Changes in forested wetland composition, structure, and processes along a tidal gradient on the Apalachicola River, FL, USA

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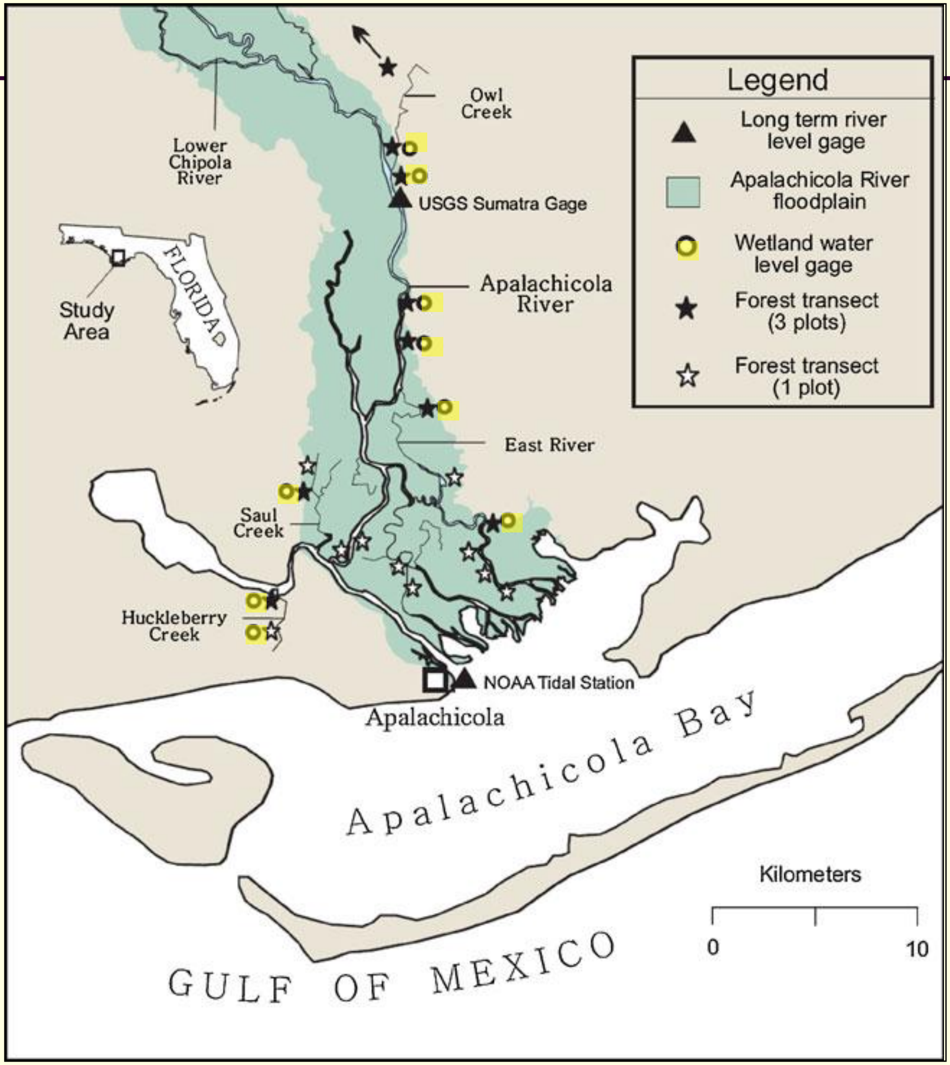
- Tidal freshwater forested wetlands
  - Upriver extent of tidal influence
  - Most prominent on larger rivers with gradual relief
  - Normally freshwater but prone to periodic saltwater intrusion

- Environmental services related to forested riparian wetlands along the river
  - Carbon/nutrient cycling
  - Water quality
  - Wildlife habitat
  - Forest products

- Project goal
  - Using the Apalachicola River, evaluate how forested wetland conditions and processes change across a tidal gradient

- Objectives
  - Examine how tidal hydrology influences:
    - Forest structure and composition
    - Physio-chemical conditions
    - Foliar nutrient cycling



