

Ecohydrological Background for the Conservation of Pantanal and Everglades National Parks

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Aim

- Illustrate :
- how hydrology “works” in the Pantanal and in the Everglades at the scale of the entire ecosystem
- How hydrological connectivity locally controls habitat diversity, ecosystem productivity /services in both wetlands



Both wet lands are quite similar. However: **Everglades National Park has a *growing* marine component.**

Station	Elevation (m)	Trend (mm/yr)
P35	0.25	2.56
P37	0.27	2.27
KW (Key West)	-	2.36

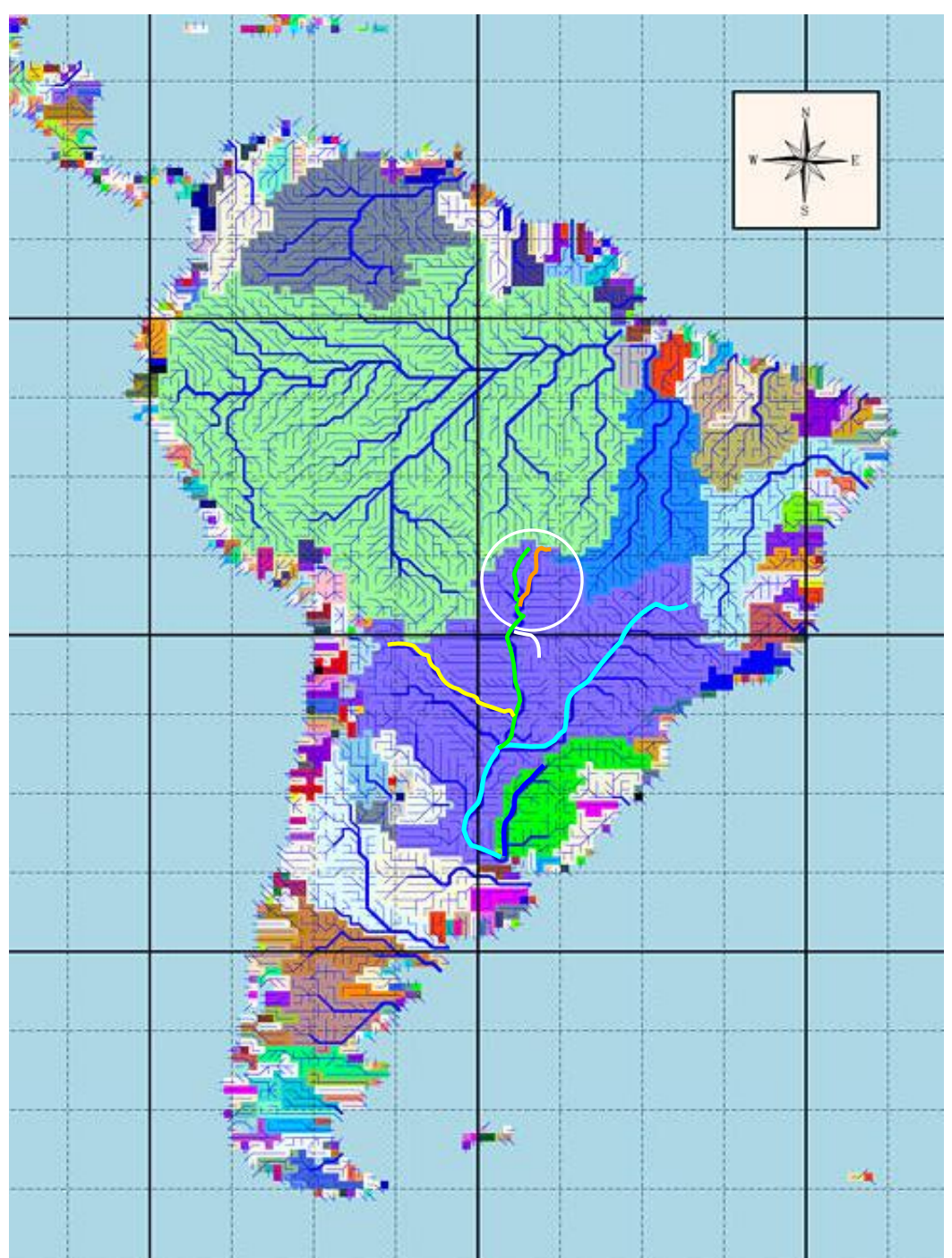


Pantanal

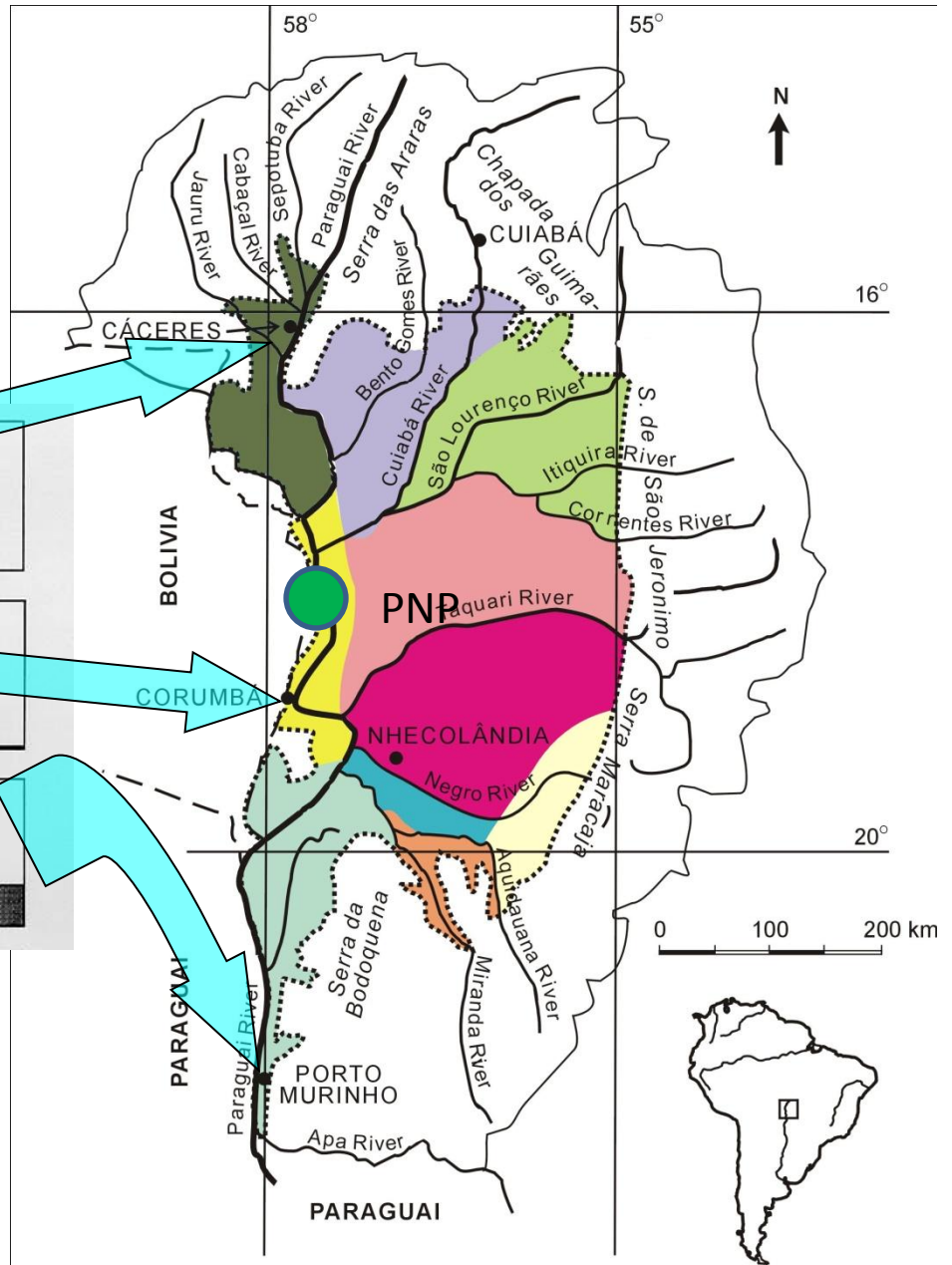
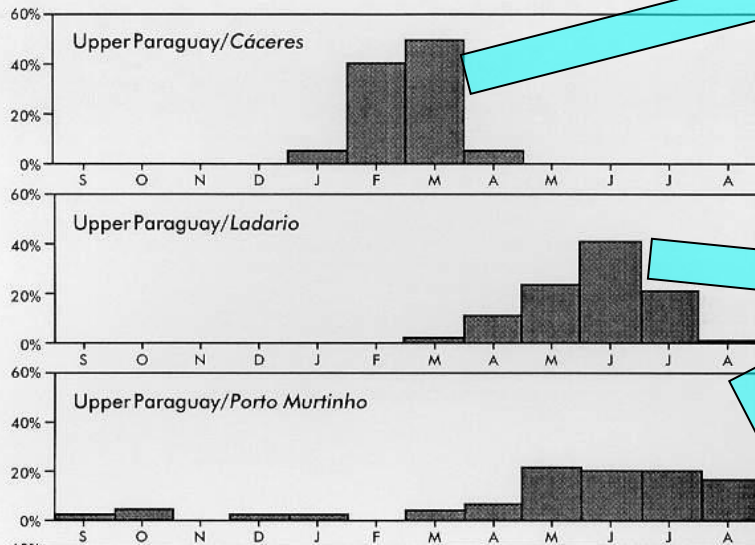
At continental scale

