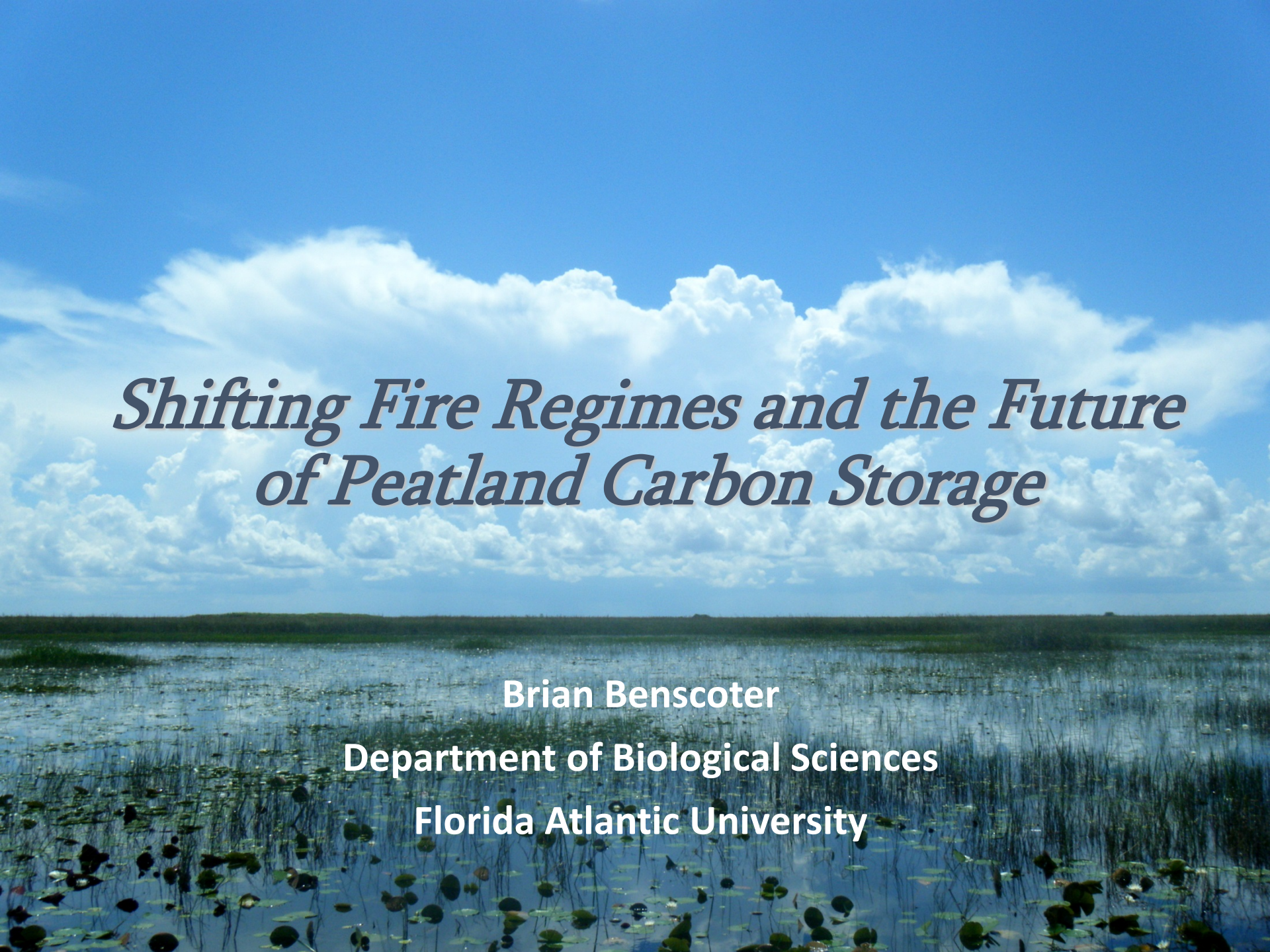


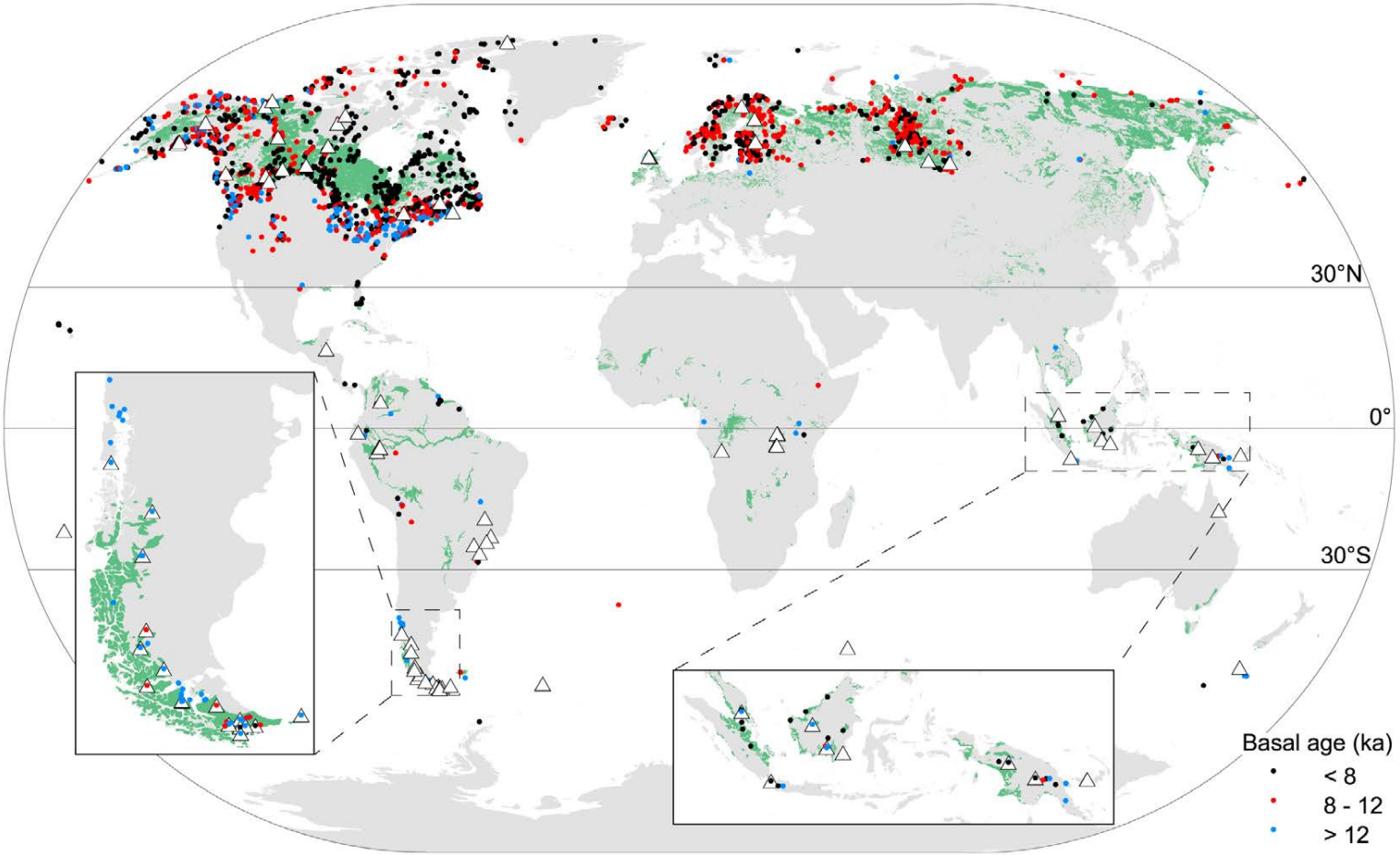
Shifting Fire Regimes and the Future of Peatland Carbon Storage

Brian Benscoter

Department of Biological Sciences

Florida Atlantic University

Distribution of Peat-Forming Wetlands



(Yu et al. 2010 – GRL)

