

130 Years of Ecohydrological Change in the Everglades:

What's Different and What's Not, and Why It Matters

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Disclaimer I

The thoughts presented here are mine and my coauthors. They do not represent the positions or policies of my employer, the SFWMD.

That said, I would like to thank the SFWMD for its generous support of our Everglades research.

Disclaimer II

Contains no global warming!

Thoughts Toward a Vision of Everglades Restoration

(a thought experiment)

Summary:

A sizable portion of the remaining Everglades could in fact be restored to close to pre-drainage hydrologic conditions,

and

there are good sustainability arguments for doing so,

but

we should be conscious of the transient “bumps” that could be expected.

Premises

- 1) At the scale of 10^2 , possibly 10^3 years, the pre-drainage Everglades was relatively stable, e.g., the Sawgrass Plains were dominated by sawgrass, the Ridge and Slough landscape included ridges, sloughs and tree islands in a directional pattern, the Marl Marshes were slightly higher/drier landscapes.
 - 2) Anthropogenic water management has displaced the remaining Everglades into a new condition.
 - 3) This new condition is not only different, but unstable, following an undesirable trajectory, e.g., Ridge & Slough turning into undifferentiated sawgrass.
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- 1) The remaining Everglades need to be returned to a desirable trajectory.
 - 2) Restoring to pre-drainage hydrologic conditions has the highest probability of yielding a desirable, and sustainable, trajectory.

Implications

If a return to pre-drainage conditions has highest probability of success, then we need to know these pre-drainage hydrologic conditions, and to clearly understand the difference between them and current hydrologic conditions.

Pre-Drainage Hydrological Conditions – Regional

Outflows from Lake Okeechobee: continued throughout much of most years

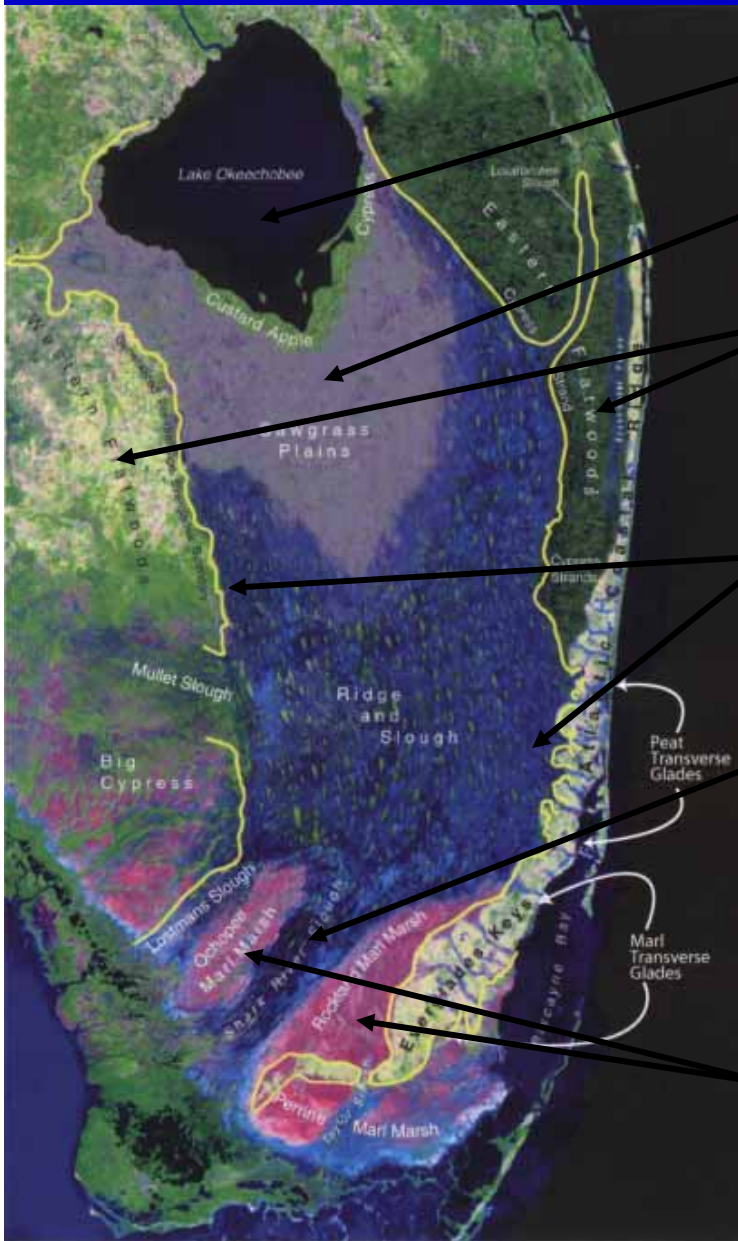
Sawgrass Plains: slowly released water downstream

Eastern (and Western) Flatwoods: seasonal ponds

R&S landscape: extended directly up to bordering uplands

Shark Slough: same as R&S landscape further upstream

Marl Marshes: bordering, slightly higher floodplain areas



Pre-Drainage Hydrological Conditions – Sloughs

Slough water depths:

- 3 ft (90 cm) typ. max; 1 ft (30 cm) typ min
- Sloughs typically did not dry out
- Flocc typically did not dry down and compact
- White water lily ubiquitous; Spatterdock frequent
- Usually too deep for many wading birds
- Bass apparently widespread

Sawgrass Ridges:

- 1.5-2 ft (45-60 cm) higher than sloughs
- seasonally terrestrial

Tree Islands:

- many boggy; wet for camping
- red bay, whitewood, myrtle



Pre-Drainage Hydrological Conditions – Marl Marshes

Vegetation:

- Sawgrass, “open Everglades,” “few scattering islands” (1885-6)
- Sawgrass, “Round Water Grass,” Pickerel Weed, Spatterdock, White Water Lily (1917)

Soil:

- “Marl,” “Muck” or “Mucky;” 0.5-1.5 feet (15-45 cm) thick

Water Depths:

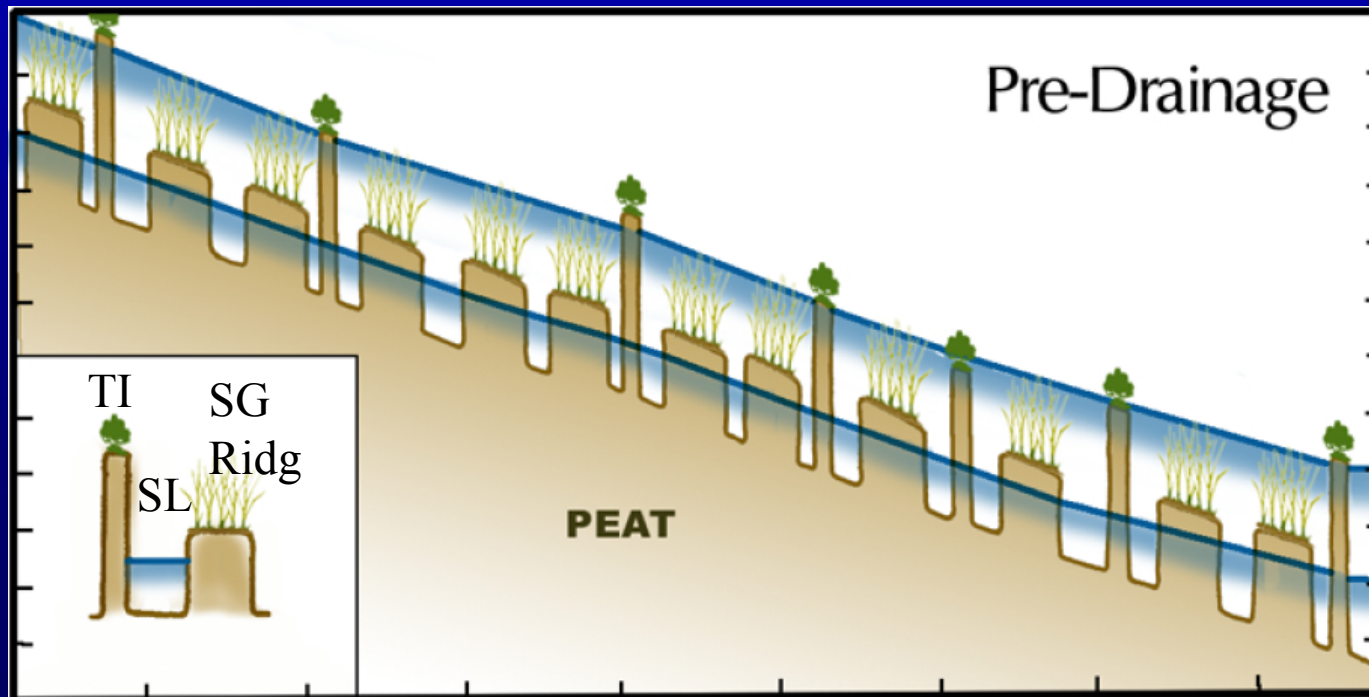
- “15-30 inches” (38-76 cm)



Pre-Drainage Hydrological Conditions – Slopes

Water surface (relative to ground surface):

- parallel
- depths very similar throughout landscape
- seasonal rise and fall, synchronous throughout landscape
- any threshold/optimal depths were temporary



Pre-Drainage Hydrological Conditions – Summary

- Ridges and sloughs – patterning apparently persisted
- Tree islands – apparently persisted
- Marl Marshes – a degree of peat probably was present
- Marl Marshes – flora possibly less diverse

- Sloughs deep – usually too deep for most wading bird foraging
- Sloughs deep – wet prairie species infrequent; snail kite implications?
- Sloughs deep – continuous hydroperiod; drydowns infrequent

- Water flows uniformly spread across landscape; constrictions local & small scale
- Freshwater flows to Florida Bay likely substantial

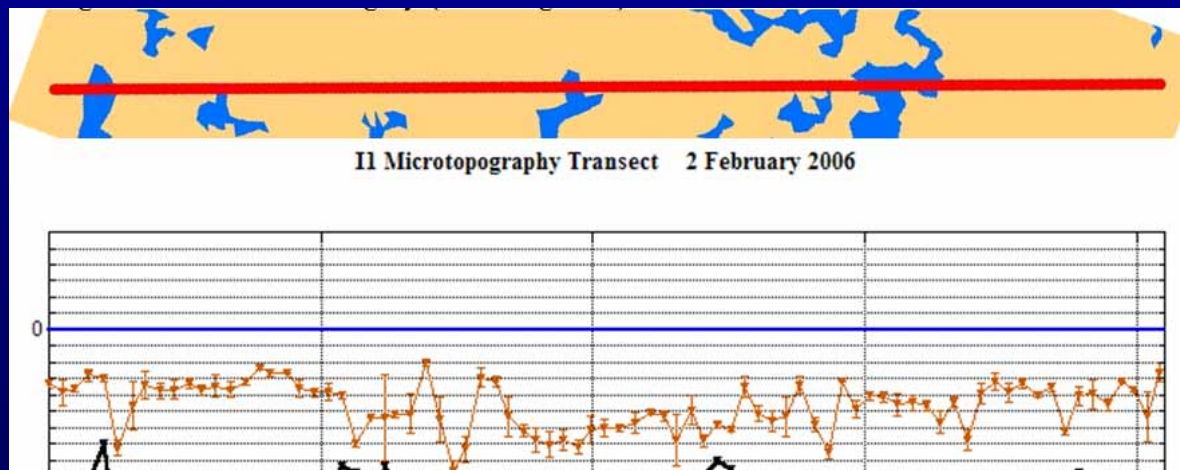
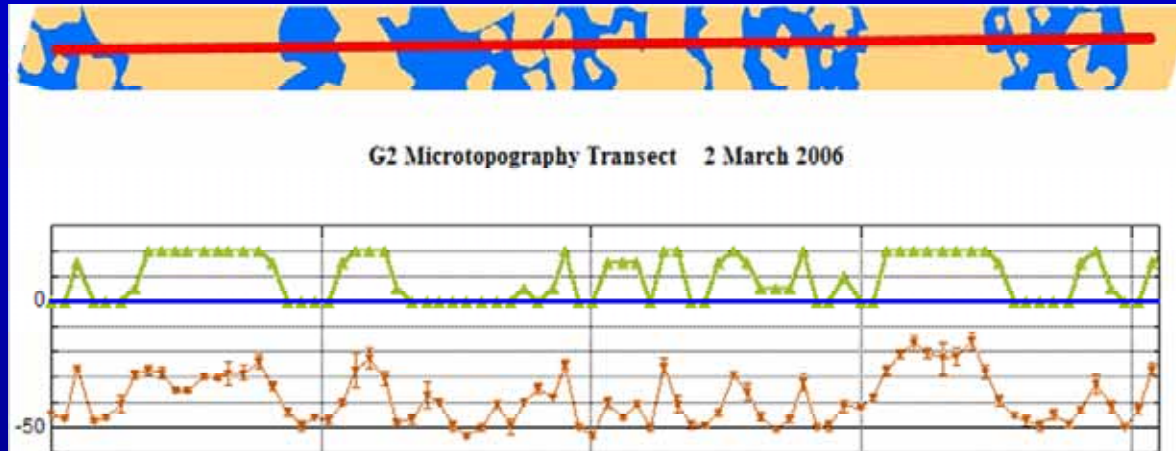
Current Hydrological Conditions - Discontinuities



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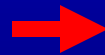
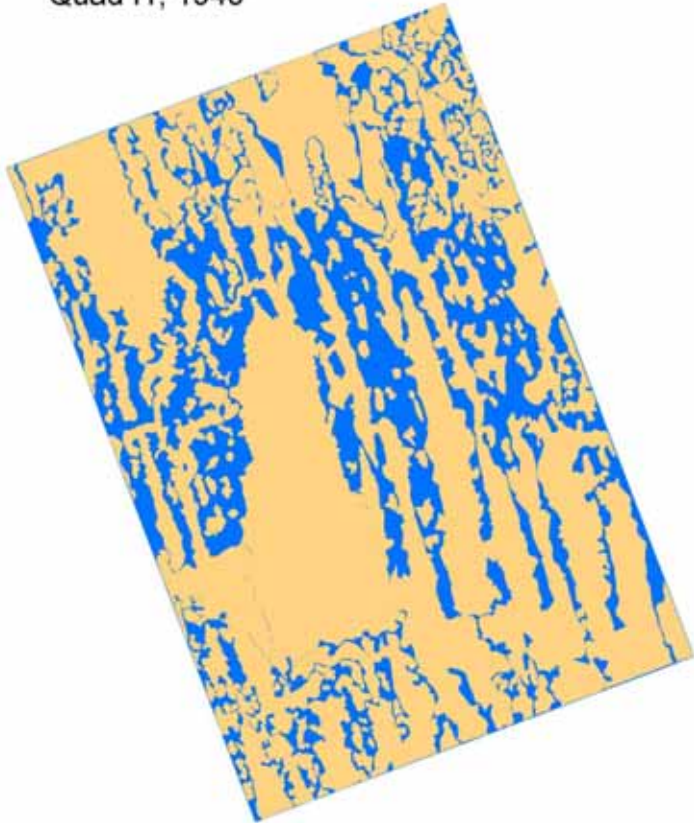


Current Hydrological Conditions – Loss of Landscape Structure

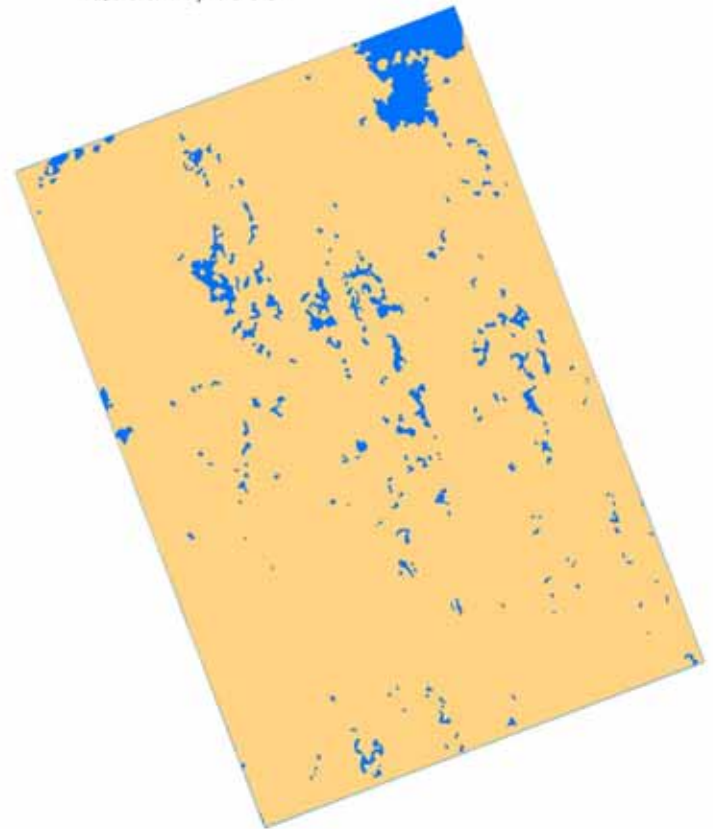


Current Hydrological Conditions – Loss of Landscape Structure

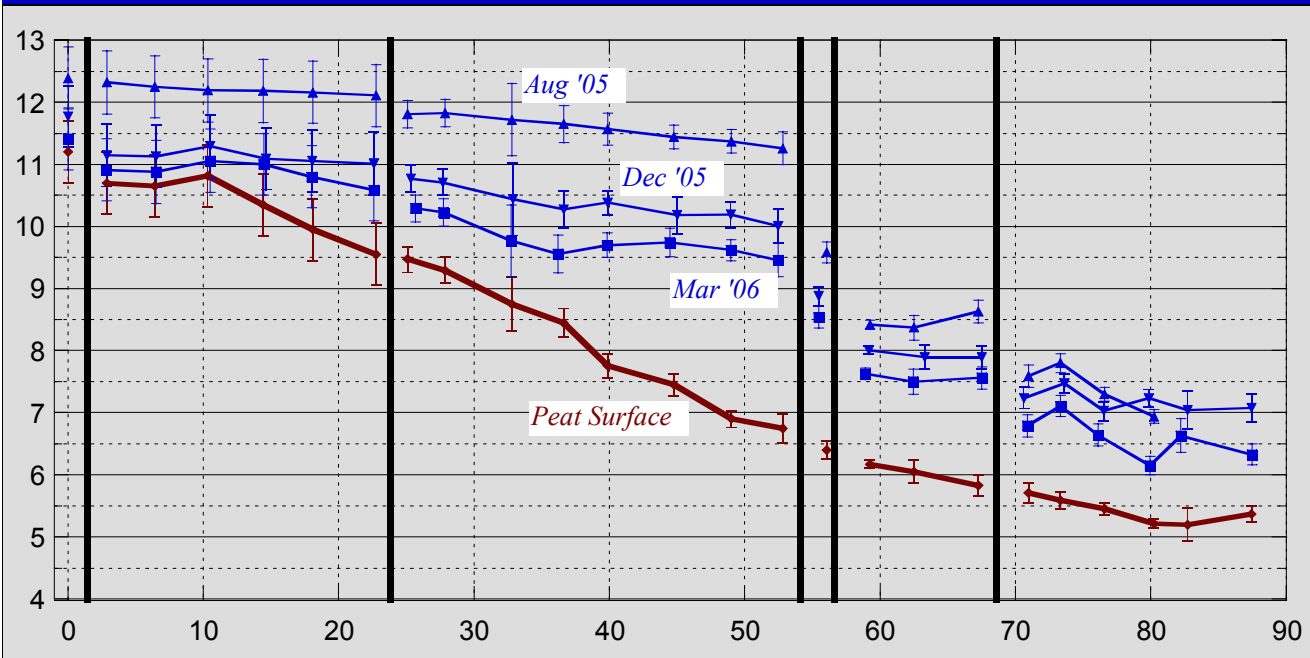
Quad I1, 1940

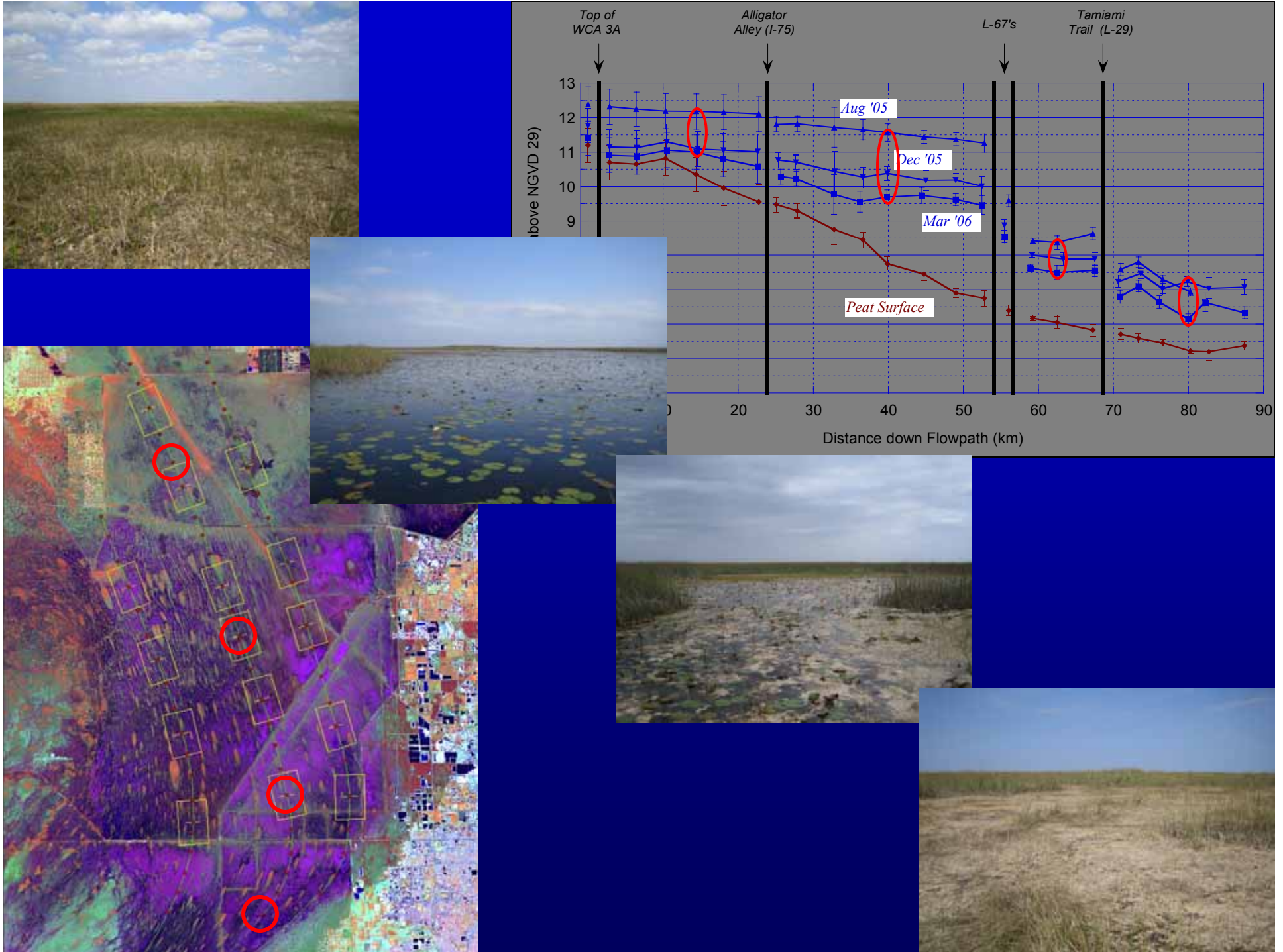


Quad I1, 1995



Current Hydrological Conditions – Artificial Depth Gradients

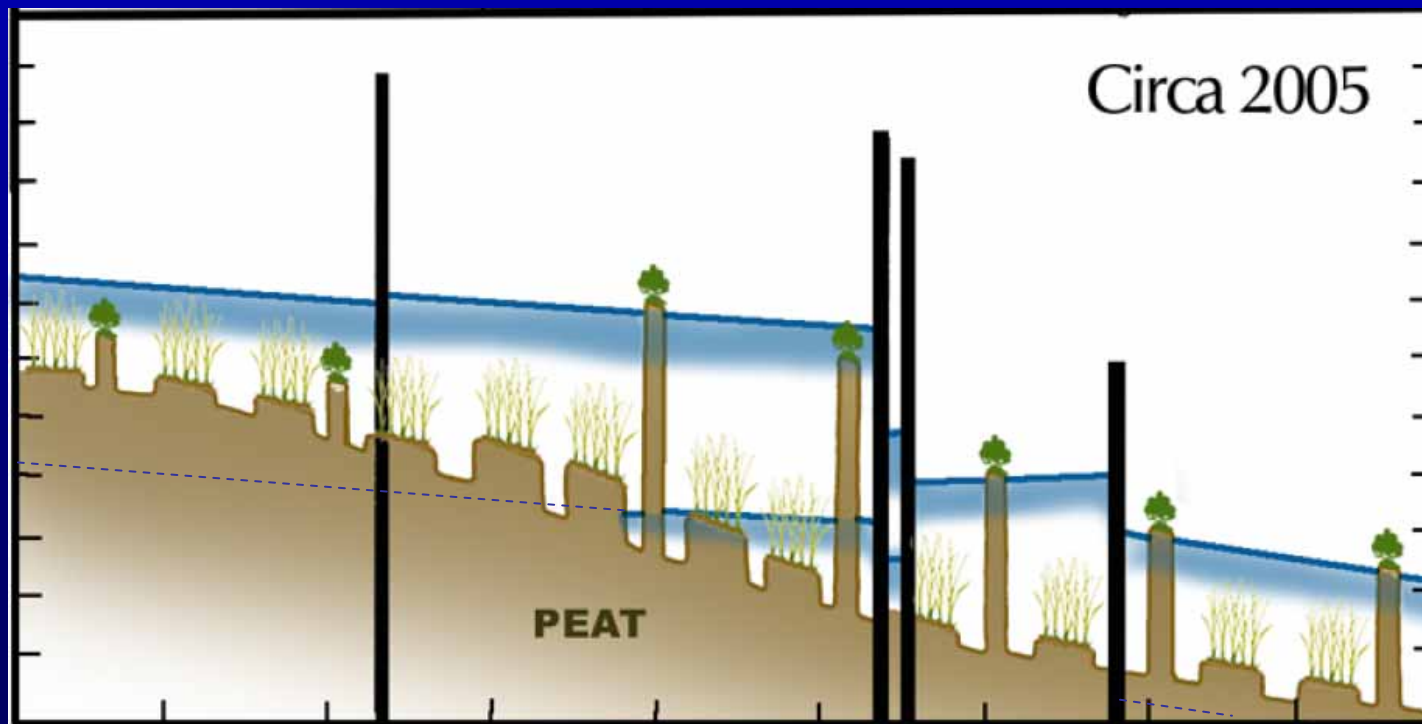




Current Hydrological Conditions – Artificial Depth Gradients

Water surface (relative to ground surface):

- “wedges”
- depths significantly different within and between compartments
- moving fronts of water depth



Current Conditions – Summary

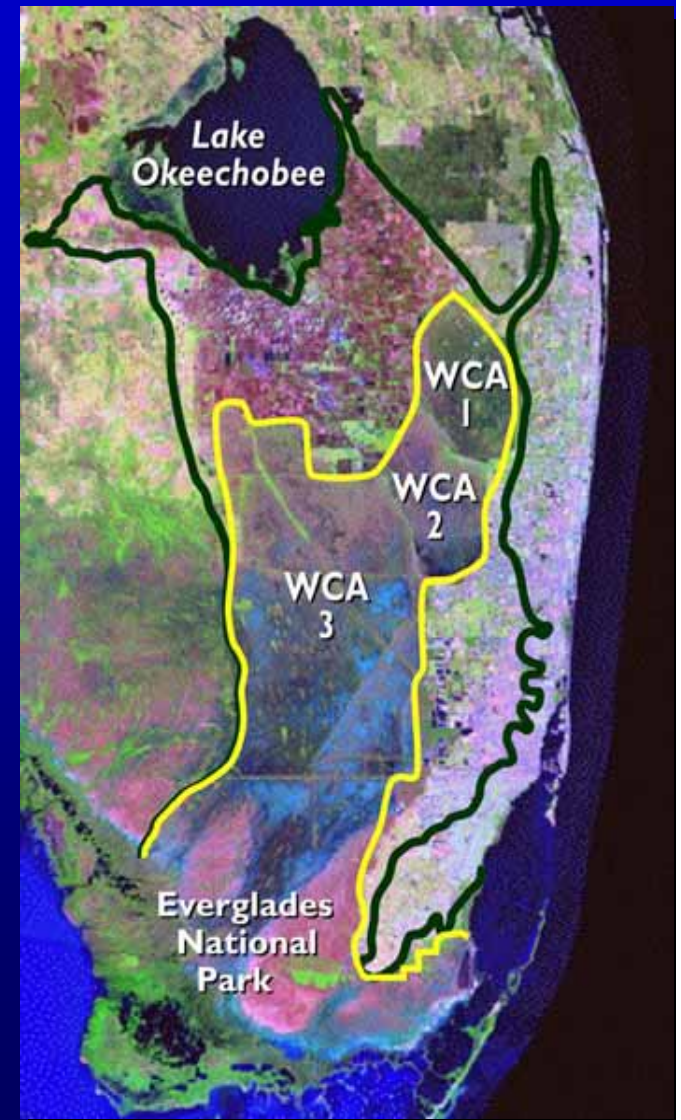
- Ridges and Sloughs – patterning being lost (vert. and horiz.)
- Tree islands – height loss, species lost
- Marl Marshes – drier; floral shifts

- Water depths both too deep and too shallow
- Large areas too dry (e.g., ENP, northern WCA 3A, possibly WCA 3B)
- Sloughs dry out too frequently; reduction in larger fish
- White water lilies (*Nymphaea odorata*) infrequent in Shark Slough
- Spatterdock (*Nuphar advena*) almost absent throughout

- Water flows much reduced in large areas
- Water flow directions no longer parallel to landscape directionality
- Freshwater flows to Florida Bay much reduced

Aspects Same or Similar (in remnant Everglades)

- Peat still present
- Slope still present
- Most plant species still present
- Aspects of patterning (both vert. and horiz.) still present
- An original “watershed” or “flowpath” still largely present
- Higher-lying landscapes still present (marl prairies)



Conclusions

- Seems feasible to restore to pre-drainage hydrology
- Would likely yield more sustainable landscape
- Would probably address a number of current problems

Challenges

- Ecological – implies big change from current
- Water Quality
- Water Quantity
- Different thinking / paradigm shift??