A “head water”
region

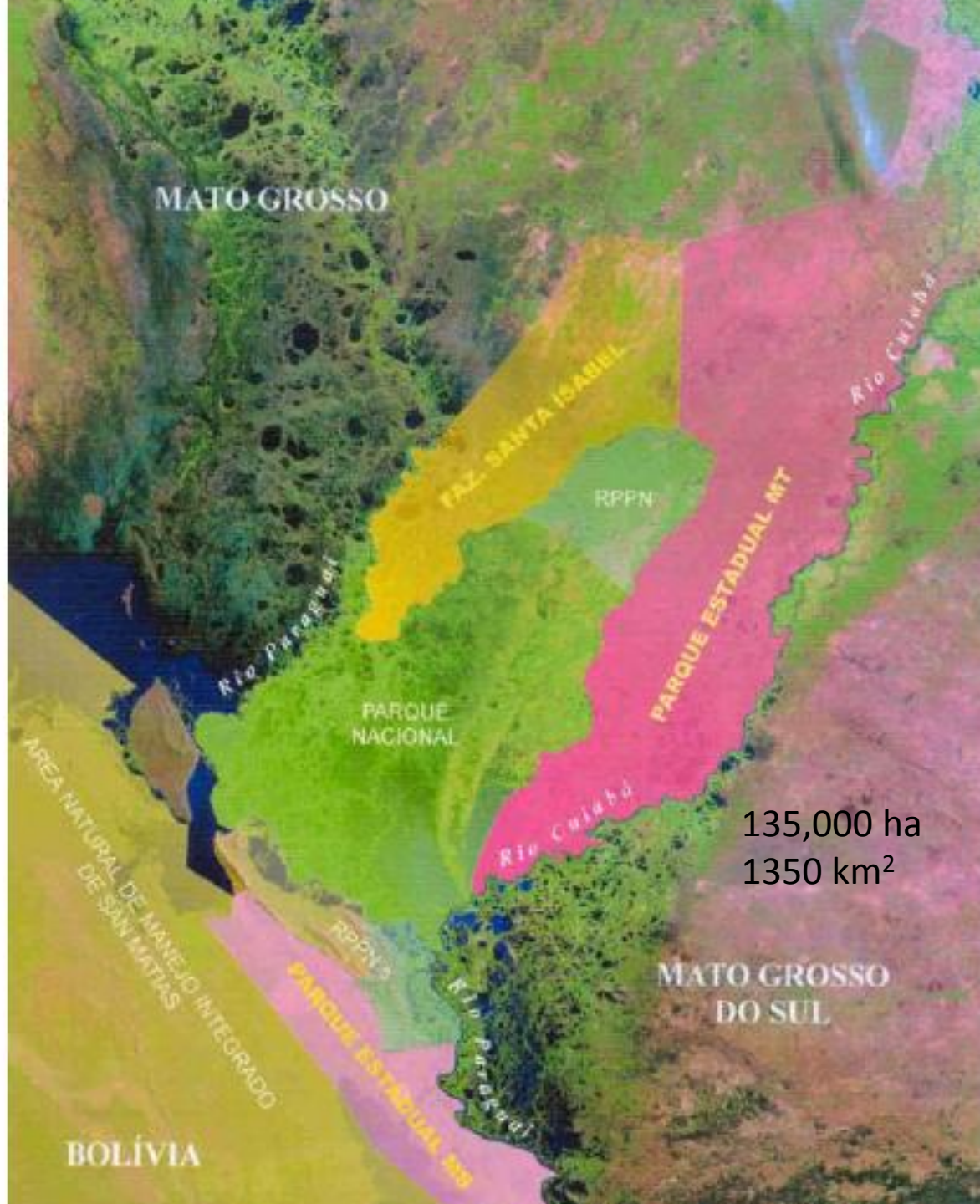
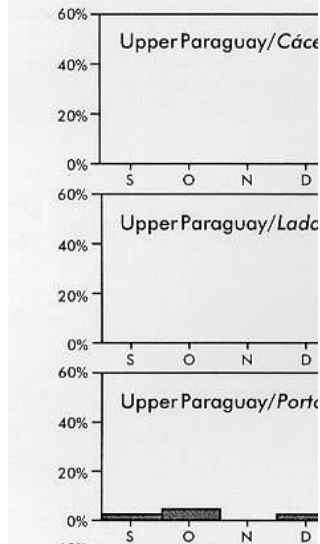
A water and
sediment collector
Flood (water &
sediments) /
climate regulator