The Paradox of Fire in Fire-Adapted Ecosystems

"the herbaceous Everglades and the surrounding pinelands were born in fires…they can survive only with fires…they are dying today because of fires."

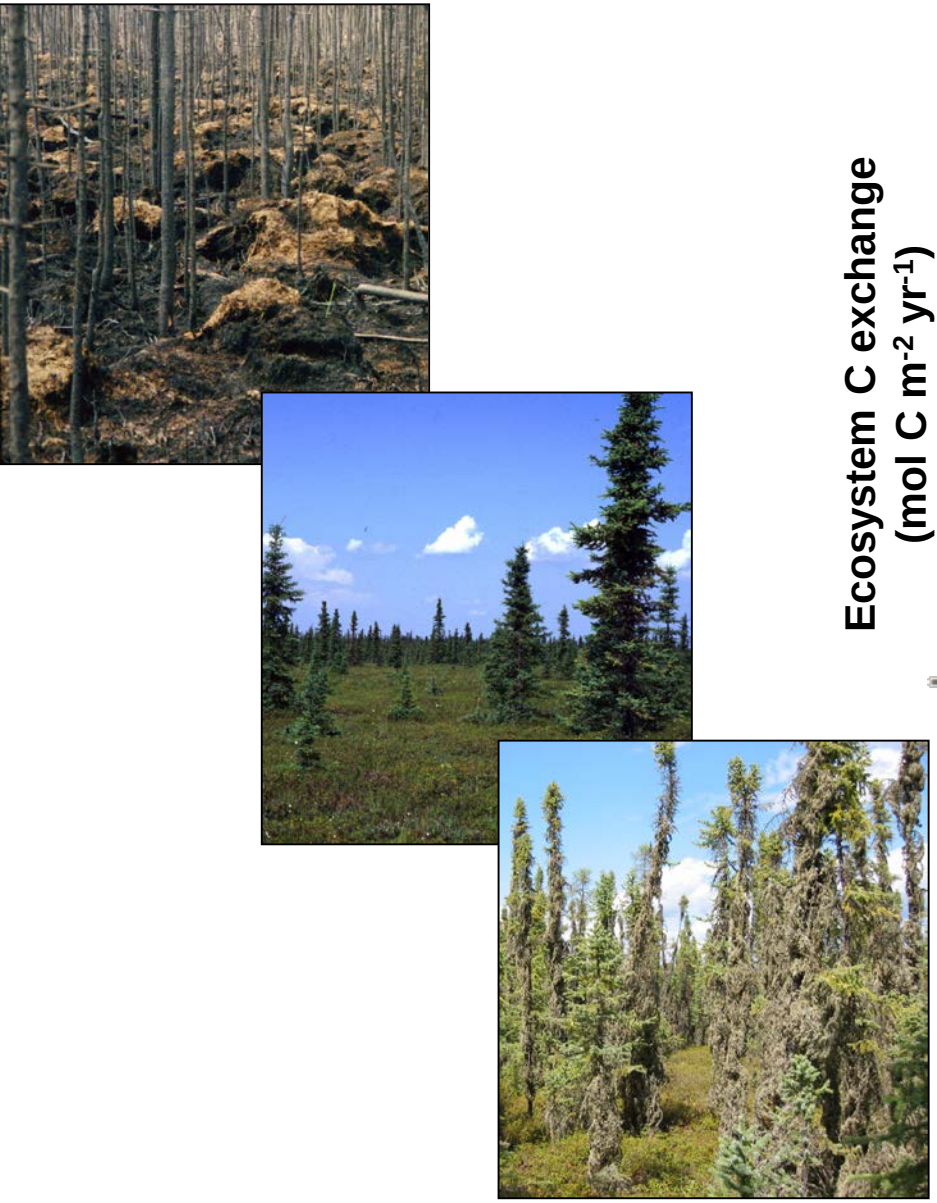
– Egler 1952 (sensu Gunderson and Snyder 1994)

