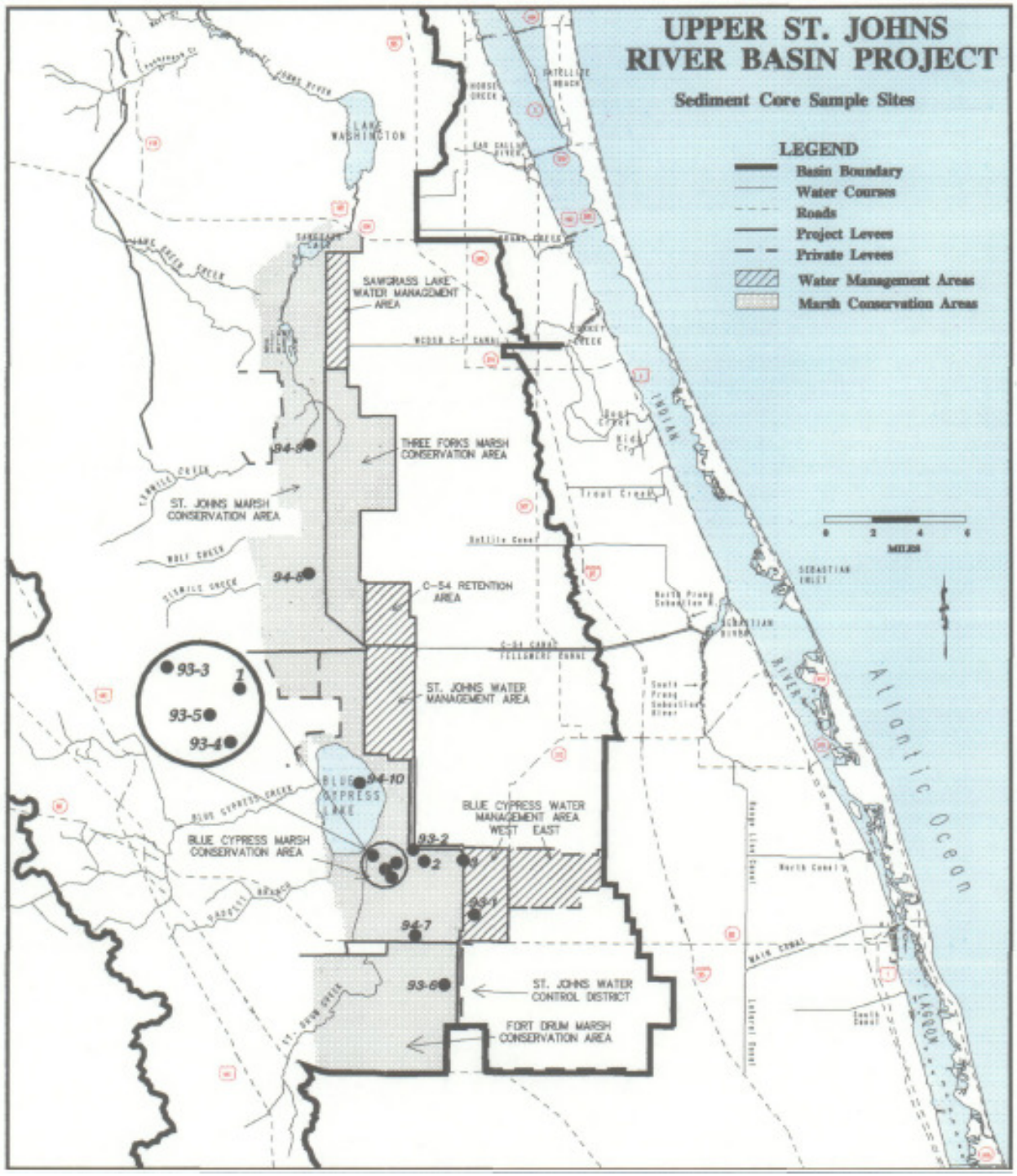
Calculating carbon storage performance of three St. John's River Water Management District wetland restoration projects

