SOUTH FLORIDA WATER MANAGEMENT DISTRICT

How has our Understanding of the Greater Everglades Ecosystem Changed since 2001?

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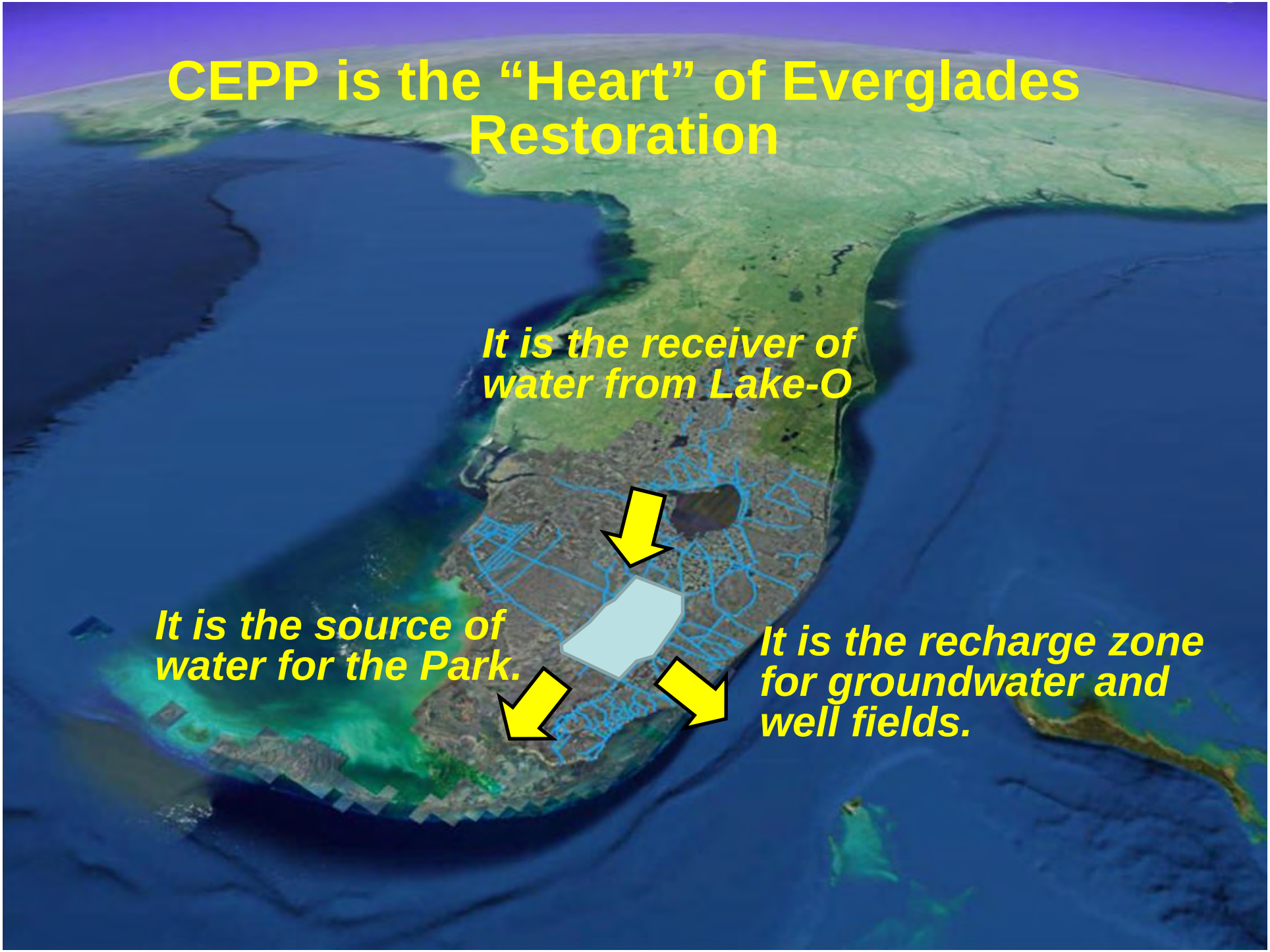
Everglades Systems Assessment Section, SFWMD

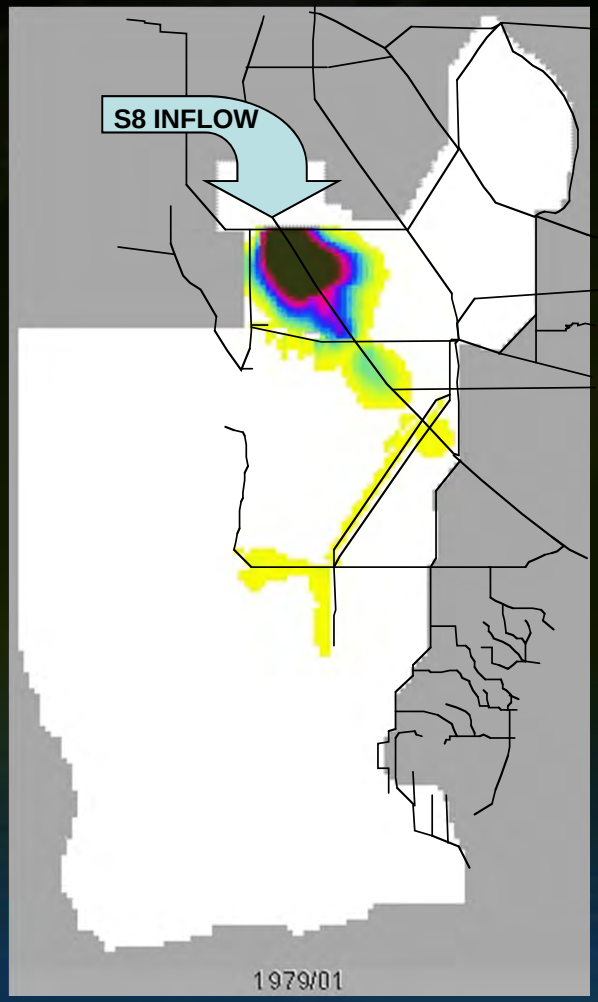
Ecosystem Restoration SCG Public Workshop, West Palm Beach, FL
Feb. 13-14, 2012

CEPP is the "Heart" of Everglades Restoration



CEPP is the "Heart" of Everglades Restoration

Tracer Flow at the S-8 according to the ELM*



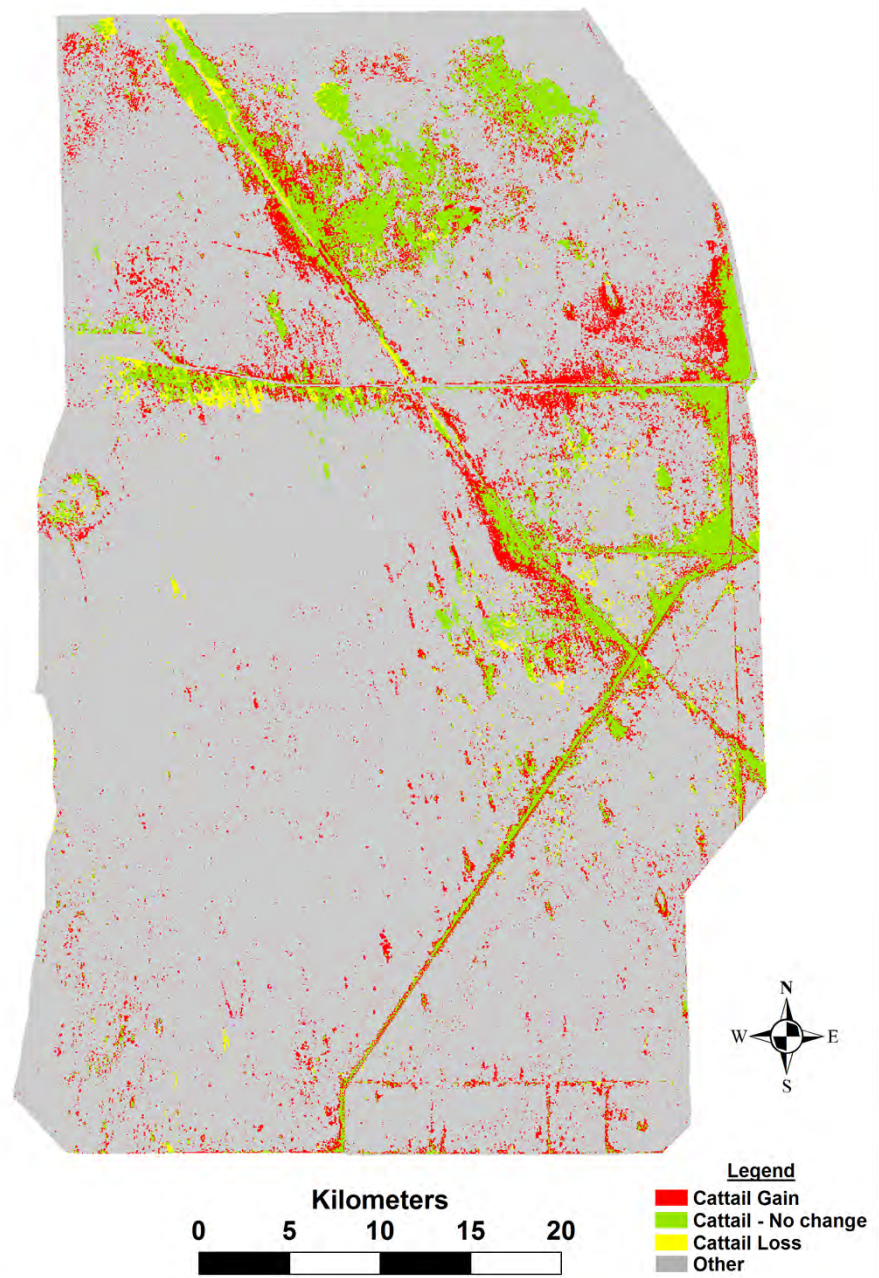
*** The Everglades Landscape Model, developed by Dr. Carl Fitz, University of Florida.**

The *HEART* of the Everglades has the following Medical Emergencies:

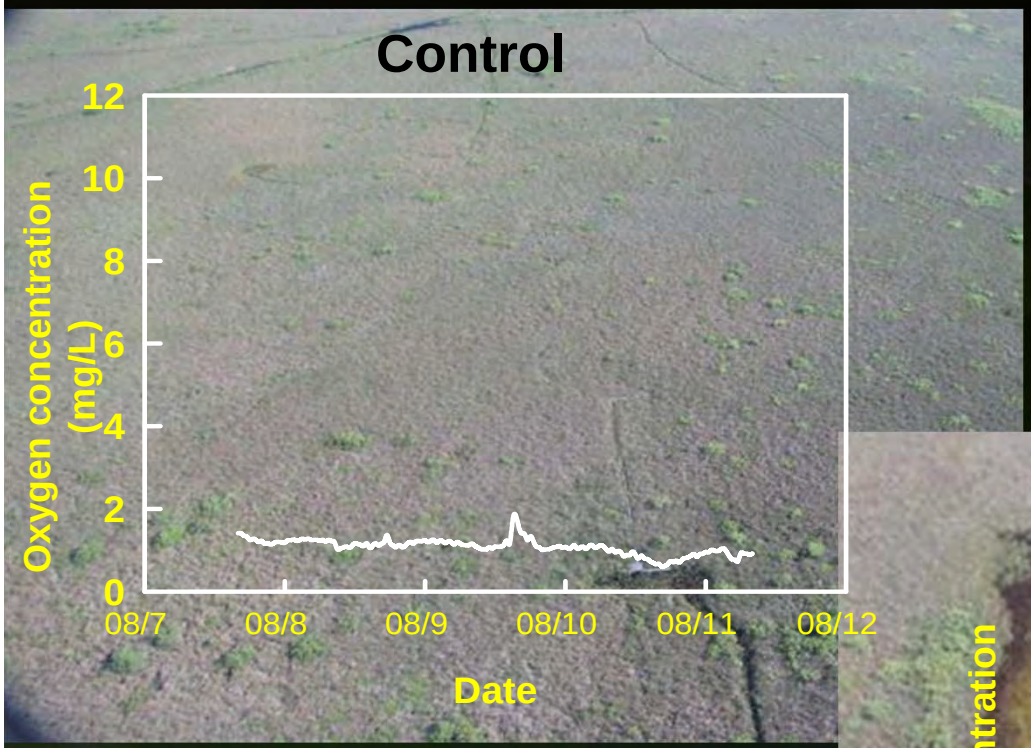
1. High cholesterol
2. Leaky valves
3. Not enough exercise (a couch potato)
4. A compromised immune system
5. Poor circulation

The *heart* of the Everglades has a high cholesterol (cattail) problem

1. Cattails are expanding along canals and downstream of point sources
2. Cattails are now "popping up" all over WCA-3

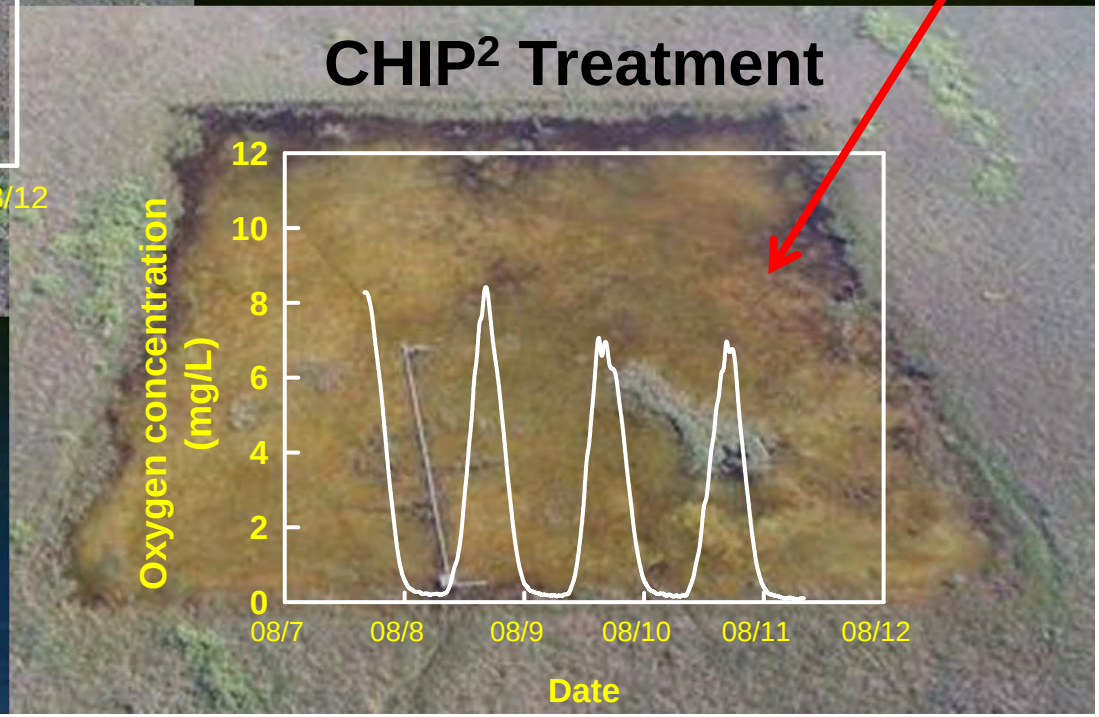


Active Marsh Improvement (AMI[1]) can Temporally Restore Oxygen to the Brain



[1]AMI is a SFWMD initiative designed by Sue Newman and Mark Cook

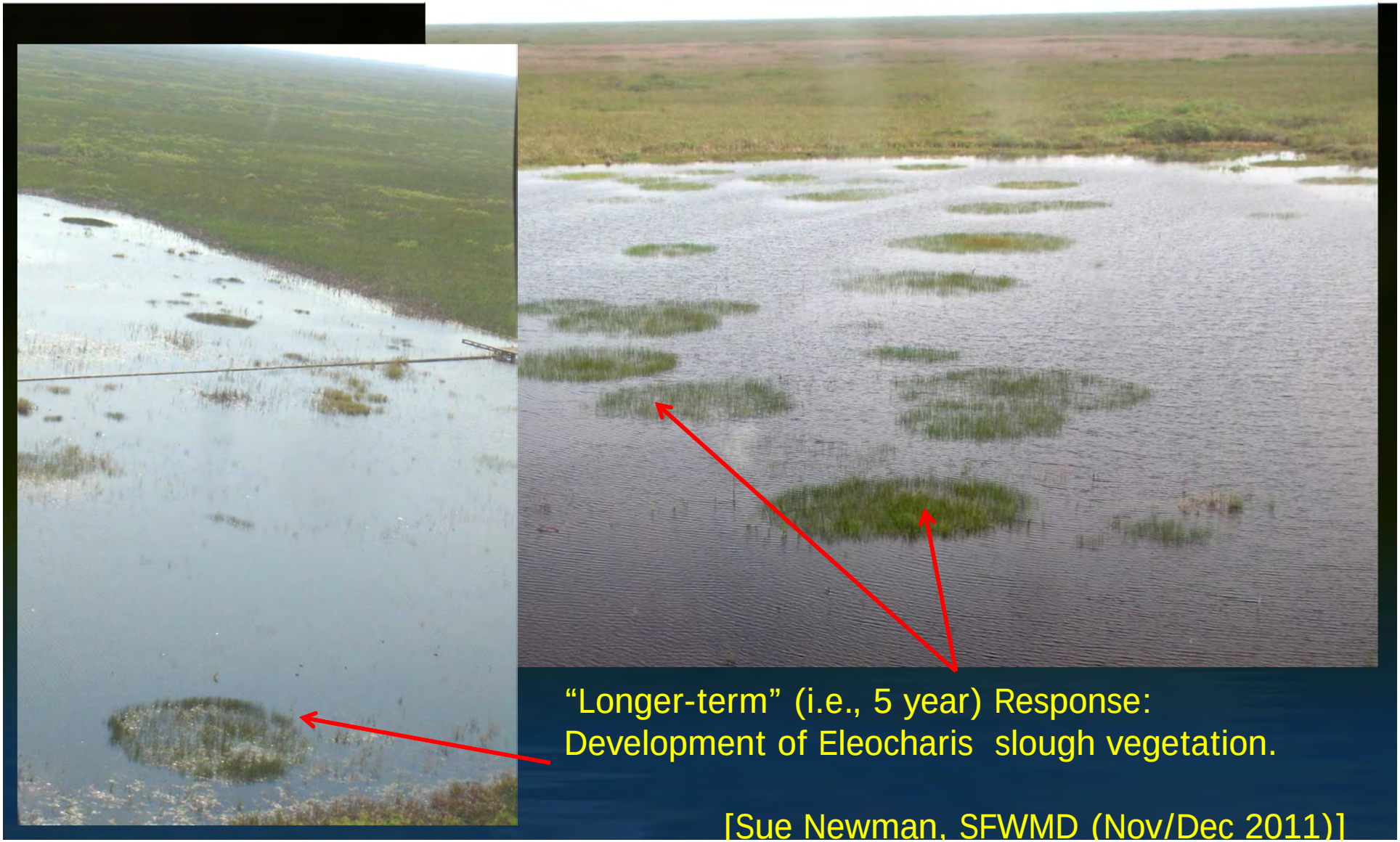
Algae and submerged vegetation increase the oxygen levels.



[2]Cattail Habitat Improvement Project designed by Sue Newman, Scot Hagerthey and Mark Cook

sfwmd.gov

Active Marsh Improvement (AMI) may help Jump-start Slough Vegetation



"Longer-term" (i.e., 5 year) Response:
Development of Eleocharis slough vegetation.