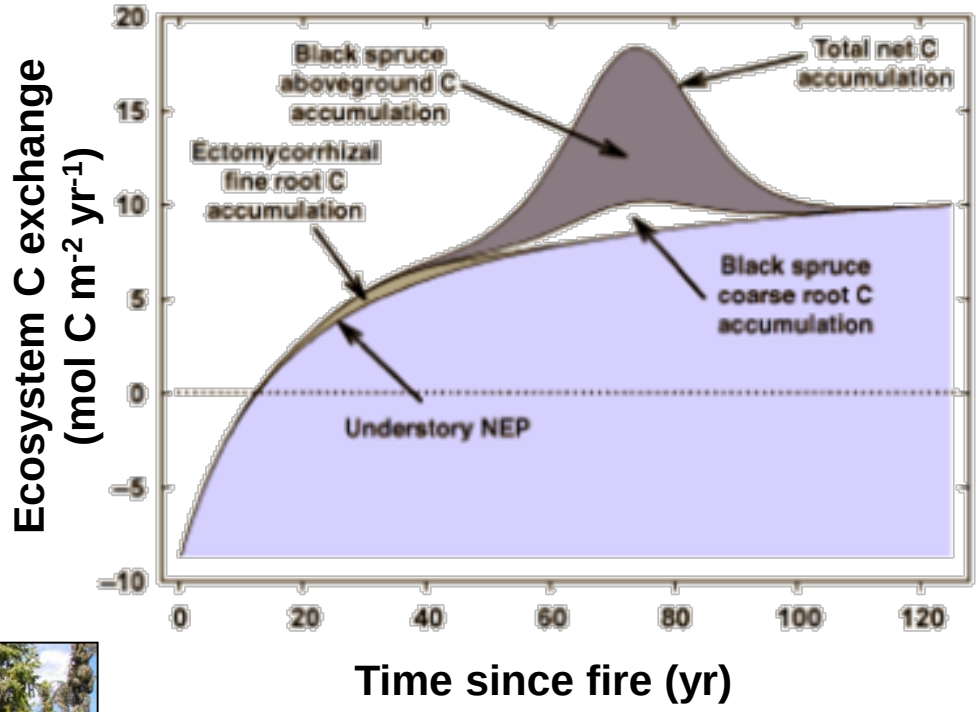
Photo: J Wallace

Peatland Fire & Fuels

Canopy-Driven Burning in Boreal Wetlands

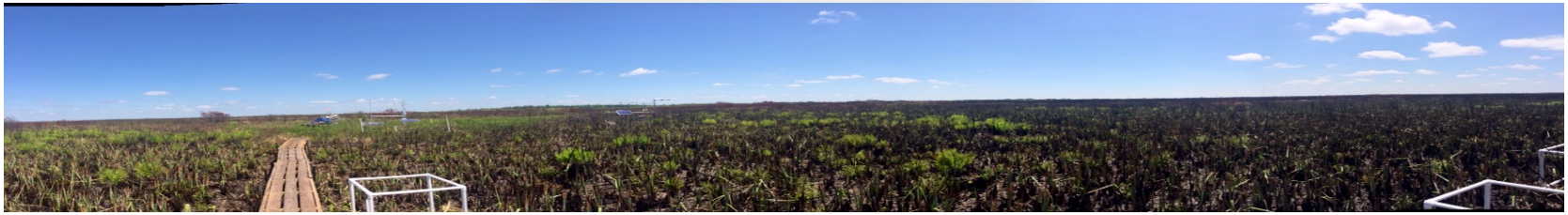
Post-Fire Carbon Cycling in Boreal Wetlands



