Linkages between Microbial Biomass, Litter Decomposition, and Salinity in Tidal Forested Wetlands

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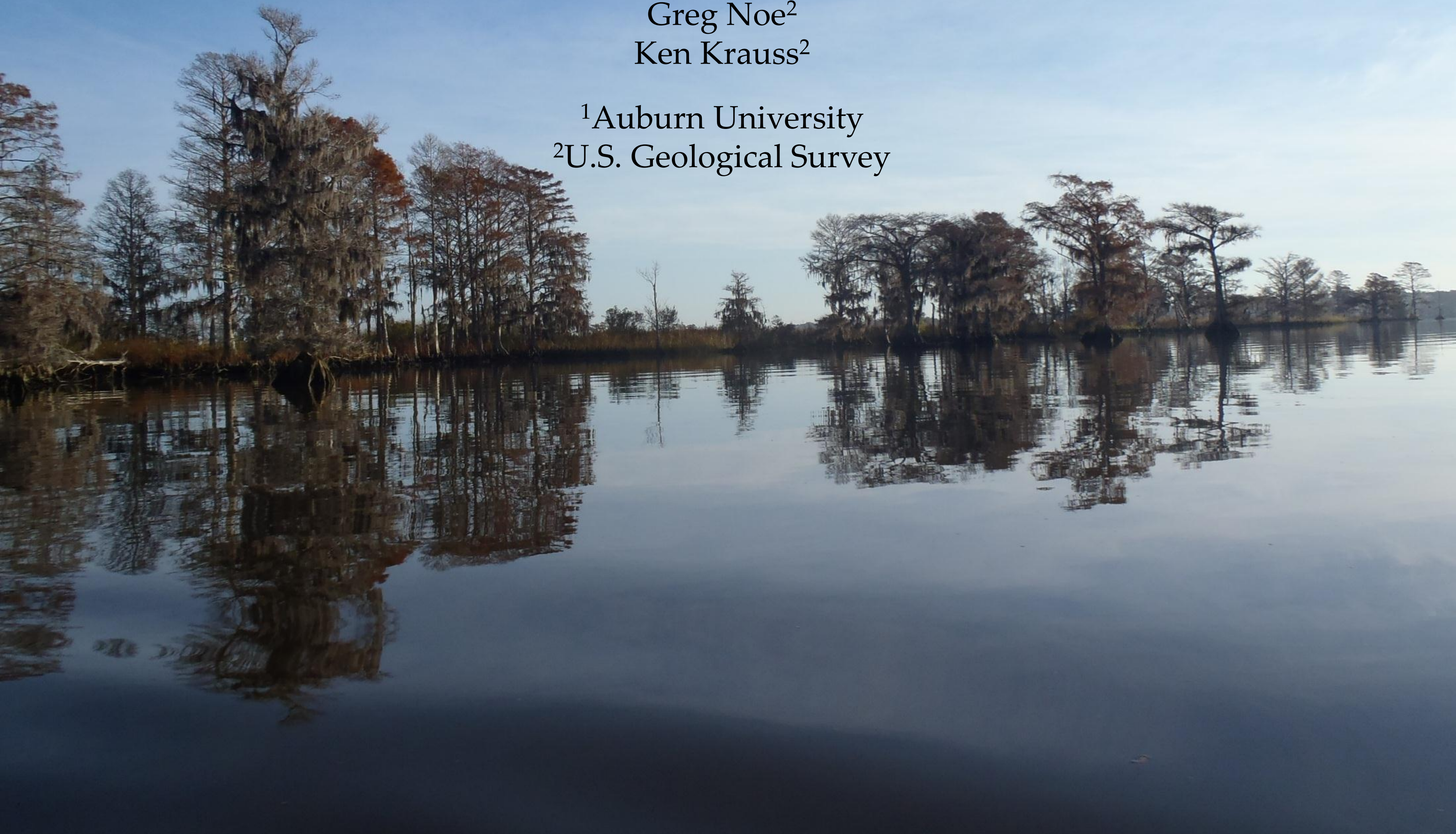
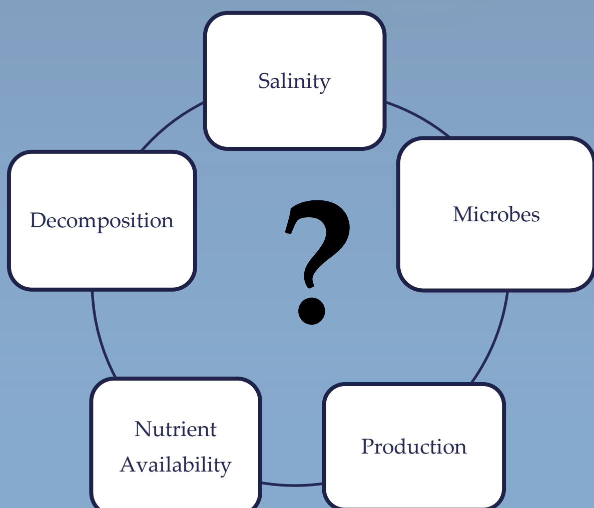
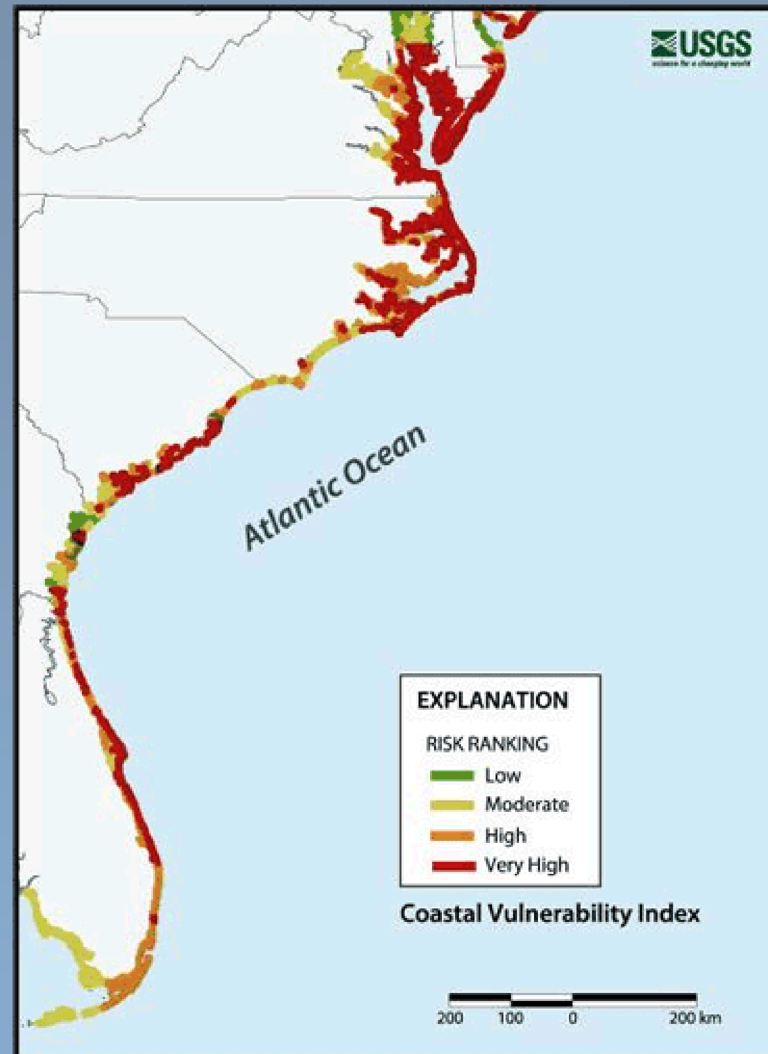


