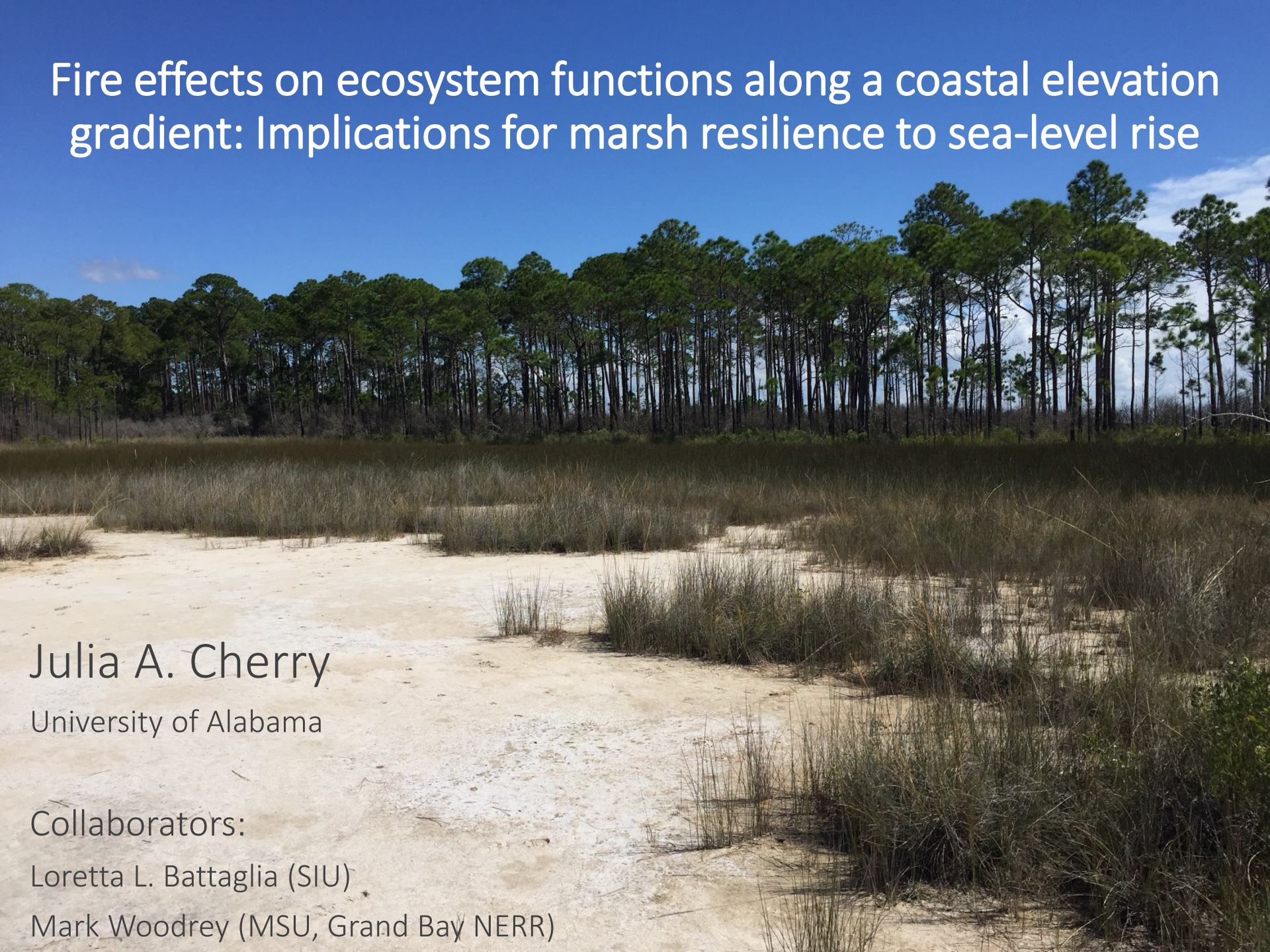
Fire effects on ecosystem functions along a coastal elevation gradient: Implications for marsh resilience to sea-level rise



Julia A. Cherry

University of Alabama

Collaborators:

Loretta L. Battaglia (SIU)