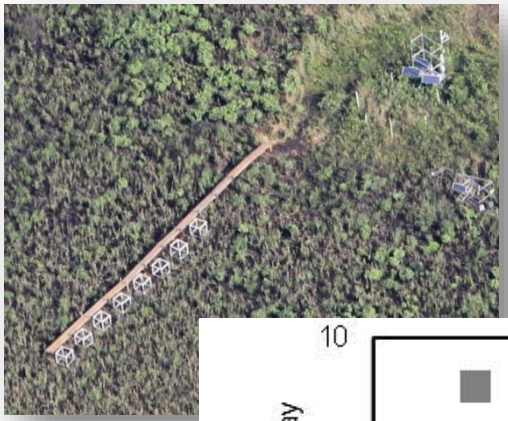


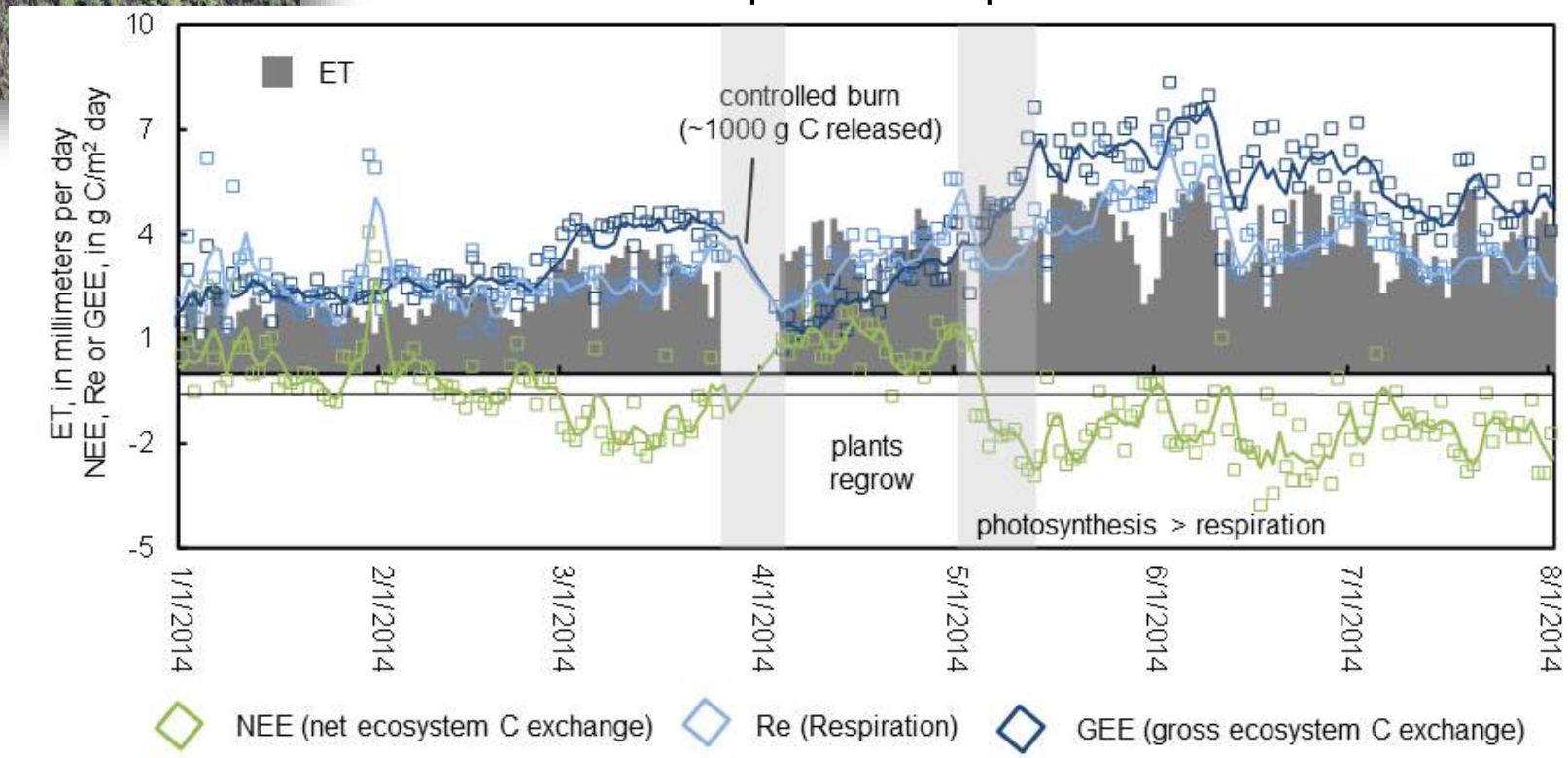
Wieder et al 2009 Global Change Biol.