Background

Functions and Services



Research Interest



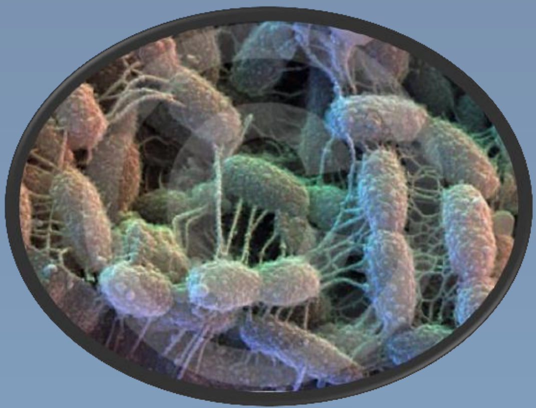
Climate and Development Threats


Upper
1
Murrells Inlet
Middle
2
Georgetown
Pawleys Island
Georgetown
3
Lower
Data SIO, NOAA, U.S. Navy, NGA, G
© 2011 Google
Image U.S. Geological Survey
Image USDA Farm Service Agen
33°21'28.53" N 79°09'15.19" W elev -1 ft
Kentucky
Virginia
Nashville
Tennessee
North Carolina
Charlotte
South Carolina
South Carolina
Atlanta
Alabama
Georgia
Jacksonville
Google

Project Objective

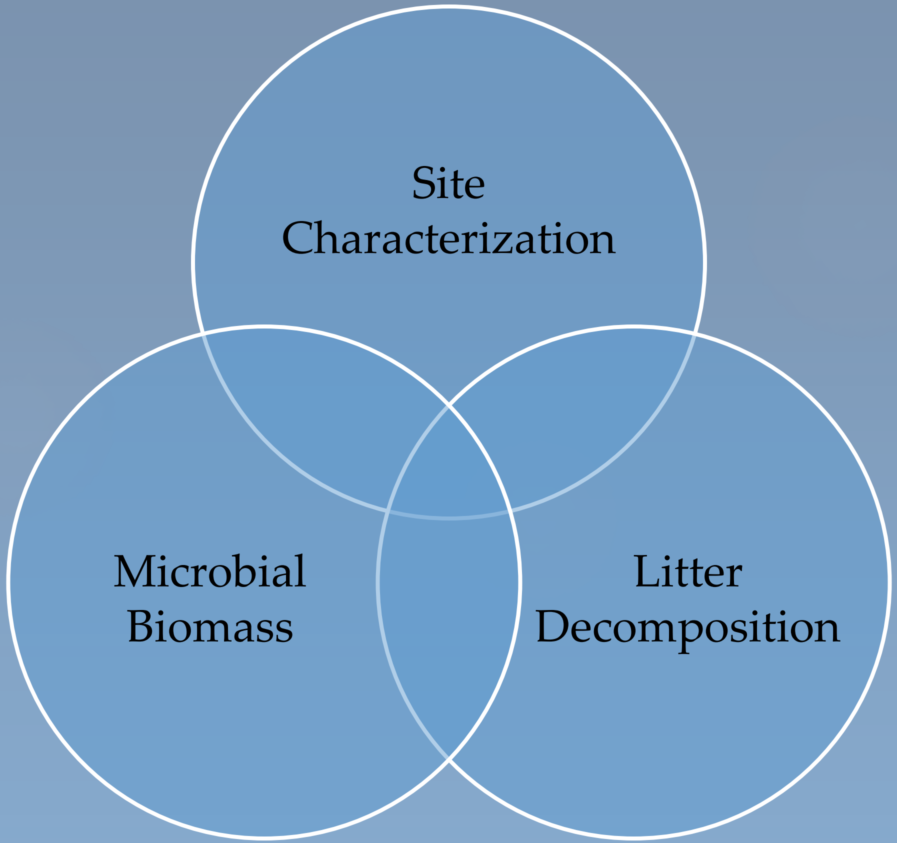
Quantify microbial biomass and litter decomposition dynamics along a salinification gradient.