[Sue Newman, SFWMD (Nov/Dec 2011)]

The *heart* of the Everglades has a leaky valve (seepage)

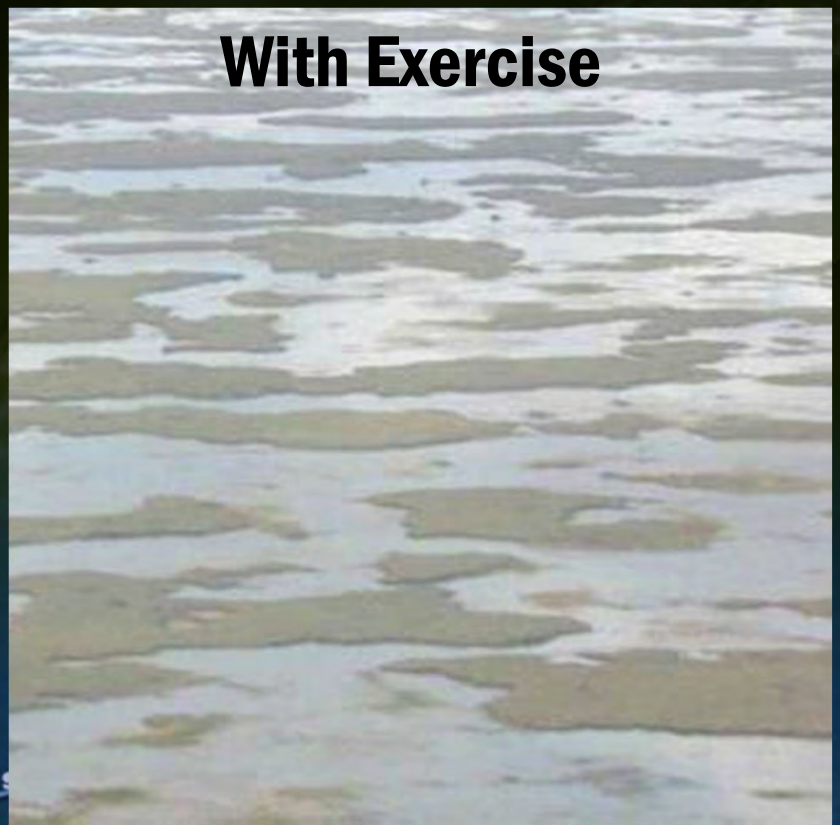
It is hard to keep water in the Everglades because it is difficult to counteract the <u>extremely porous bedrock</u>;

CEPP can keep more water in the system by creating and managing seepage-control canals combined with some form of a belowground curtain-wall.

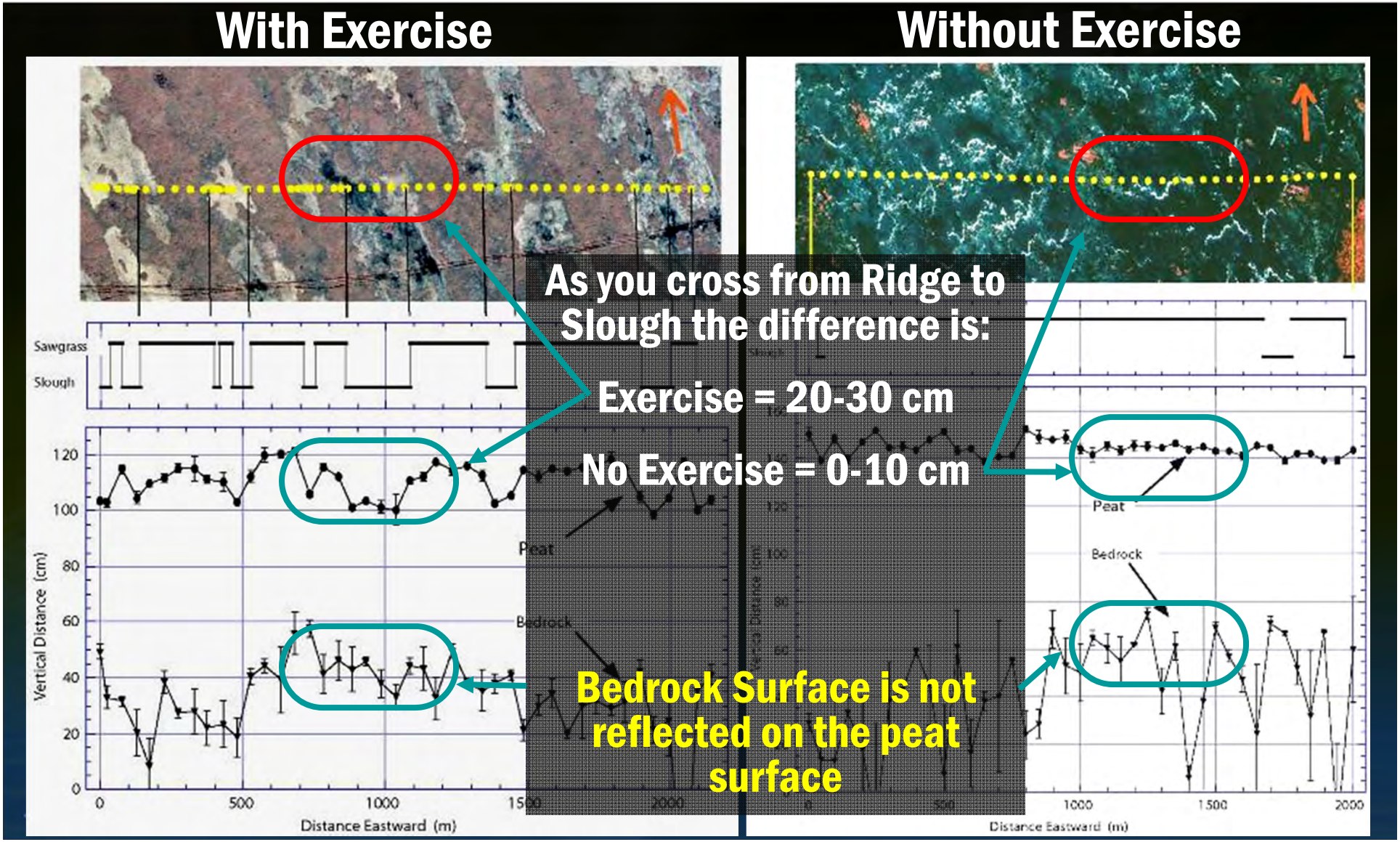
Click here to see bedrock

The *heart* of the Everglades is not getting enough exercise

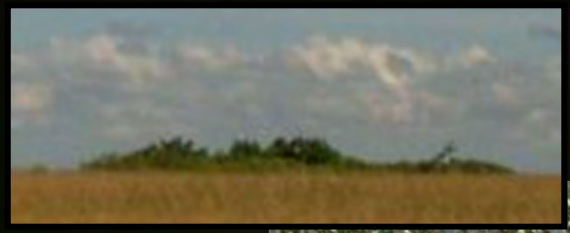
Water levels are too low, for too long, in too many regions of WCA-3. The marsh can not create soil fast enough to keep up with peat oxidation. Wetlands that get too dry are like couch potatoes – they lose healthy structure.

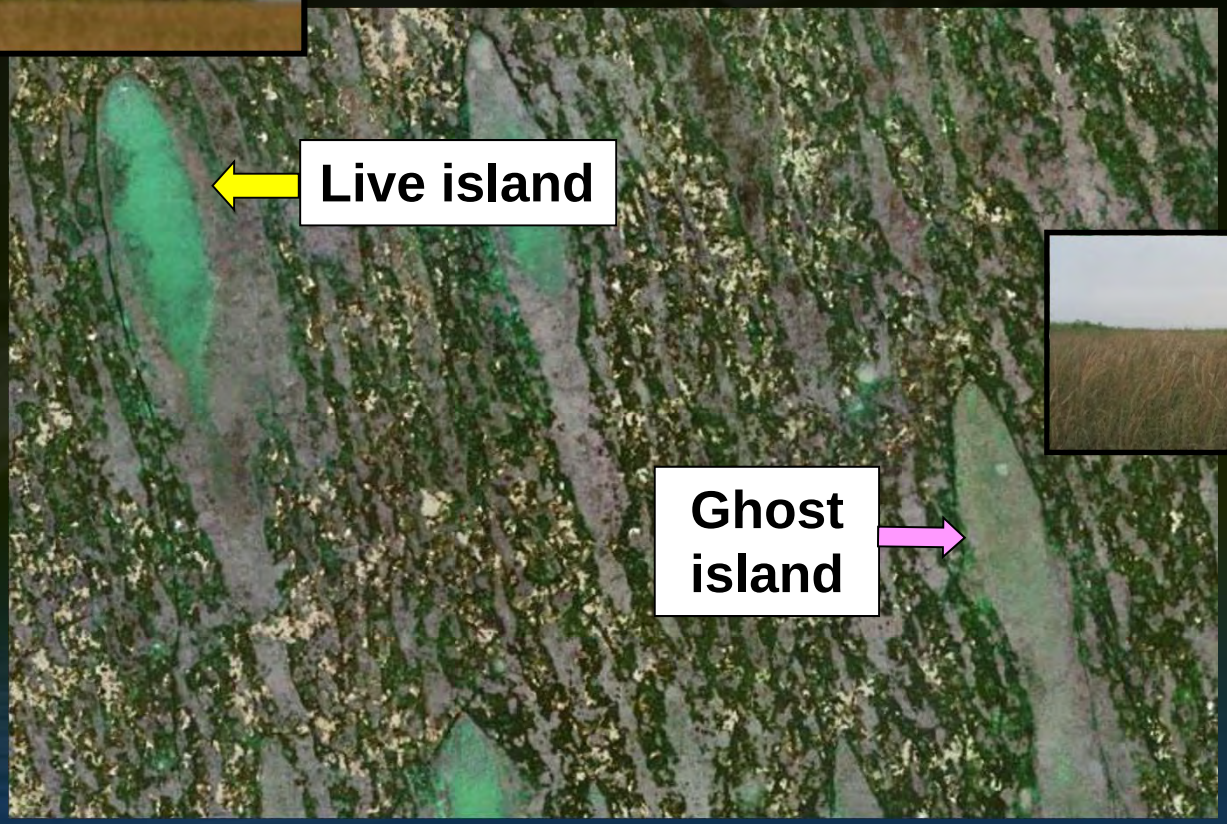


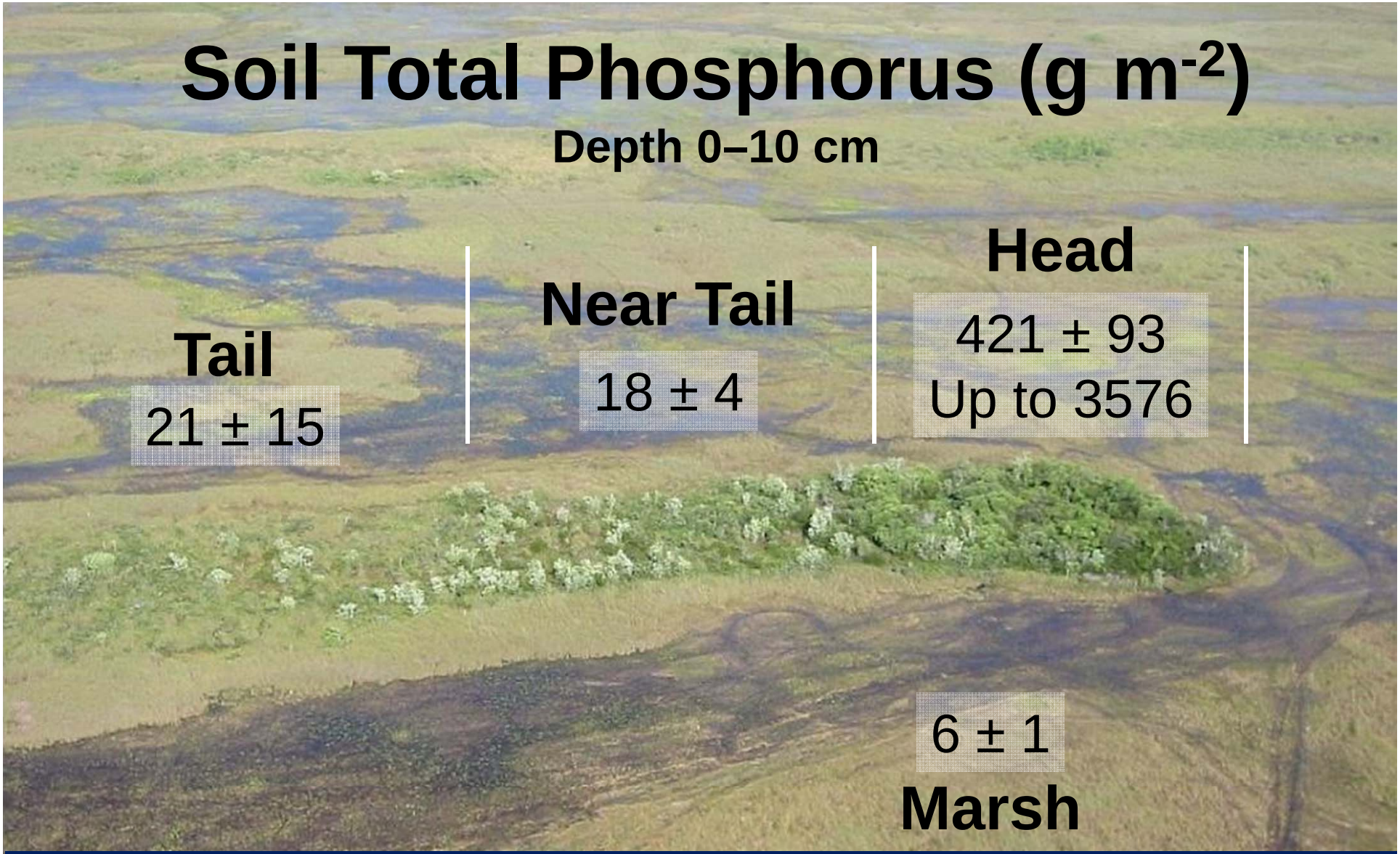
The *heart* of the Everglades is not getting enough exercise (Chris McVoy)



The Immune System of the Everglades has become Compromised

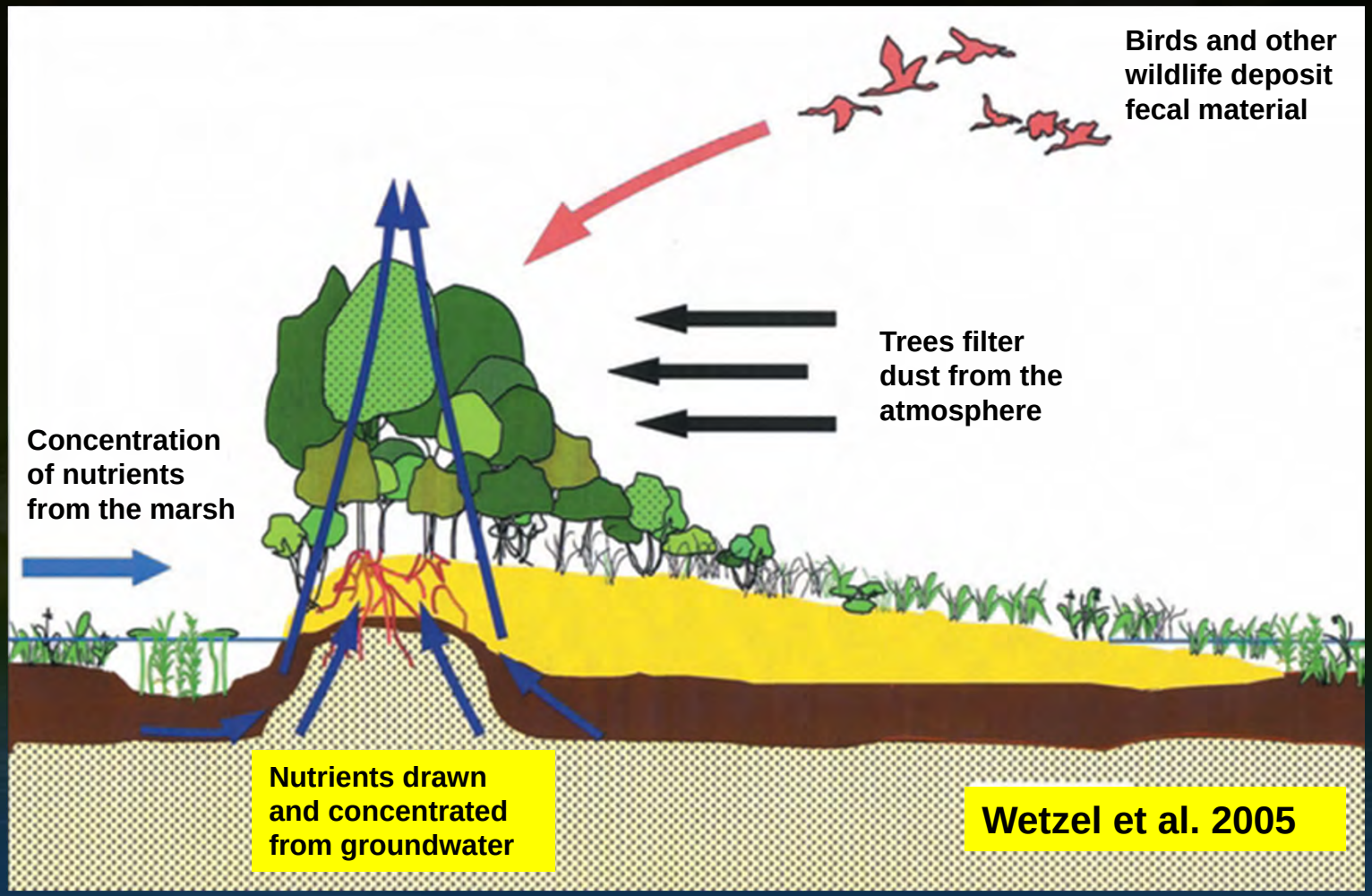






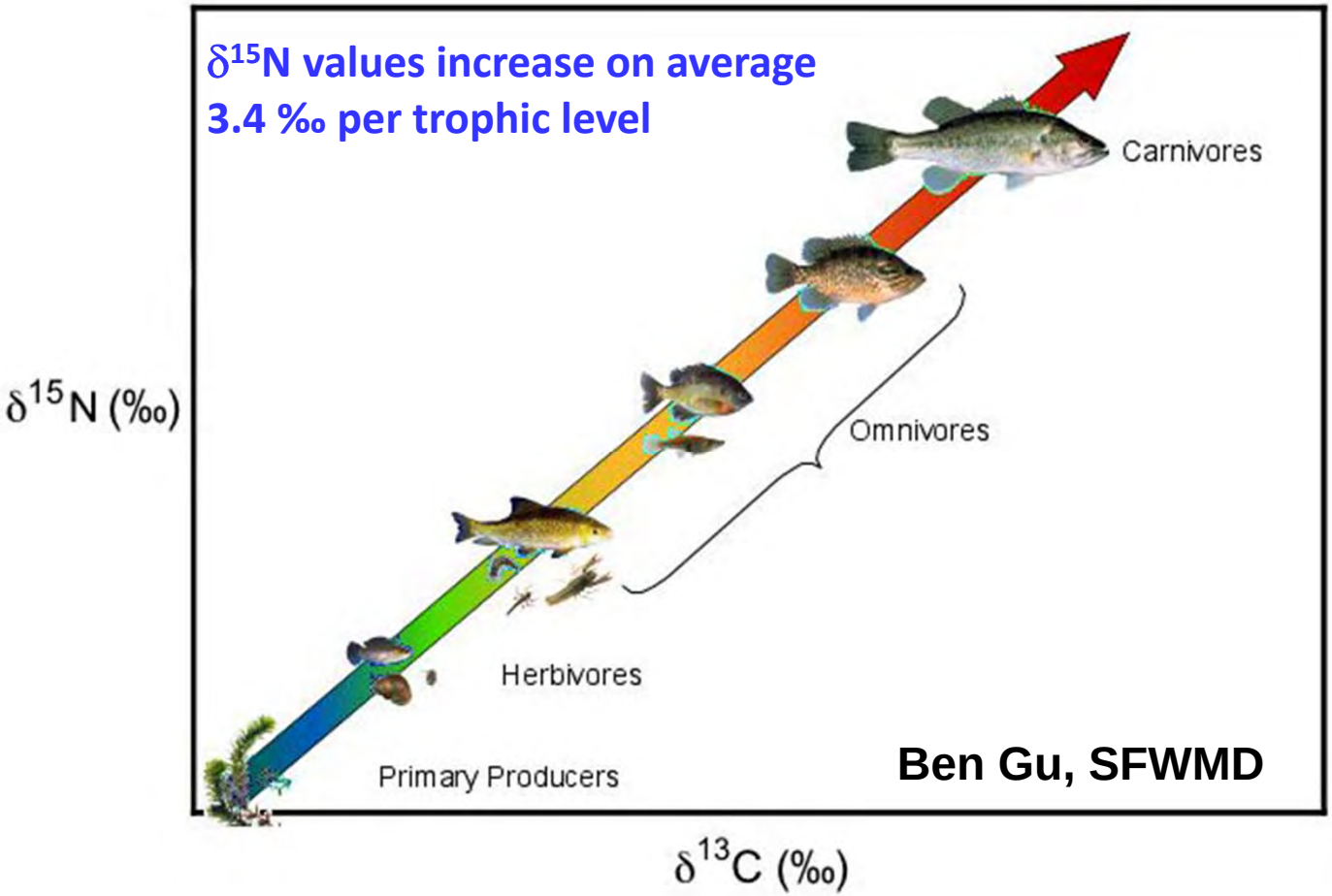
Tree islands (biodiversity hotspots) are like immune systems because they help keep the disease of phosphorus contained (Carlos Coronado, SFWMD).