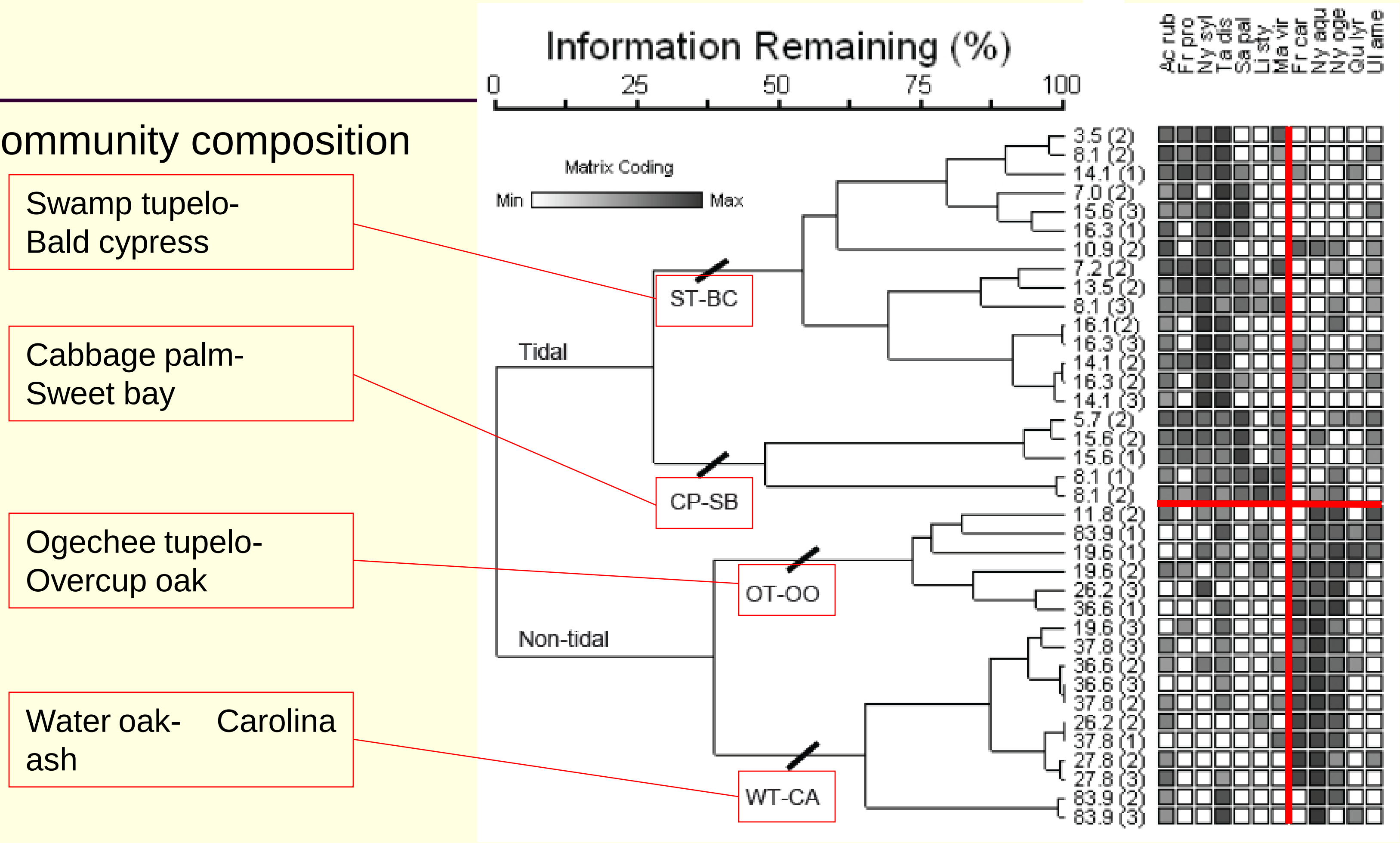
Lower Apalachicola River study sites.