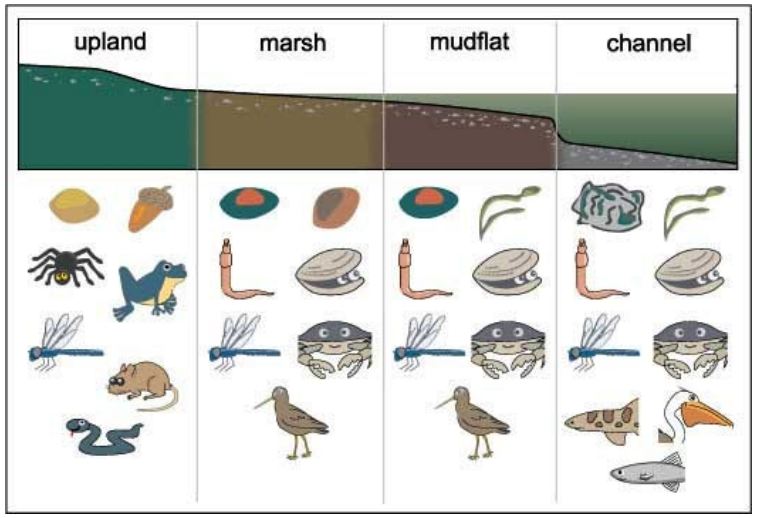
Mark Woodrey (MSU, Grand Bay NERR)

Coastal gradients: a Gulf Coast analog

elevation gradient → flooding & salinity → distinct plant zonation

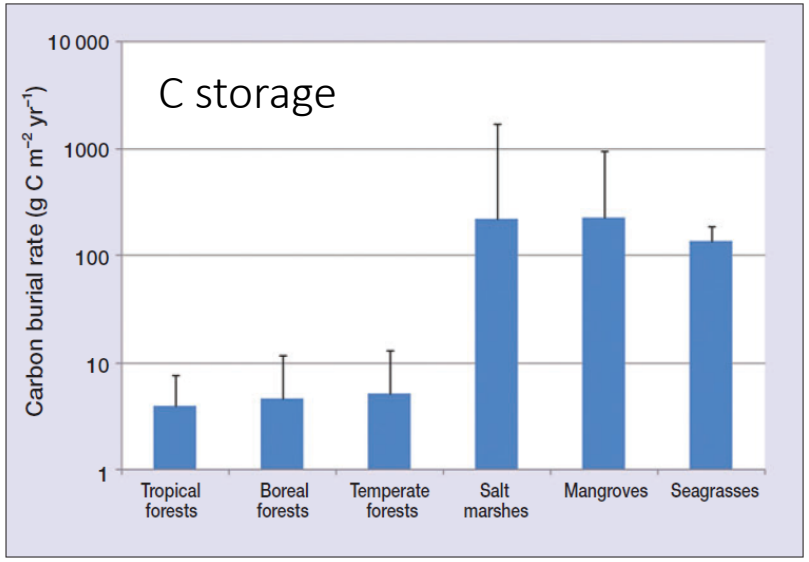
Associated ecosystem functions:

habitat for important species



flood & storm protection

http://www.noaanews.noaa.gov/



McLeod et al. (2013) *Front Ecol Environ*

climate adaptation & mitigation

Coastal wetland vulnerability:

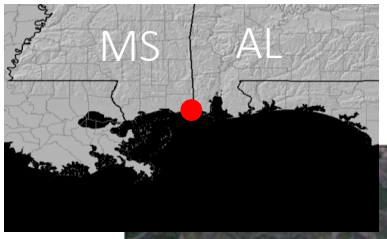
SLR & storm surges → increased flooding & salinity