Potential Sources of P in Tree Islands



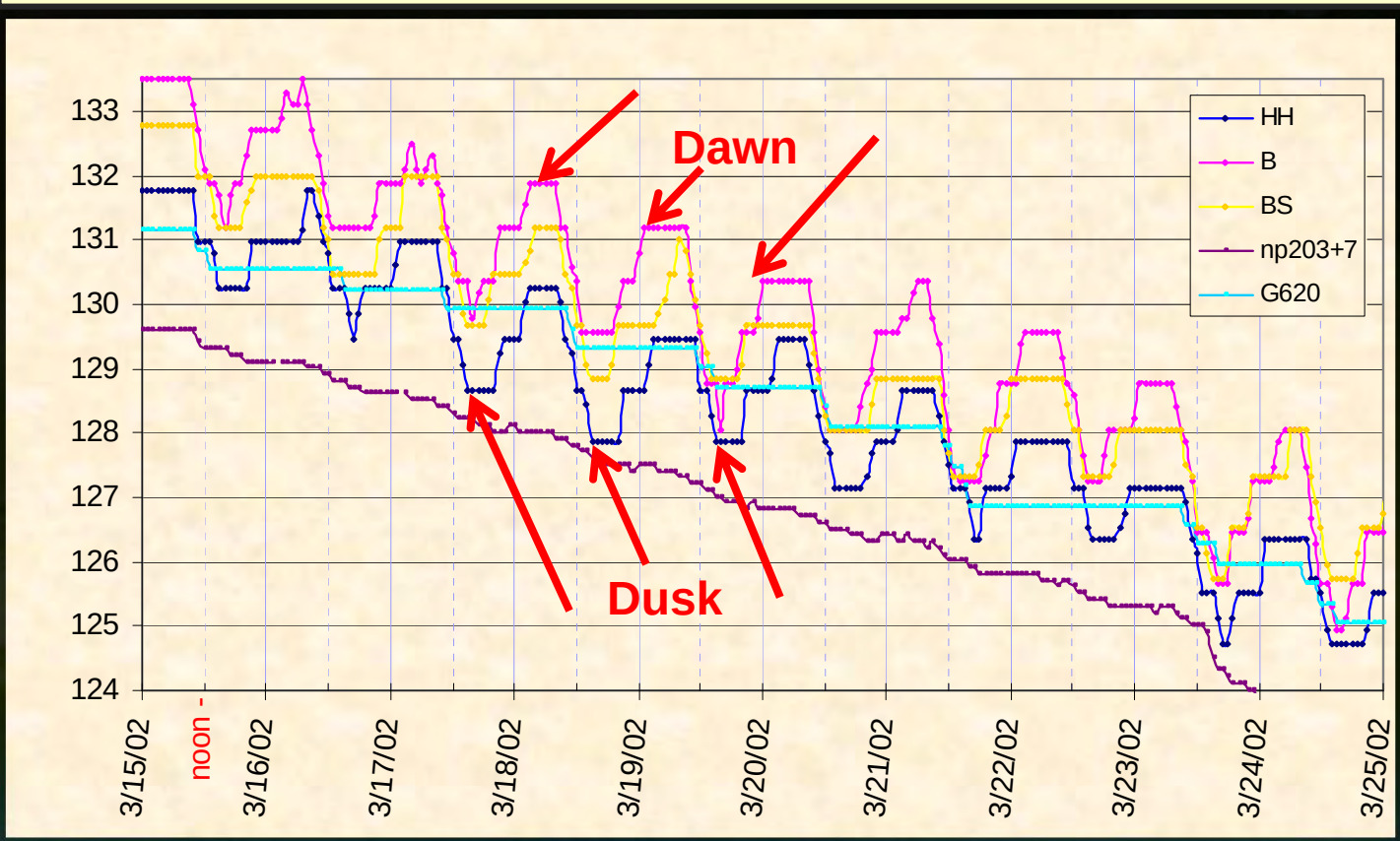
Wetzel et al. 2005

Isotope Enrichment was found in Wading Bird Guano and Tree Island Soil.



Do wading birds and Tree Islands keep the Everglades oligotrophic (a very low nutrient wetland)?

Trees islands are Connected to the Groundwater

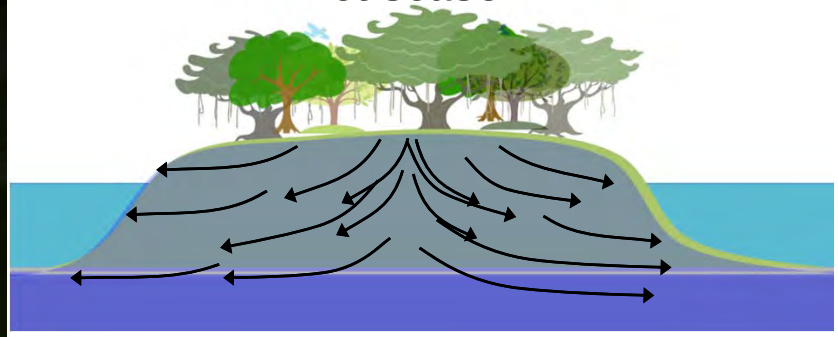


Daily water table fluctuation in neighboring Shark Slough environments, dry season, March 2002

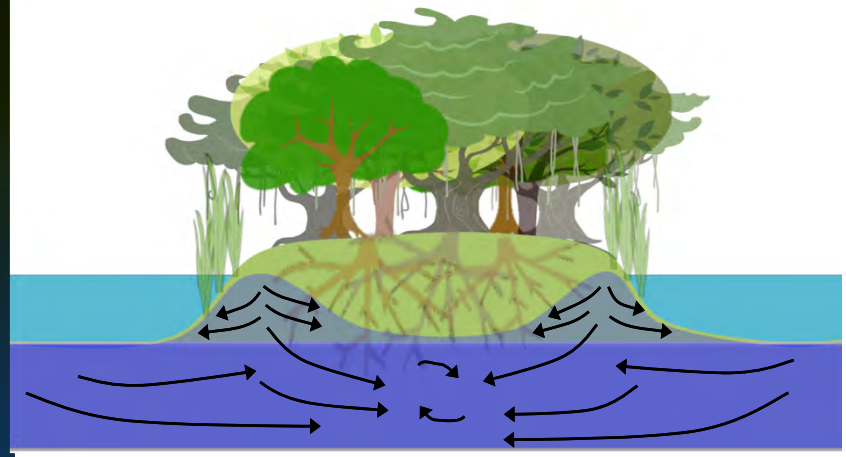
Mike Ross, FIU; Steve Krupa, SFWMD; Pam Sullivan, FIU

Exchange of Groundwater on LILA Tree Islands Indicates the Importance of a Dry Season

Predominant GW flow direction during the **wet season**

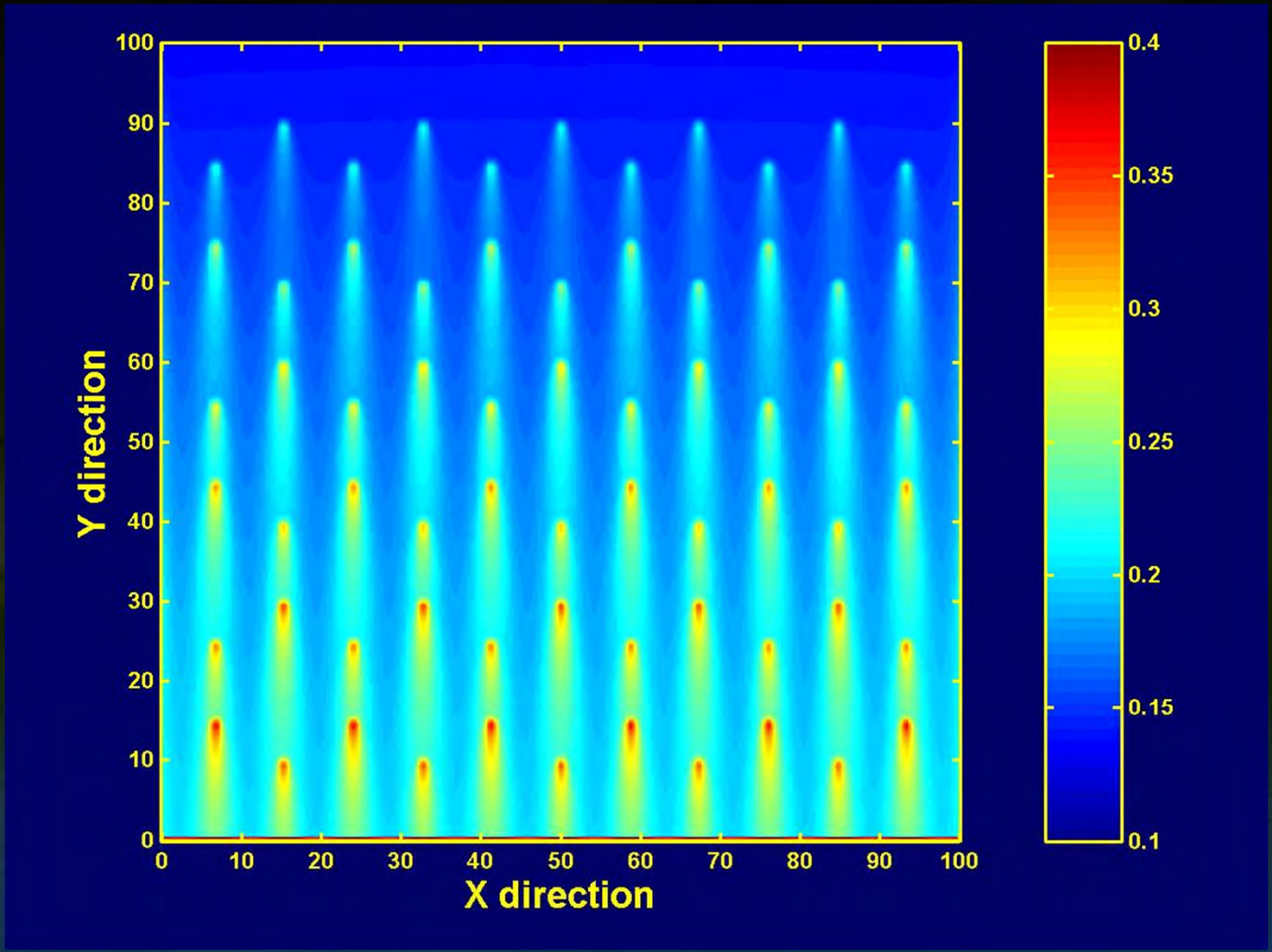


Predominant GW flow direction during the **dry season**



(Sullivan 2011, FIU)

ET-driven convergent flow, in conjunction with directional GW and SW flow, yields nutrient-enriched ridges and tree islands parallel to regional flow path.



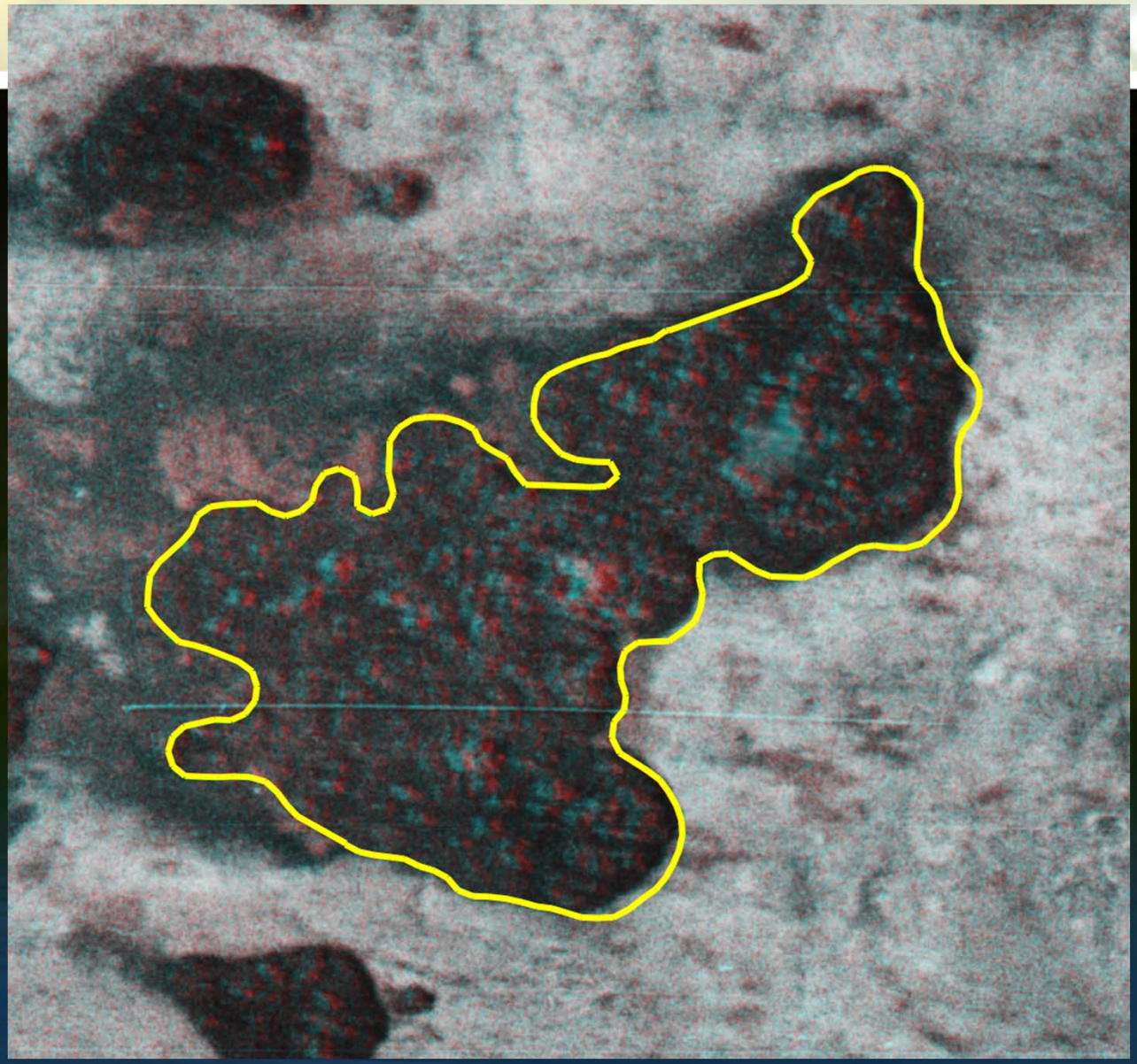
Stuart Stothoff and Mike Ross, 2005, FIU

3-D Vision Test (Ted Schall, USACOE)