Study design

- 17 transects
- 37 forest plots (500 m^2)
- 10 water level recorders

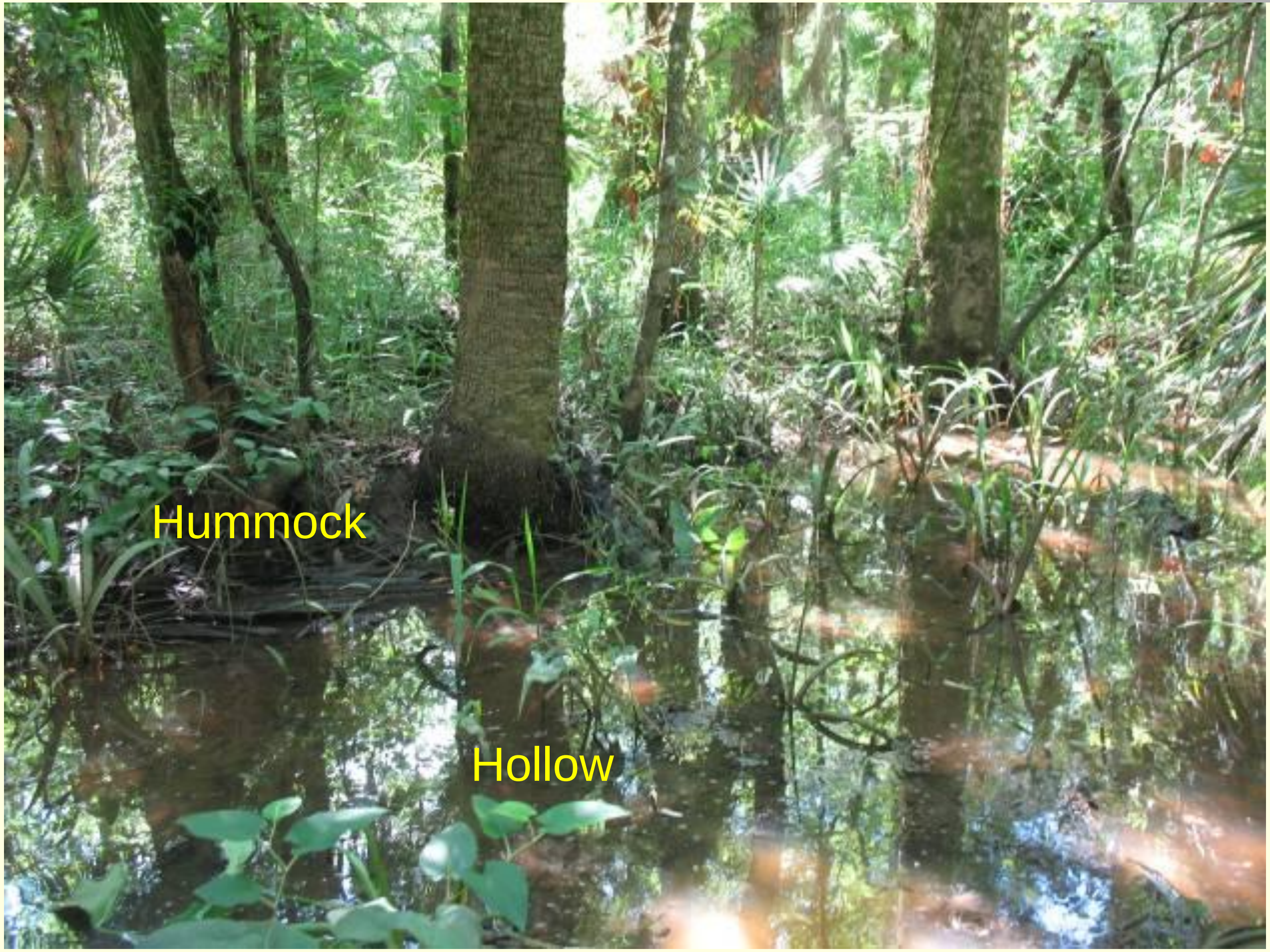
- Wetland measures across a tidal gradient
  - Species structure and composition (2007-10):
    - Measured forest tree (>2.5 cm dbh) density, basal area/growth, and size class
    - Determined species importance values and community composition
  - Forest soils and woody debris (2009-10)
    - Soil nutrient conditions (% C, N, S, exch. P)
    - Electrical conductivity
    - Coarse woody debris
  - Examined N and P leaf translocation and flux by tidal and non-tidal trees(2008)