Fire & C Cycling in Subtropical Wetlands



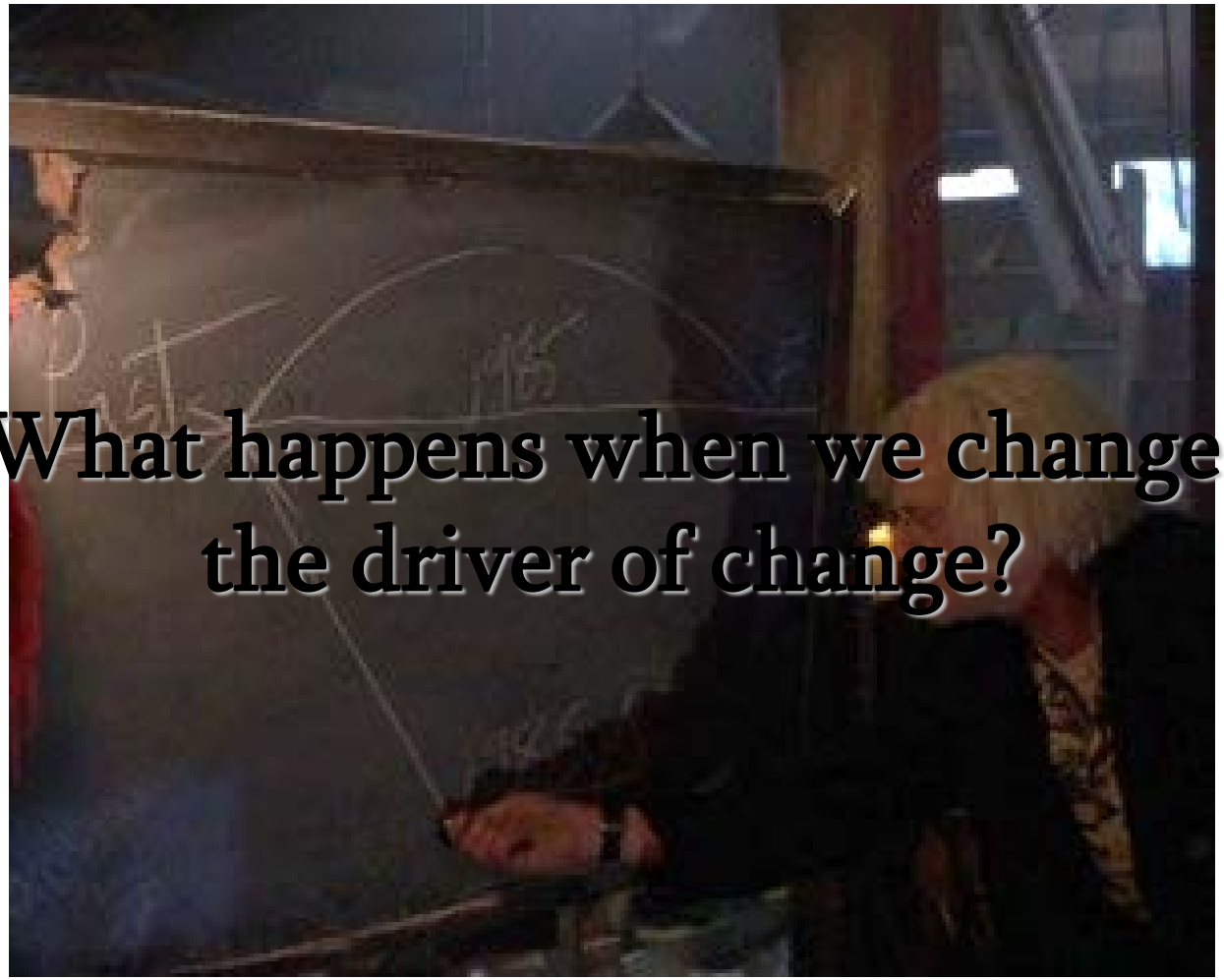
C Impacts Short-lived in Fast Recovering Ecosystems





Data: Ross Hinkle (UCF) and Barclay Shoemaker (USGS)

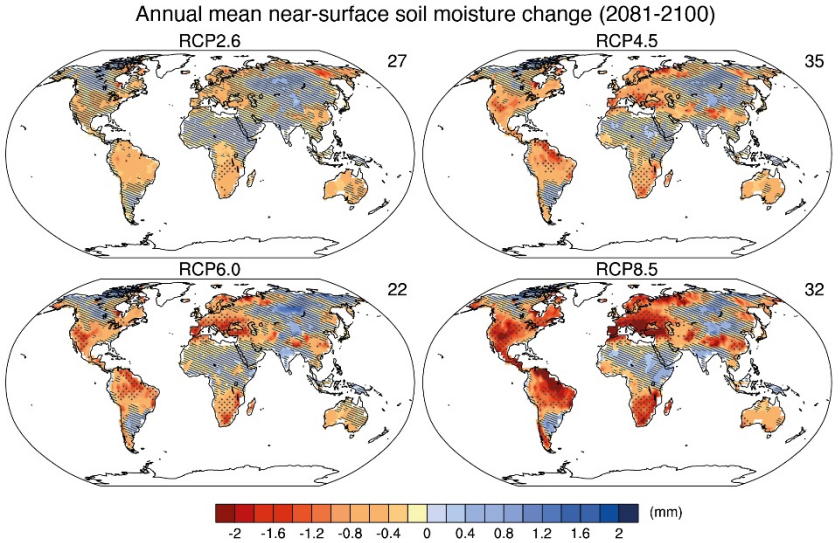
Disturbing the Disturbance



Back to the Future II, (1989)

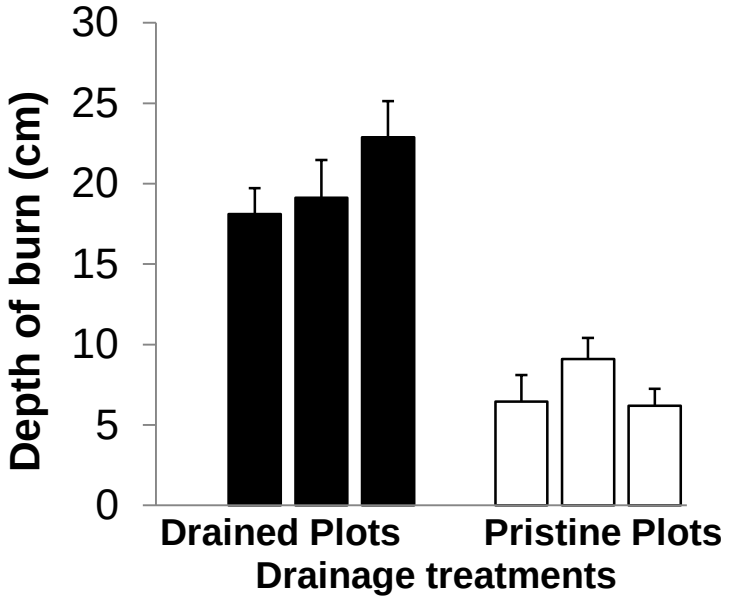
Pressures on Wetlands & their Disturbances

