Vegetation Response and Elevation Change in a Perturbed Hydrologic Regime: The Subsidy-Stress Gradient in a Peat-Based Floodplain Marsh

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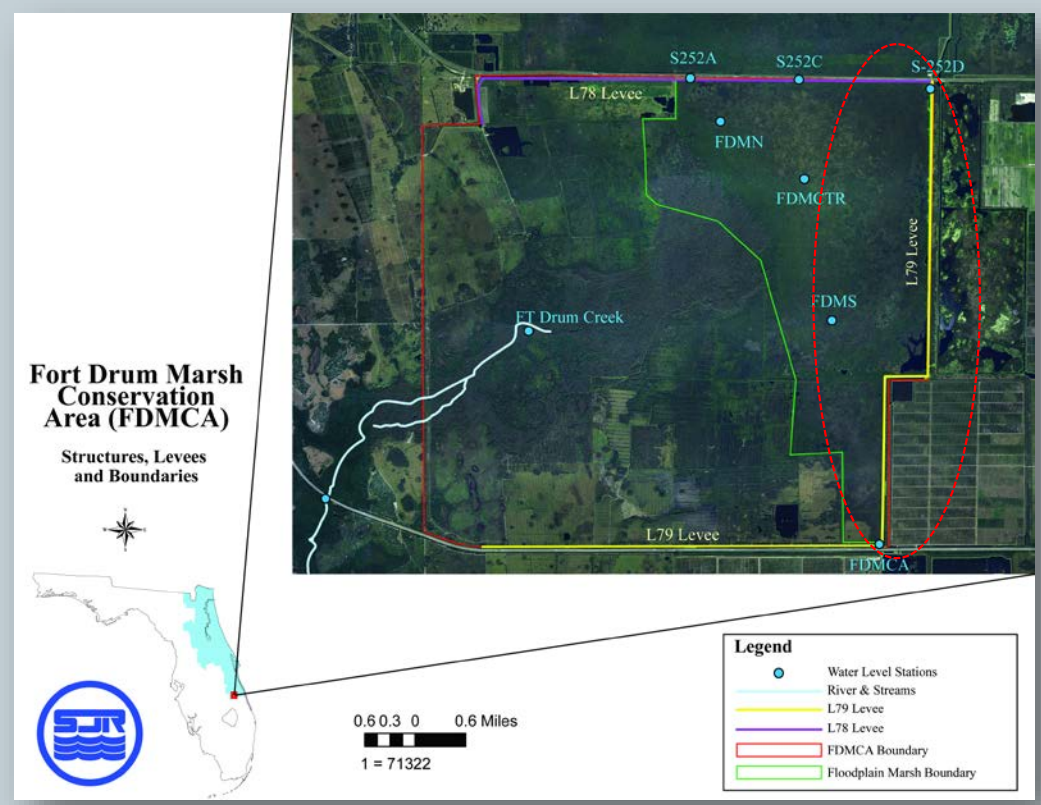
Wetlands and Flood Control

- Wetland restoration projects can provide additional values by flood control
  - To meet flood control objectives, wetland hydroperiods may be altered
- Conflicting management objectives
- Can we better manage wetlands in the wake of climate change for flood control, and additional functions/values?

Fort Drum Marsh Conservation Area (FDMCA)

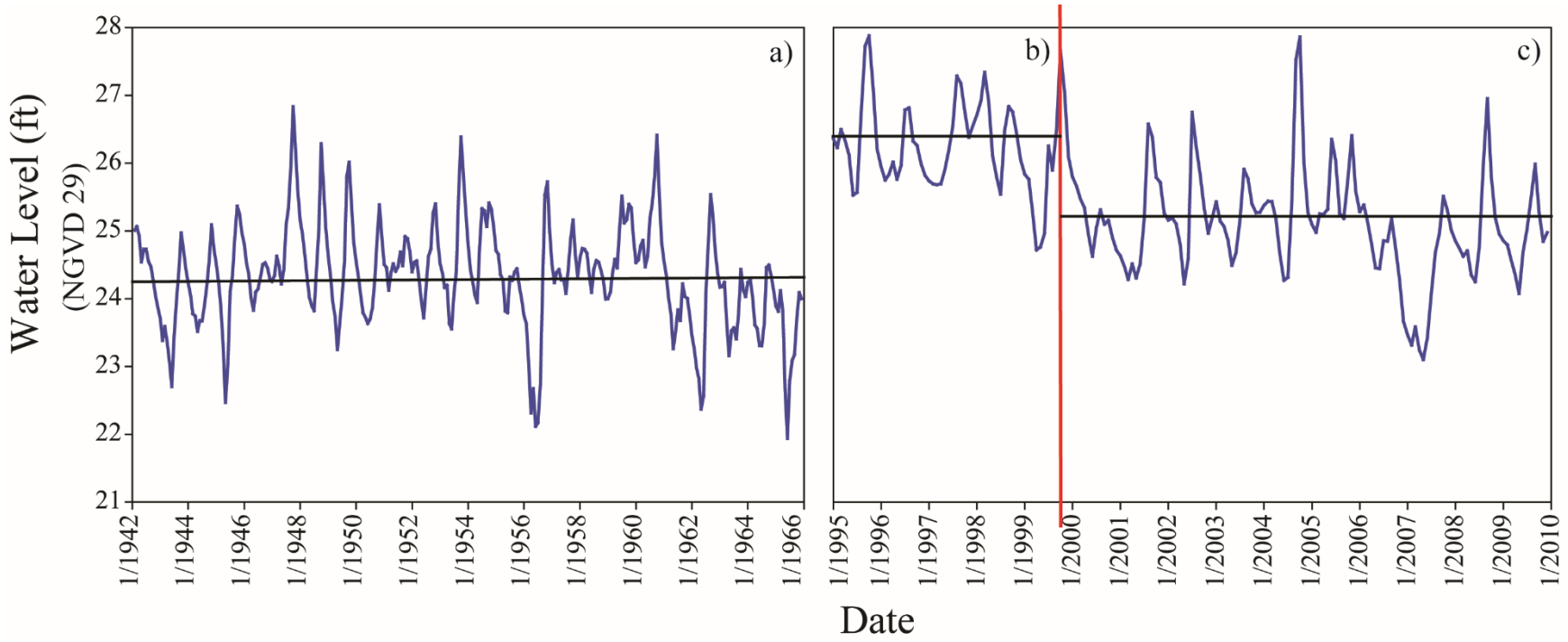
- 20,600 acre component of the Upper St. Johns River Basin flood control project
  - Fort Drum floodplain marsh occupies 6,700 acres
- L79 construction in 1991



FDMCA Floodplain Marsh Study

- Evaluate the impact of L79 construction on FDMCA floodplain marsh
  - Vegetative community structure, soil characteristics, and elevation pre- and post- construction
- Study Questions
  - Impacts/changes to Herbaceous marsh community. Would we see a die-off, shifting to an open slough community?
  - Increase in invasive species colonization?
  - Impacts/changes to soil accretion rates?
  - What is the system response?

FDMCA Floodplain Marsh Study: Hydrologic Conditions



FDMCA Study: Elevation Survey

- Elevation measured in 1983, 2002, and 2007
  - Four cross sections bisecting marsh east-west
- 1983: traditional surveying techniques, supplemental depth soundings in 1994
- 2002 and 2007: RTK

Transect	Number of Restricted Observations
Transect 1	4
Transect 2	5
Transect 3	6
Transect 4	8
Total	23

FDMCA Study: Elevation Survey

Transect	Number of Points	1983 Average Elevation (ft)	2002 Average Elevation (ft)	2007 Average Elevation (ft)	Change (ft)	Adjusted Elevation (ft)
1	4	23.1	24.1	23.6	0.5	24.2
3	6	23.5	23.7	24.0	0.5	24.6
2	6	22.7	23.1	23.7	1.0	24.3
4	8	22.7	25.0	24.8	2.1	25.4

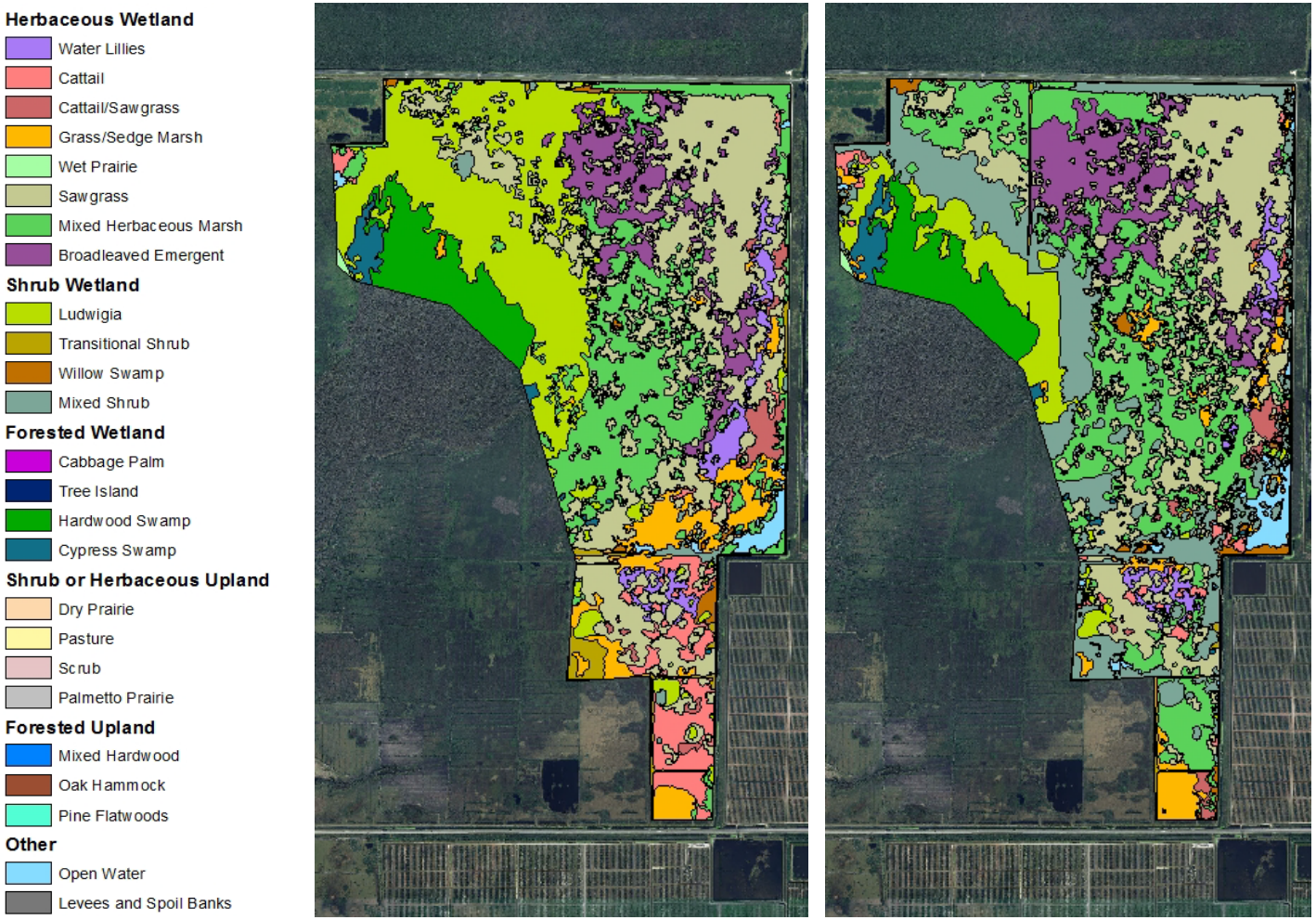
FDMCA Floodplain Marsh Study: Vegetation Mapping

- Determined via remote sensing analysis using color infrared aerial photography (2001 and 2009)
- Vegetative community classifications
  - Herbaceous wetland (7 community types)
  - Shrub wetland (4 community types)
  - Forested wetland (2 community types)
  - Open water

FDMCA Study Results: Vegetation Mapping

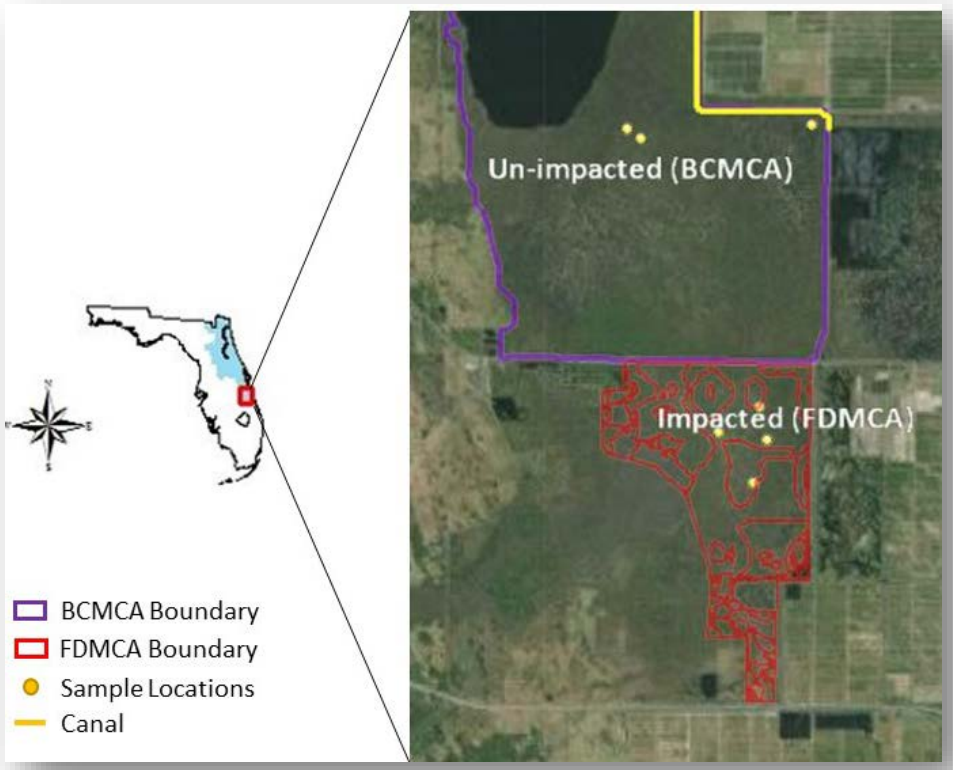
Category	Community Type	2001 Acres	2008 Acres	Difference (2008-2001 acres)	%Change
Herbaceous Wetland					
	Broadleaf Emergent (BE)	464	570	106	23
	Cattail (CT)	321	86	-235	-73
	Cattail/Sawgrass (CTSG)	103	86	-17	-17
	Grass/Sedge (GS)	378	249	-129	-34
	Mixed Herbaceous (HM)	1112	1529	417	38
	Sawgrass (SG)	1873	1698	-175	-9
	Water Lily Slough (WL)	179	117	-62	-35
	Herbaceous Wetland Total	**4431**	**4335**	**-96**	**-2**
Shrub Wetland					
	Ludwigia (LU)	1491	470	-1021	-68
	Mixed Shrub (MS)	51	1169	1118	2207
	Transitional Shrub (TS)	91	29	-62	-69
	Willow Swamp (WS)	47	69	21	45
	Shrub Wetland Total	**1680**	**1736**	**57**	**3**
Forested Wetland					
	Cypress Swamp (CY)	73	88	16	22
	Hardwood Swamp (HS)	398	368	-30	-7
	Forested Wetland Total	**471**	**457**	**-14**	**-3**
Open Water					
	Open Water (OW)	71	125	54	76

FDMCA Study Results: Vegetation Mapping

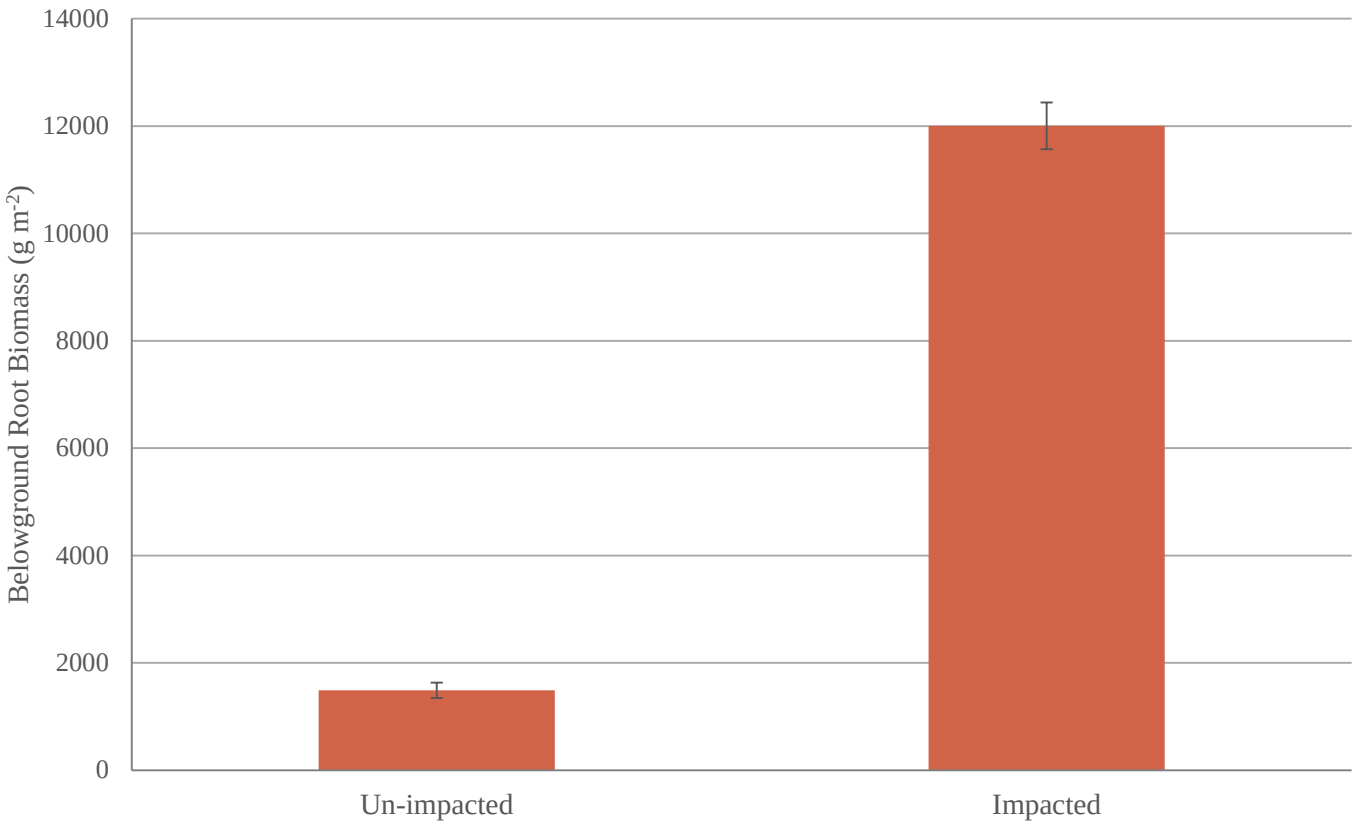


FDMCA Study: Soil Characteristics and Root Biomass

- 4 stations sampled in FDMCA floodplain, 1 station sampled in BCMCA
- Three replicate soil cores collected from each station in May 2009
  - Analyzed for bulk density, C, N, and P
- Three replicate deep soil cores for belowground root biomass in May 2009
  - Dry weight biomass (g/m^2)



FDMCA Study: Root Biomass



FDMCA Study: Soil Characteristics

Study	Bulk Density (g/cm^3)	TP (g/m^2)	TN (g/m^2)	TC (g/m^2)	OC (g/m^2)
Blue Cypress Marsh	0.079 ± 0.002	5.3 ± 0.15	242 ± 7.1	3,972 ± 117	3,734 ± 110
Fort Drum Marsh	0.058 ± 0.0009	5.3 ± 0.08	165 ± 2.9	2,842 ± 45	2,692 ± 43

Discussion

- To overcome the stress of extended hydroperiods, the plant community responded by increasing belowground biomass production
  - Increase in the surface elevation to a level that is more reflective of historic hydroperiods that meet plant community needs
- Disturbance < plant community tolerance level
  - What is new optimal condition?

Discussion

- From a management perspective, this means that FDMCA marsh is not managed at inappropriate water levels
  - Historic surface elevations and water levels compared to current levels suggest that optimal conditions have been reached
- Implications for managing for climate change?

Questions?

Special thanks to the SJRWMD for data used in this presentation