Hypotheses



Increasing Salinity

Investigation Strategy



Methods- Site

- Soil
  - Samples gathered in September 2010 and sieved through 2mm mesh
  - Extractable P, K, Ca, Mg, Mn, Zn (Mehlich-1 extraction)
  - Perkin-Elmer 2400 series II analyzer (C and N)
  - LabFit AS-3000 pH analyzer (pH)

- Salinity
  - Data acquired directly from U.S.G.S. for all sites (2011)
  - Monthly measurements with data

- Hydrology
  - Data acquired directly from U.S.G.S. for the middle site (2010)

- Vegetation
  - Data acquired from Baruch Institute for overstory

Site Salinity

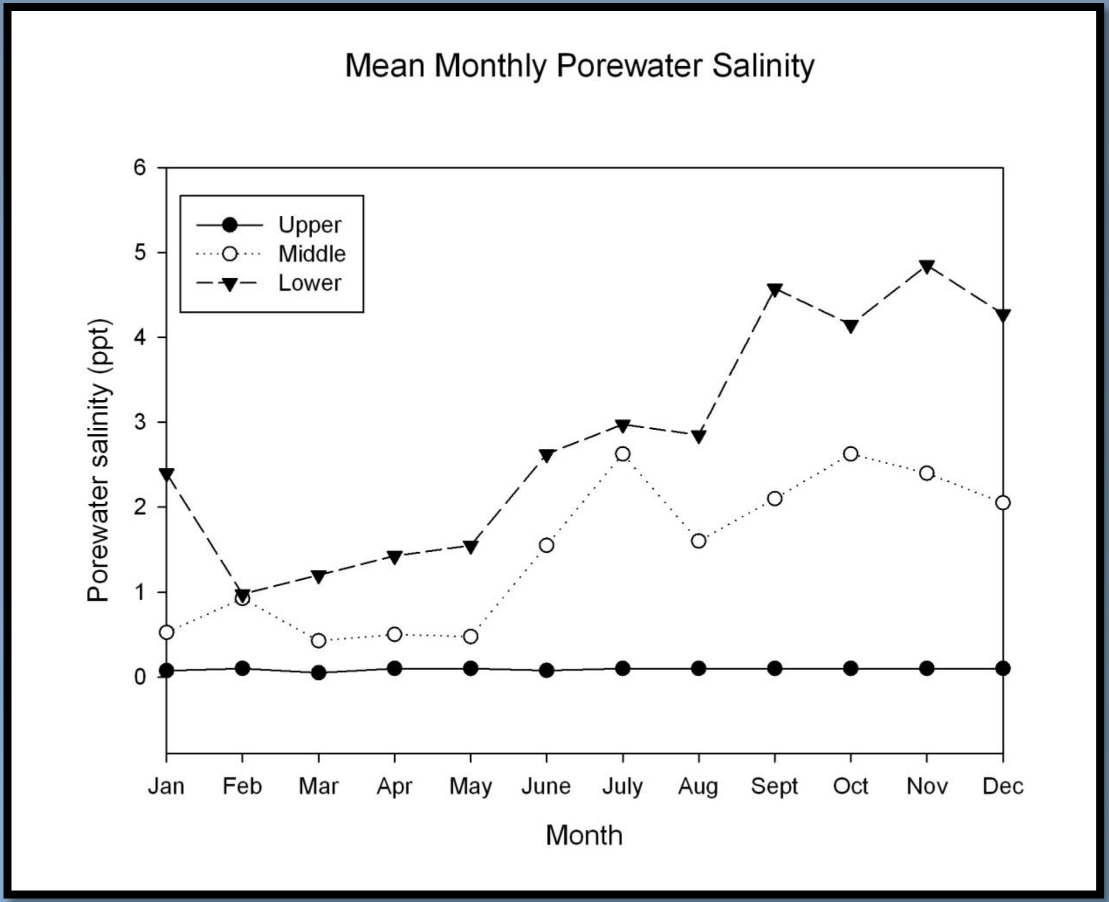
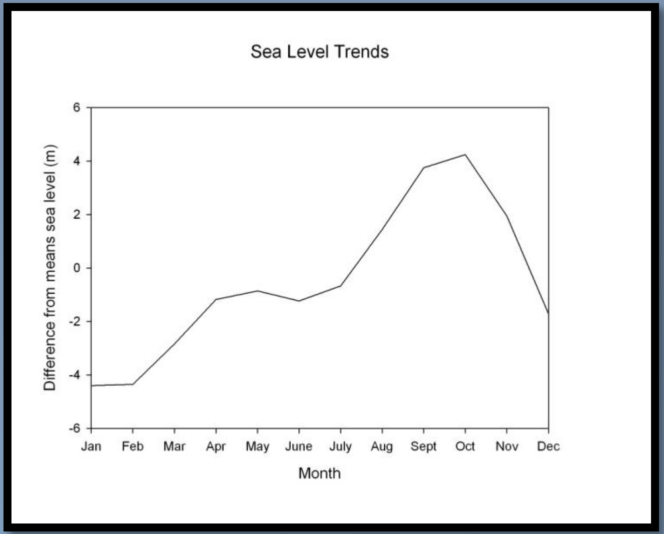
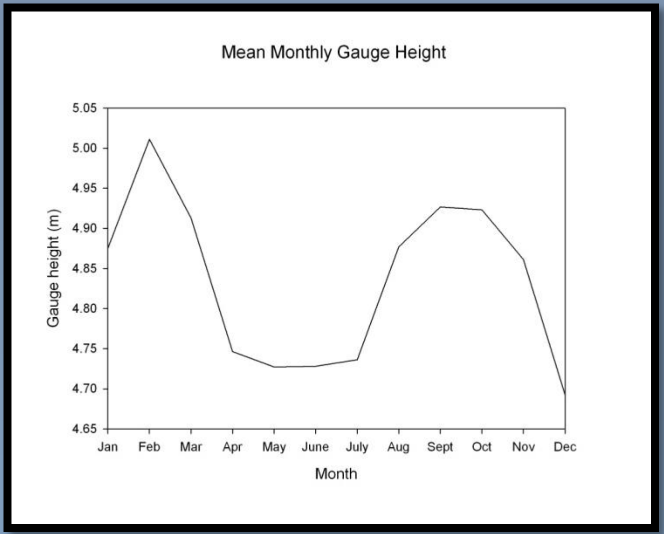


Figure 1. Mean monthly porewater salinity for all three sites in 2011.