A pulsing system

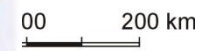


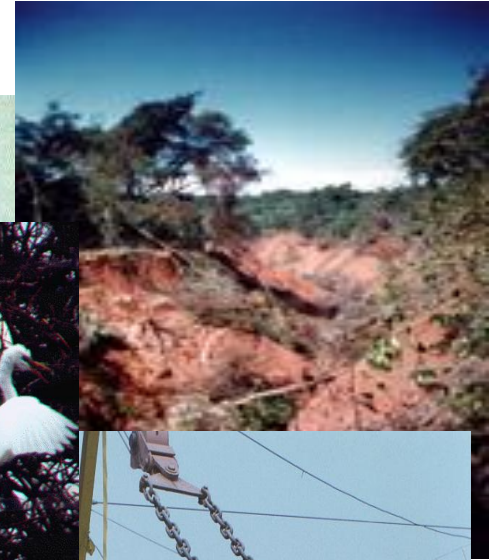
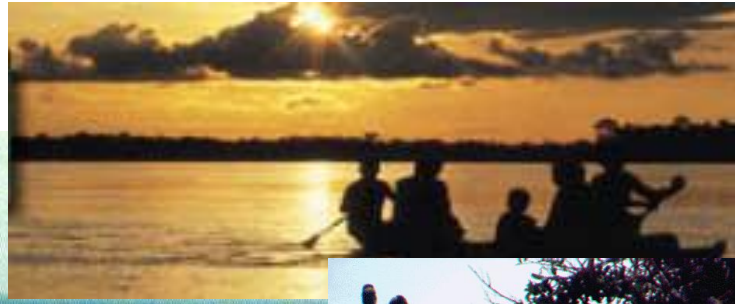
A puls