RECOVER Tree Island Mapping – Near S-12B

1960

Flight Direction

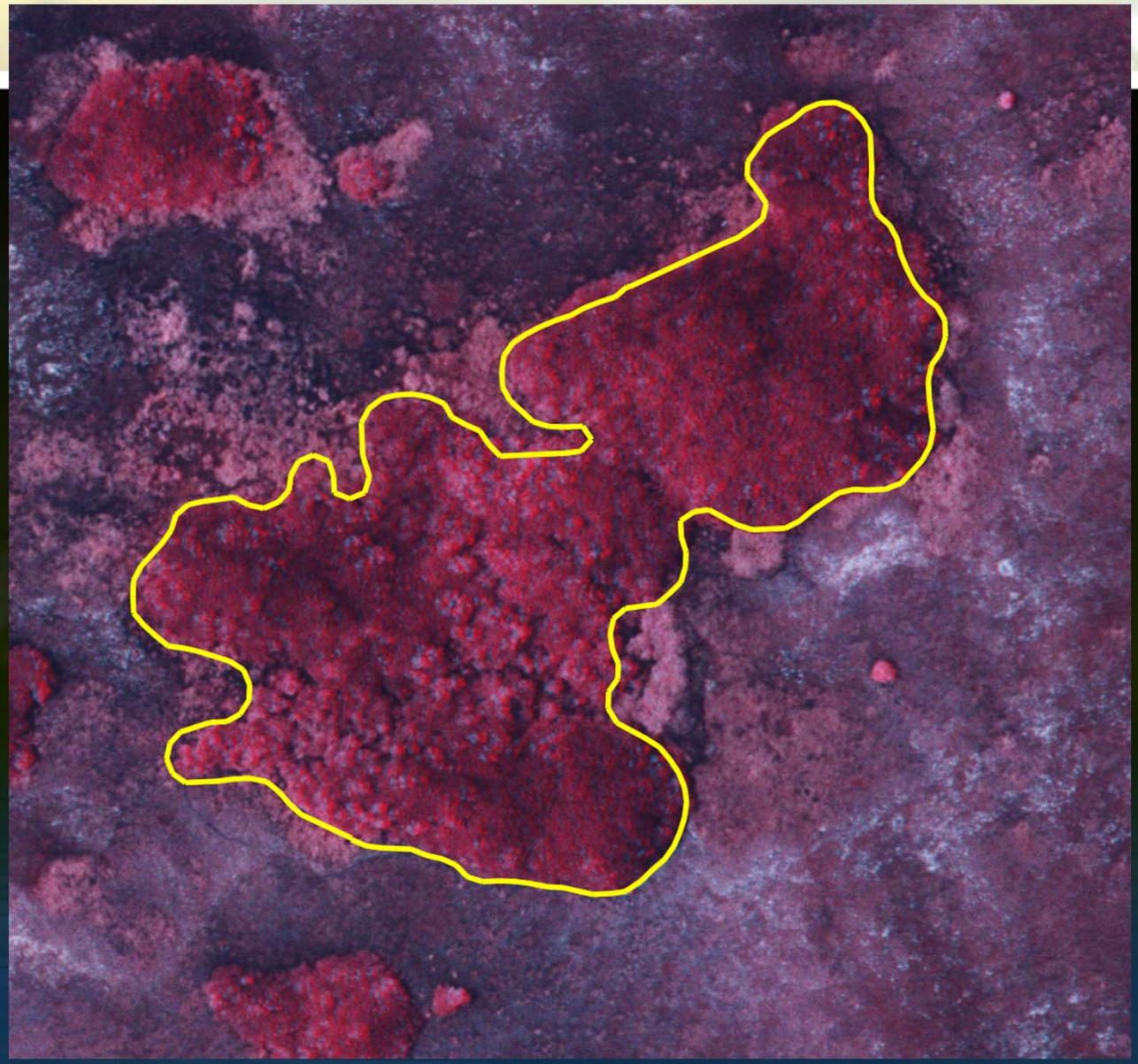


N →

RECOVER Tree Island Mapping – Near S-12B

2004

Flight Direction



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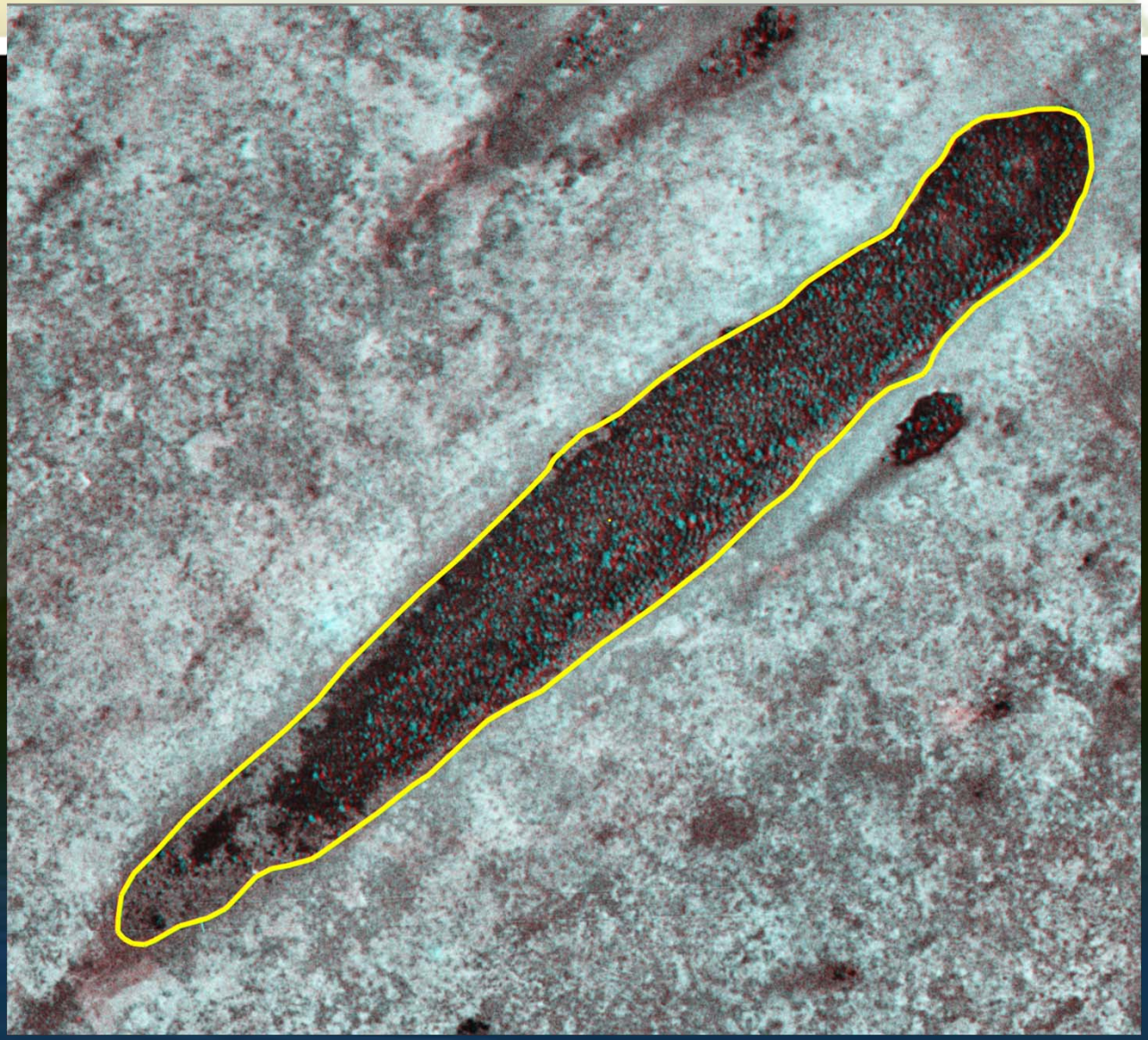
1952 (Base Map)

Flight Direction



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RECOVER Tree Island Mapping – Southern SRS

1973

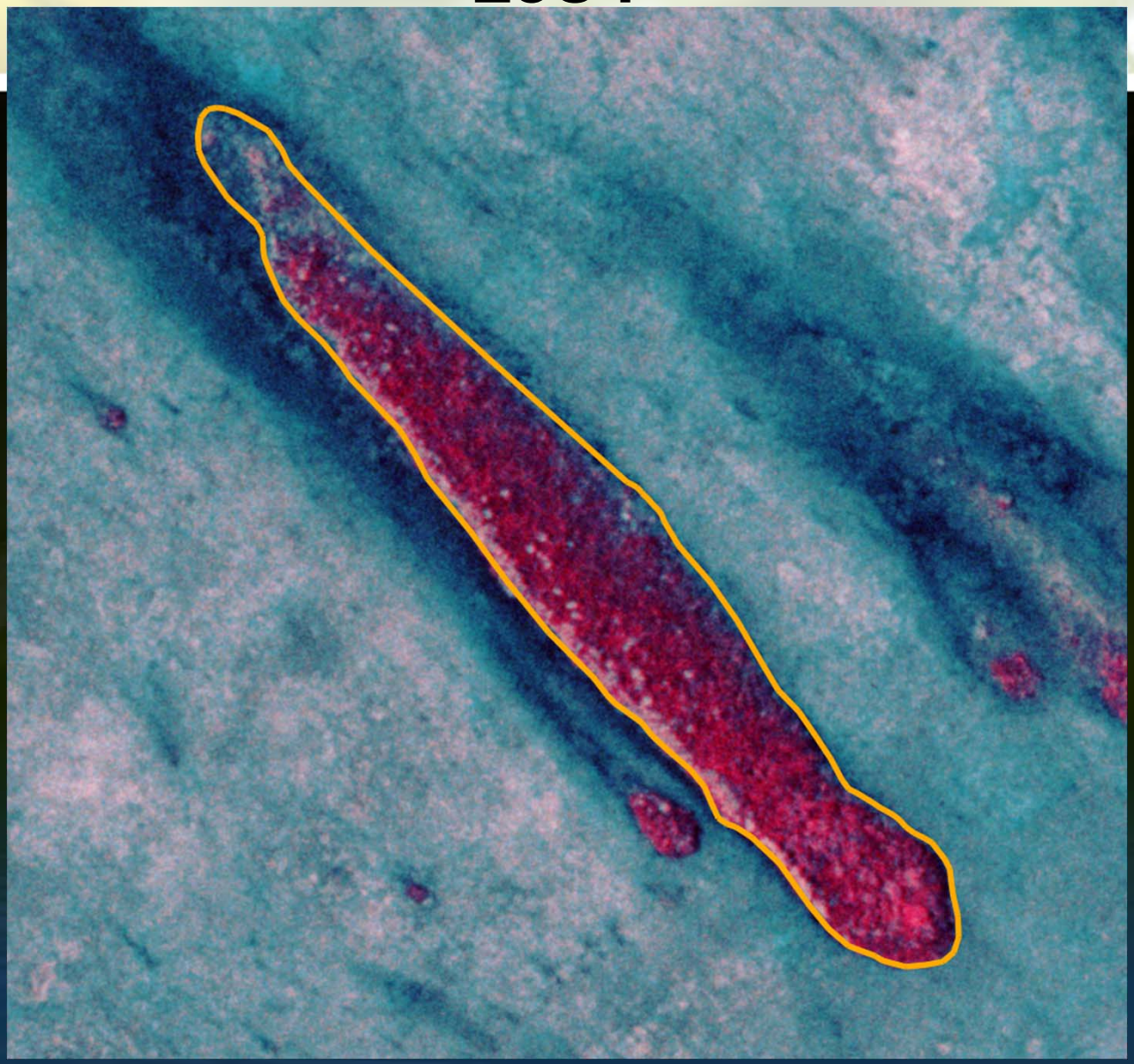
Flight Direction

N →

sfwmd.gov

RECOVER Tree Island Mapping – Southern SRS

1984



Flight Direction

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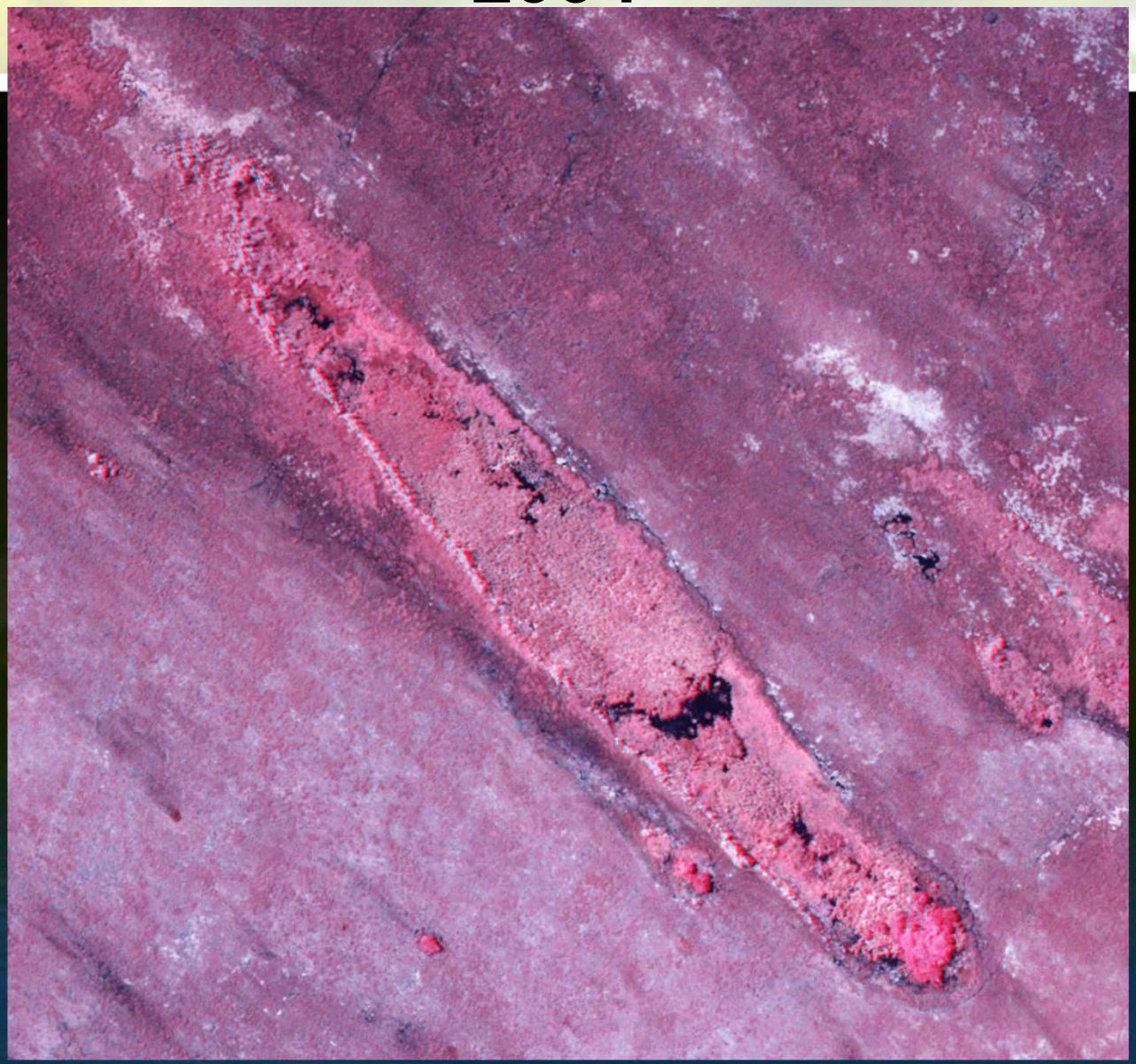
RECOVER Tree Island Mapping – Southern SRS

2004



Flight Direction

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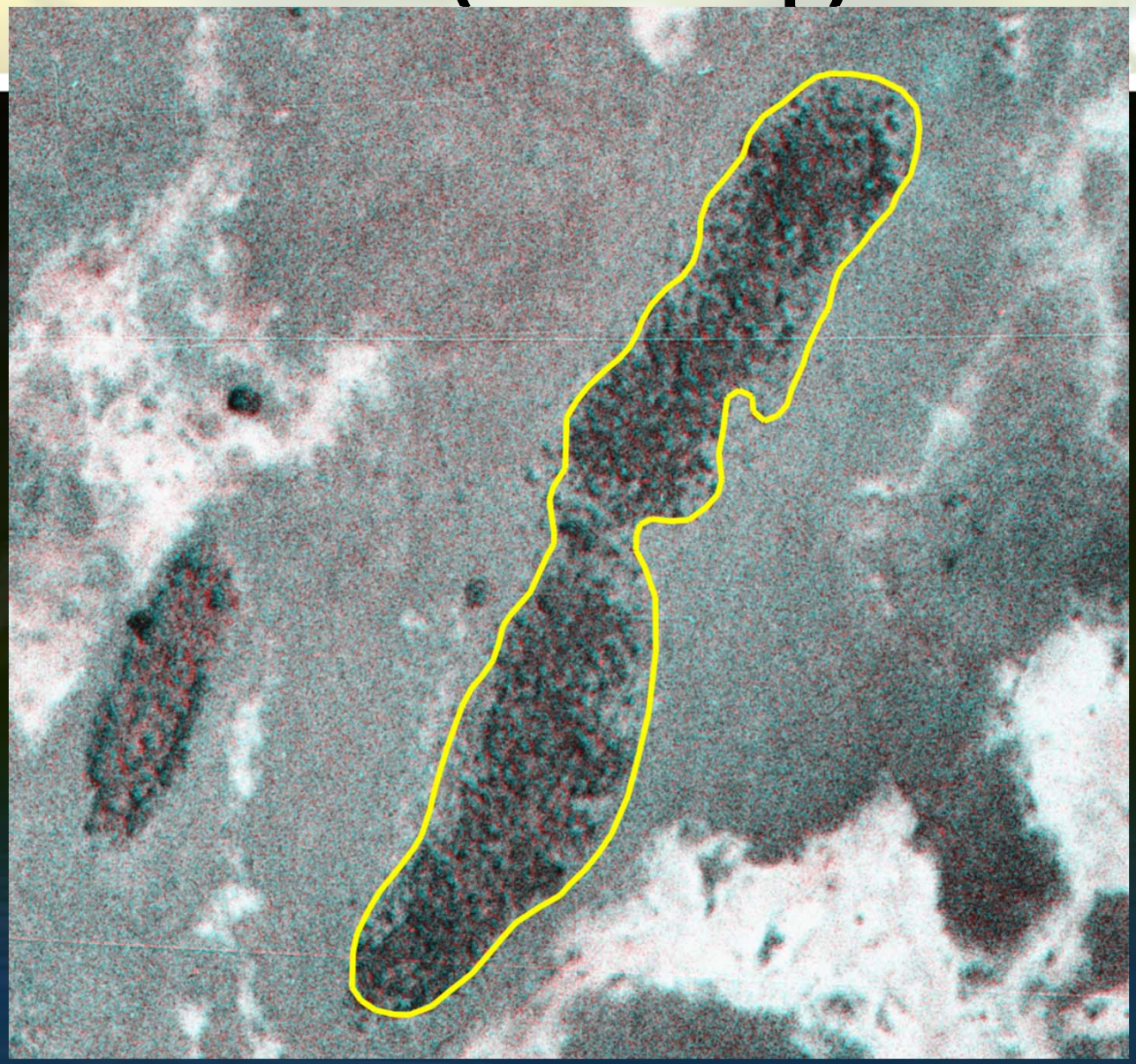
RECOVER Tree Island Mapping – Central SRS

1952 (Base Map)

Flight Direction



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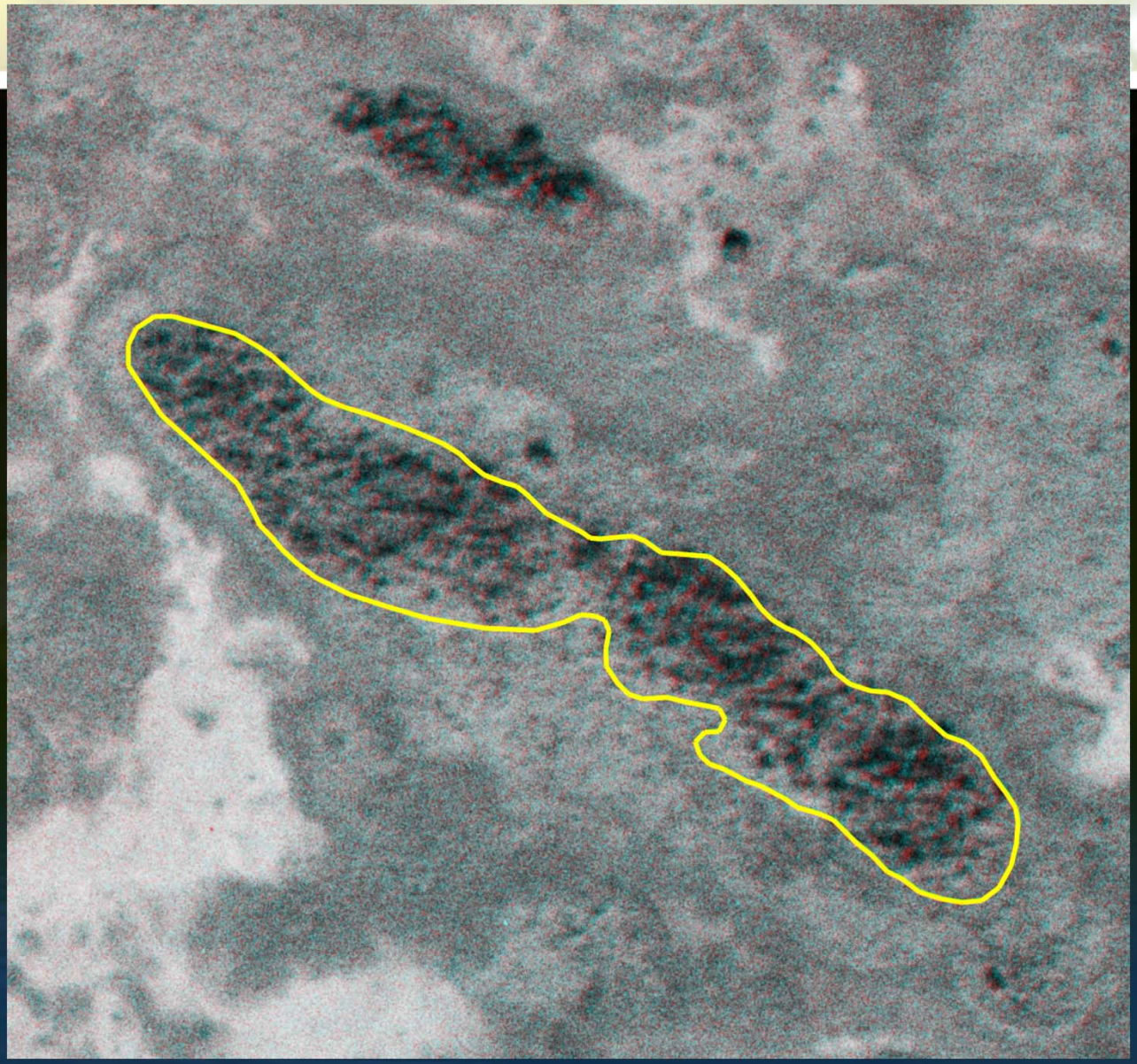
RECOVER Tree Island Mapping – Central SRS