- Increased Temperatures
- Net drying & 'megadroughts' *(Cook et al. 2015)*
- US NPS lands already at climate extremes *(Monahan and Fisichelli 2014)*
- Land use-land cover change
  - Greater impact than climate *(Parmesan et al. 2005)*



(IPCC AR5 Fig 12.23)

Disturbance Synergy: Drought & Wildfire



Combustion losses (kg C/m^2/yr)

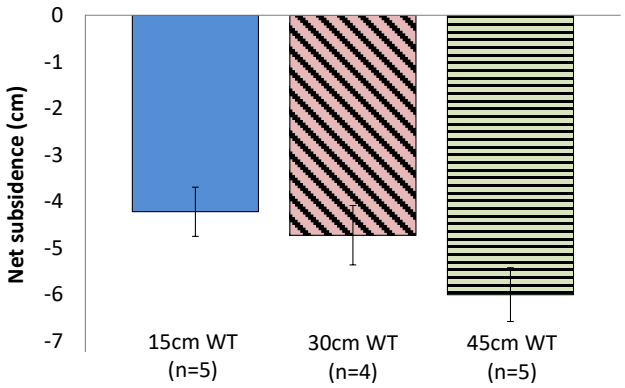
Reference plots: 2.0 ± 0.5 kg C m$^-$

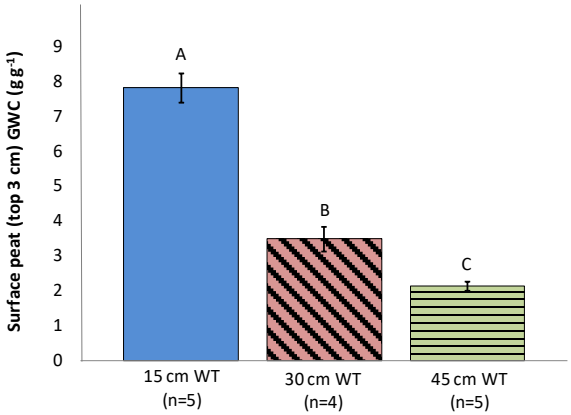
Drained plots: 16.8 ± 0.2 kg C m^{-2}

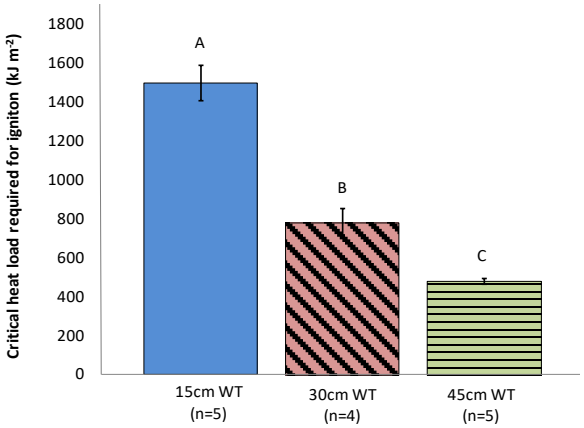
Turetsky et al. 2011. Nature Communications

Everglades Soils with Drought

- Water table drawdown
  - ➢ Subsidence
  - ➢ Soil drying
- Increase fire risk



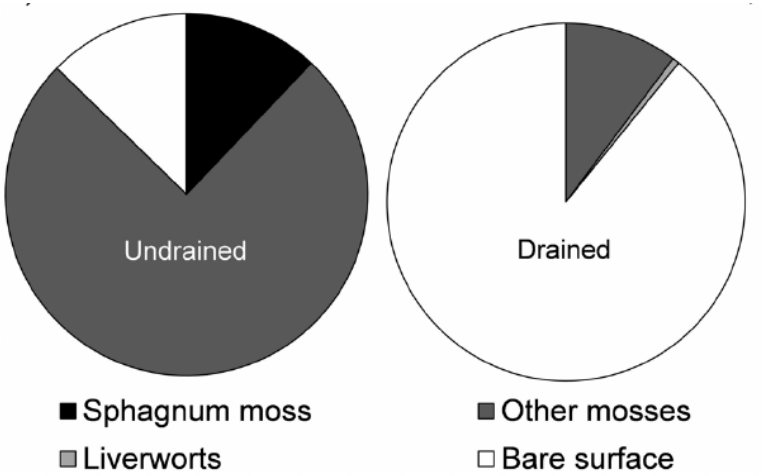


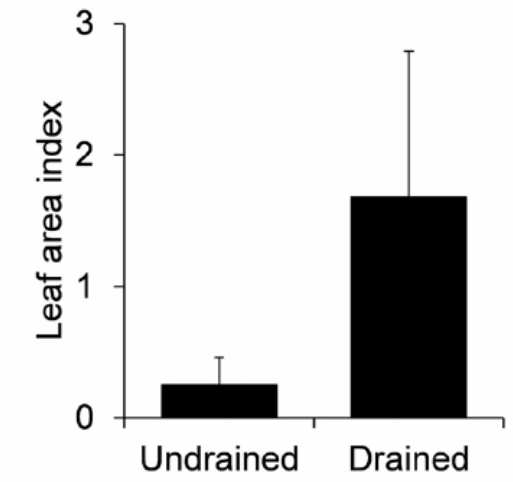


Data: Johnson et al. in prep.