Community composition

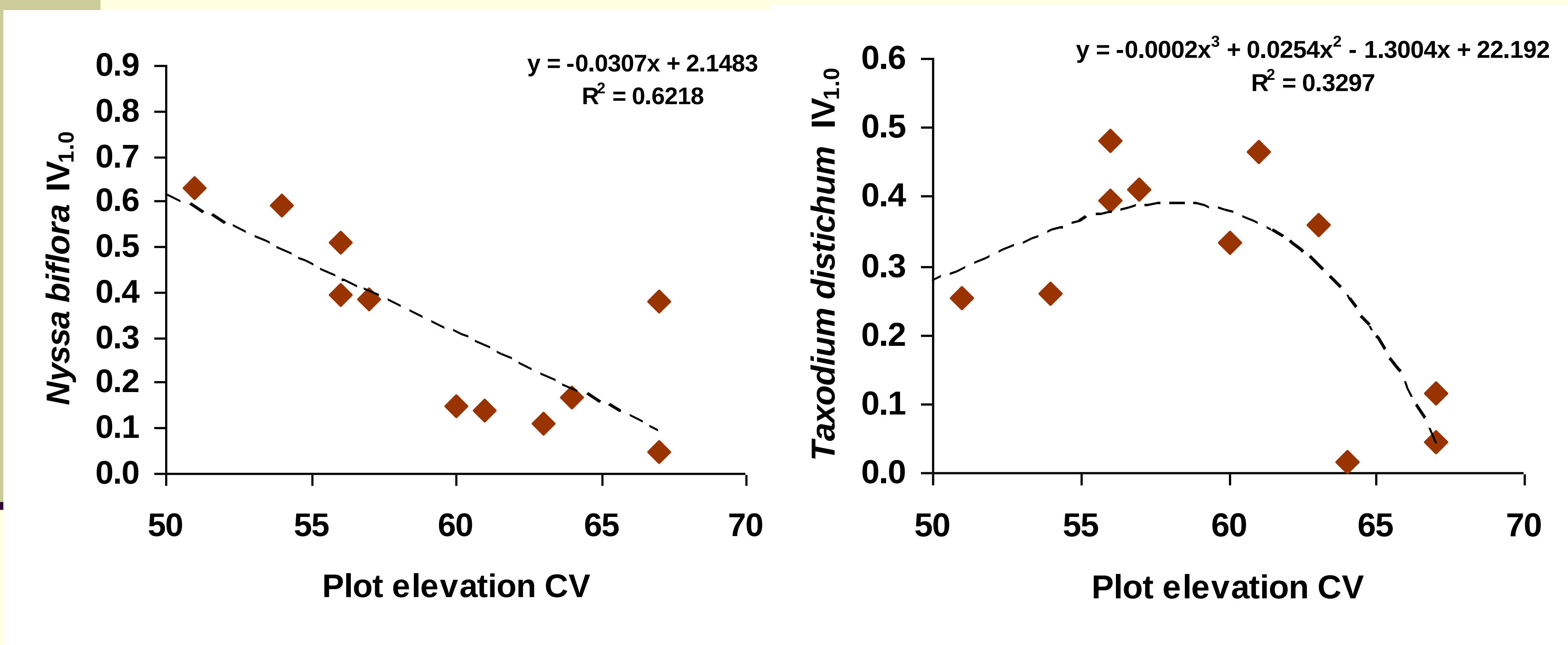


Cluster analysis dendrogram for lower Apalachicola River forested wetlands. Matrix color coding based on species IV range between 0 (Min) and 64 (Max).

Anderson and Lockaby. 2011. *Wetlands* 31:895-906.