Site Hydrology





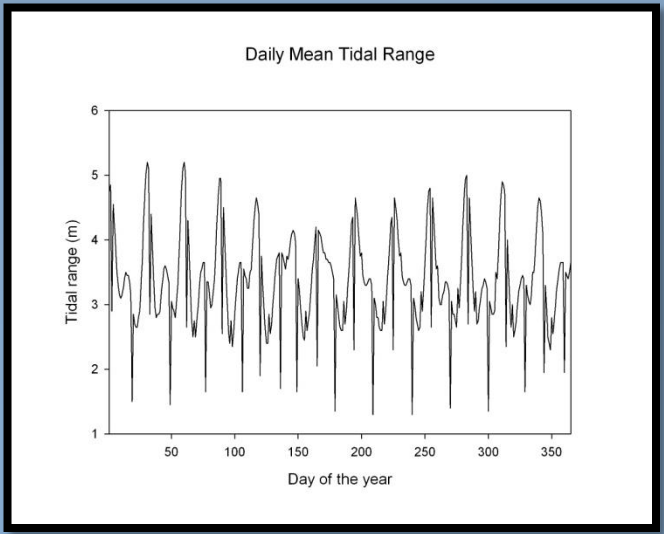
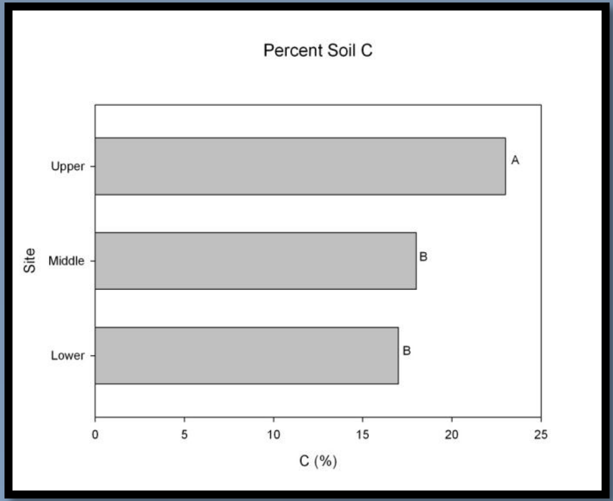
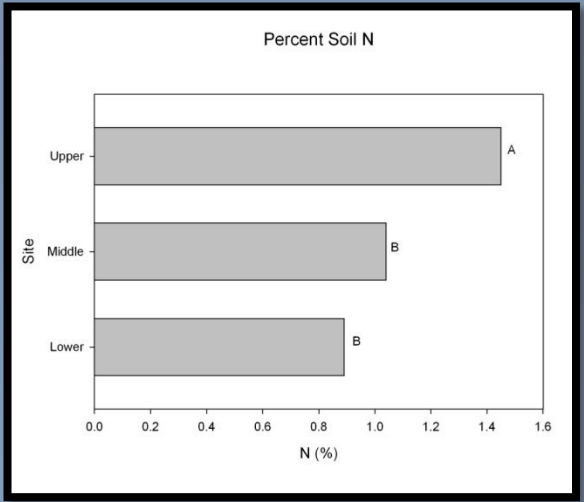


Figure 2. Hydrology data for middle site, 2010.

Site Soil Measurements





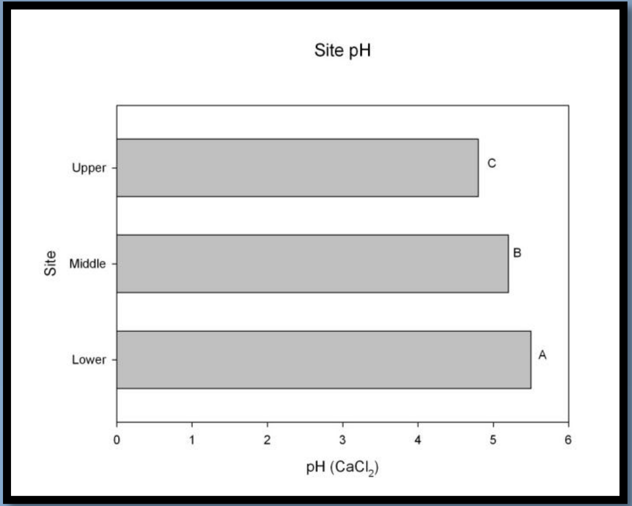


Figure 3. Site soil pH and percent soil C and N for each site (September 2010).