Drive shifts in plant communities & associated ecosystem functions

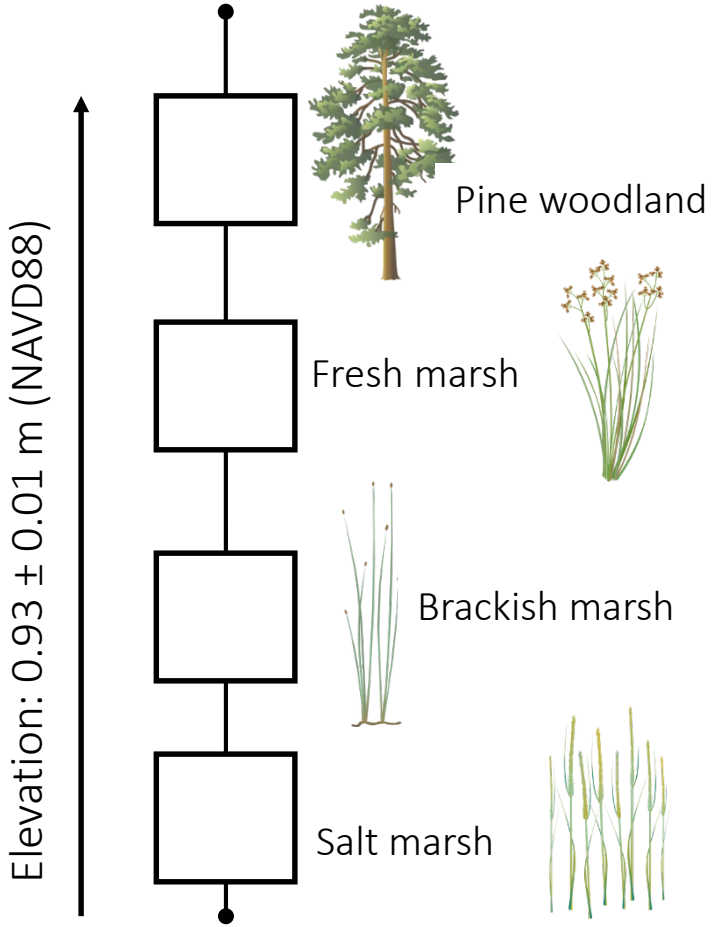
Can coastal wetlands keep pace via migration?
How does prescribed fire affect capacity for lateral upslope migration?

Animation by L. Shirley

Study site: Grand Bay NERR, MS, USA



Burn plots
Control plots



Measurements:

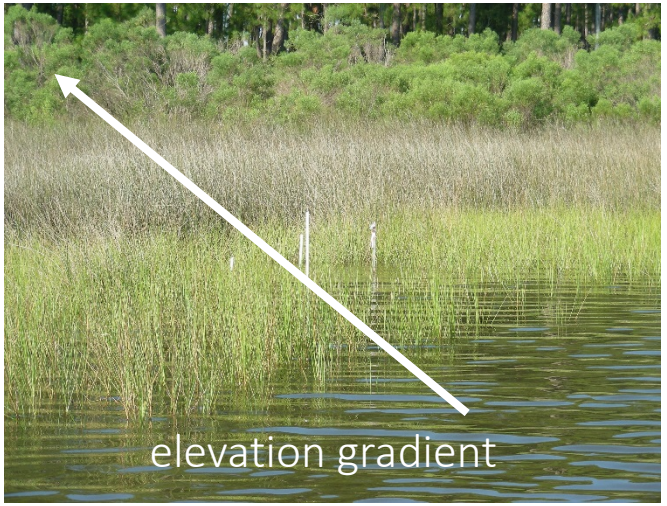
- Porewater chemistry (marshes only)
- Sediment characteristics (%OM, C, etc.)
- Plant community composition
- Sediment accumulation
- Above- & belowground plant biomass
- Decomposition

sediment cores

AG biomass & cover

dual-compartment litterbags

Site Gradients:



Salt and brackish marsh:

porewater salinities: ~14 – 17 psu

porewater sulfides: 1 – 2 mM

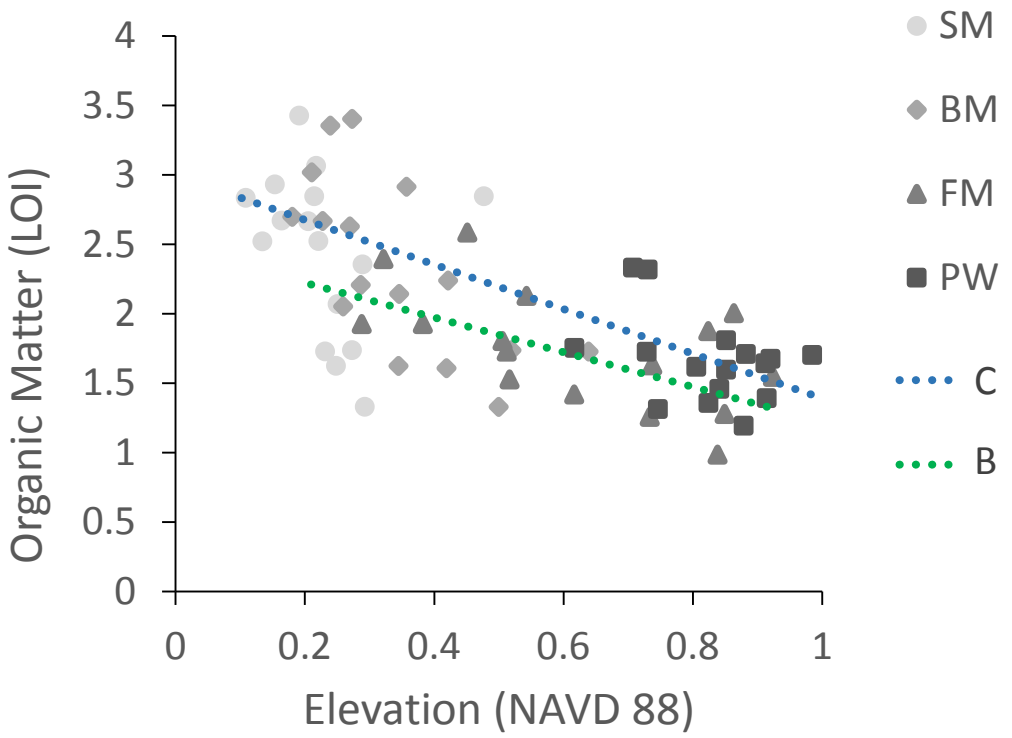
Along gradient:

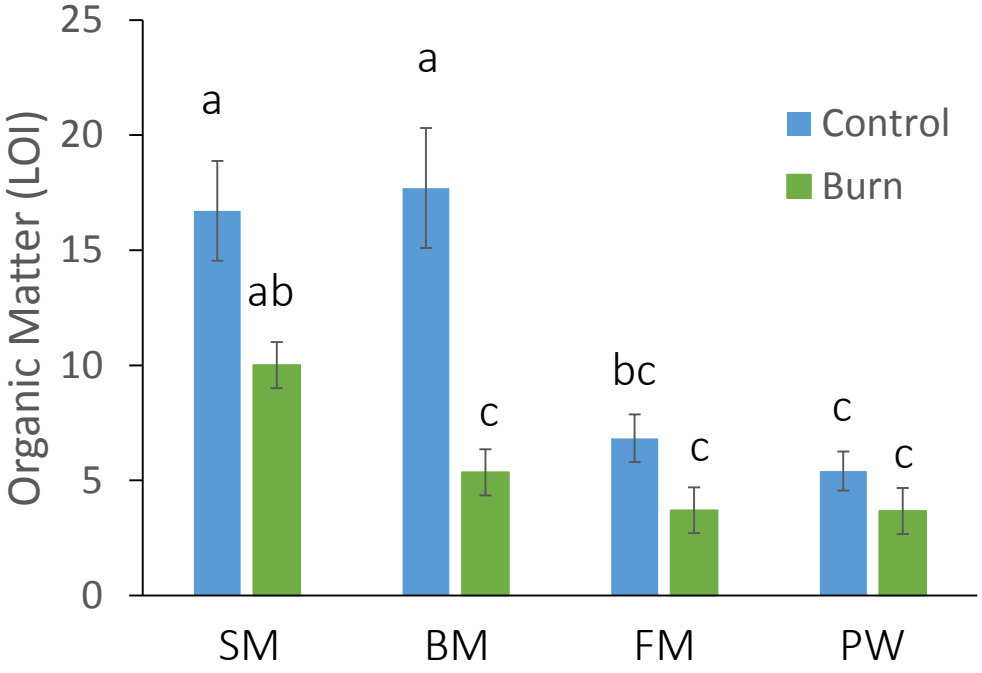
sediment NH_4^+: ↑ with ↑ elev.

sediment PO_4^{3-}: ↓ with ↑ elev.