1964

Flight Direction



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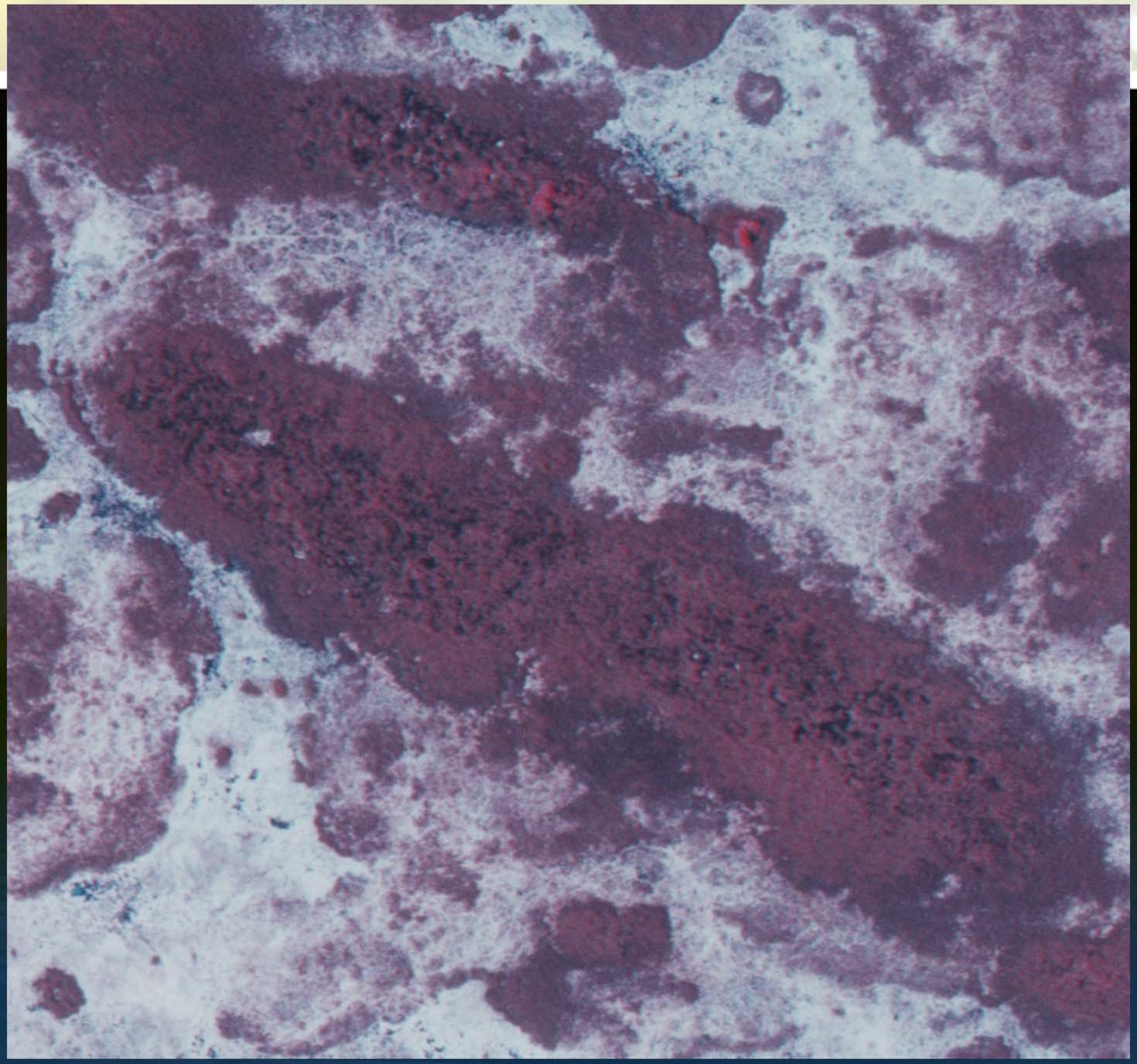
RECOVER Tree Island Mapping – Central SRS

2004

Flight Direction



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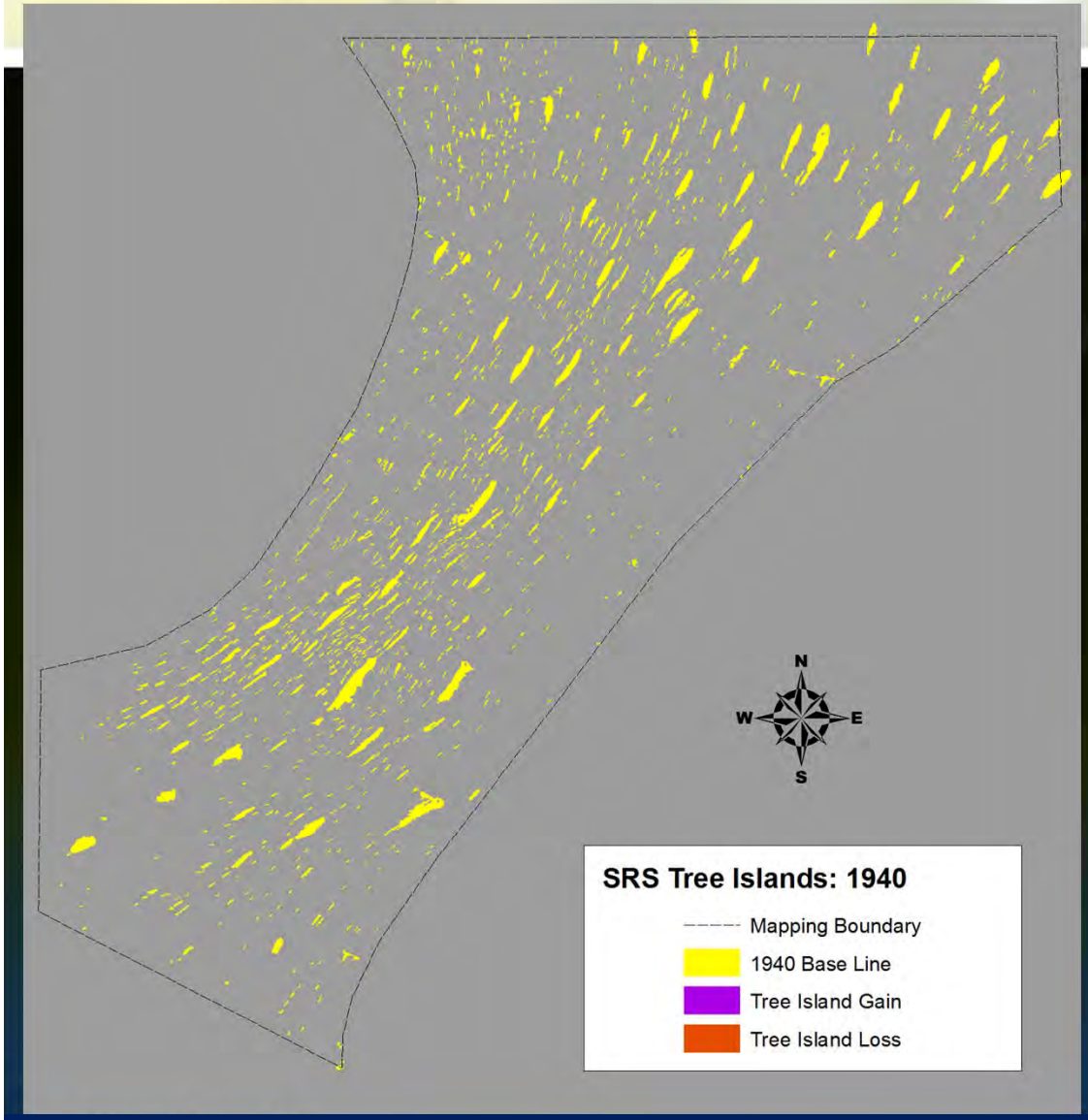
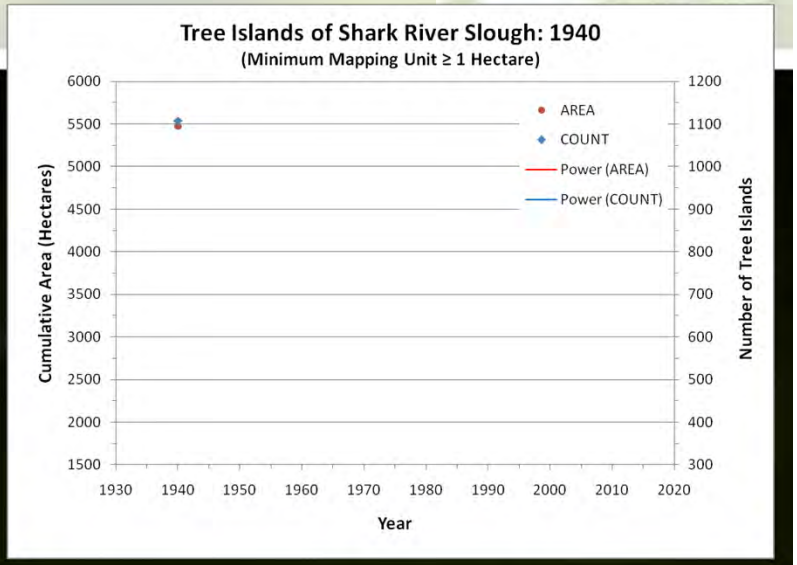
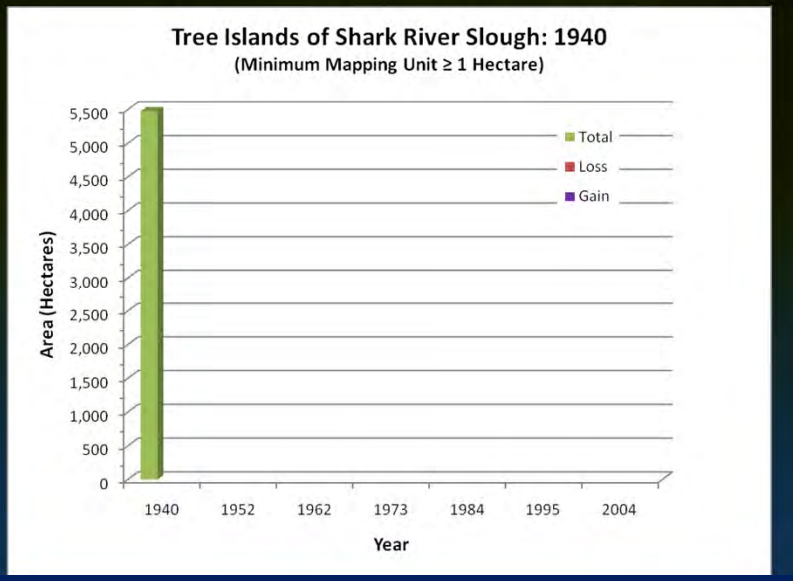
RECOVER Tree Island Mapping – SRS Results

Date: 1940 Count: 1,107 (Base) Hectares: 5,473.4 (Base)



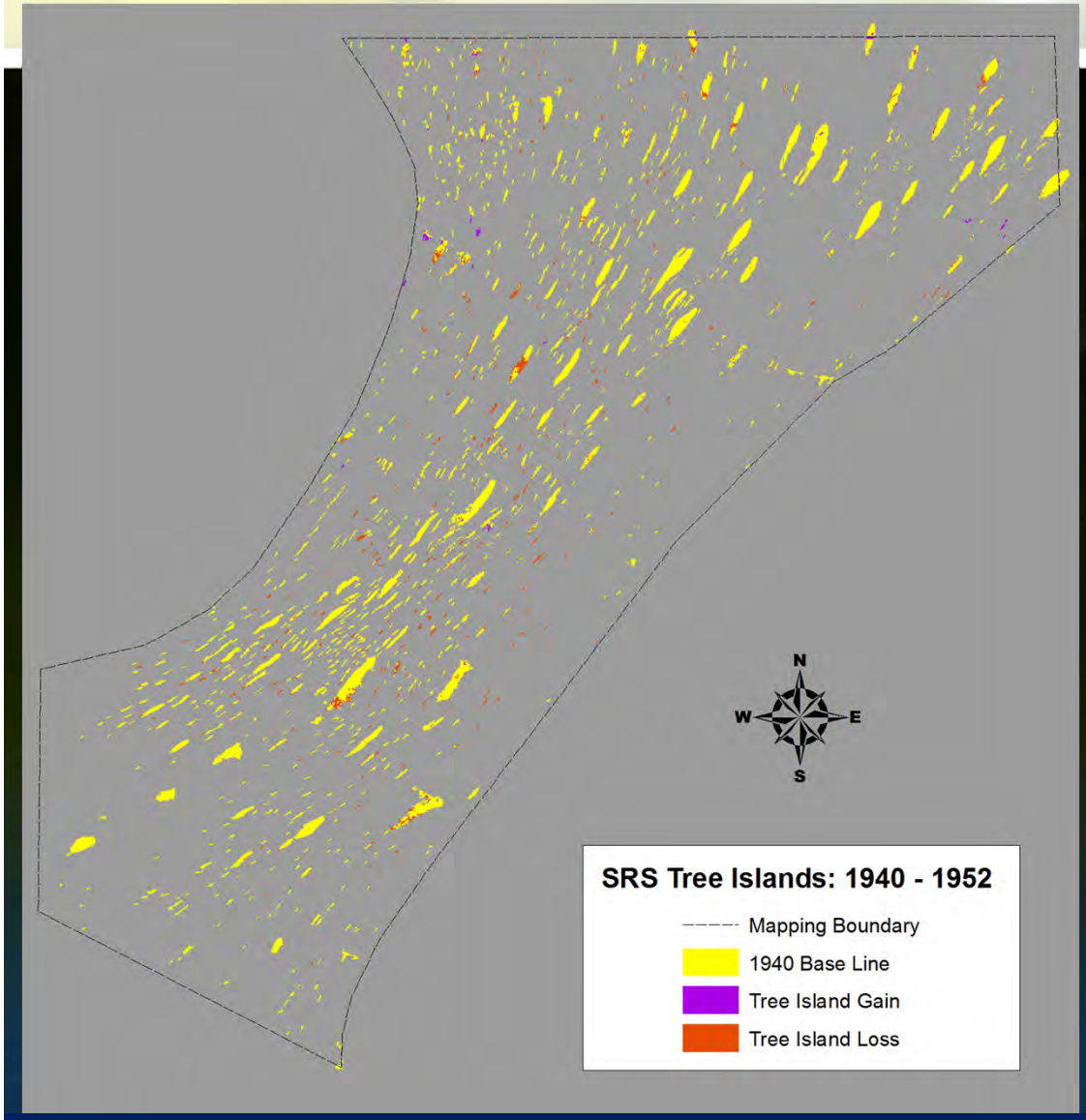


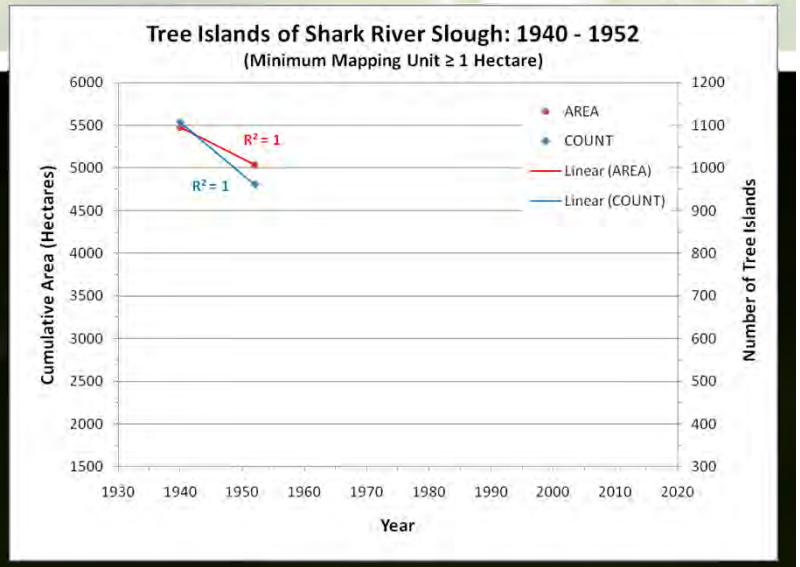


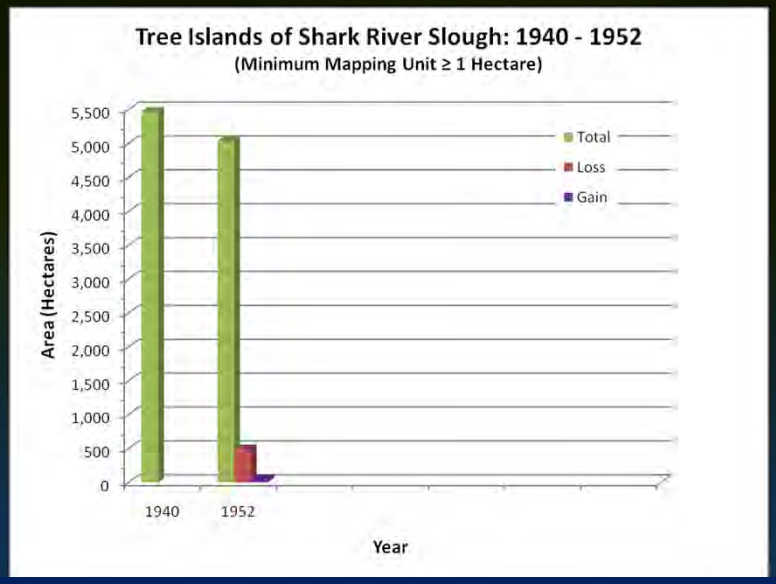
Ted Schall, USACOE

RECOVER Tree Island Mapping Project – SRS Results

Date: 1952 Count: 961 (-13.2%) Hectares: 5,036.6 (-8.0%)