Site Soil Nutrient

Site	Ca	Cd	Cu	Fe	K	Mg	Mn	Na	Ni	P	Pb	Zn
						----mg/kg----						
Upper	5425a	0.16a	2.24a	413a	247b	821b	219a	244b	1.38a	11.4b	1.31a	19.8a
Middle	3099b	0.11b	2.40a	399a	313a	2029a	189ab	1372a	1.10a	17.6a	1.46a	15.3b
Lower	3524b	0.07b	1.30b	129b	206b	1687a	111b	1717a	1.37a	10.7b	1.58a	11.3c

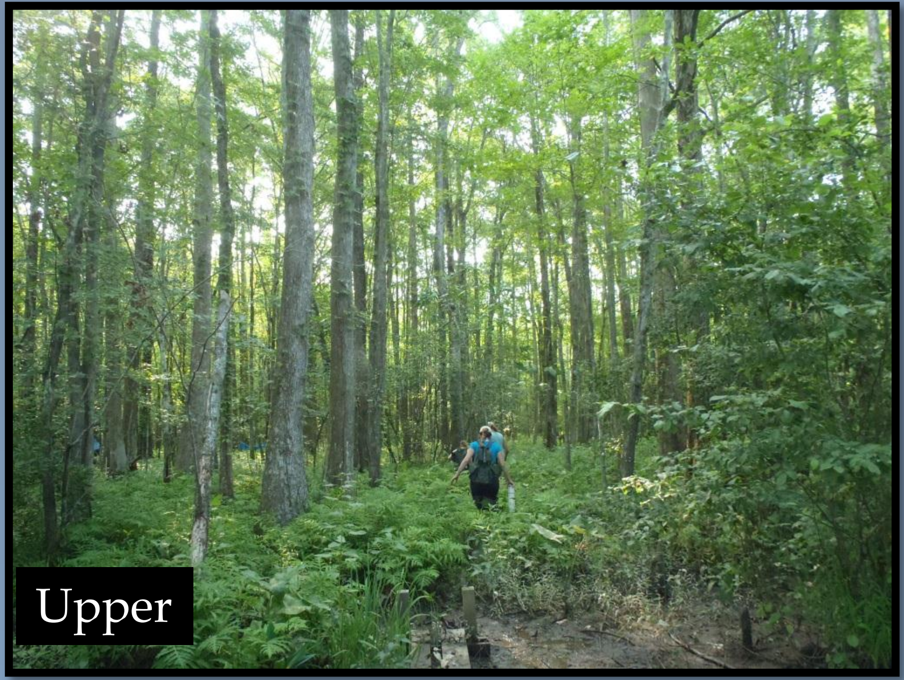
Table 1. Soil nutrients for each site with letters representing significant differences among sites at $p<0.05$ (September 2010).

Site Vegetation

<u>Dominant Species</u>

Baldcypress (*Taxodium distichum*)

Blackgum (*Nyssa sylvatica*)


Upper

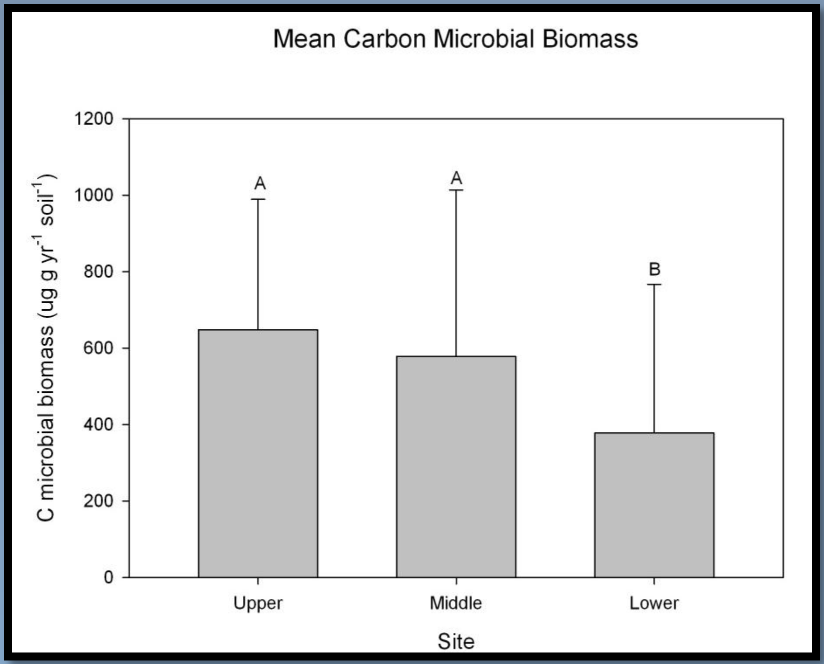

Middle


Lower

Methods- Microbial Biomass

- Chloroform fumigation-extraction
  - (Brooks, 1985 ;Vance, 1987)
- ½ gallon soil (3 subsamples from each plot)
- Sieved through 2 mm wire mesh
- Analyses performed <24hrs
- Determined microbial C and N
- Samples from Sept 2010-Dec 2011
- Statistical analysis
  - Proc GLM
  - Alpha = .05

