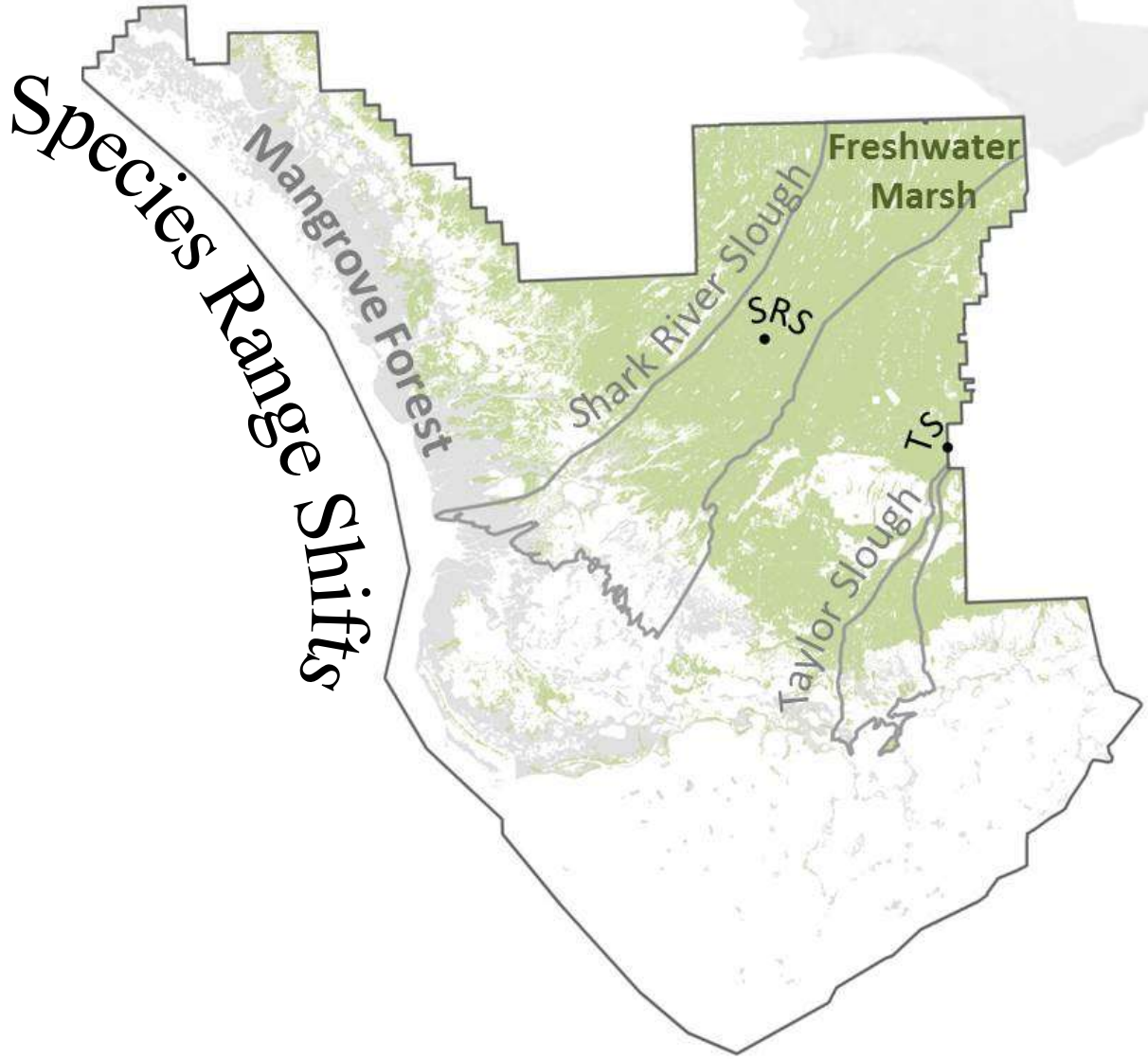


Conclusion

- Seasonal hydrological pattern controls ecosystem energy partitioning and further determines the frequency and intensity of low-temperature

- Where low-temperature events are less frequent (mangrove), there is an increase in NEE (greater CO_2 loss).

Significance



- **More frequent extreme events**
- **Ecosystem carbon balance**