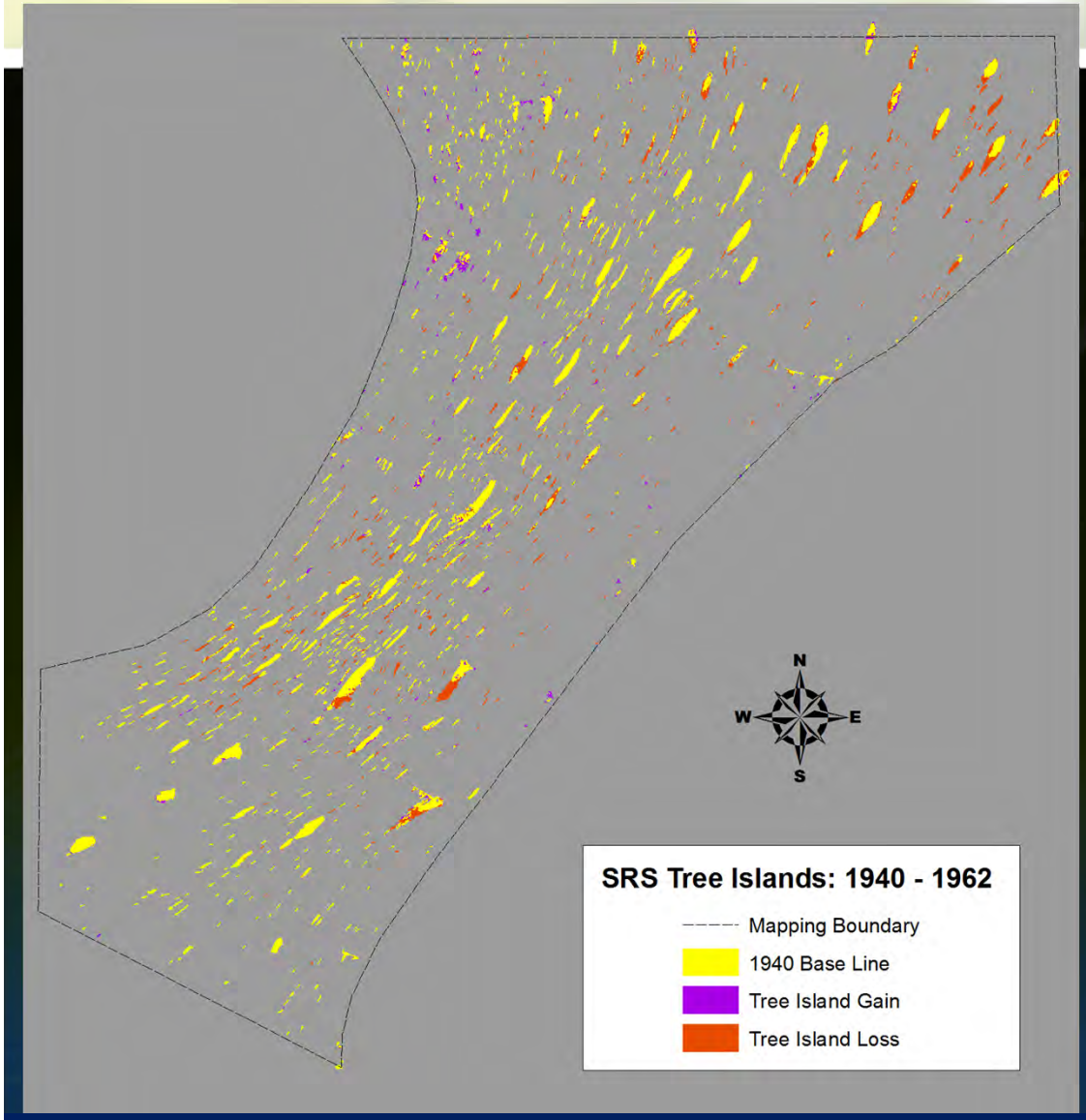


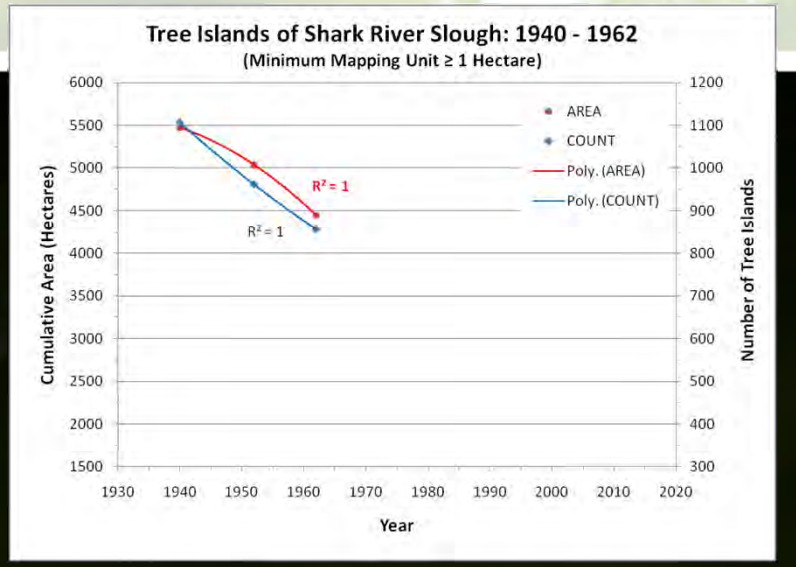


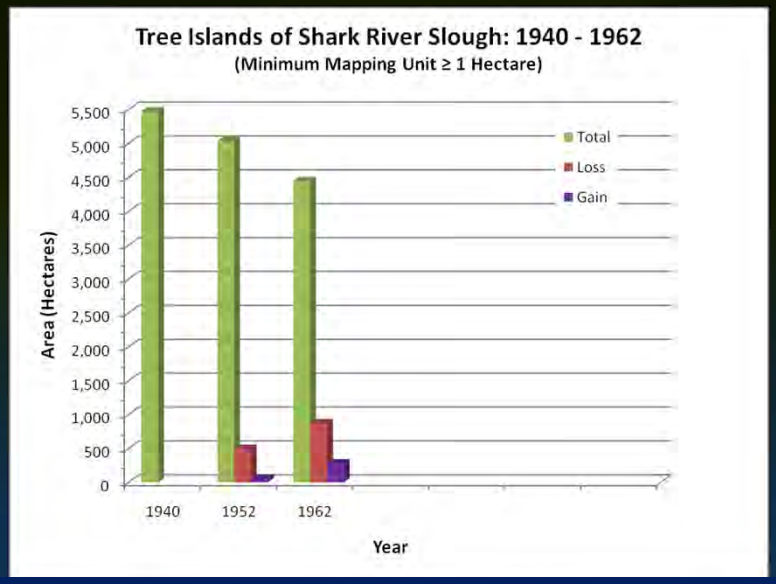
Ted Schall, USACOE

RECOVER Tree Island Mapping – SRS Results

Date: 1962 Count: 856 (-22.7%) Hectares: 4,445.8 (-18.8)



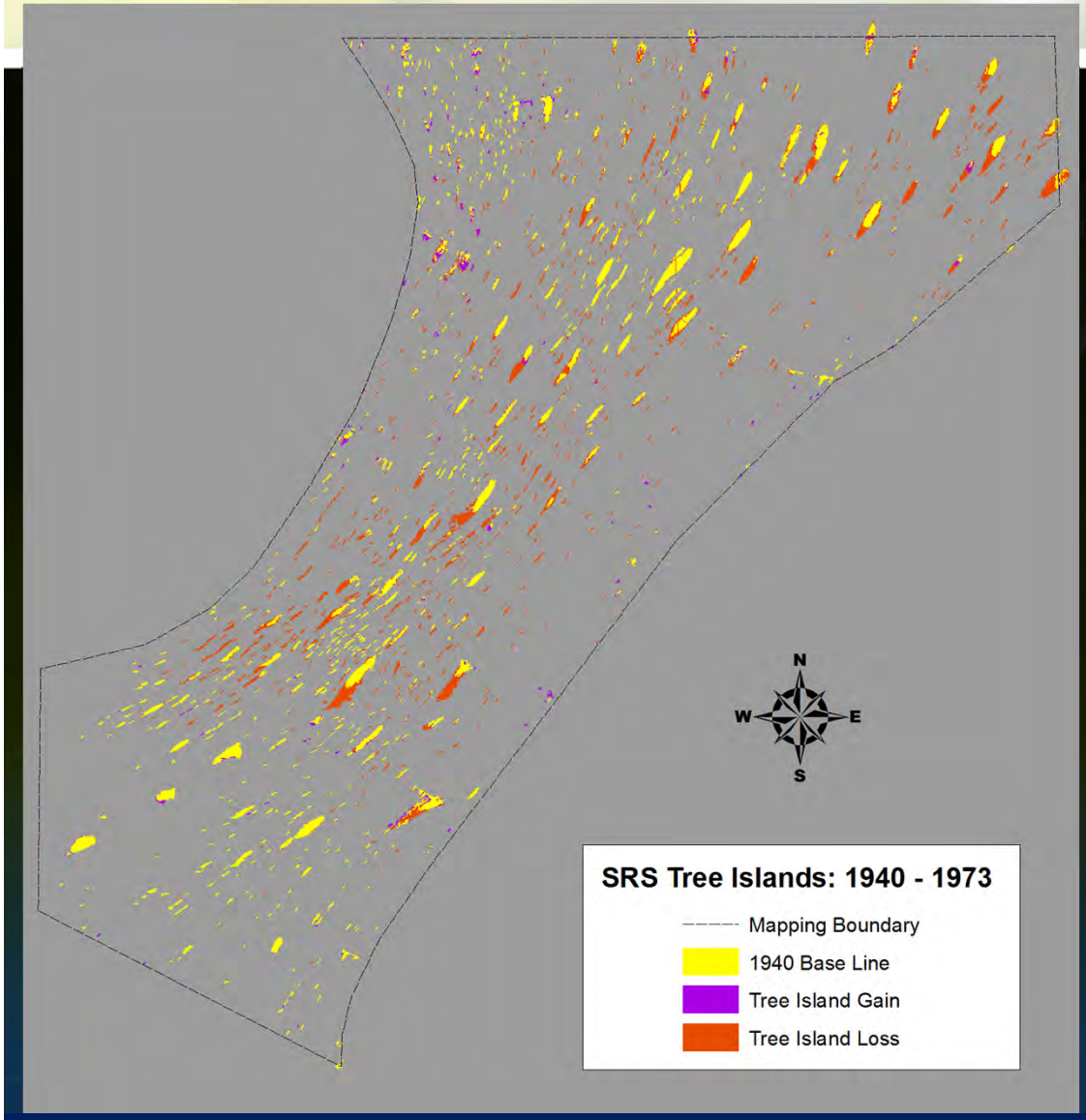


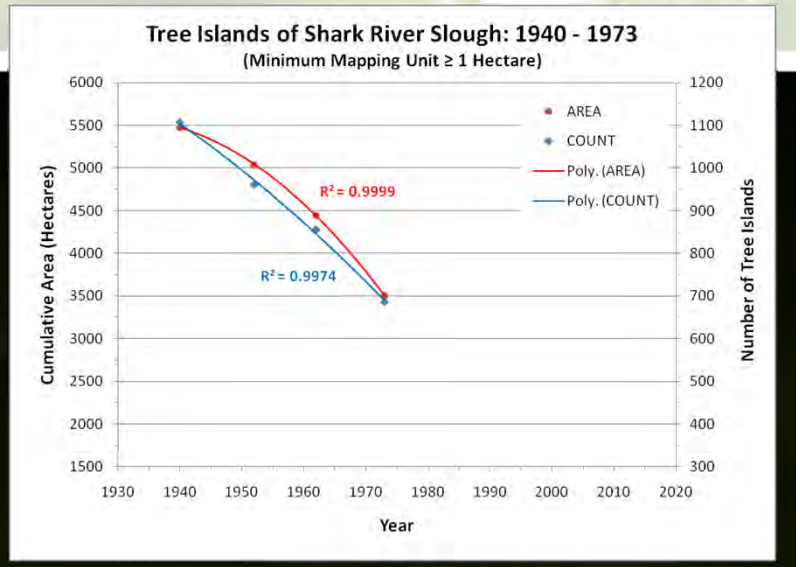


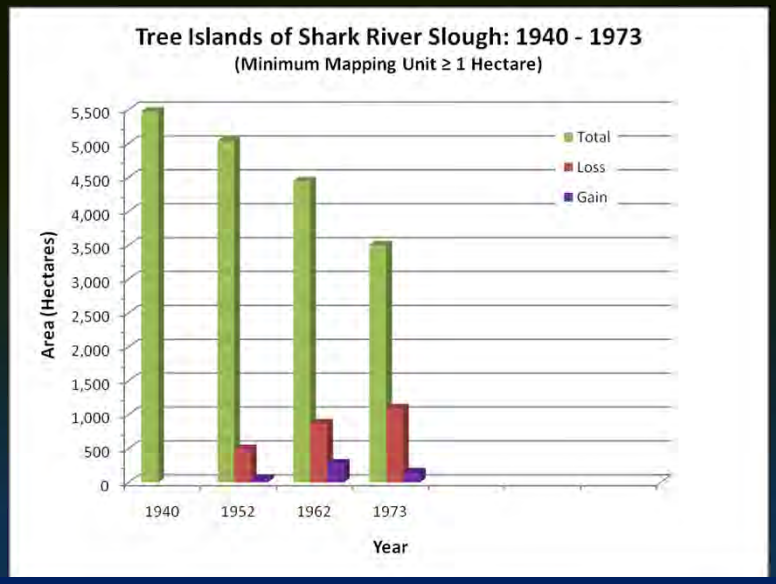
Ted Schall, USACOE

RECOVER Tree Island Mapping – SRS Results

Date: 1973 Count: 686 (-38.0%) Hectares: 3,501.0 (-36.0%)



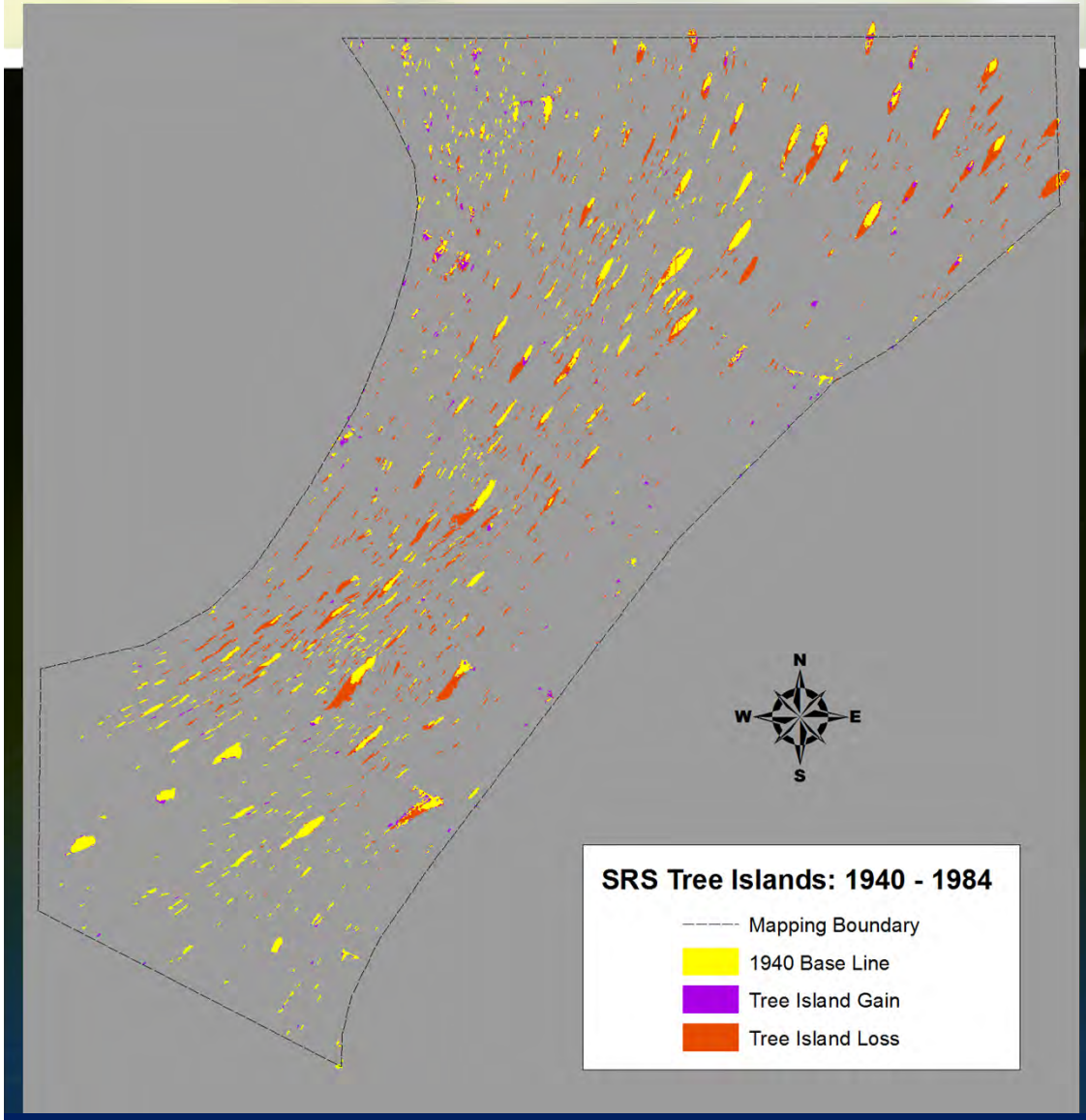


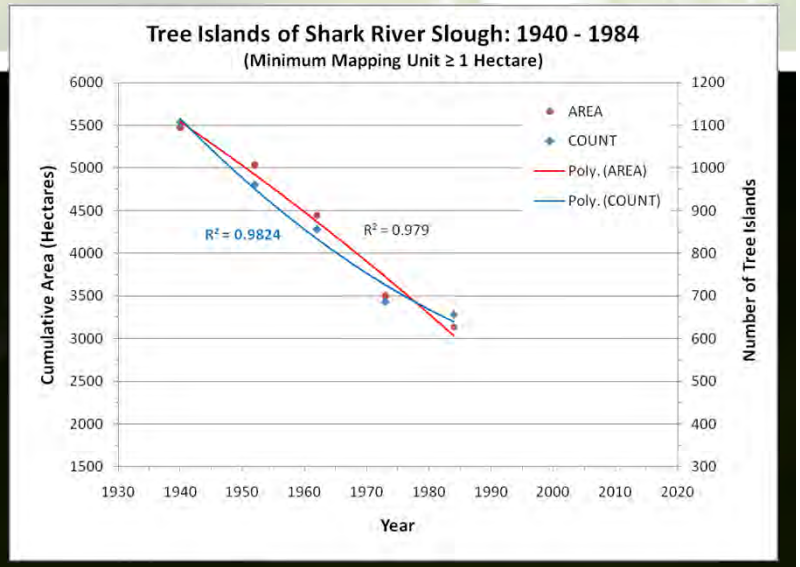


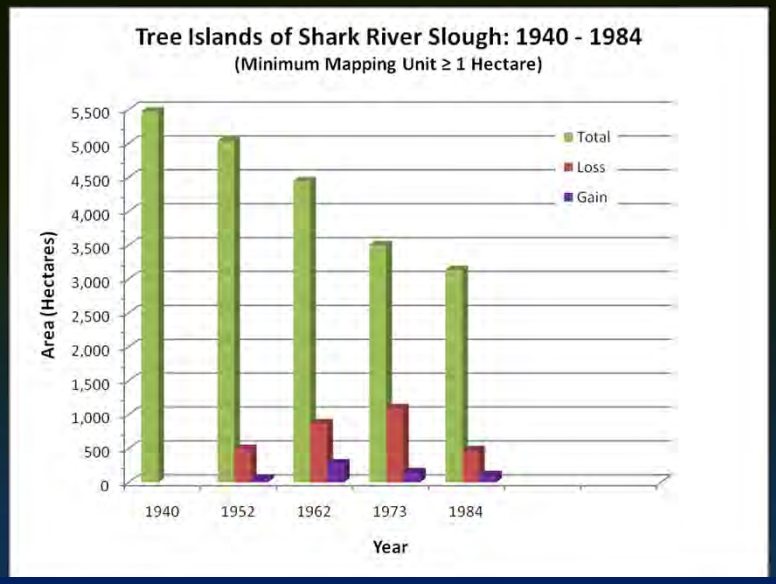
Ted Schall, USACOE

RECOVER Tree Island Mapping – SRS Results

Date: 1984 Count: 656 (-40.7%) Hectares: 3,134.5 (-42.7)