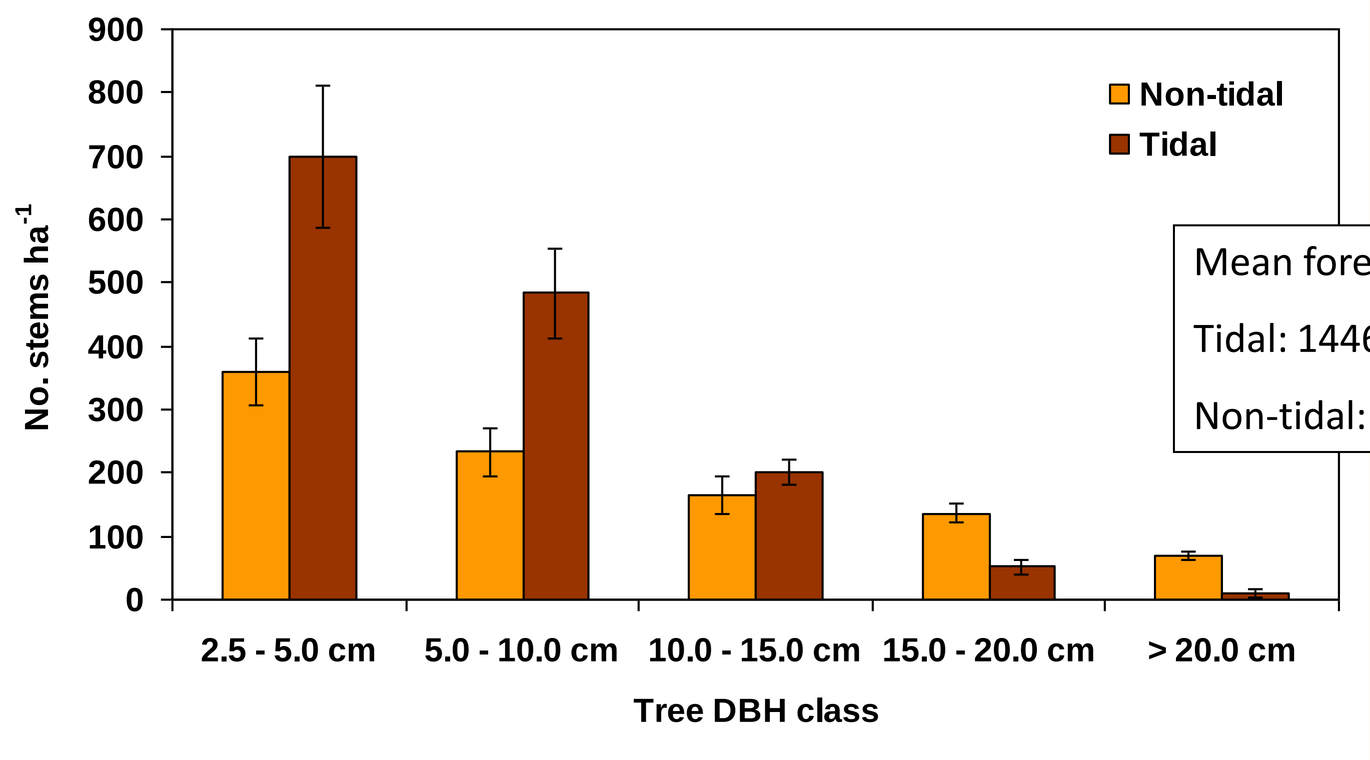

Hummock
Hollow

Micro-topography and species composition



Importance values for *Nyssa biflora* and *Taxodium distichum* related to plot elevation coefficient of variation in tidal stands along the lower Apalachicola River.

Tree stem density and size class



Mean forest tree density:

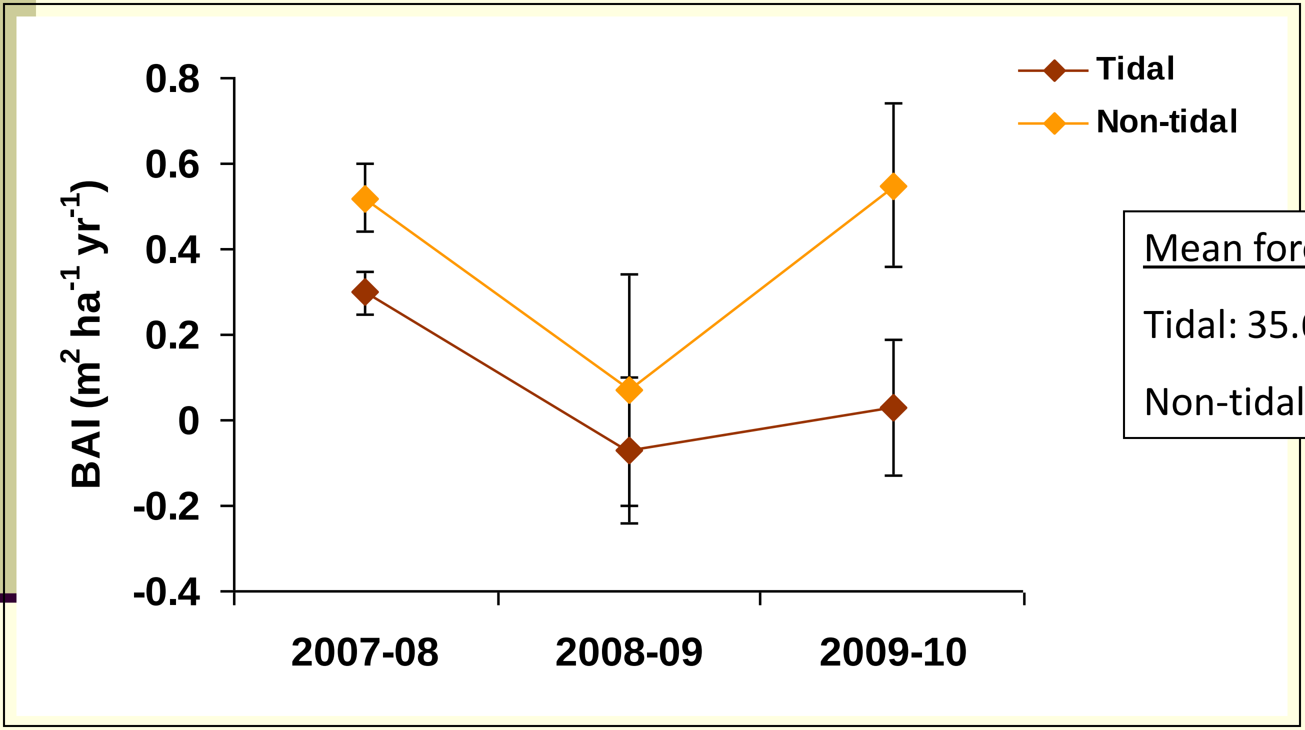
Tidal: 1446 ±159 stems ha^{-1}

Non-tidal: 962 ±962 stems ha^{-1}

Mean (±SE) density and tree size classes for tidal (n=7) and non-tidal (n=8) forest stands along the lower Apalachicola River.

Anderson, Lockaby, and Click. In revision.