Results-Microbial Biomass



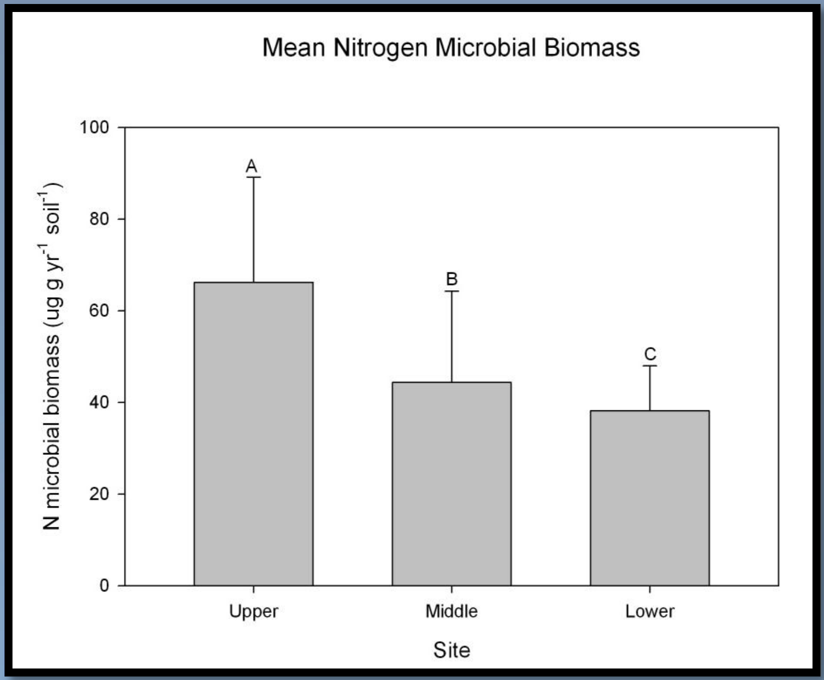
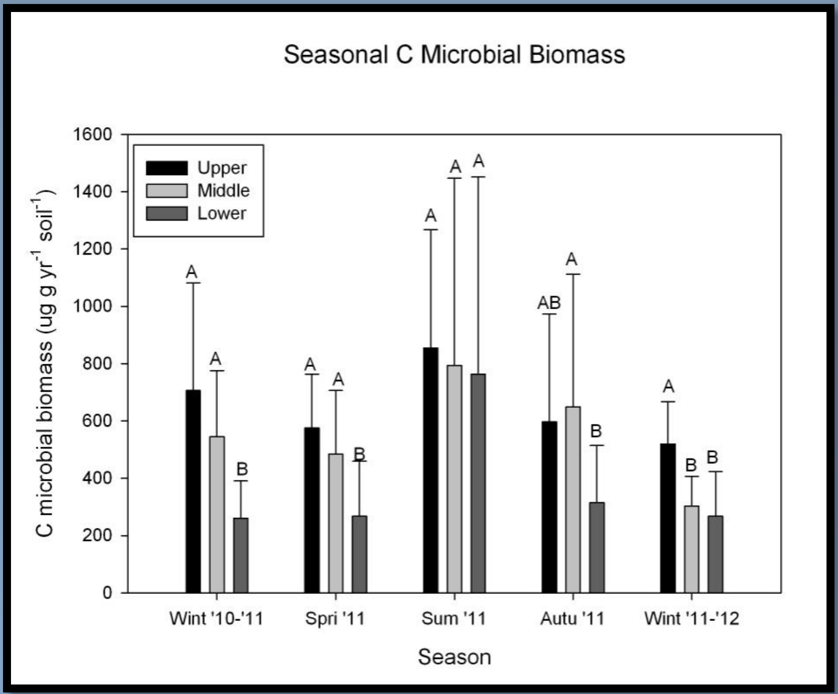


Figure 4. Mean C and N microbial biomass for 2011, with letters representing significance at $p<0.05$.

Results- Microbial Biomass



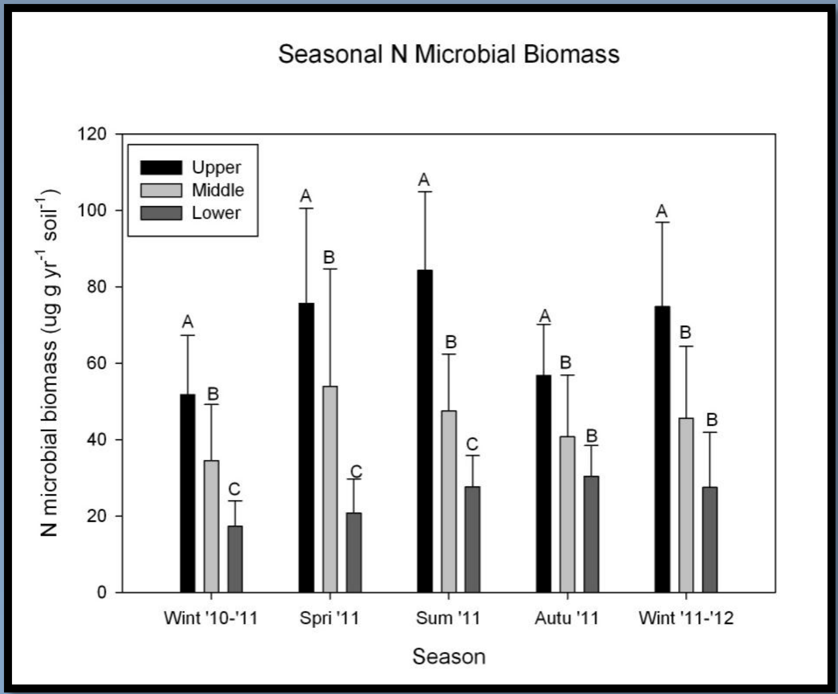


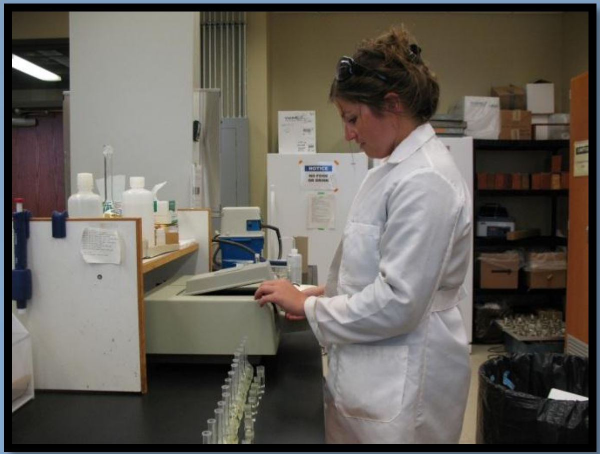
Figure 5. Seasonal microbial C and N for 2011. Different letters represent significances among sites for each season at $p<0.05$.

Methods- Litter Decomposition

- Raised traps
- Sort species by site

- 3 sets of 8x8 nylon bags
- Bottom (2 cm), top (5cm)
- Popsicle sticks

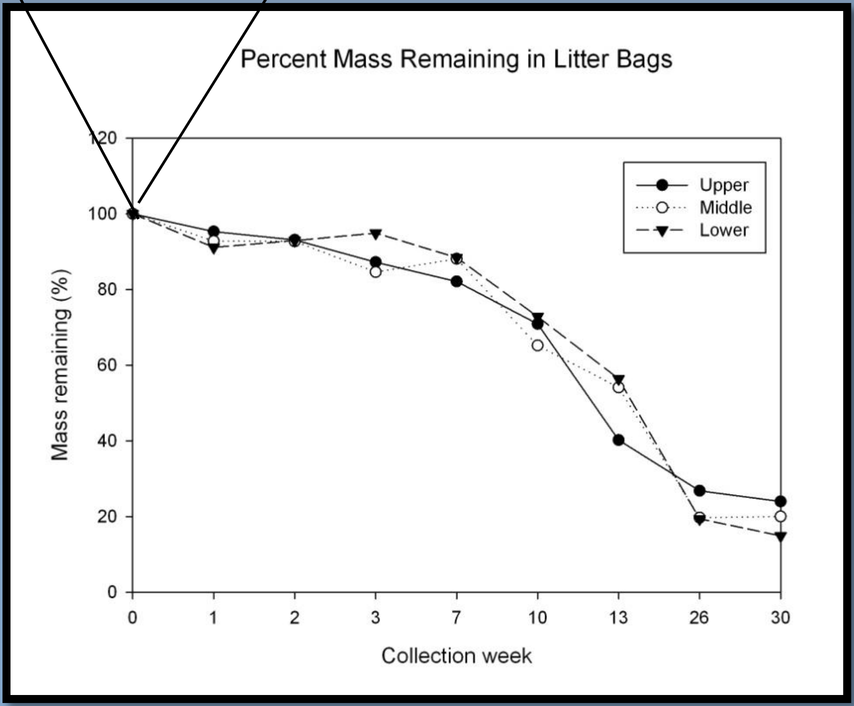
- Collected at weeks:
  0,2, 4, 10, 16, 25, 36, and 48



- Analyze for C, N, and P
- Statistical analysis (alpha=.05)

Results- Litter Decomposition

Litter quality at time zero			
Variable	Upper	Middle	Lower
CN	53	56	62
CP	339	367	625
LignN	23	26	30



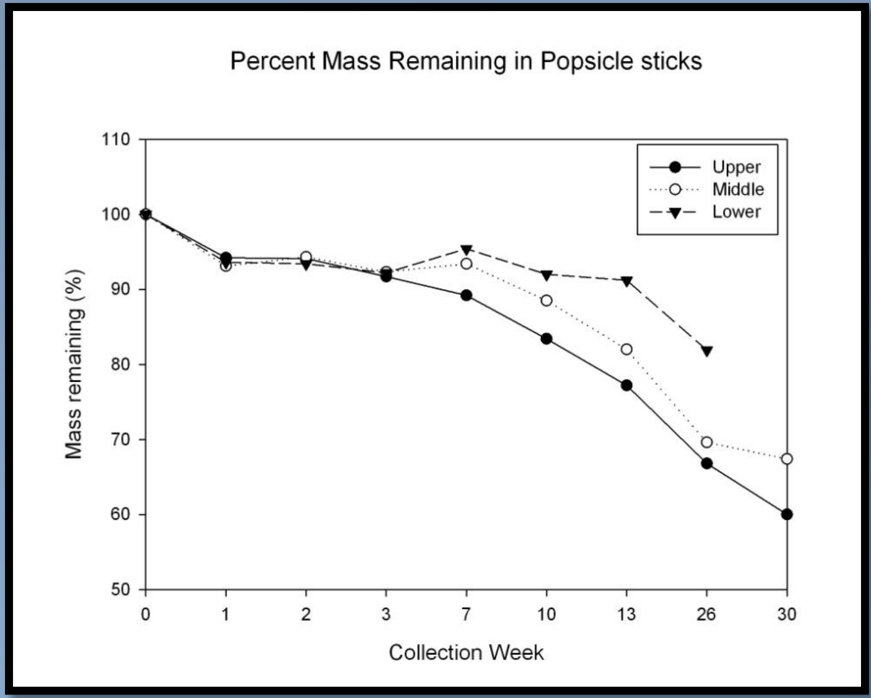
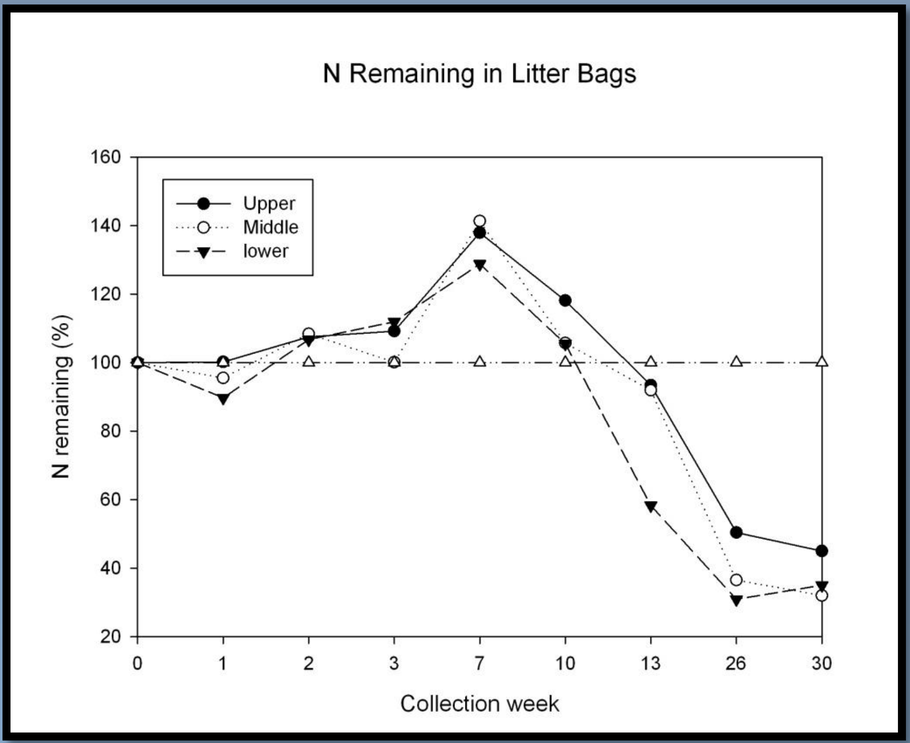


Figure 6. Mass remaining in litter and popsicle stick bags after 30 weeks (March-December), and litter quality at time zero.

Results- Litter Decomposition



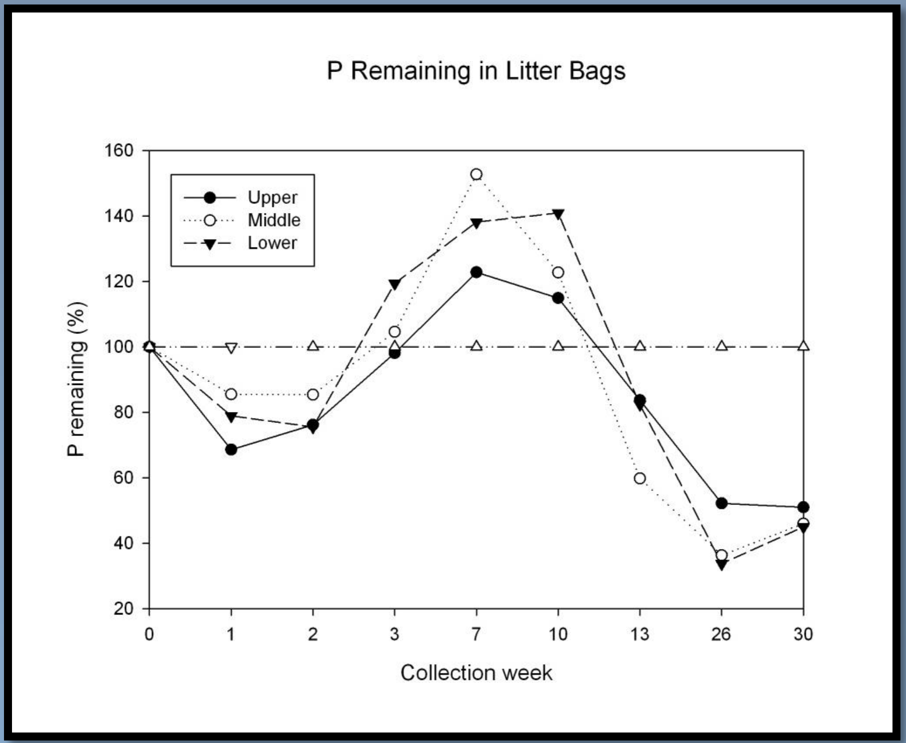
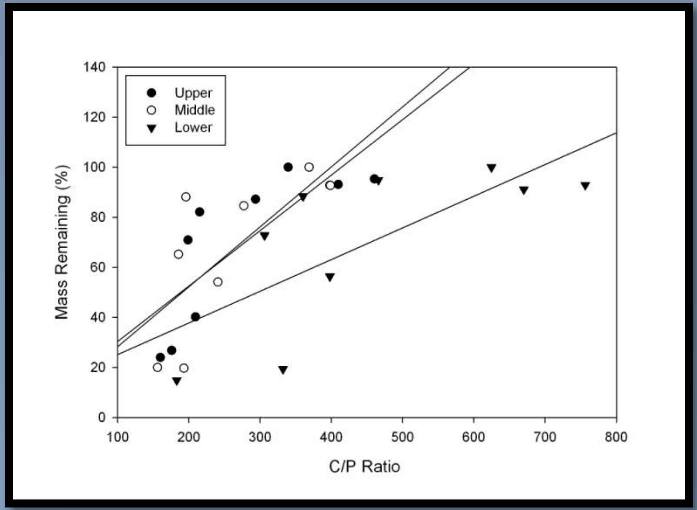


Figure 7. N and P remaining (%) in litter through week 30 of the decomposition for each site.

Results- Litter Decomposition



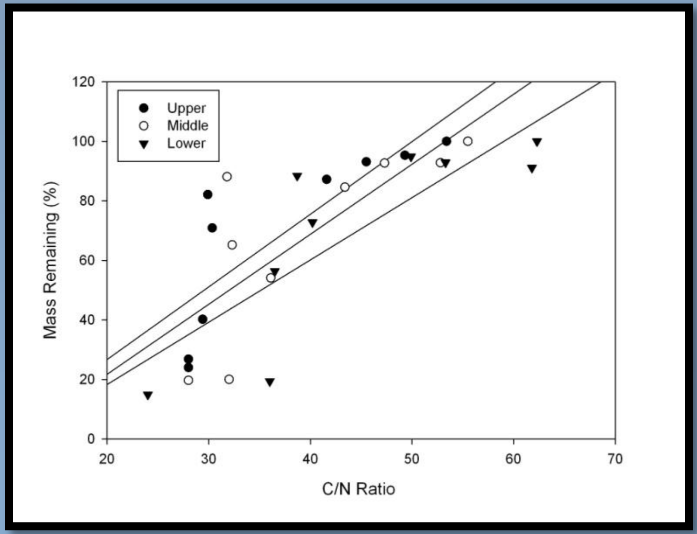


Figure 8. C/P and C/N ratios plotted against percent mass remaining.

Discussion

As salinity increases microbial biomass will decline and decomposition will be inhibited

- Microbial biomass wanes as salinification increases
- Similar litter decomposition, despite litter quality differences
- Popsicle sticks suggest differences in microbe and edaphic influences among sites

Additional and Future Research

- Compare results with:
  - Productivity measurements
  - Nutrient limitations
- Quantify microclimate data
  - Temperature
  - Precipitation
- Identify microbial species
- Particulate loss issue

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•http://wn.com/national_wildlife_refuge?orderby=relevance&upload_time=this_month

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Questions?