Photo: Watts and Kobziar 2013, Fire Ecology

Novel Fires Drive Novel Vegetation

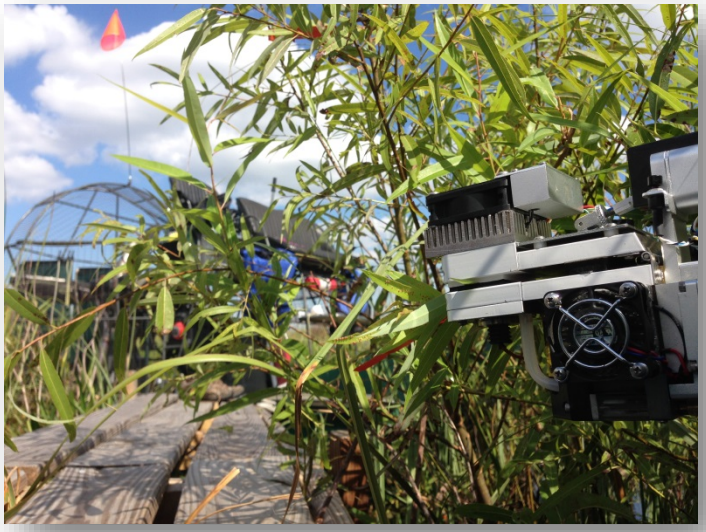




Kettridge et al. 2015 - Scientific Reports

Plant Invasion Consequences

- Shrub encroachment in herbaceous wetlands
- Structural and functional differences
- Drying leads to more willow leads to more drying…



	A_{net}	g_s	LAI
Sawgrass	12.52	0.240	0.792
Willow	14.81	0.359	1.773

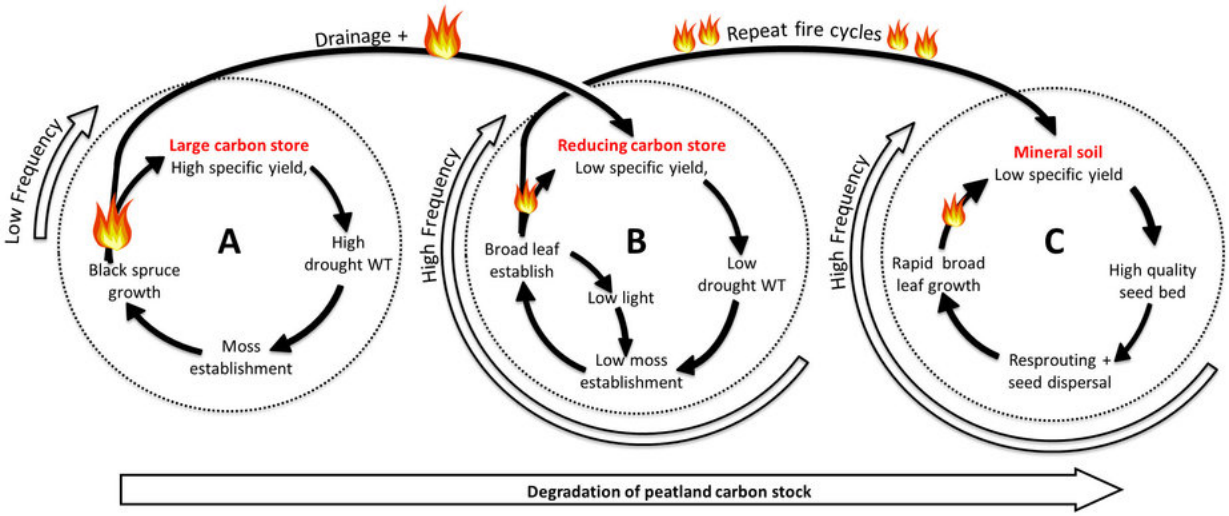
Budny and Benscoter 2016 - Wetlands

Impact of Novel Fuels on Wetland Fire Regime

- "Willow kills fire behavior"
- Slow-spreading fires have greater soil heat flux (Thompson et al. 2015)
- Increased risk of severe burning

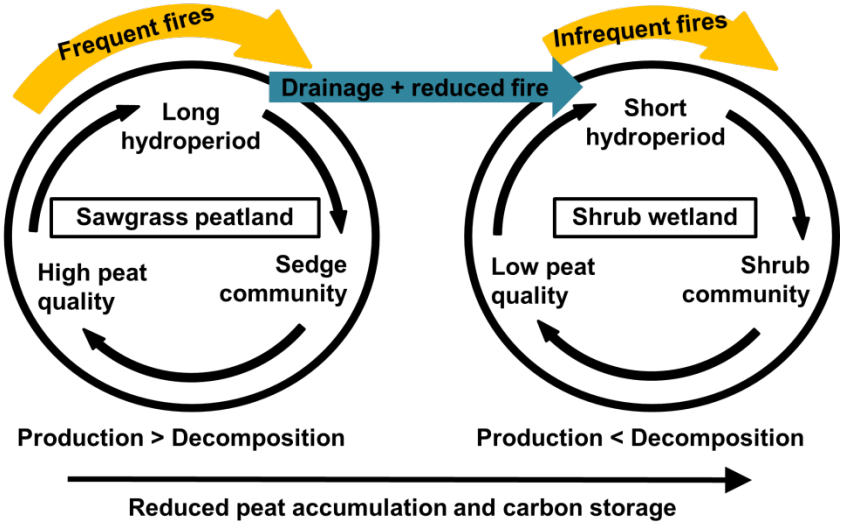
Shrubs, Fire, and Peatland Resilience

Boreal Fen (Canada)



Kettridge et al. 2015 –Scientific Reports

Subtropical Fen (Everglades)



J. Dell, FAU IB PhD Program

Consequences of Altered Peatland Fires

- Ecological Impact
  - Loss of soil C & sequestration
  - Increased radiative forcing
  - Altered habitat

www.geocities.ws

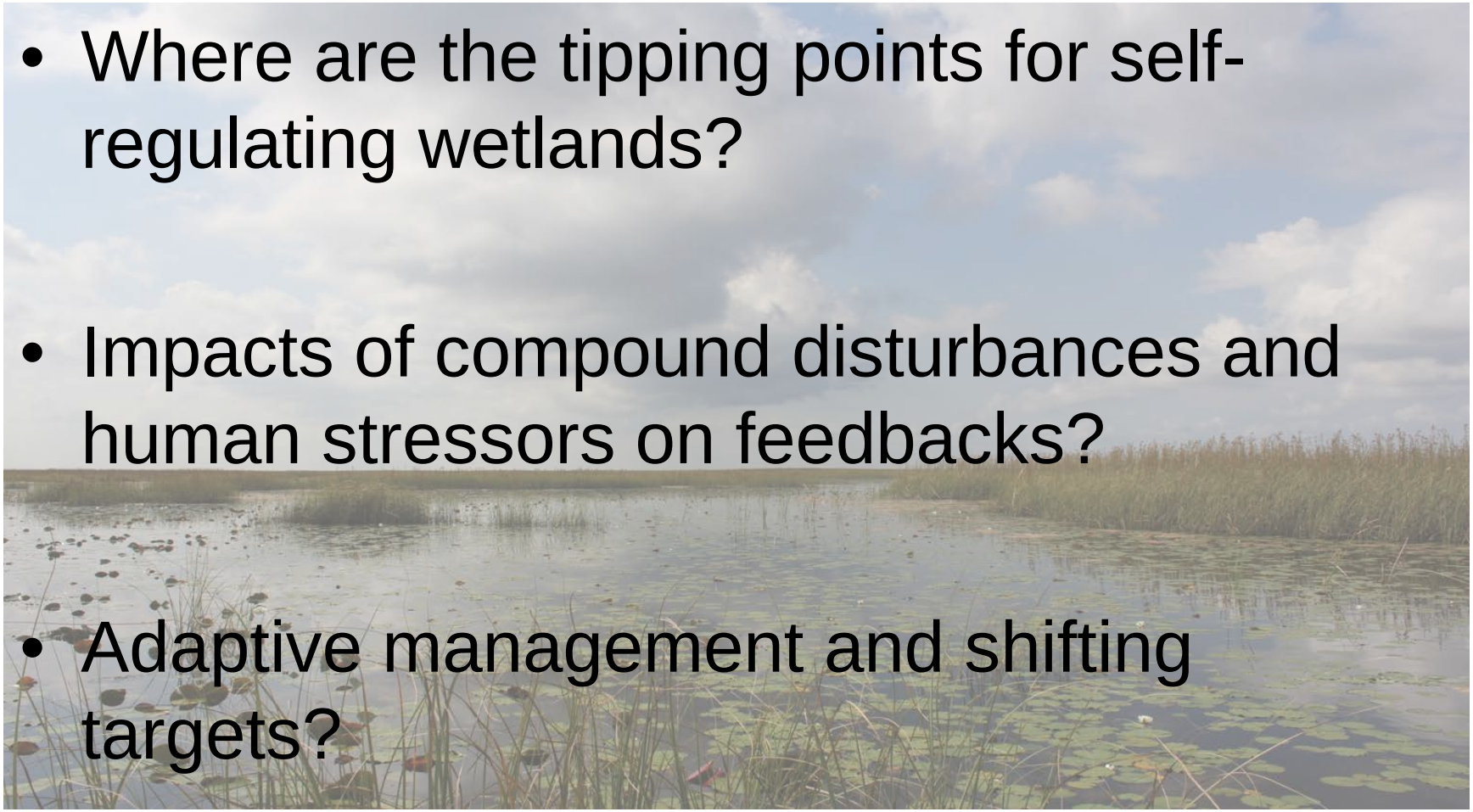
- Human Impact
  - Smoke-related risk
  - Loss of ecosystem services

www.washingtonpost.com

www.nytimes.com

- Management Impact
  - High suppression costs
  - Diminished effectiveness of management practices

Key Questions for Peatland Conservation



- Where are the tipping points for self-regulating wetlands?
- Impacts of compound disturbances and human stressors on feedbacks?
- Adaptive management and shifting targets?

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- Dr. Dale Vitt (SIUC)
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- Dr. Eric Kasischke (UMD)
- Dr. Evan Kane (MTU)
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- Dr. Mike Falkowski (CSU)
- Dr. Jim Reardon (USFS)
- Dr. David Sumner (USGS)
- Dr. Don DeAngelis (USGS)
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Partner Agencies & Facilities

- Canadian Forest Service
- University of Alberta Research Station
- US Geological Survey
- USFWS- A.R.M. Loxahatchee NWR
- US Forest Service – Fire Sciences Lab
- US DOE-Pacific Northwest National Lab
- US DOE-Environmental Molecular Science Lab
- US State Department
- SFWMD
- SJRWMD
- The Nature Conservancy-DWP

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USGS science for a changing world

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

U.S. FISH & WILDLIFE SERVICE · DEPARTMENT OF THE INTERIOR

U.S. DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT

NATIONAL PARK SERVICE

SWS

(Photo: J Johnson, SWS SAC Student Photo Contest)