Basal area and increment growth



<u>Mean forest basal area*</u>

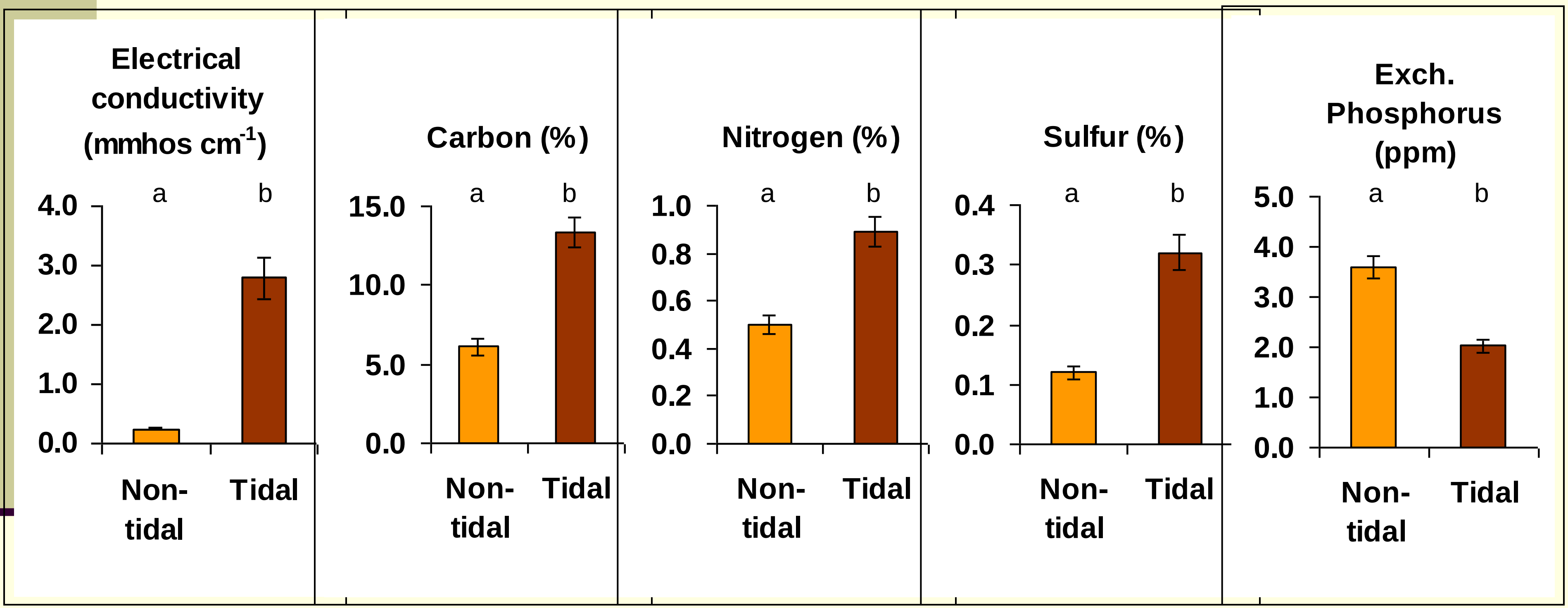
Tidal: 35.6 ±3.3 m^2 ha^{-1}

Non-tidal: 64.4 ±2.8 m^2 ha^{-1}

Mean (±SE) basal area and annual increment growth of tidal (n=7) and non-tidal (n=8) forest stands

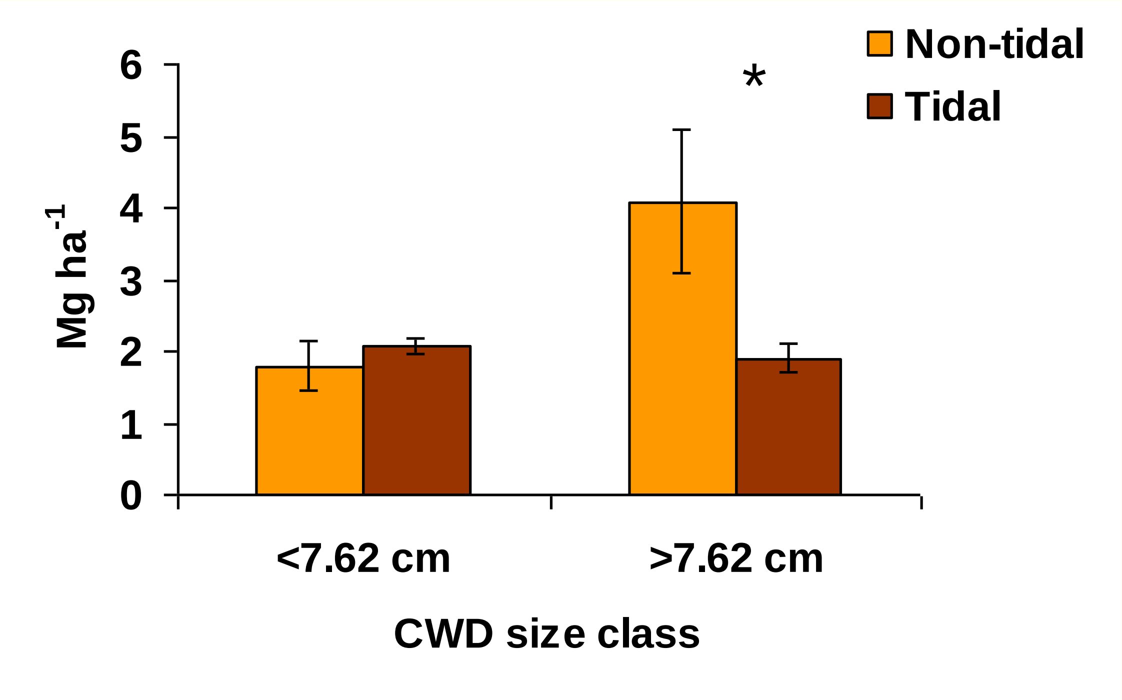
Anderson, Lockaby, and Click. In revision.

Mean surface soil measures



Mean (±SE) surface soil (0-15 cm) measures for tidal (n=20) and non-tidal (n=17) forest plots along the lower Apalachicola River. Letters denote significant differences ($p<0.05$) per nested ANOVA.