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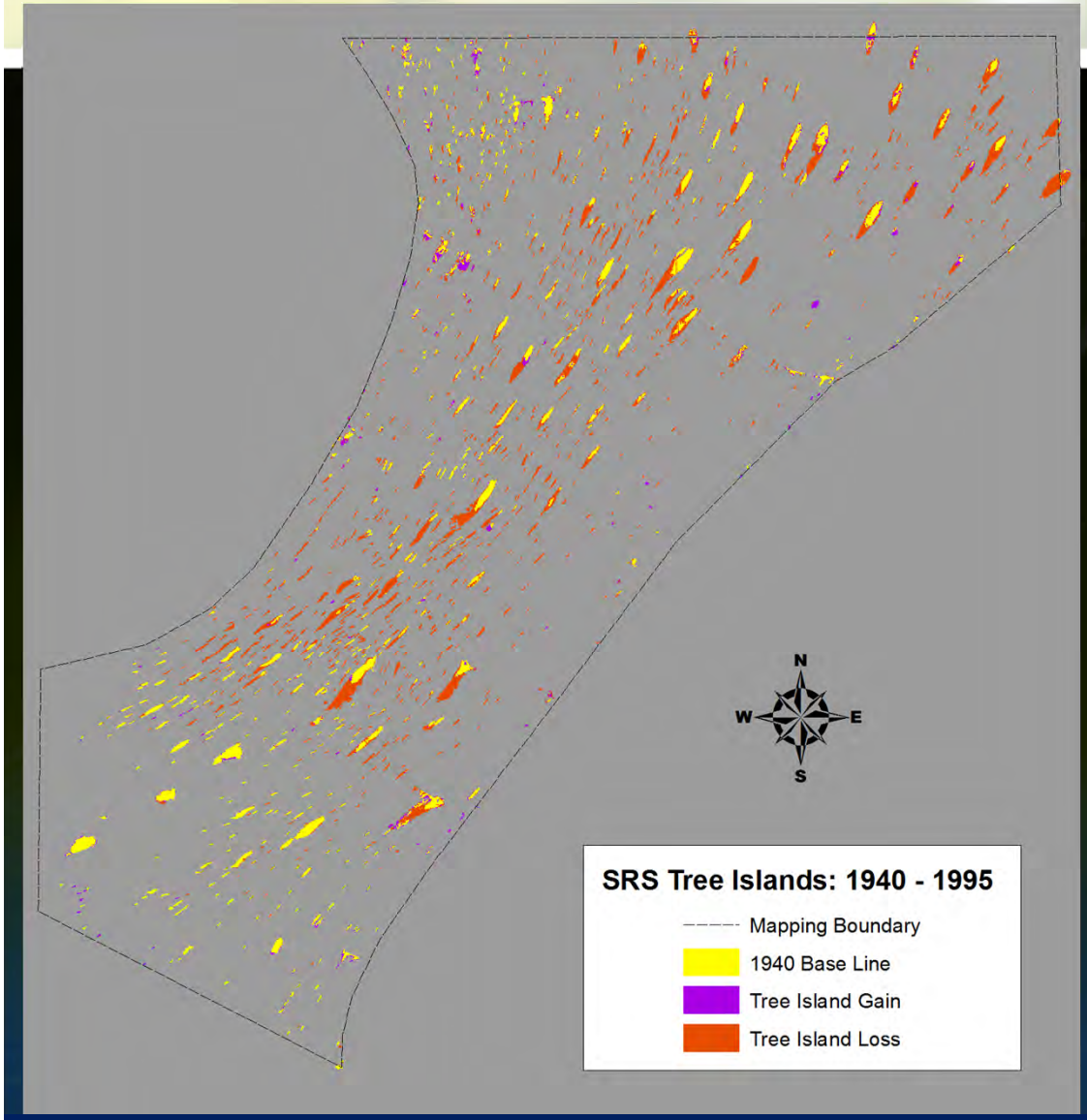
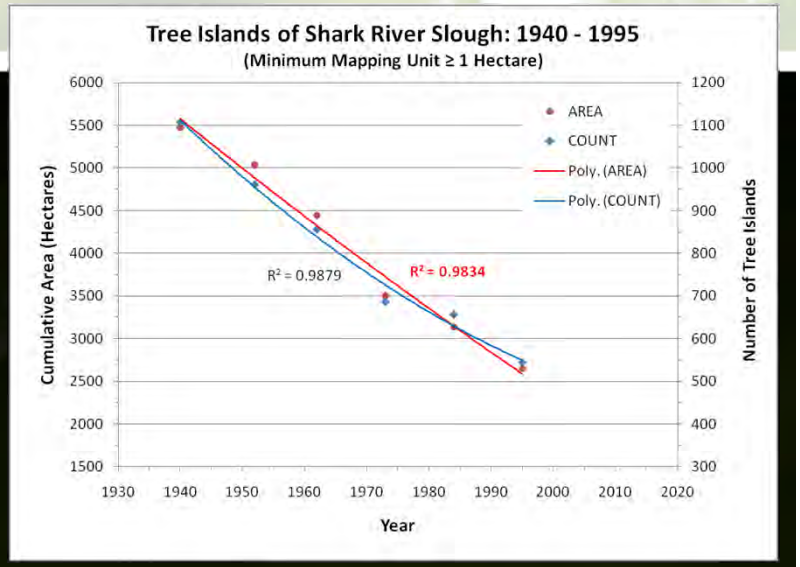
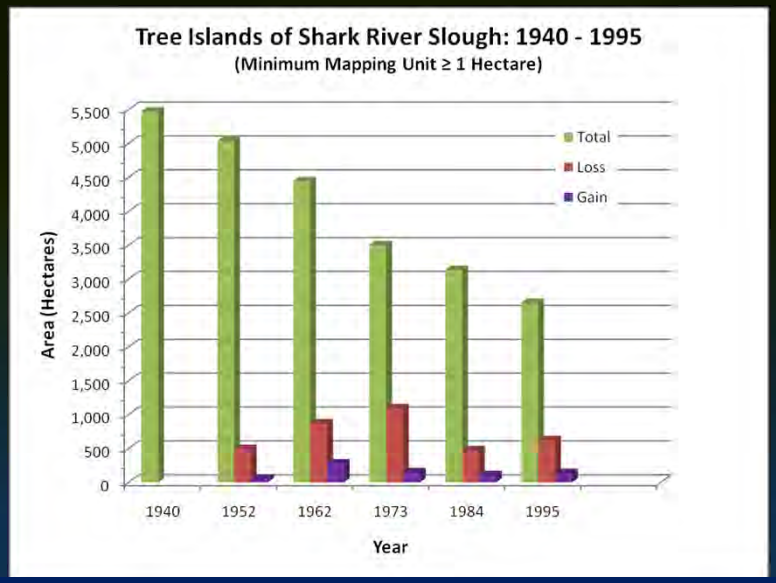
RECOVER Tree Island Mapping – SRS Results

Date: 1995 Count: 544 (-50.9%) Hectares: 2,651 (-51.6%)



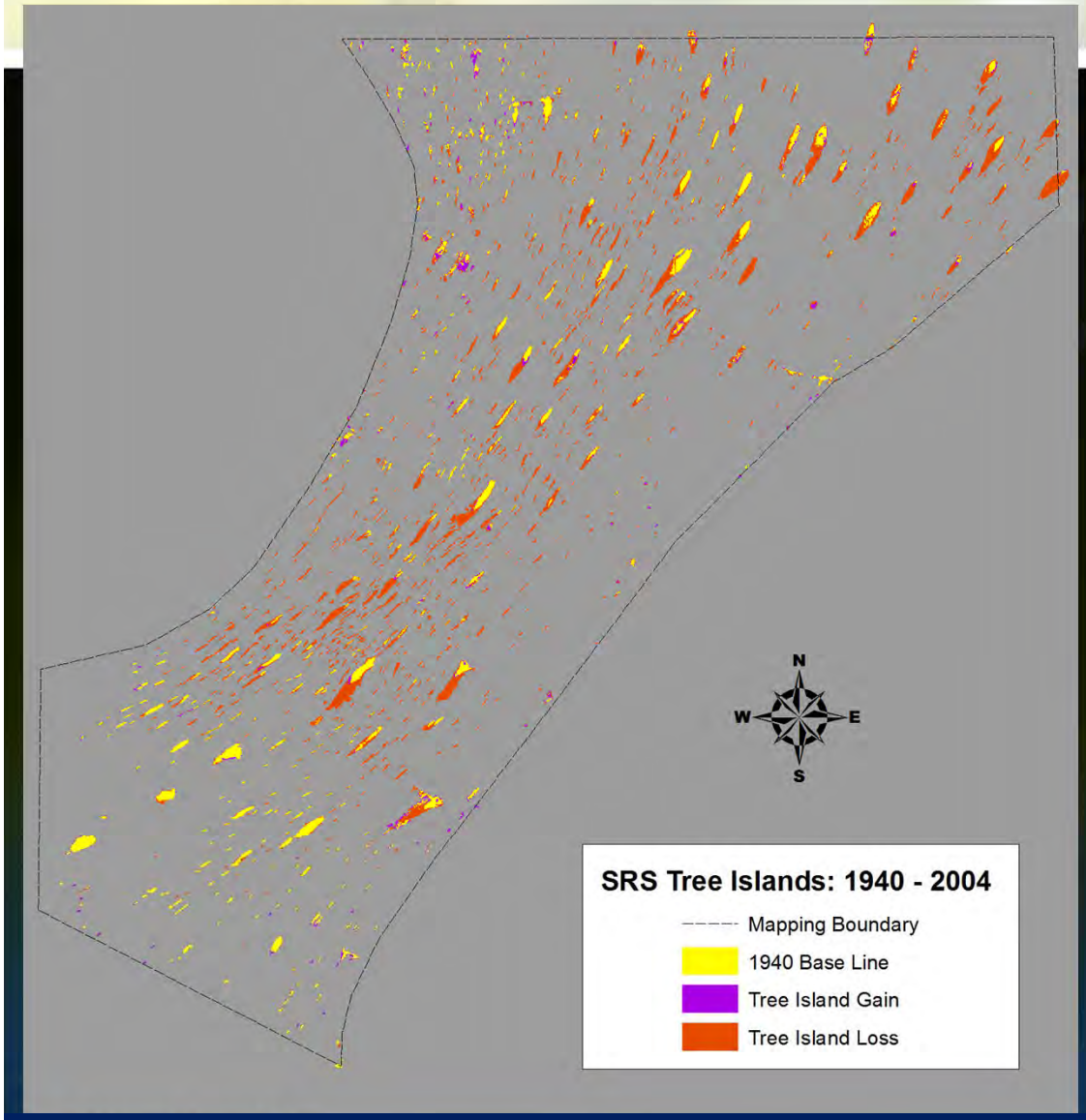


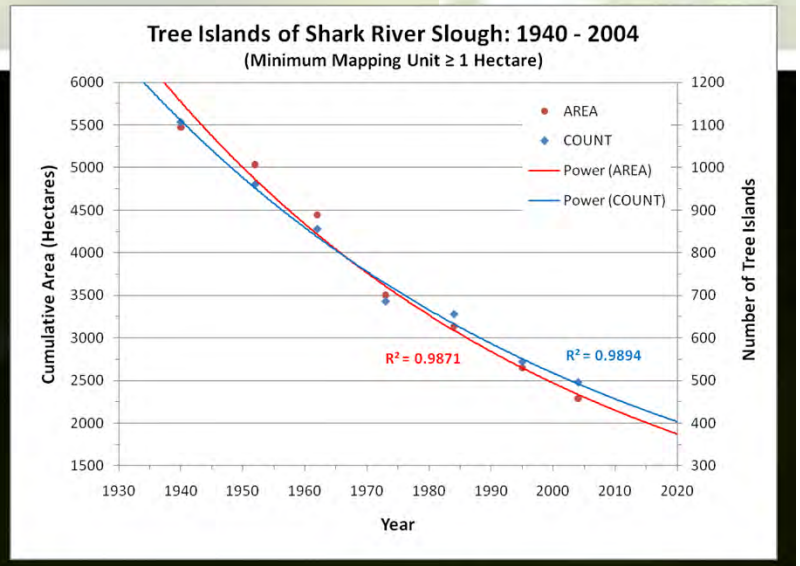


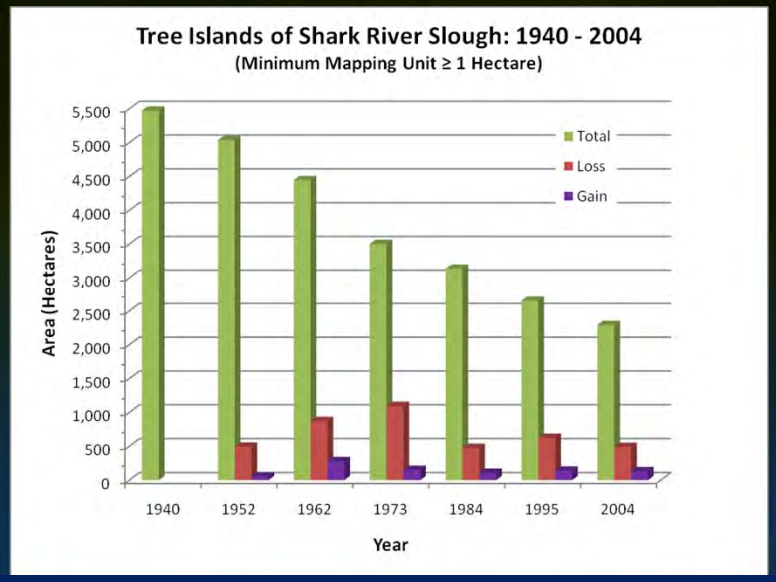
Ted Schall, USACOE

RECOVER Tree Island Mapping – SRS Results

Date: 2004 Count: 496 (-55.2%) Hectares: 2,291.3 (-58.1%)







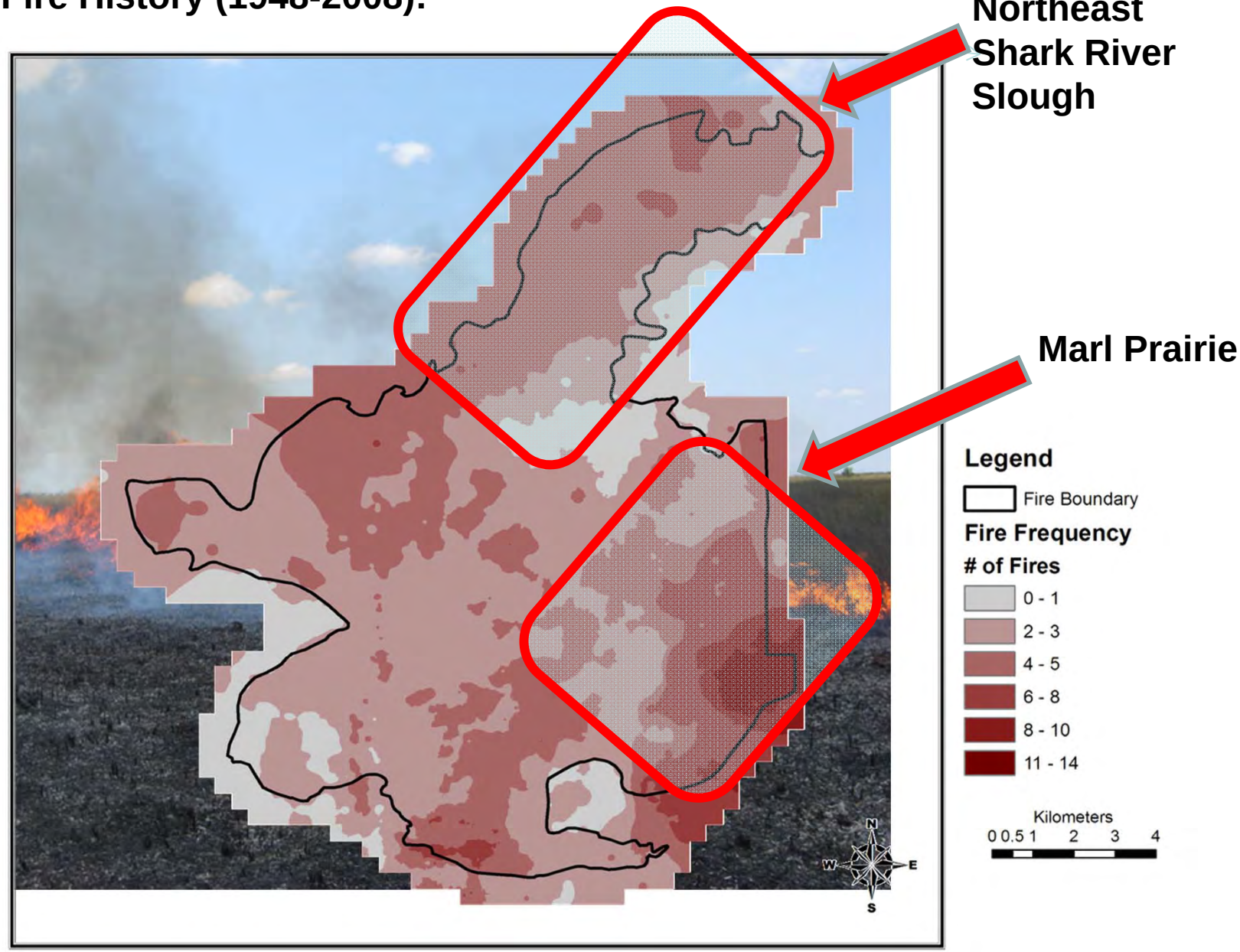
Ted Schall, USACOE

Periodic natural fires, together with suitable hydrologic regimes, maintain and advance the dominance of marsh grass(Sah et al. 2008), and suppress the encroachment of woody stems (Hanan et al. 2009) within the marl prairies of the Everglades.

<u>However:</u>

Fire can burn through tree islands, oxidizing soils and consuming all litter and killing most, if not all, of the trees present. (Mike Ross, FIU)

Fire History (1948-2008):

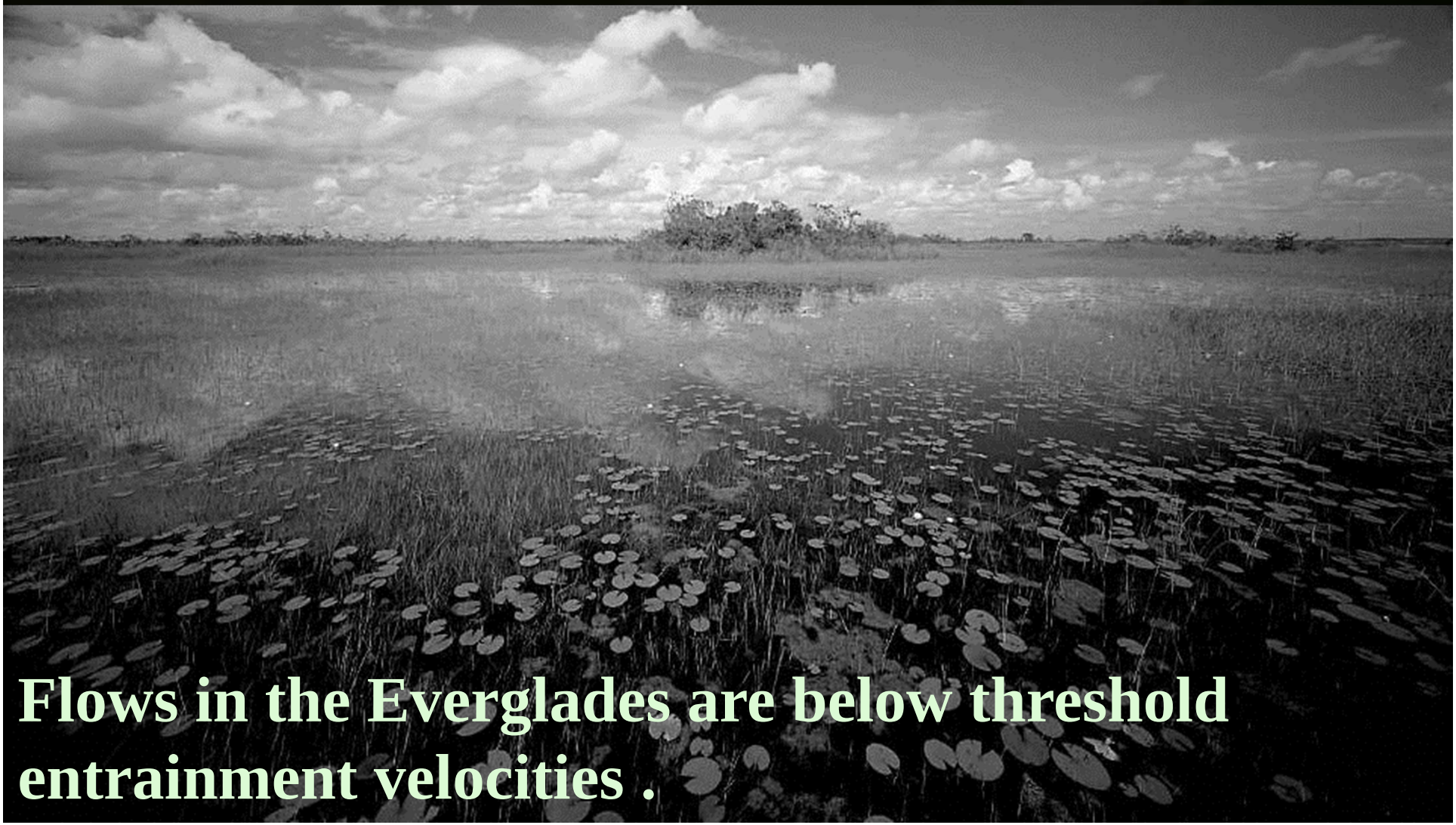


Everglades National Park Fire Geodatabase

(Mike Ross, FIU)