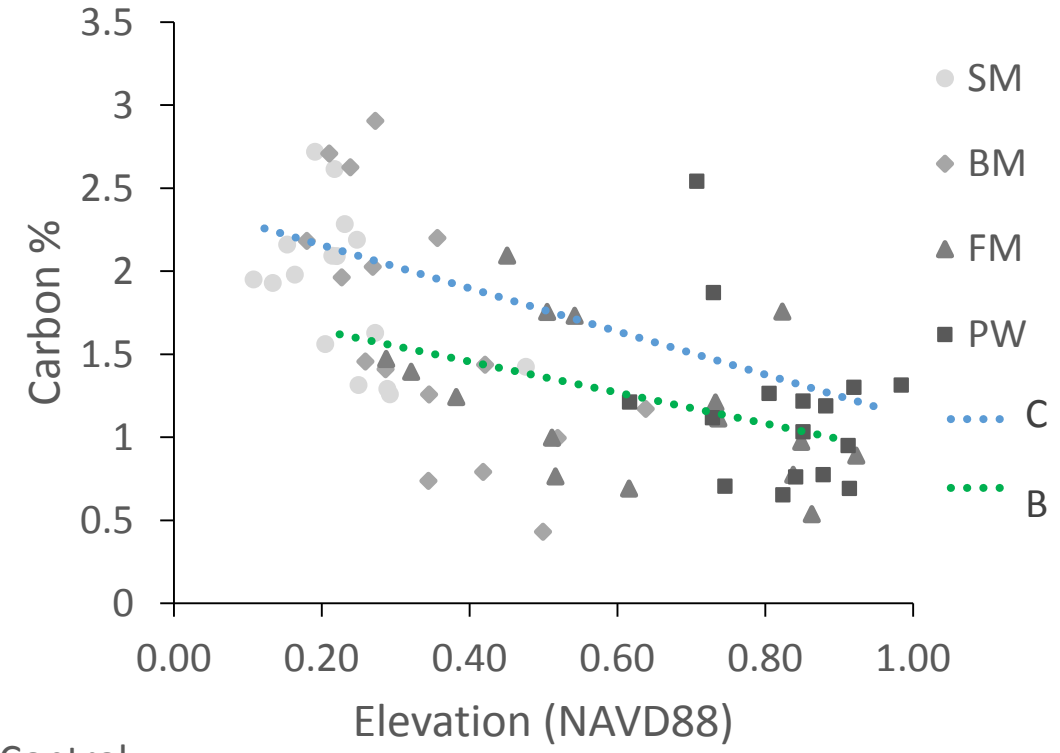
Vegetation Zone	Elevation (m NAVD88)	Soil *EC* (Sm^{-1})	Common Plants
Salt marsh	0.23 ± 0.02	1.46 ± 0.16	*Spartina alterniflora* *Juncus roemerianus*
Brackish marsh	0.34 ± 0.03	1.48 ± 0.16	*J. roemerianus*
Fresh marsh	0.62 ± 0.05	0.25 ± 0.06	*Cladium mariscus* *Panicum virgatum* *Solidago spp.* *Spartina patens*
Pine woodland	0.82 ± 0.02	0.13 ± 0.02	

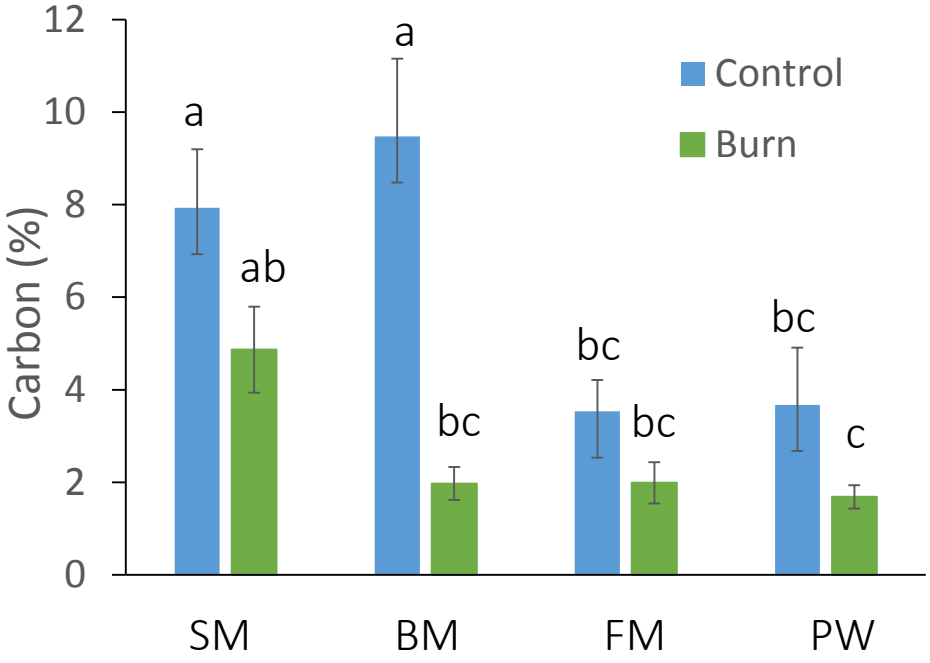
Organic Matter:





Carbon:


3.5
3
2.5
2
1.5
1
0.5
0
Carbon %
0.00
0.20
0.40
0.60
0.80
1.00
Elevation (NAVD88)
SM
BM
FM
PW
C
B


12
10
8
6
4
2
0
Carbon (%)
Control
Burn
a
ab
a
bc
bc
bc
bc
c
SM
BM
FM
PW

Acknowledgments

- Cherry & Battaglia Labs
- Grand Bay NERR crew
- Funding sources: