Hydrologic modification and peat dynamics in the Everglades ridge- slough mosaic

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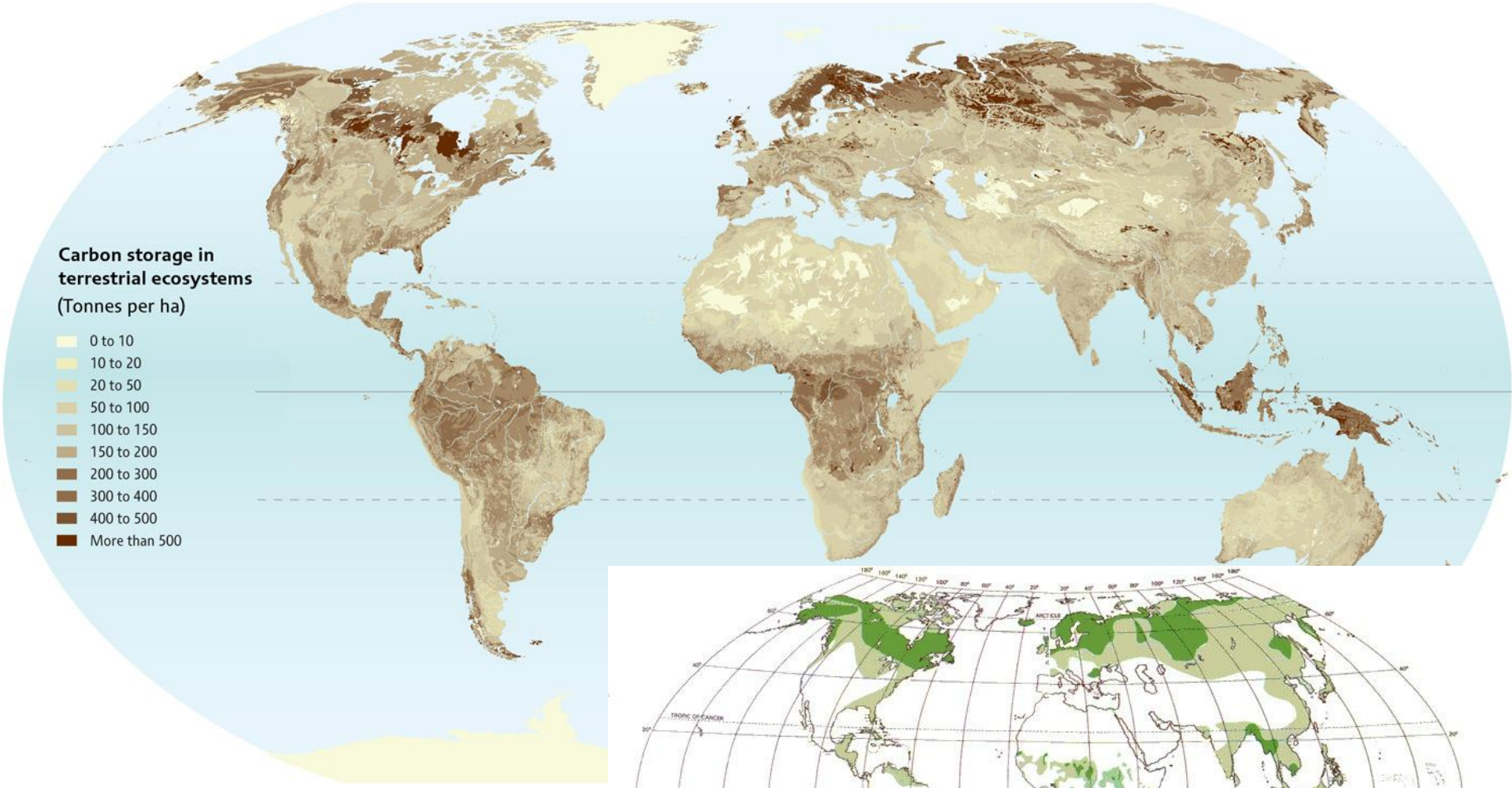
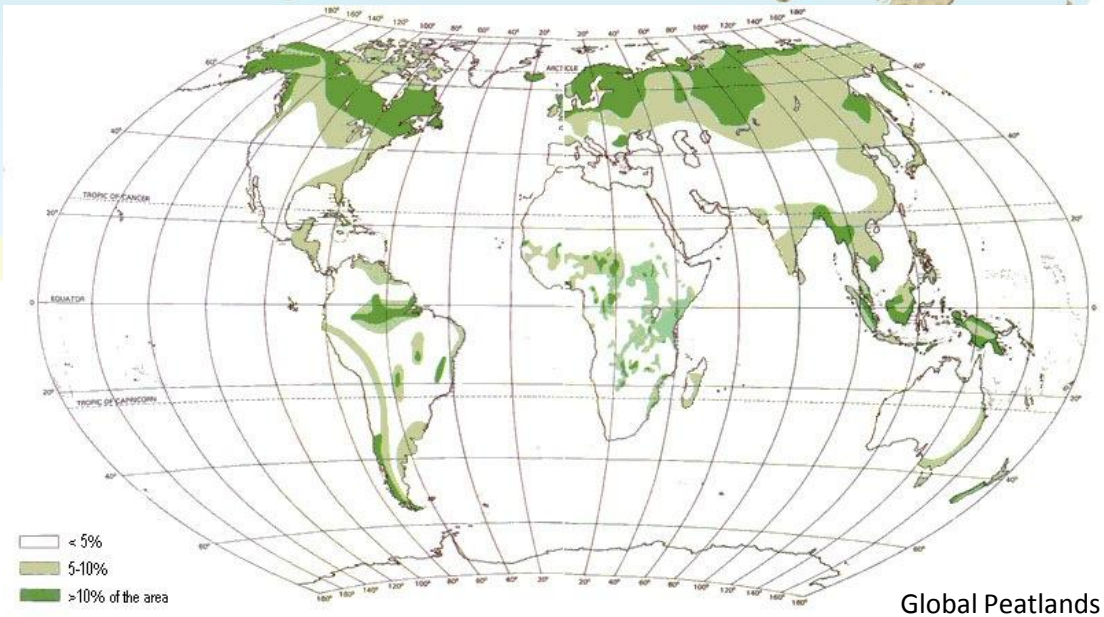
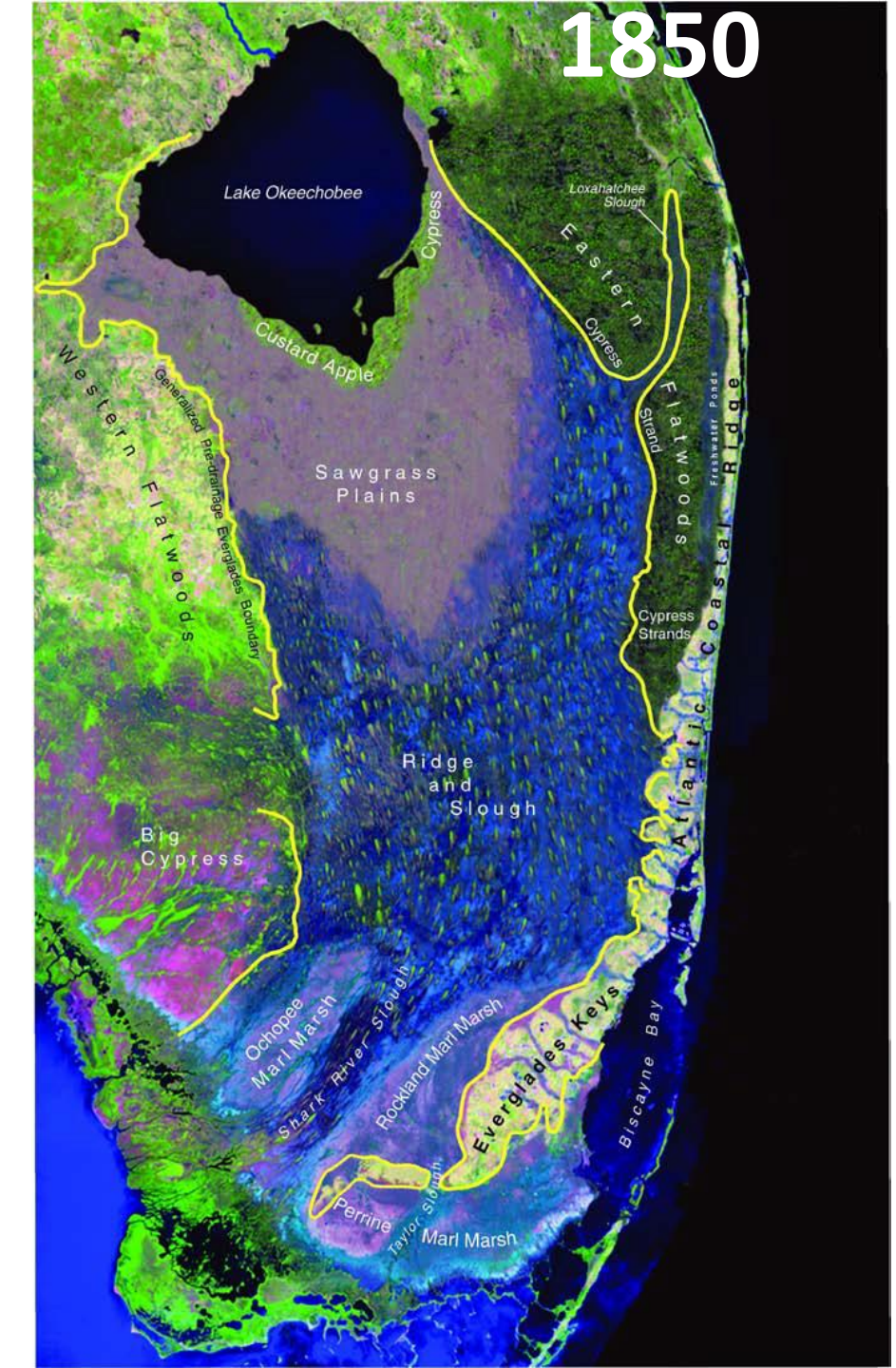
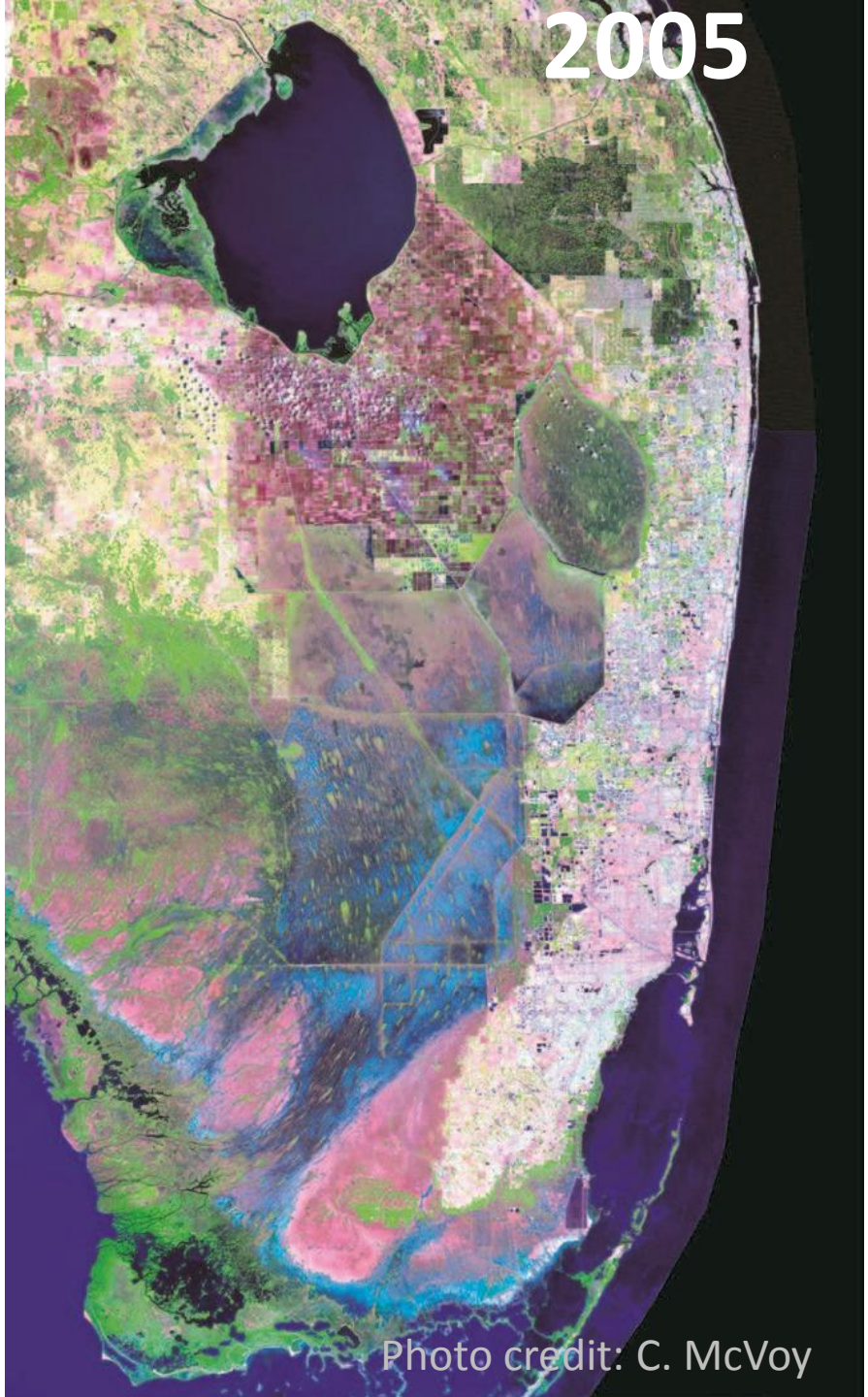
Credit: Riccardo Pravettoni, UNEP/GRID-Arendal

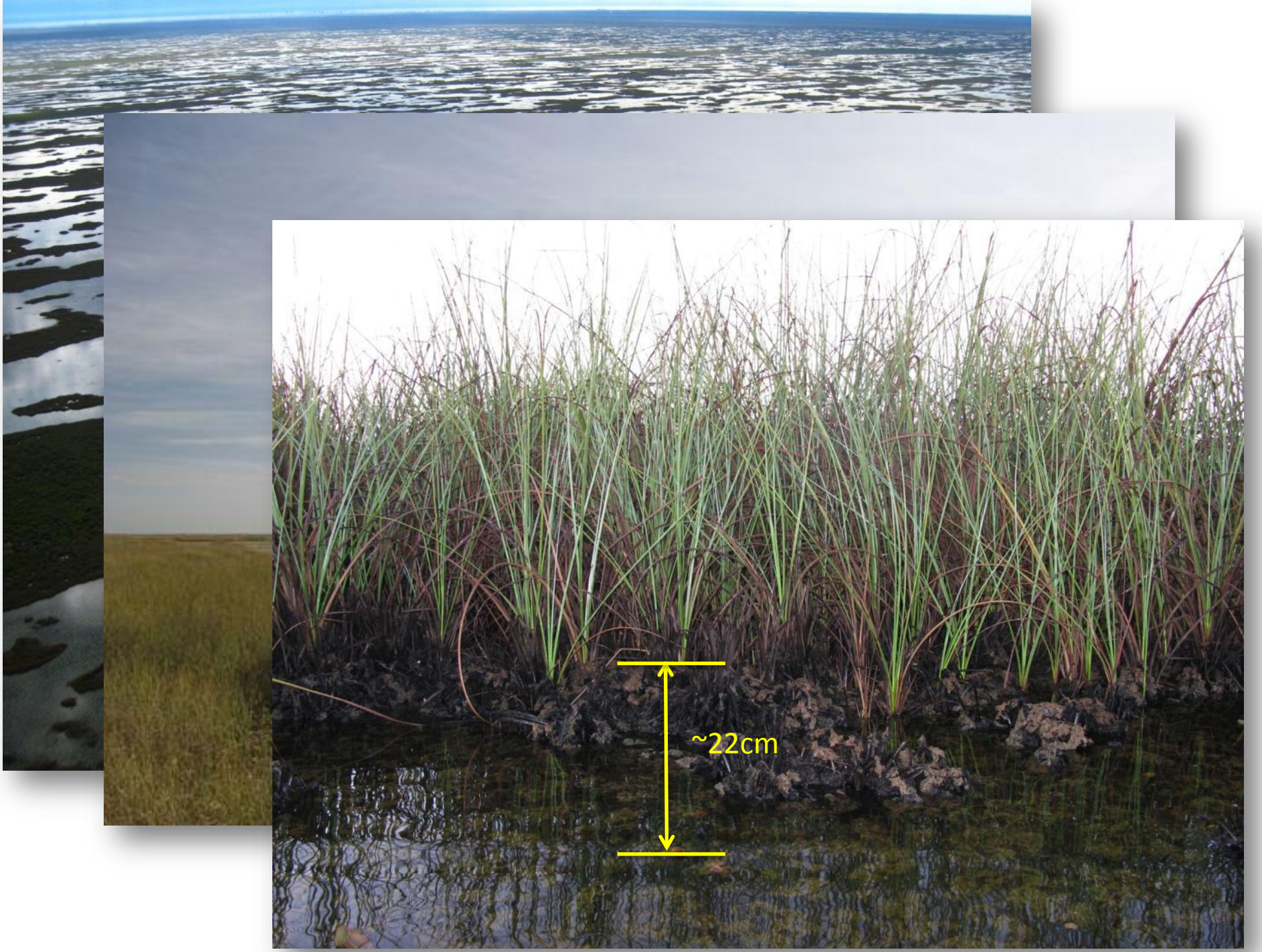


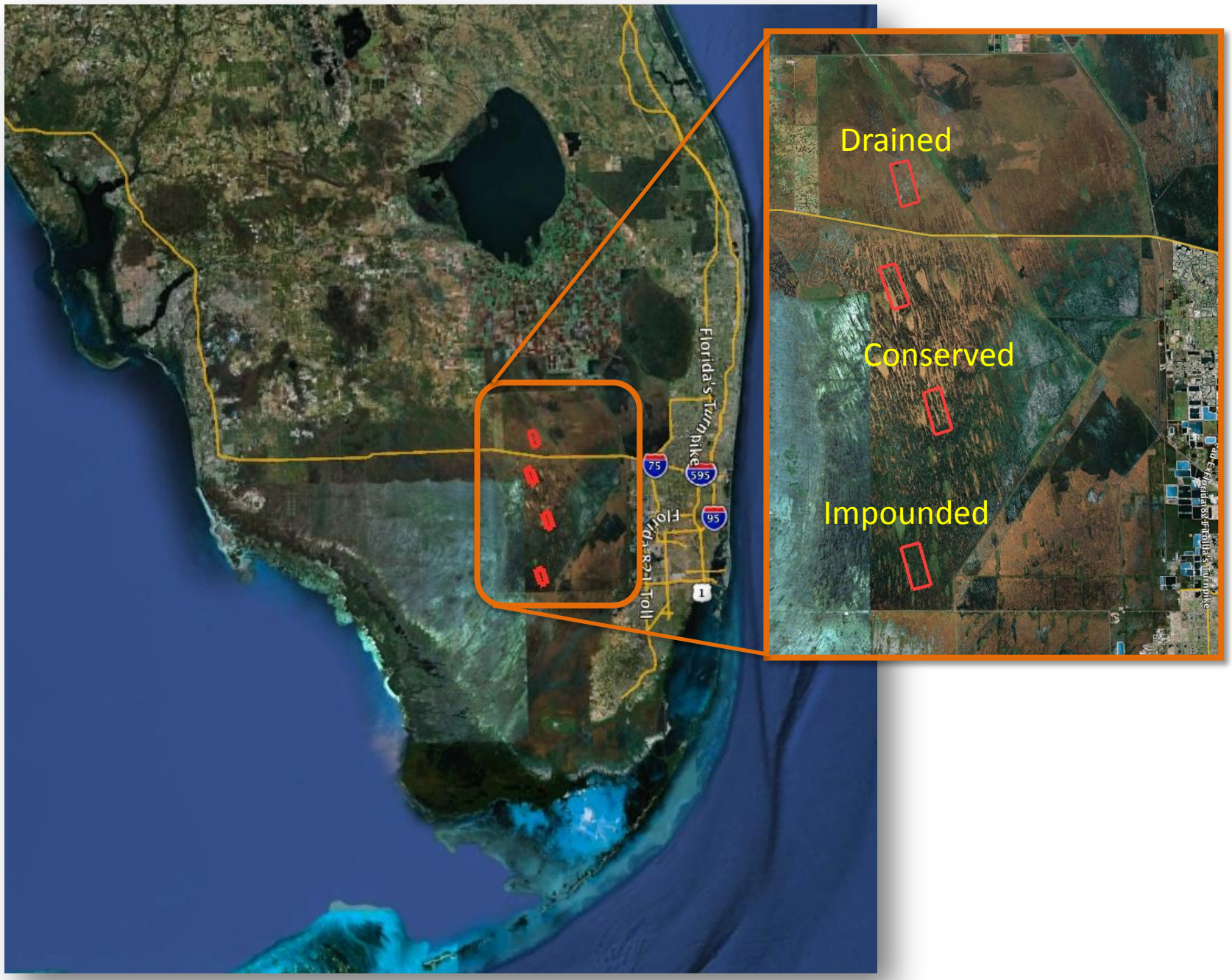


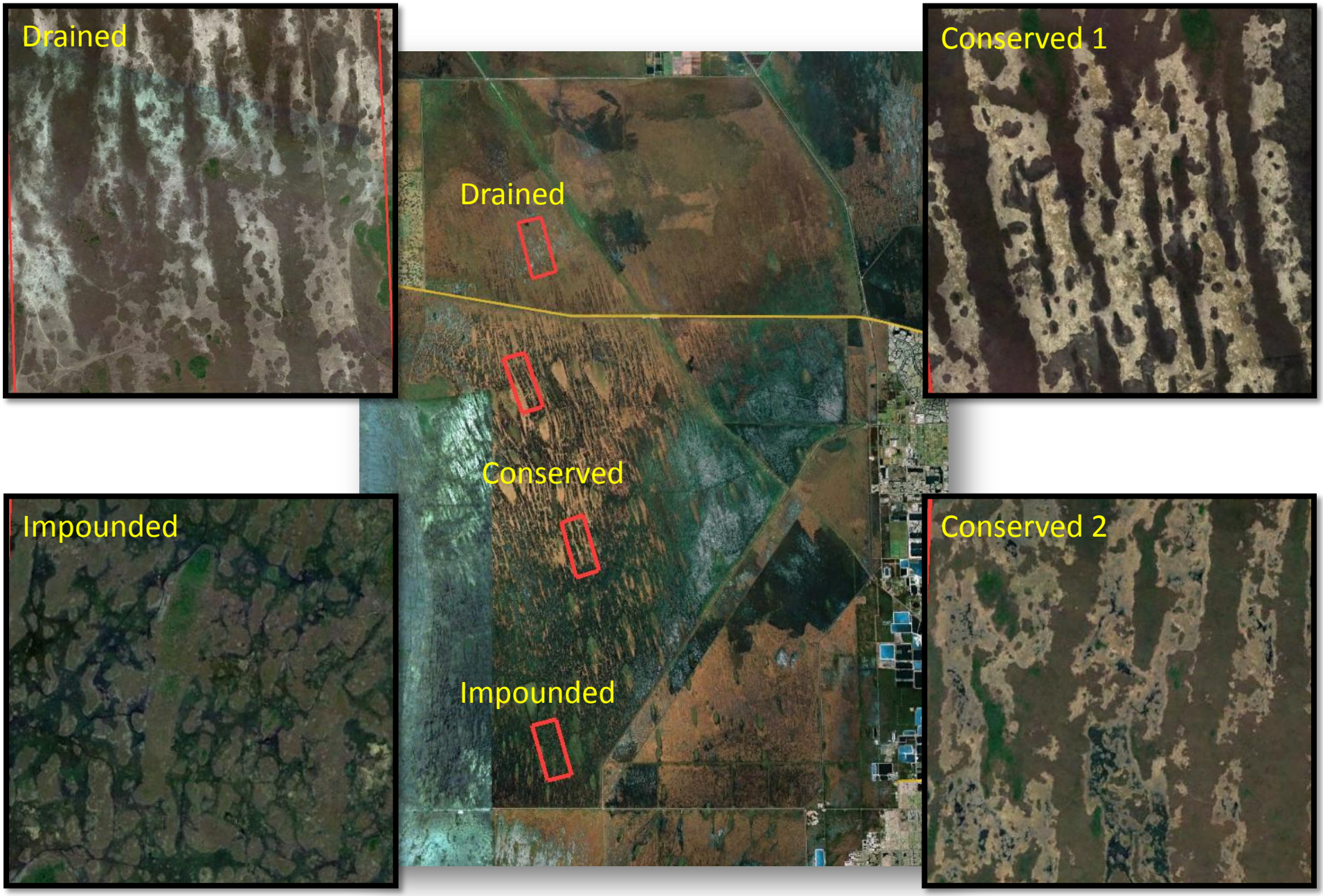
Global Peatlands

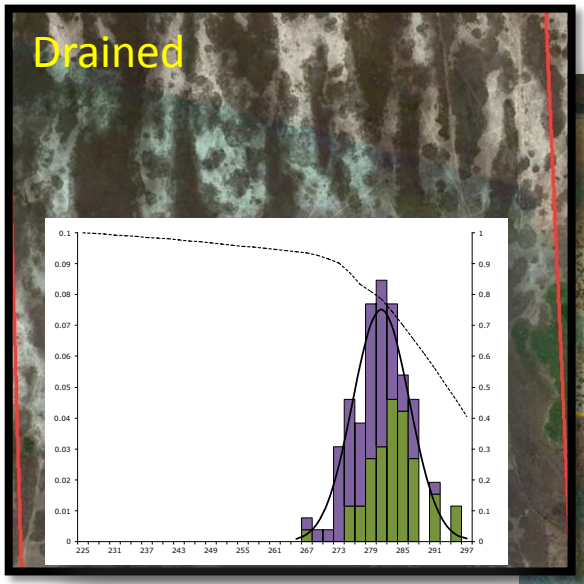

1850
Lake Okeechobee
Cypress
Loxahatchee Slough
Eastern Cypress
Custard Apple
Western Flatwoods
Generalized Pre-drainage Everglades Boundary
Sawgrass Plains
Flatwoods
Strand
Freshwater Ponds
Ridge
Cypress Strands
Atlantic Coastal
Ridge and Slough
Big Cypress
Ochopee Marl Marsh
Shark River Slough
Rockland Marl Marsh
Everglades Keys
Biscayne Bay
Perrine Marl Marsh
Taylor Slough

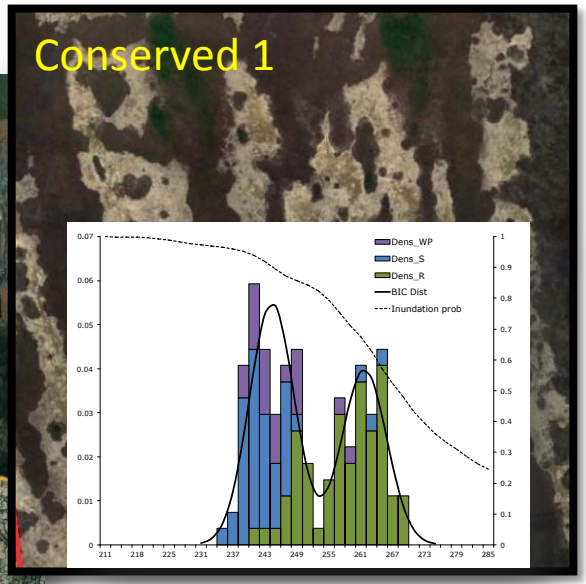

2005
Photo credit: C. McVoy

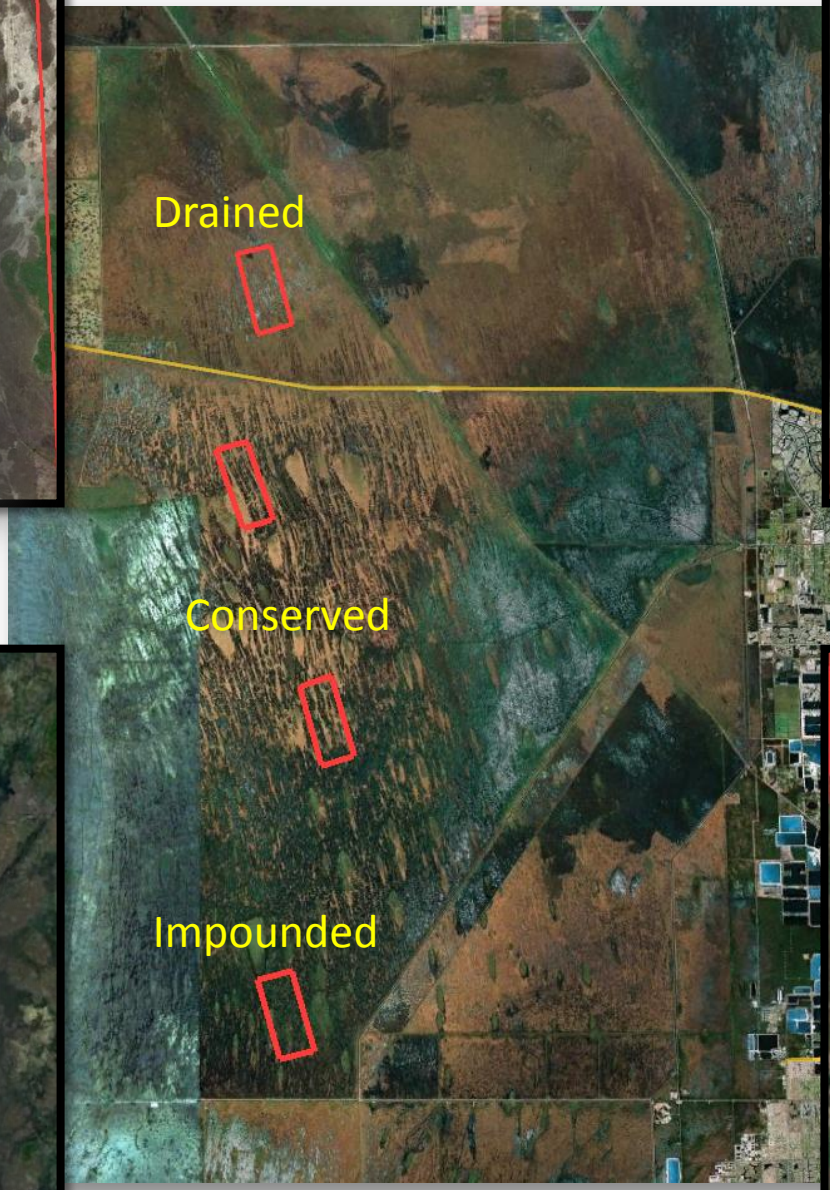

~22cm

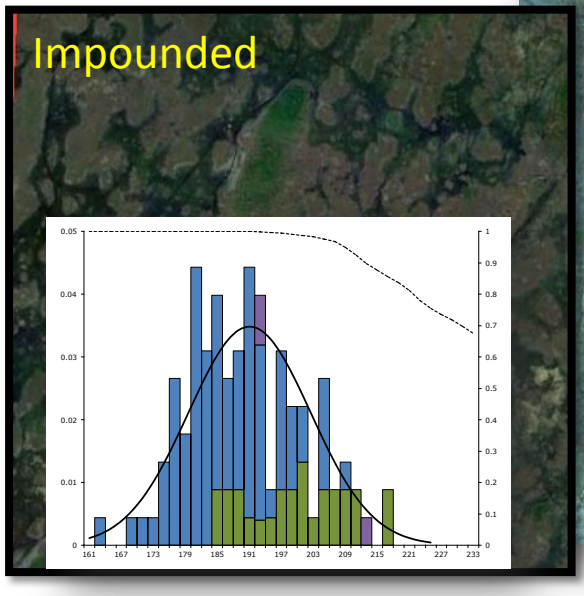

Drained
Conserved
Impounded
Florida's Turnpike
75
595
95
1
Florida's Turnpike

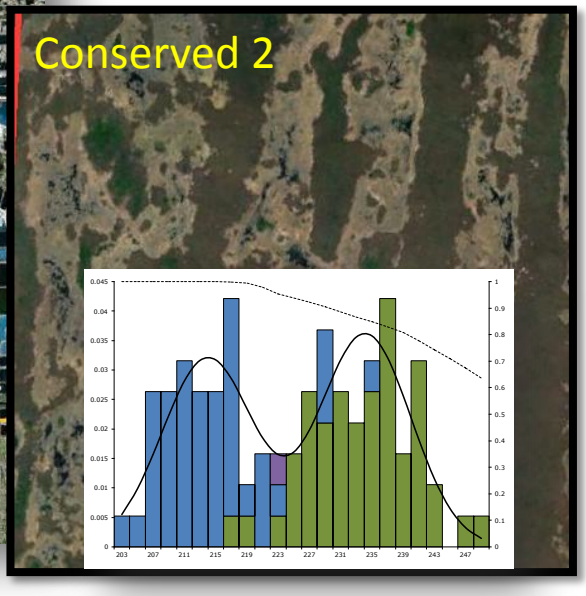

Drained
Drained
Conserved 1
Conserved
Impounded
Impounded
Conserved 2



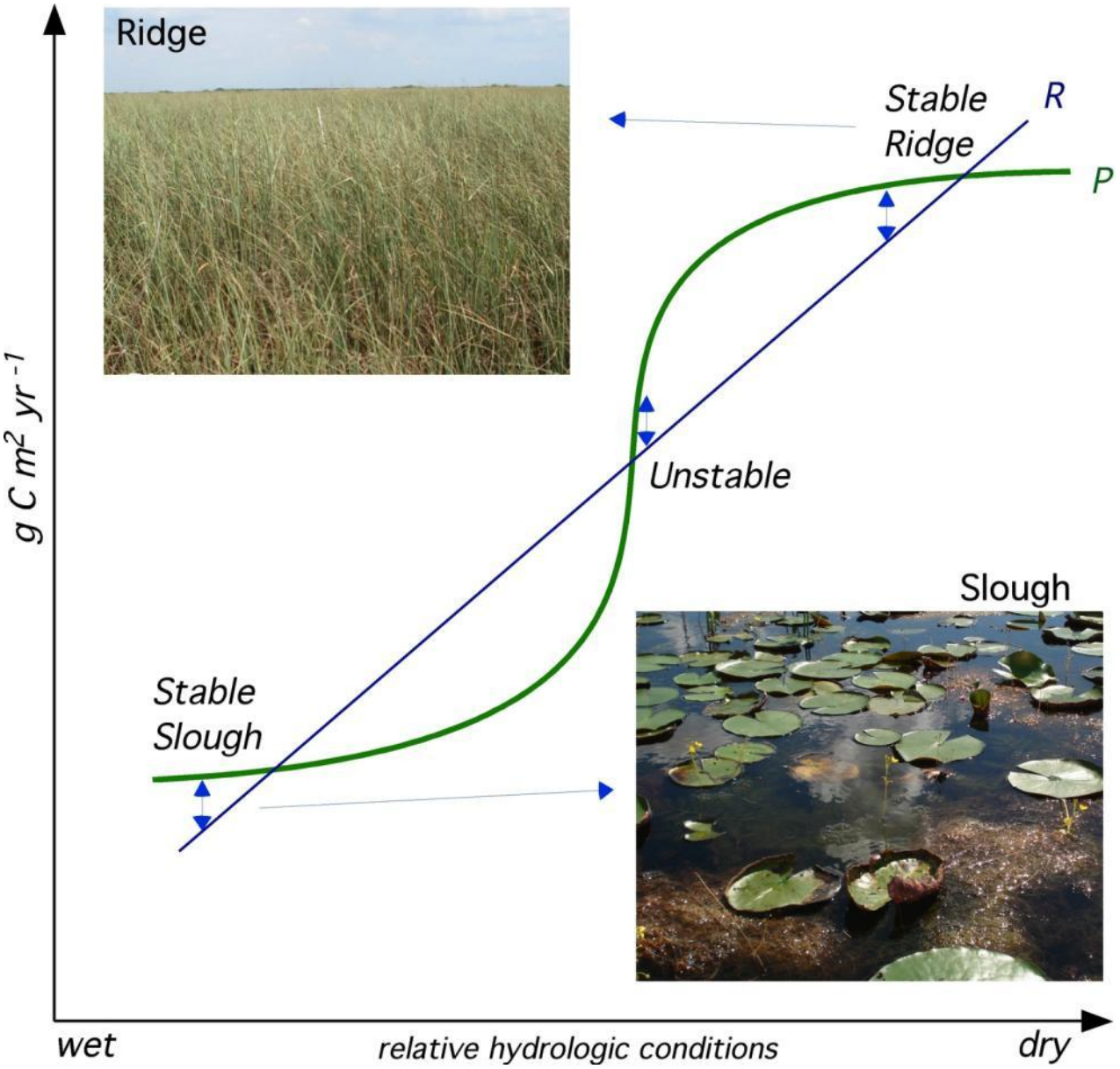




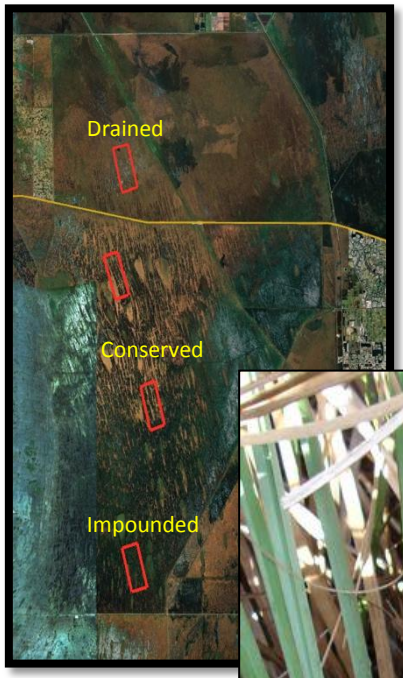


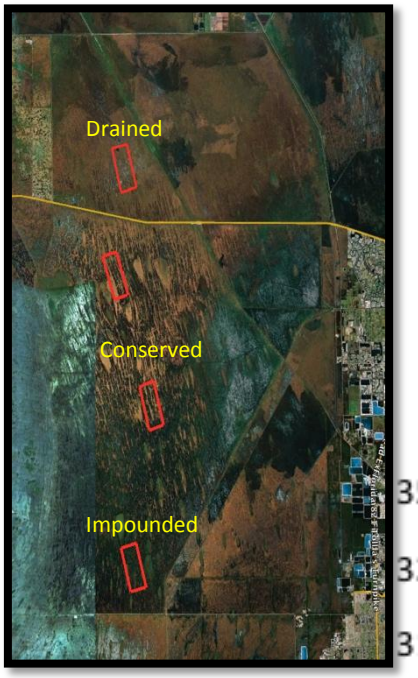


Watts et al. 2010. Ecosystems **13**: 813-827.


Ridge
Stable
Ridge
R
P
Unstable
Slough
Stable
Slough
g C m2 yr -1
wet
relative hydrologic conditions
dry

Soil Respiration



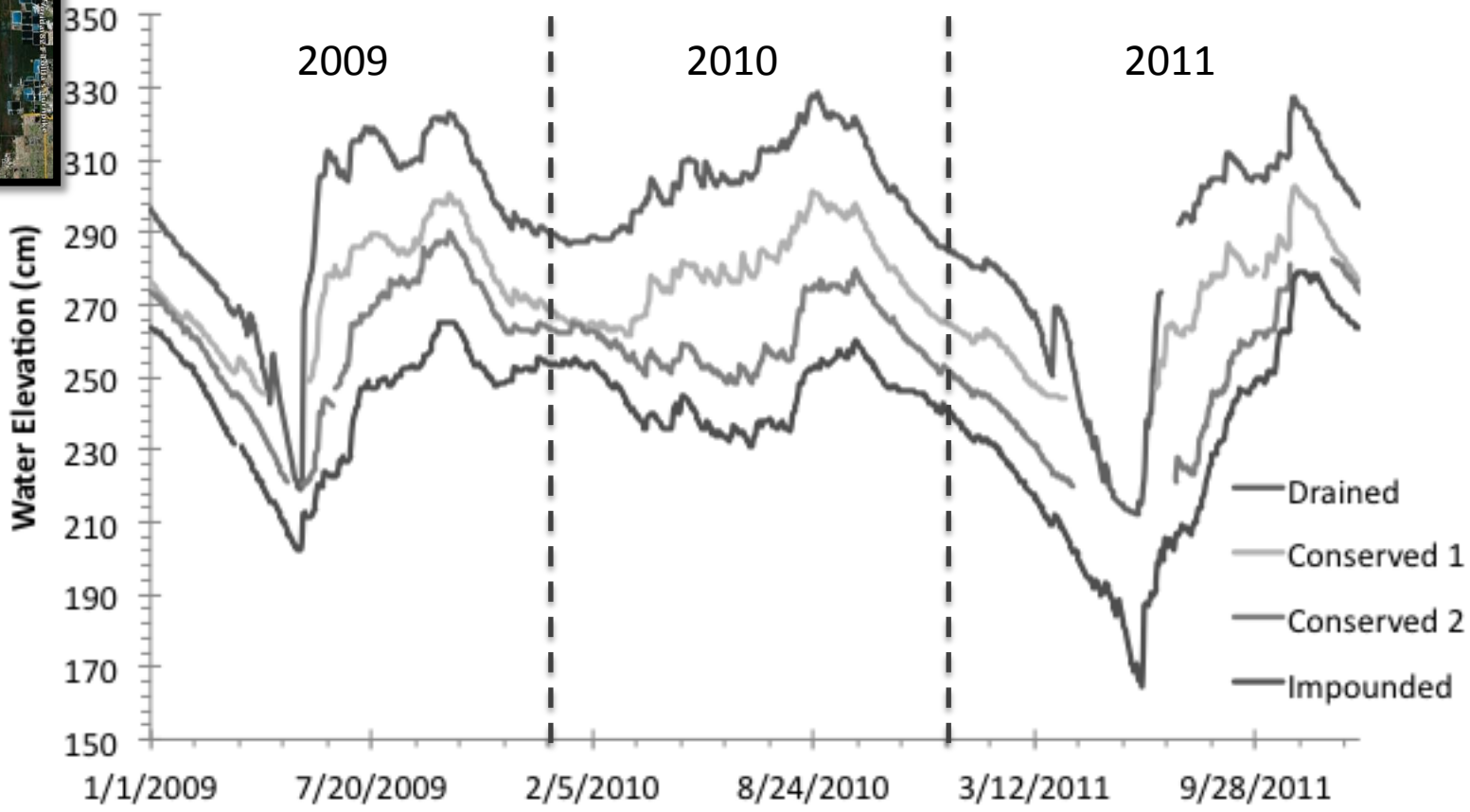


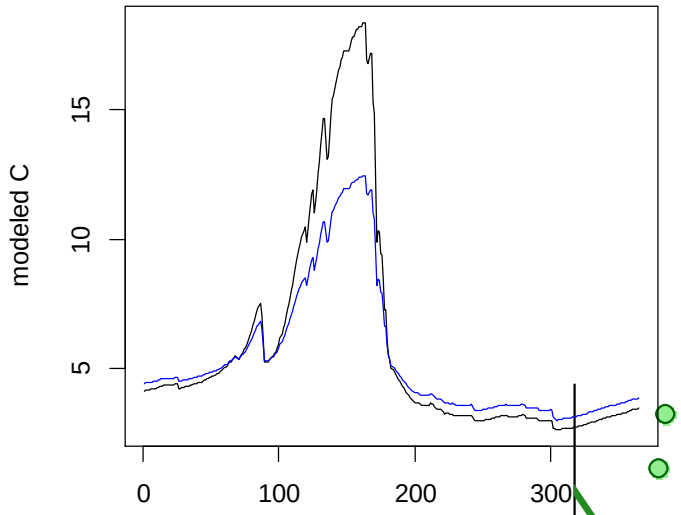
3 Years of hydrologic variation:

2009– Moderate year

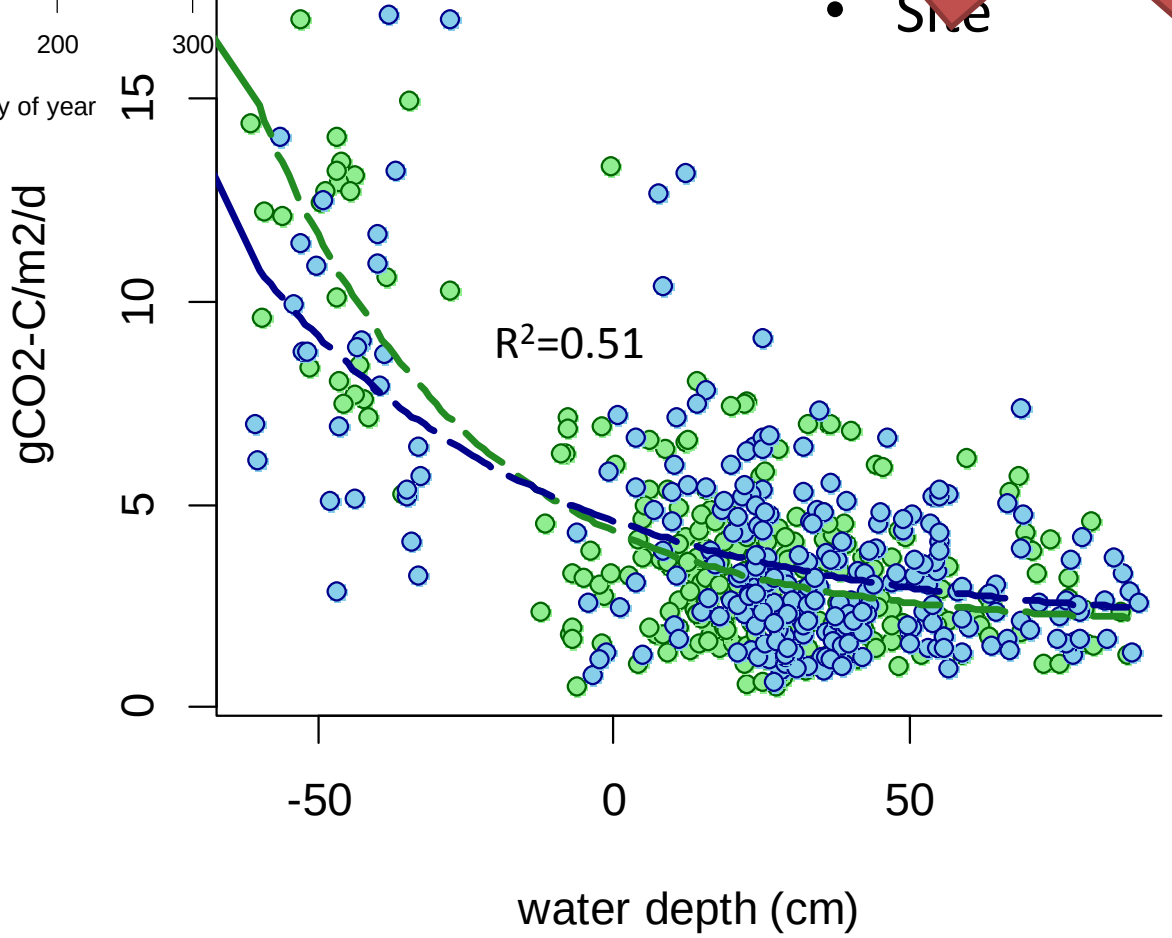
2010– Wet year

2011– Dry year

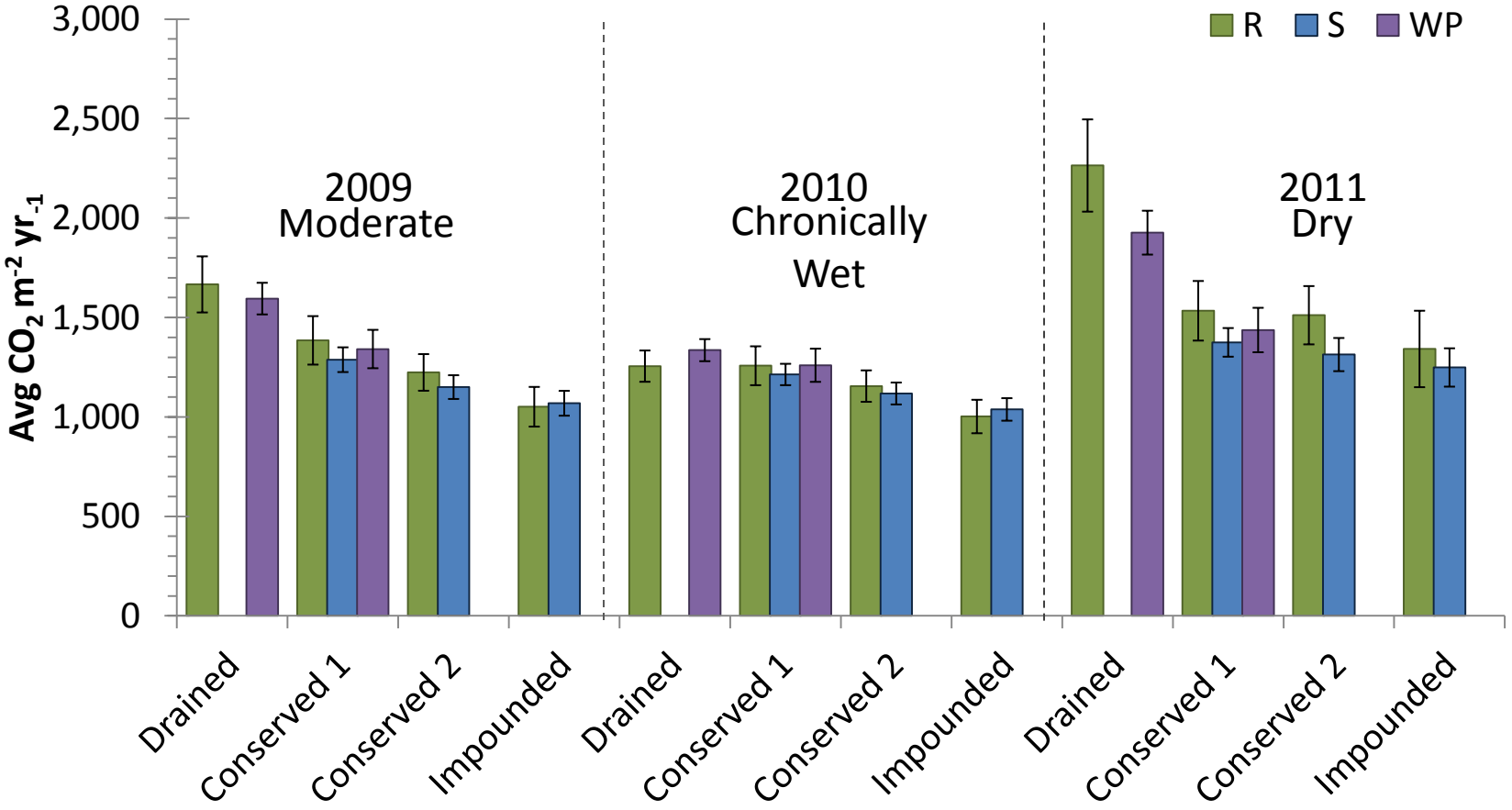




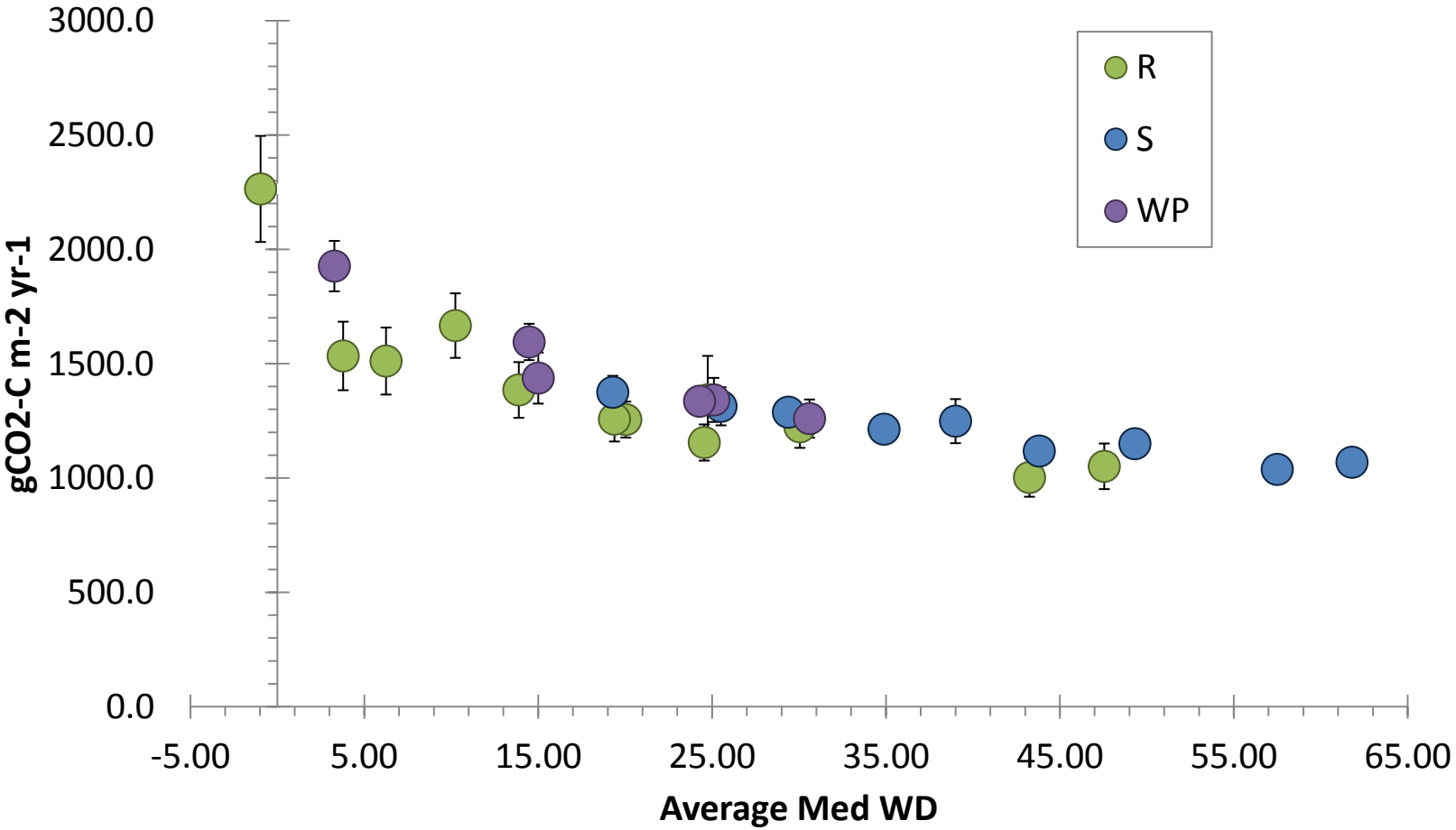
- W ter/so emperature
- Wat
- Tim y
- Site

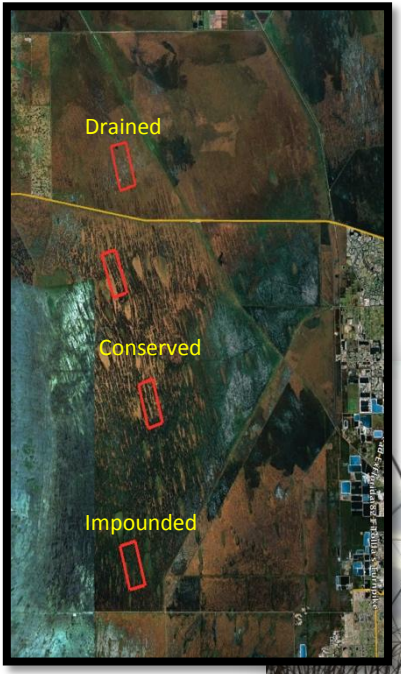


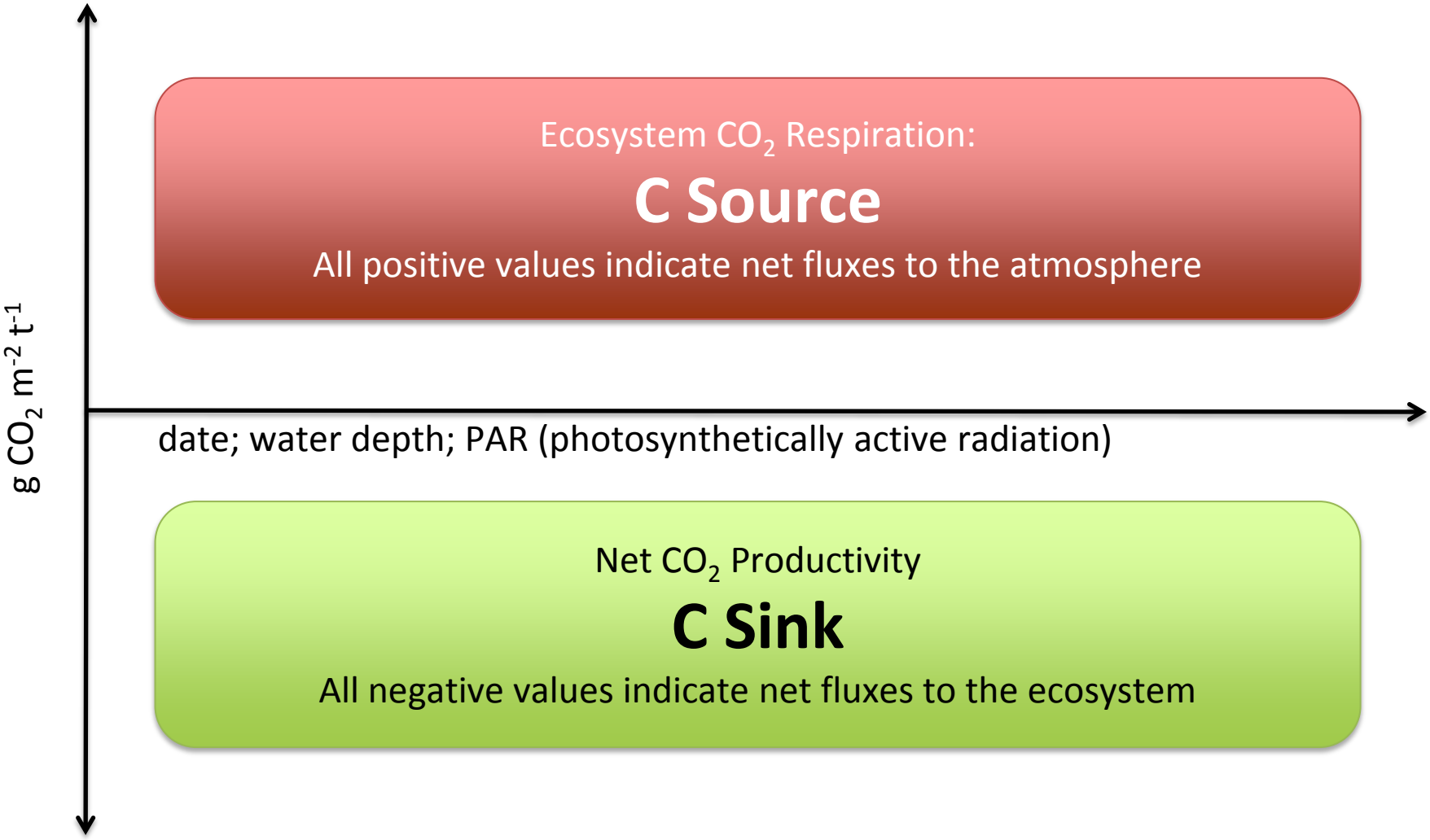
Higher water levels dampens differences in flux rates.

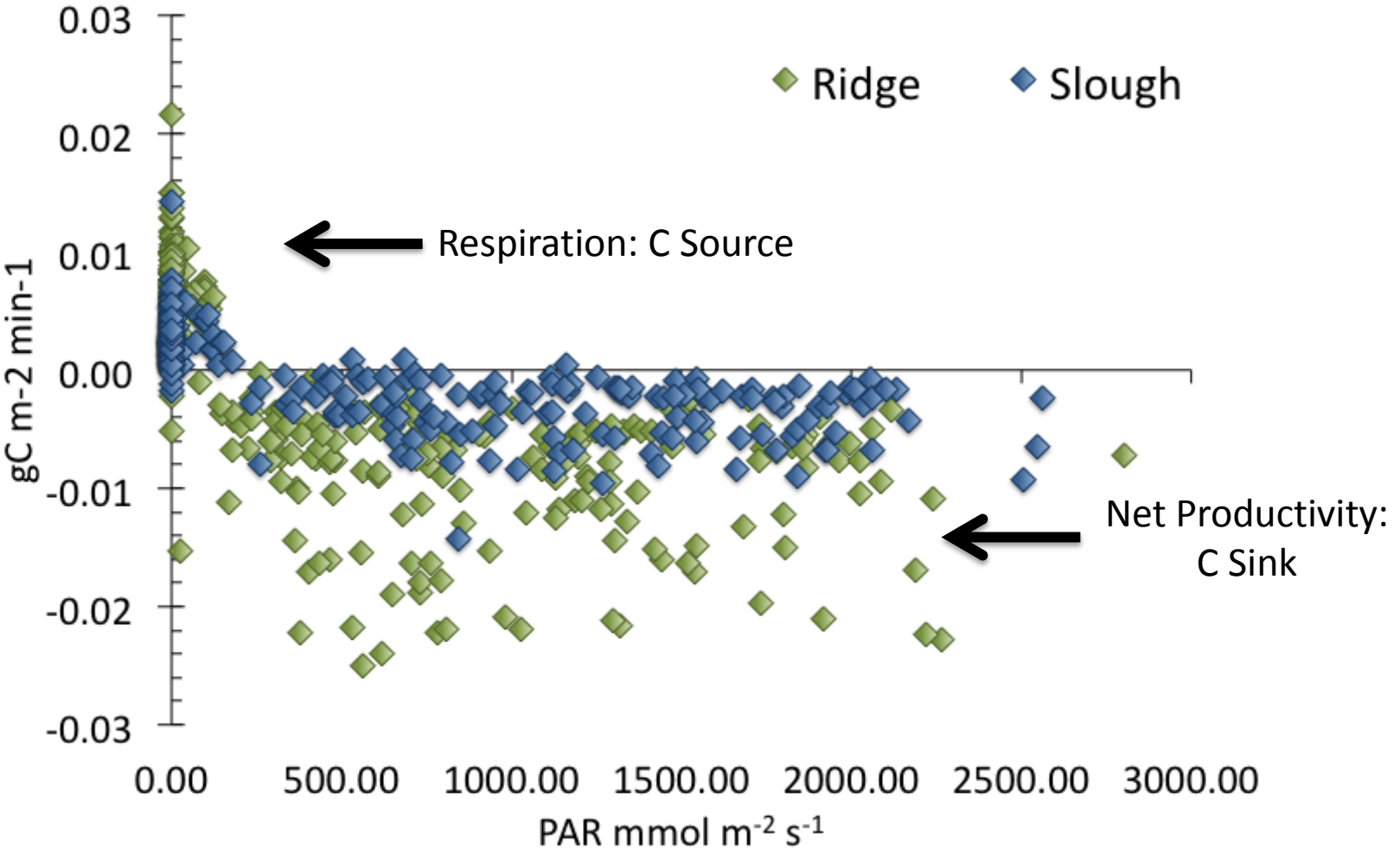


Monotonic increases in respiration with lowered water table



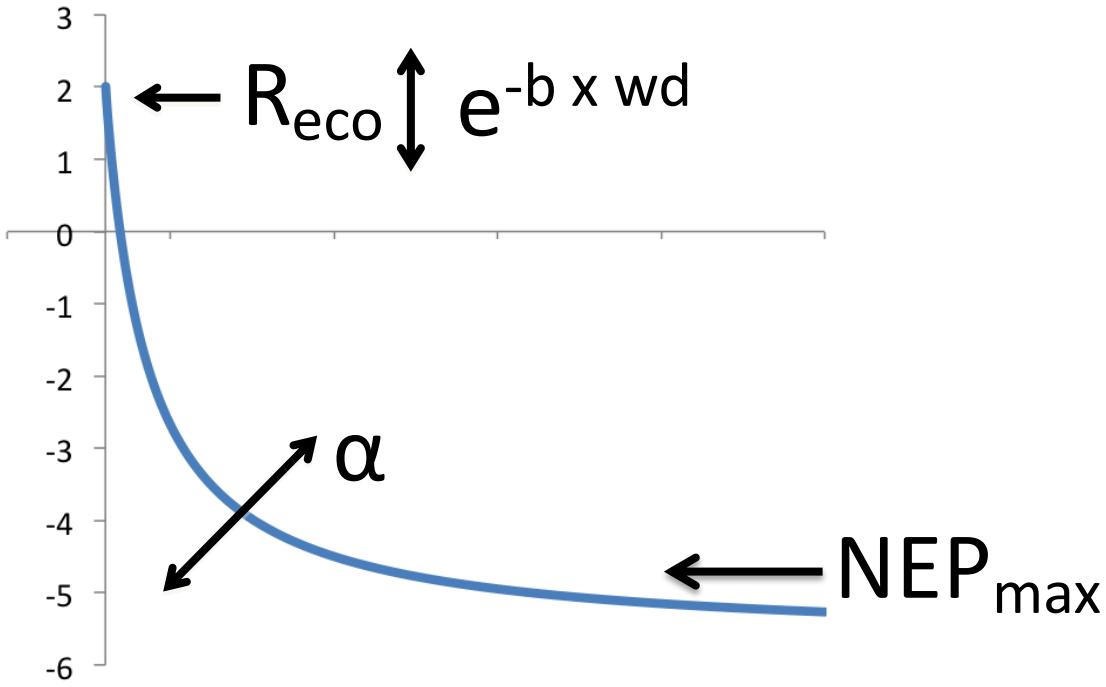

Drained
Conserved
Impounded


Ecosystem CO_2 Respiration:
C Source
All positive values indicate net fluxes to the atmosphere
g CO_2 m^{-2} t^{-1}
date; water depth; PAR (photosynthetically active radiation)
Net CO_2 Productivity
C Sink
All negative values indicate net fluxes to the ecosystem

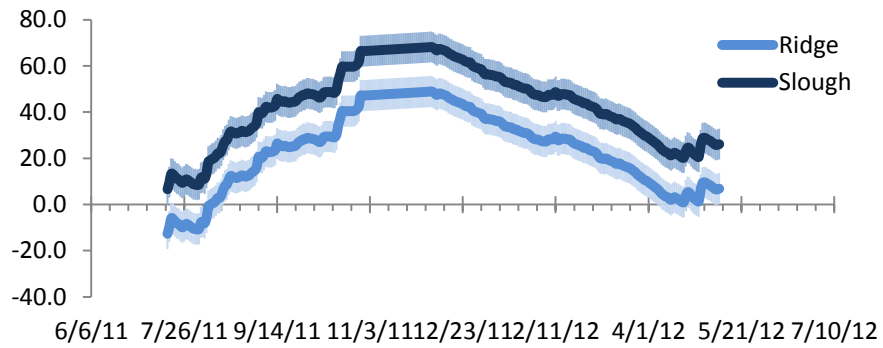

0.03
0.02
0.01
0.00
-0.01
-0.02
-0.03
gC m-2 min-1
Ridge
Slough
Respiration: C Source
Net Productivity:
C Sink
0.00
500.00
1000.00
1500.00
2000.00
2500.00
3000.00
PAR mmol m-2 s-1

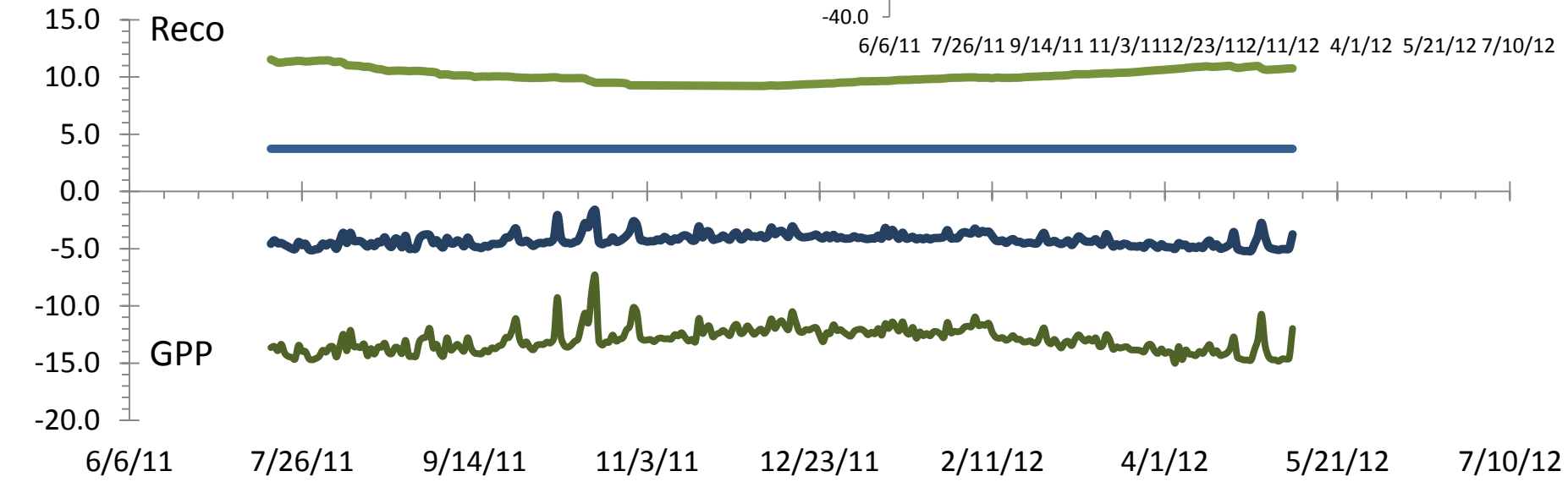
$$NEP = \frac{\alpha \times PAR \times NEP_{max}}{\alpha \times PAR + NEP_{max}} + Reco$$

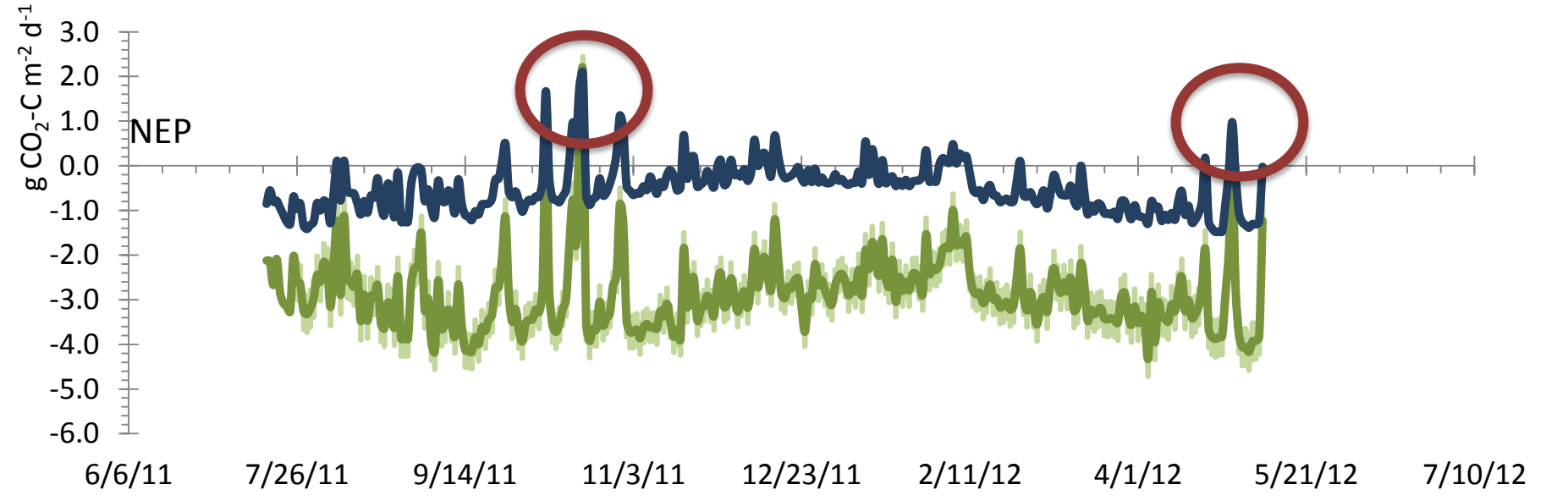
$\exp^{-b \times \text{water depth}}$

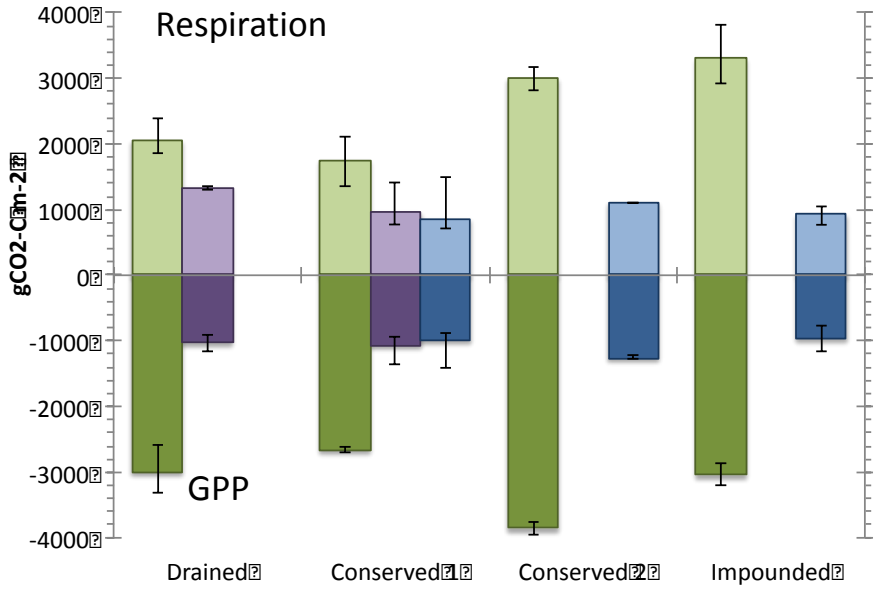


Conserved 2

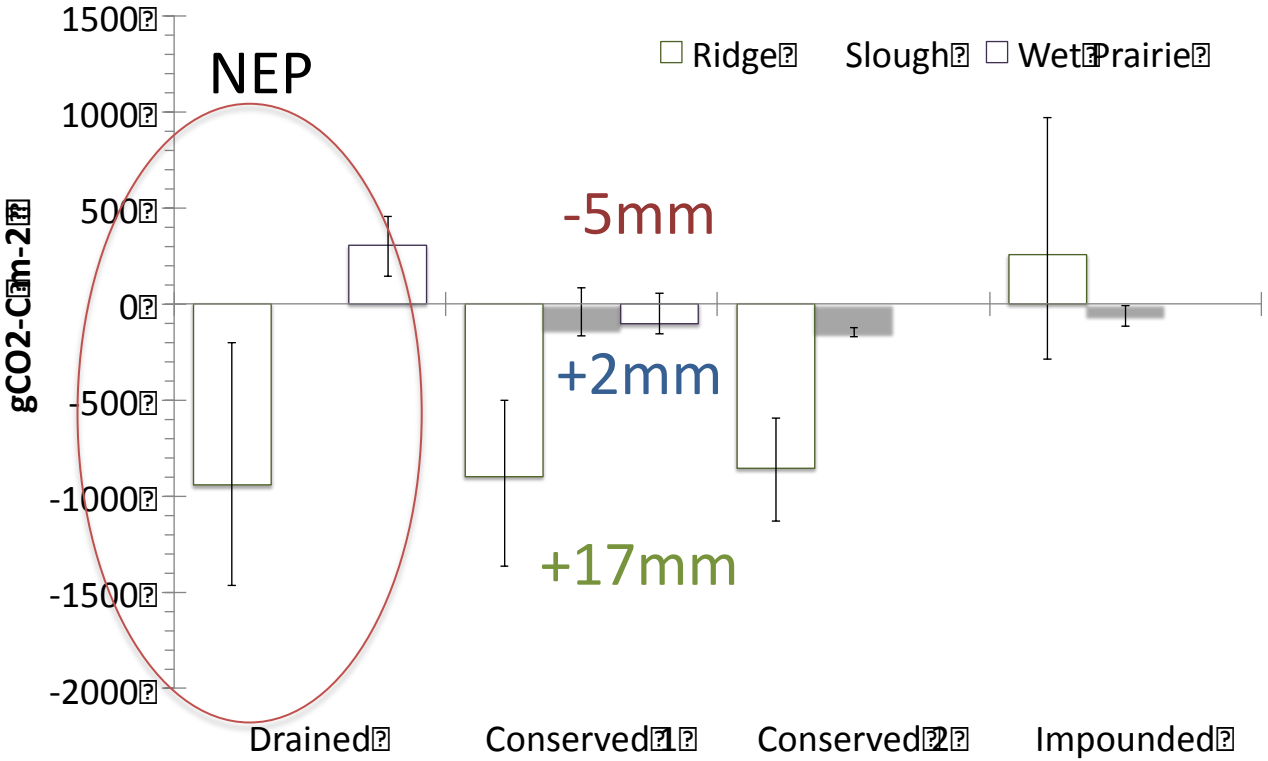

80.0
60.0
40.0
20.0
0.0
-20.0
-40.0
Ridge
Slough
6/6/11
7/26/11
9/14/11
11/3/11
12/23/11
2/11/12
4/1/12
5/21/12
7/10/12


15.0
10.0
5.0
0.0
-5.0
-10.0
-15.0
-20.0
Reco
GPP
6/6/11
7/26/11
9/14/11
11/3/11
12/23/11
2/11/12
4/1/12
5/21/12
7/10/12


g CO_2-C m^{-2} d^{-1}
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
NEP
6/6/11
7/26/11
9/14/11
11/3/11
12/23/11
2/11/12
4/1/12
5/21/12
7/10/12



Surprising results when looking at sums



~10 months:
306 days Impounded,
Conserved 1

297 days Conserved 2

294 days Drained

Ridges and sloughs…

…exhibit distinct, regular patterning;

…are still autotrophic;

… with carbon budgets driven by local hydrology;

…

Hydrologic modification…

…is associated with a convergence of ridges and sloughs;

…results in community abundance shifts;

…alters metrics of state stability and pattern dynamics;

…increases soil respiration;

…leads to losses of net autotrophy.

Thank you.

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Graduate Alumni Fellowship

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Ted Schuur
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Jing Yuan
Mike Camp
David Kaplan

Want More?

David Kaplan: Thursday at 2:00pm (Antigua 3&4)
Jim Heffernan: Wednesday at 2:40pm (Bonaire 7&8)
Jing Yuan: Wednesday, Poster Session 2