The *HEART* of the Everglades has Poor Circulation

Photo by Clyde Butcher



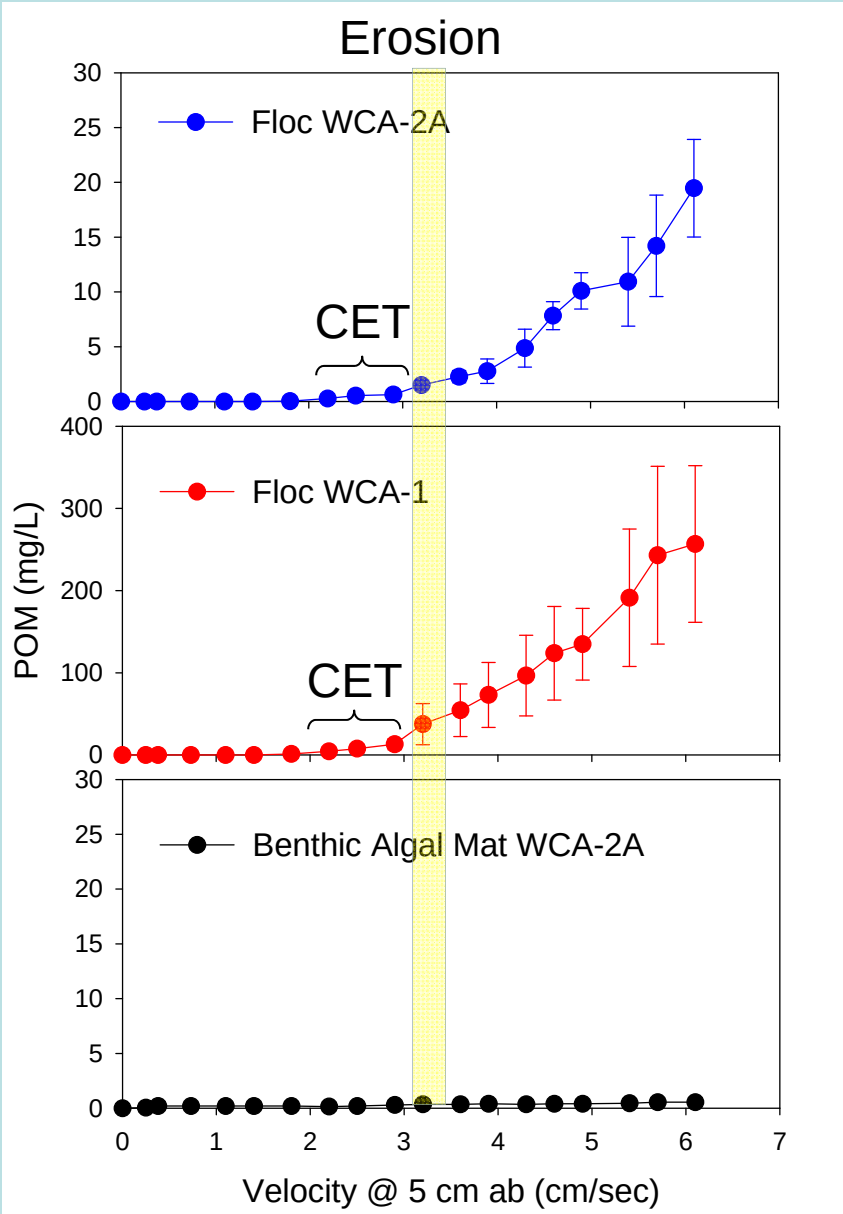
Flows in the Everglades are below threshold entrainment velocities .

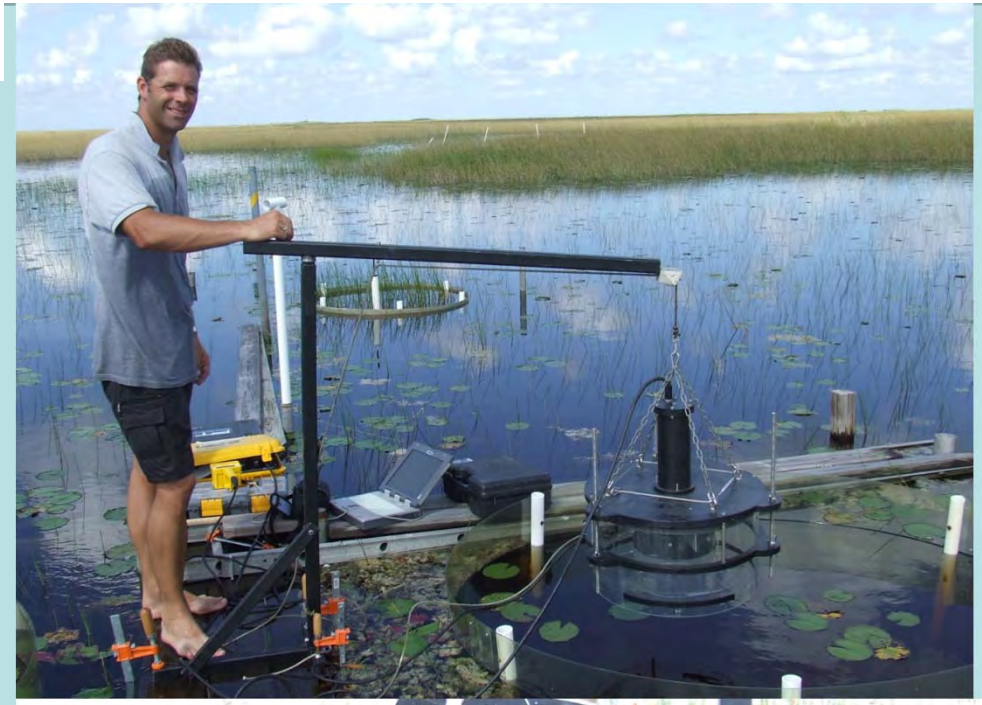
Velocity Range
Mean=2.5 cm/sec
Max=5.3 cm/sec
Min=0.0 cm/sec

Sediment Transport & Artificial Floc

Scot Hagerthey (SFWMD) and Kevin Black (PARTRAC, Ltd)

CET = Critical Entrainment Threshold



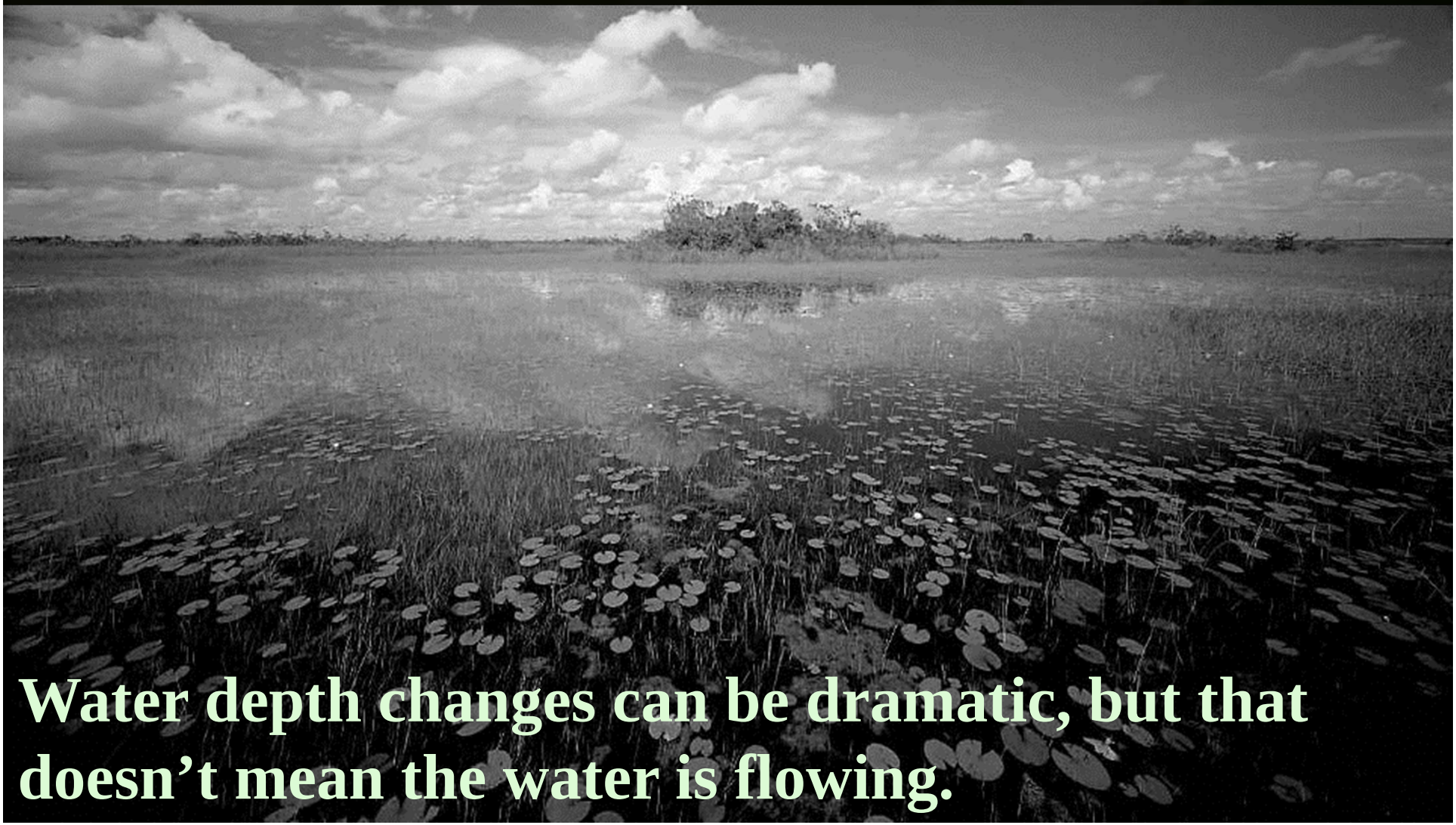


Flow in the Everglades is <1 cm/sec
However: CET = 2.5 – 3.5 cm/sec

Scot Hagerthey (SFWMD) and Kevin Black (PARTRAC, Ltd)

The *HEART* of the Everglades has Poor Circulation

Photo by Clyde Butcher



Water depth changes can be dramatic, but that doesn't mean the water is flowing.

The *HEART* of the Everglades has Poor Circulation

Photo by Clyde Butcher

The Water Depth Assessment Tool, the EDEN Program, and an Enhanced Network of Stage Recorders helps us "see" the Everglades for the first time.

Let's Review: How has our Understanding of the Greater Everglades Ecosystem Changed?

1. High cholesterol - Cattails in WCA3 are expanding along canals, but also in ways not seen before; AMI may act like an ecological "stent" .

2. Leaky valves – Vital fluids can be retained by increasing hydrologic retention in WCA-3B

3. No exercise – Lack of flow and short hydroperiods are causing the entire Everglades to flatten out. If trend continues the ridge and slough pattern will disappear.

4. A compromised immune system – Nutrients are sequestered by tree islands, but islands are degrading and disappearing. Reducing oxidation will help rebuild our TI-cells.

5. Poor circulation – More flow will lead to more sloughs and less soil oxidation.

Thank You

Questions?

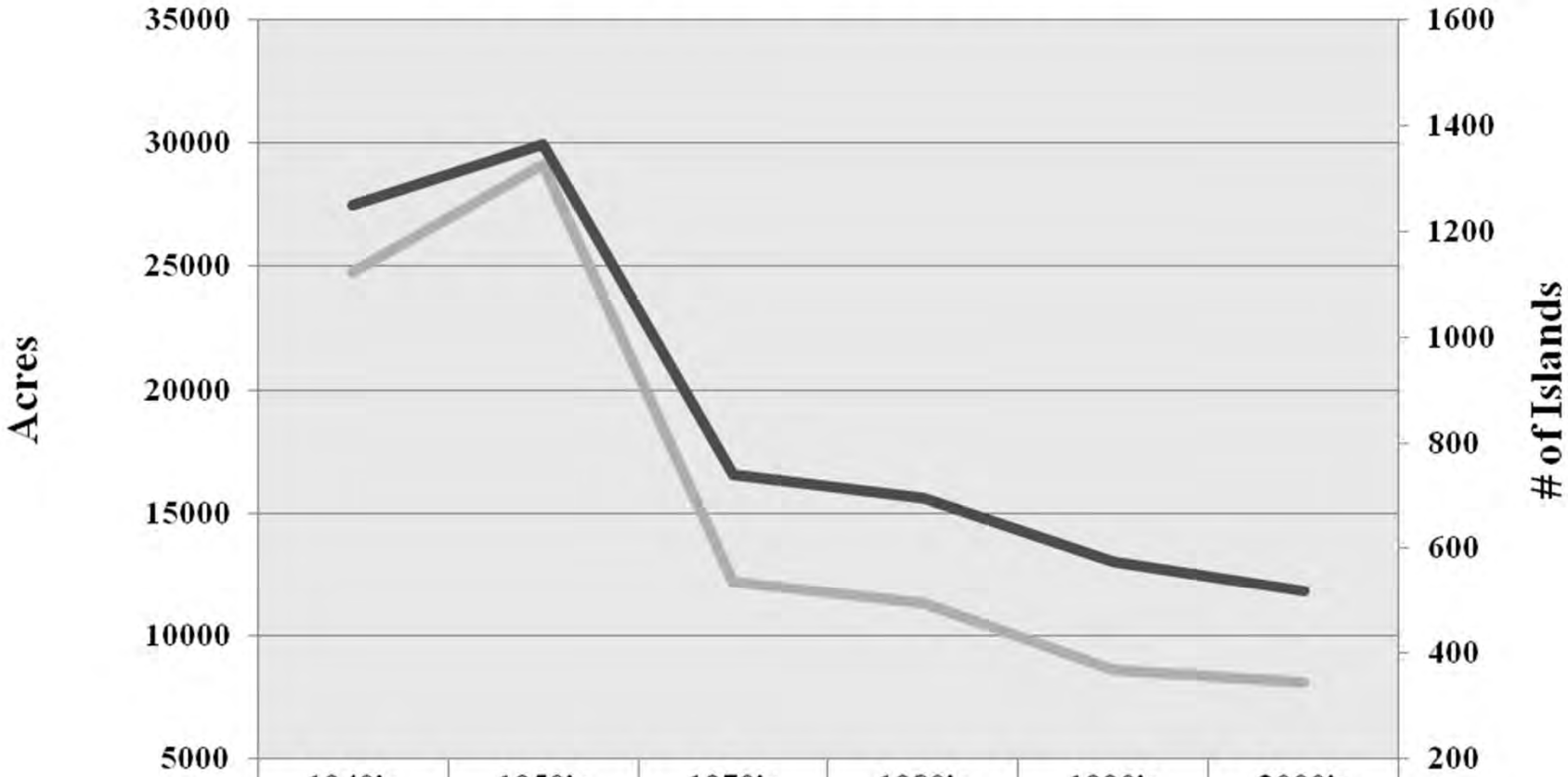
The *HEART* of the Everglades has Poor Circulation

Photo by Clyde Butcher

Backup WAT Animation

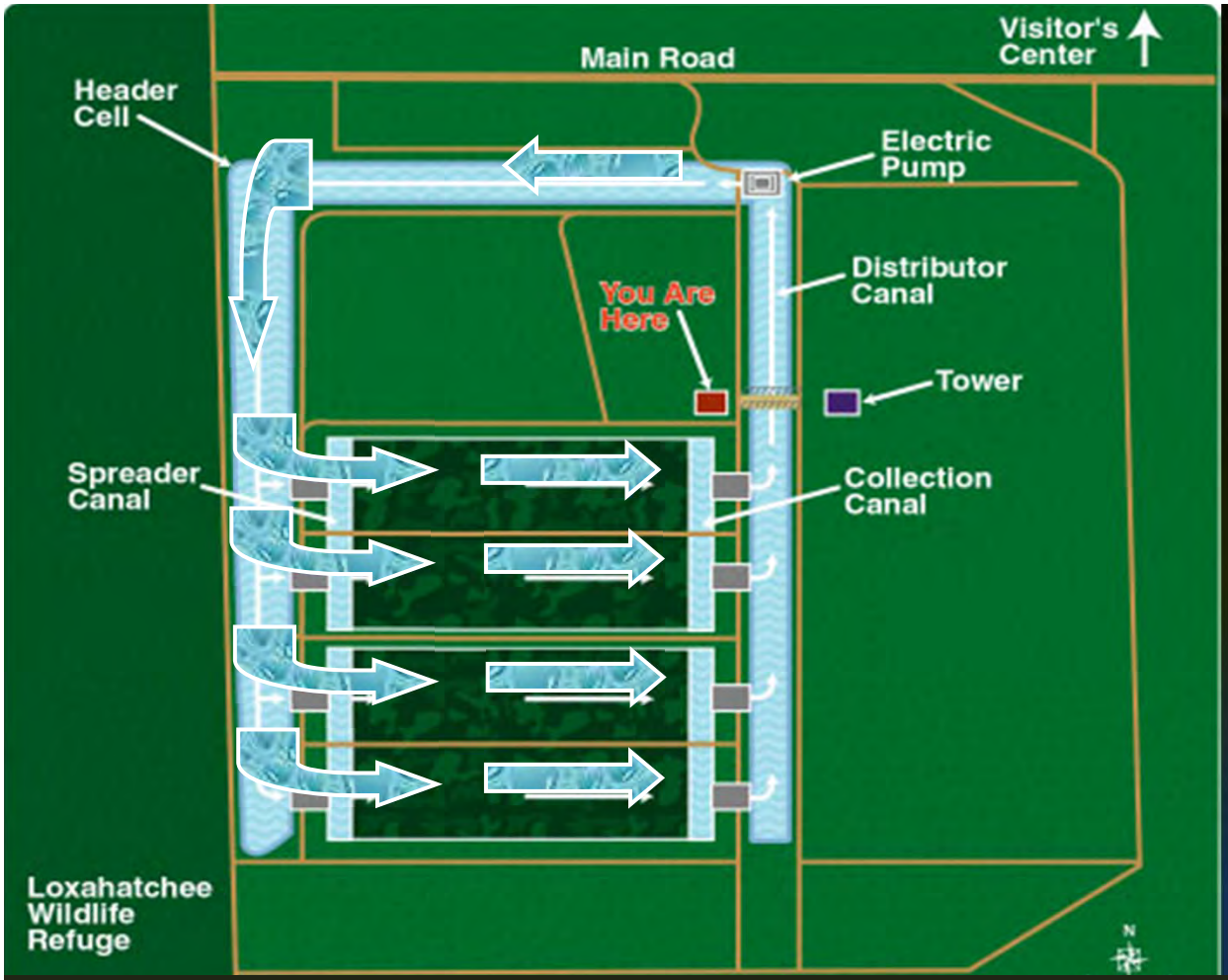
Tree Islands Continue to Disappear

(Ken Rutchey and Les Vilchek, SFWMD)



	1940's	1950's	1970's	1980's	1990's	2000's
Acres	24795	29146	12224	11303	8604	8085
# of Islands	1251	1365	739	695	575	520

An Everglades "Living Laboratory," Constructed in 2003, was Designed to Understand the Role of Hydrology on Wading Birds, Tree Islands, and Ridge & Slough Restoration



Fred Sklar (SFWMD), Dale Gawlik, (FAU) , Arnold van der Valk (Iowa State) and Eric Cline (SFWMD)