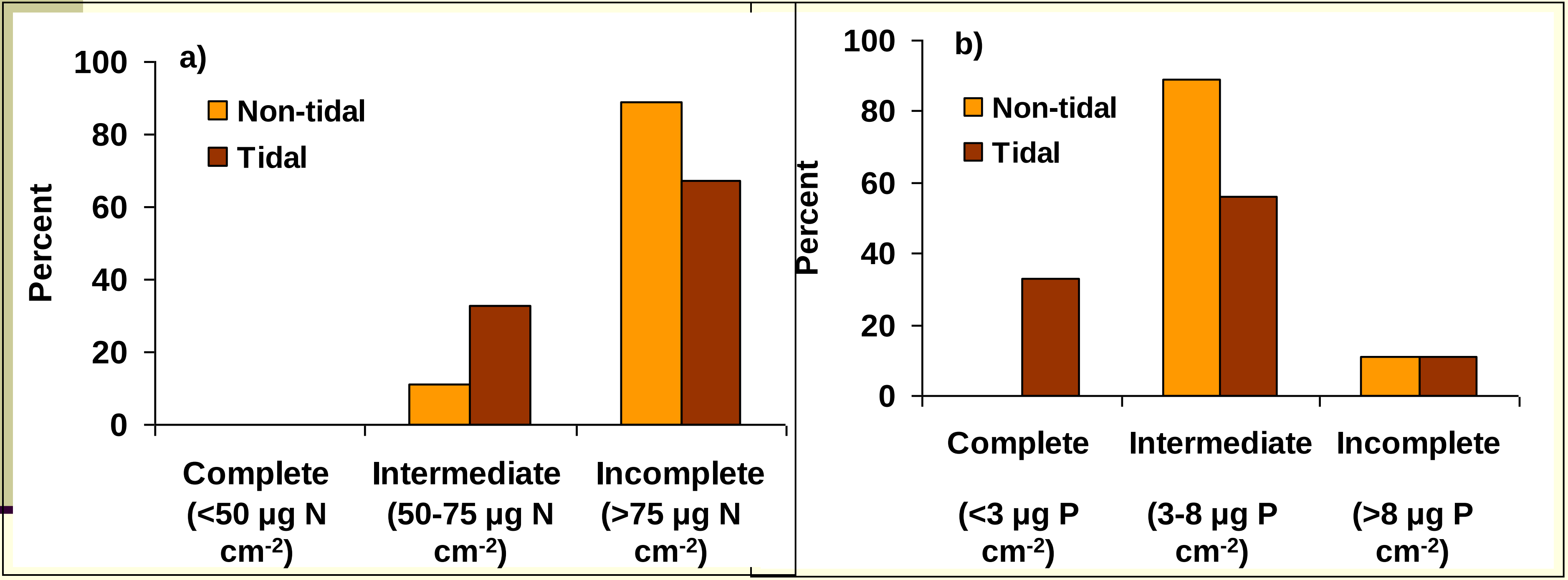
Coarse woody debris



Mean (±SE) coarse woody debris (CWD) for tidal (n=3) and non-tidal (n=5) forest stands along the lower Apalachicola River. * denotes significant difference detected at $p<0.05$ per ANOVA.

Anderson, Lockaby, and Click. In revision.

Nutrient resorption proficiency



Percent tidal (n=19) and non-tidal (n=9) trees sampled with complete, intermediate, or incomplete resorption proficiency of a) nitrogen and b) phosphorus (per Killingbeck 1996).

Anderson and Lockaby. 2011. Aquatic Botany 95:153-160.

Litterfall and nutrient flux

Plot	Litterfall (kg ha^{-1})	N (kg ha^{-1})	P (kg ha^{-1})
Tidal			
1	4399	35.8	1.4
2	3997	31.9	1.4
15	3672	31.2	1.2
7pt	4513	36.8	1.4
WS2	2472	21.0	1.0
Avg.	**3811**	**31.3**	**1.3**
Non-tidal			
3	8107	100.4	5.3
5	5661	71.6	3.9
7	6180	77.5	4.0
Avg.	**6649**	**83.2**	**4.4**

Estimated litterfall and nutrient flux for tidal (n=5) and non-tidal (n=3) forest stands along the lower Apalachicola River.

Anderson and Lockaby. 2011. Aquatic Botany 95:153-160.

- Summary of findings:
  - Forest tree species and community composition provided clear indications of tidal influence
  - Microtopography within tidal sites appears to be important for community composition
  - Tidal hydrology and periodic saltwater intrusion resulted in consistent differences in soil C, N, S, exch. P, electrical conductivity, and other soil measures
  - Tidal wetlands appeared to be P-limited based on nutrient resorption efficiencies and N:P and C:P ratios

- Summary of findings (continued):
  - Tidal wetlands appeared to be P-limited based on leaf nutrient resorption measures and foliage/litterfall N:P and C:P ratios.
  - The nutrient pool associated with tidal forests is significantly lower than non-tidal forests.

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- Environmental services related to forested riparian wetlands
  - Carbon
  - Wildlife
  - Water q