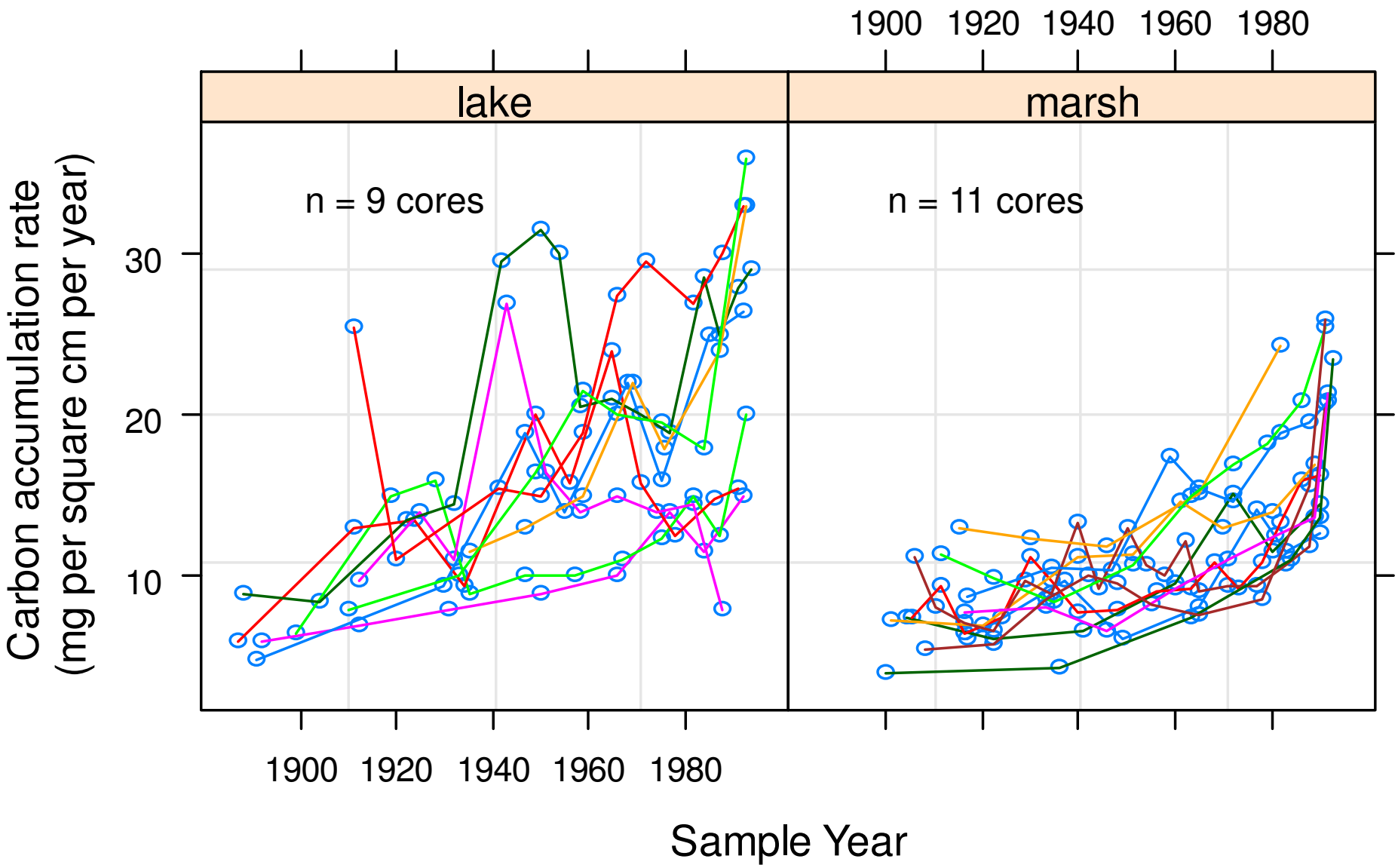
Jed R. Redwine, David Tomasko, and Tom St. Clair
PBS&J

Rationale

- Governor's executive order #07-128
  - "Establishing the Florida Governor's Action Team on Energy and Climate Change"
- Phase 2 item 4: Land use and management policies that improve the long-term storage of carbon in Florida's biomass.

Location of Restoration Projects


UPPER ST. JOHNS
RIVER BASIN PROJECT
Sediment Core Sample Sites
LEGEND
Basin Boundary
Water Courses
Roads
Project Levees
Private Levees
Water Management Areas
Marsh Conservation Areas
SAWGRASS LAKE WATER MANAGEMENT AREA
THREE FORKS MARSH CONSERVATION AREA
ST. JOHNS MARSH CONSERVATION AREA
C-54 RETENTION AREA
ST. JOHNS WATER MANAGEMENT AREA
BLUE CYPRESS WATER MANAGEMENT AREA WEST EAST
BLUE CYPRESS MARSH CONSERVATION AREA
ST. JOHNS WATER CONTROL DISTRICT
FORT DRUM MARSH CONSERVATION AREA
94-8
94-9
93-3
93-5
93-4
94-10
93-2
93-1
94-7
93-6
Atlantic Ocean
INDIAN RIVER
LAGOON


Soil Cores from Upper St. John's Basin
Shallow Lakes and Blue Cypress Marsh
lake
marsh
n = 9 cores
n = 11 cores
1900
1920
1940
1960
1980
10
20
30
Carbon accumulation rate
(mg per square cm per year)
Sample Year

Modeling/analysis

Full model:

$y_{ij} = \beta_1 + b_i + \beta_2 x_{ijz} + \varepsilon_{ij}$; z = 1 or 2, i = 1-n, j = 1-108

Final model:

$y_{ij} = \beta_1 + b_i + \beta_2 x_{ij} + \varepsilon_{ij}$; i = 1 - 20, j = 1 – 108

Conclusion: Effect of habitat type did not improve explanatory power of the model.

Table 2. Model Comparison Test of Hypothesis

Model	df	AIC	BIC	logLik	Test	L.Ratio	p-value
No habitat des. 1	6	1115.4	1134.9	-551.7			
Habitat des. 2	8	1107.4	1133.4	-545.7	1 vs 2	11.96653	0.0025

Approximate 95% confidence intervals

Fixed effects:

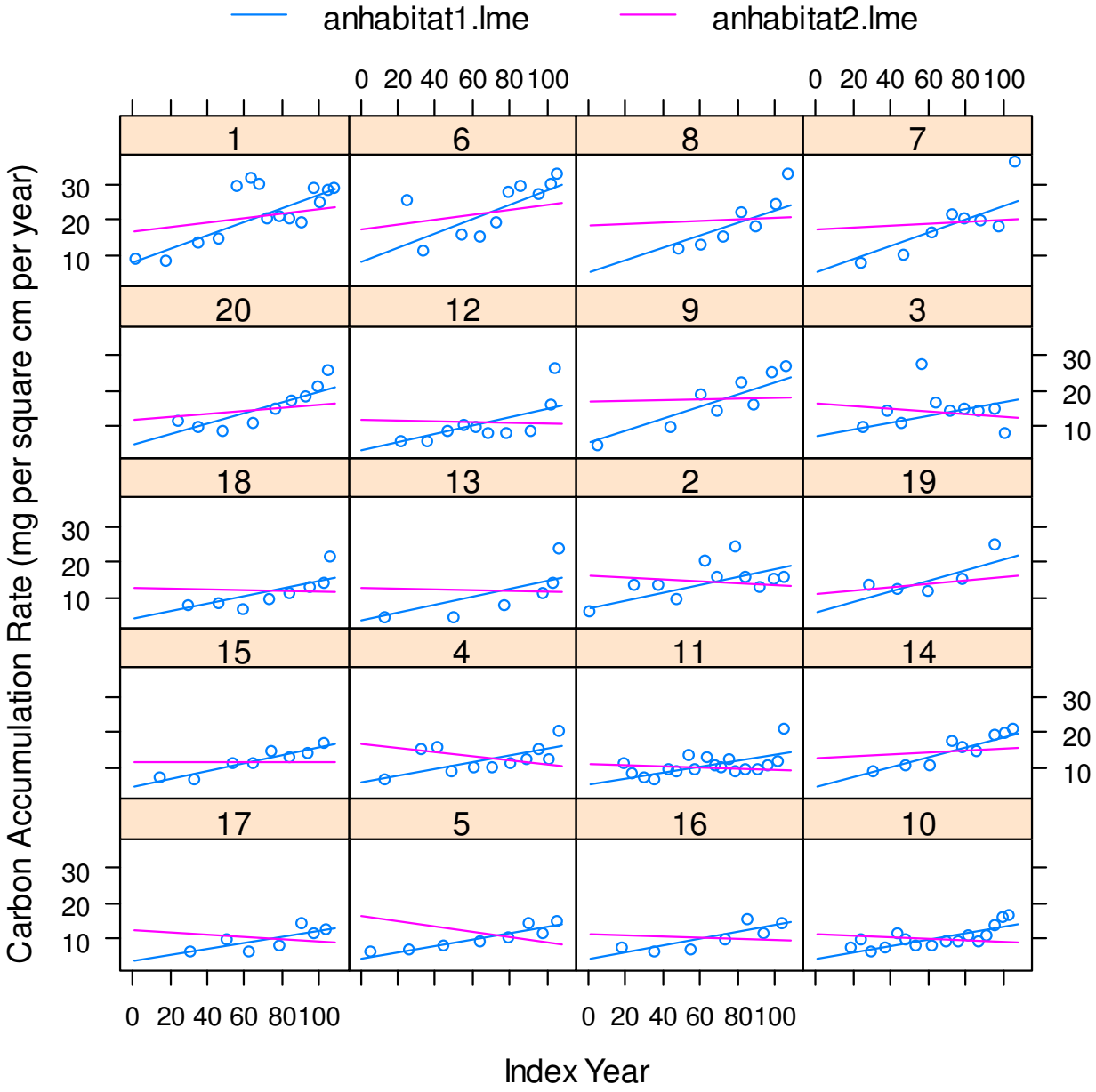
	lower	est.	upper
Intercept	3.53	5.29	7.05
Yrindx (slope)	0.099	0.127	0.16

Random Effects:

Level: code_unique

	lower	est.	upper
sd((Intercept))	0.73	2.12	6.21
sd(yrindx)	0.025	0.045	0.083

Model comparisons



Estimate of Carbon Sequestration

$$T_c = \left(\left[\int_{i=1}^{100} mx + b \right] * A \right) + C_{PB}$$

Site Name	Restoration Area (acres)	Target Restoration Community
Moccasin Island	9,200	Short (32%)/ long (68%) hydroperiod marsh
Broadmoor	2,300	Long hydroperiod marsh (100%)
Sixmile Marsh	2,700	Short (50%) / long (50%) hydroperiod marsh

Table 1 Restoration Site Characteristics

Year Completed	Century Estimate of Carbon Stored (metric tons)	Century Estimate Carbon Dioxide Equivalents (metric tons)
2005	228,060-387,939	877,187–1,492,074
2002	78,320-137,096	301,231-527,293
2002	52,866-58,041	203,331-223,234

Implications

- Executive Order # 07-128 Section 2, Phase II item 4:
  - Requests an investigation of “Land use and management policies that improve the long-term storage of carbon in Florida’s biomass.”
- Upper St. John’s Basin restoration projects have a clear, direct, positive impact on our State’s terrestrial carbon storage performance.
  - The projections made in this paper are likely transferrable to other marsh restoration projects in the region.

Implications cont'd…

- Useful for planning and outreach
  - 10 acres of marsh stores nearly the same quantity of carbon as an average US citizen produces per year.
  - Projection tool can help all of Florida's Water Management Districts quantify anticipated effects of current plans to enhance their acceptance with public.
  - This analytical method can be refined and modified as more information becomes available.

Implications for Everglades Restoration

With over 800 square miles of what was once a peat accumulating marsh, Everglades restoration is a natural recipient of carbon offset funding streams.

This projection tool may prove useful in soliciting carbon offset funding streams to finance future restoration projects.

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