16°

20°





1700 species
200 Grasses
200 leguminous
240 forages
10 palms

> 665



>160



>246



Ecosystem Productivity



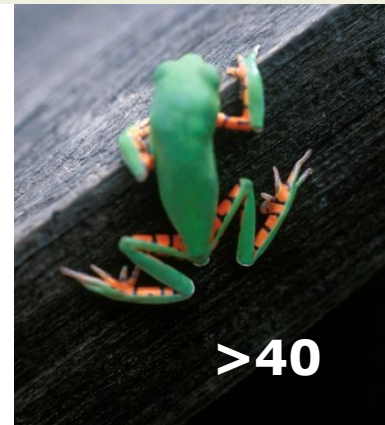
Terrestrial Phase



Aquatic Phase



>40



>1000



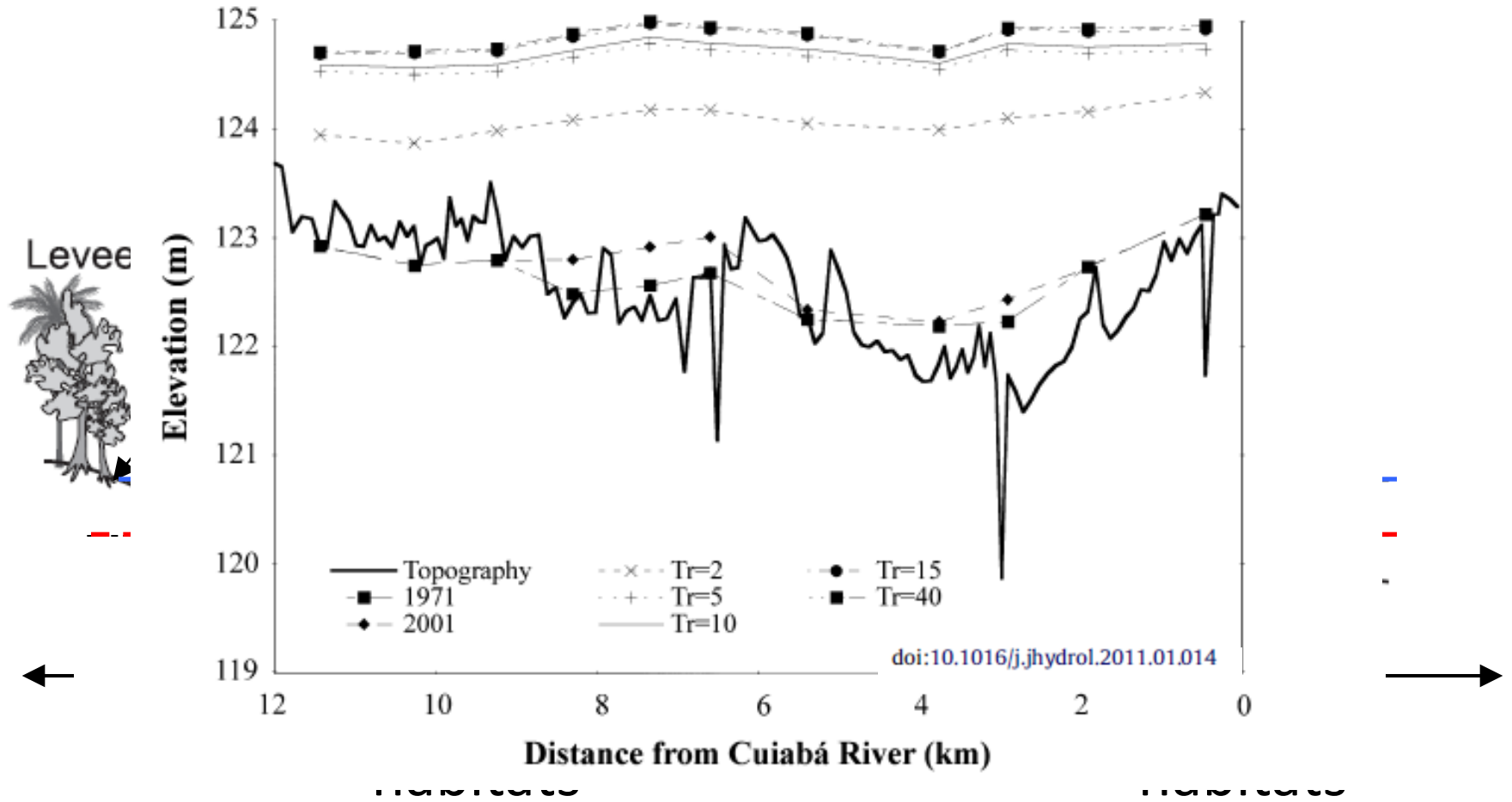
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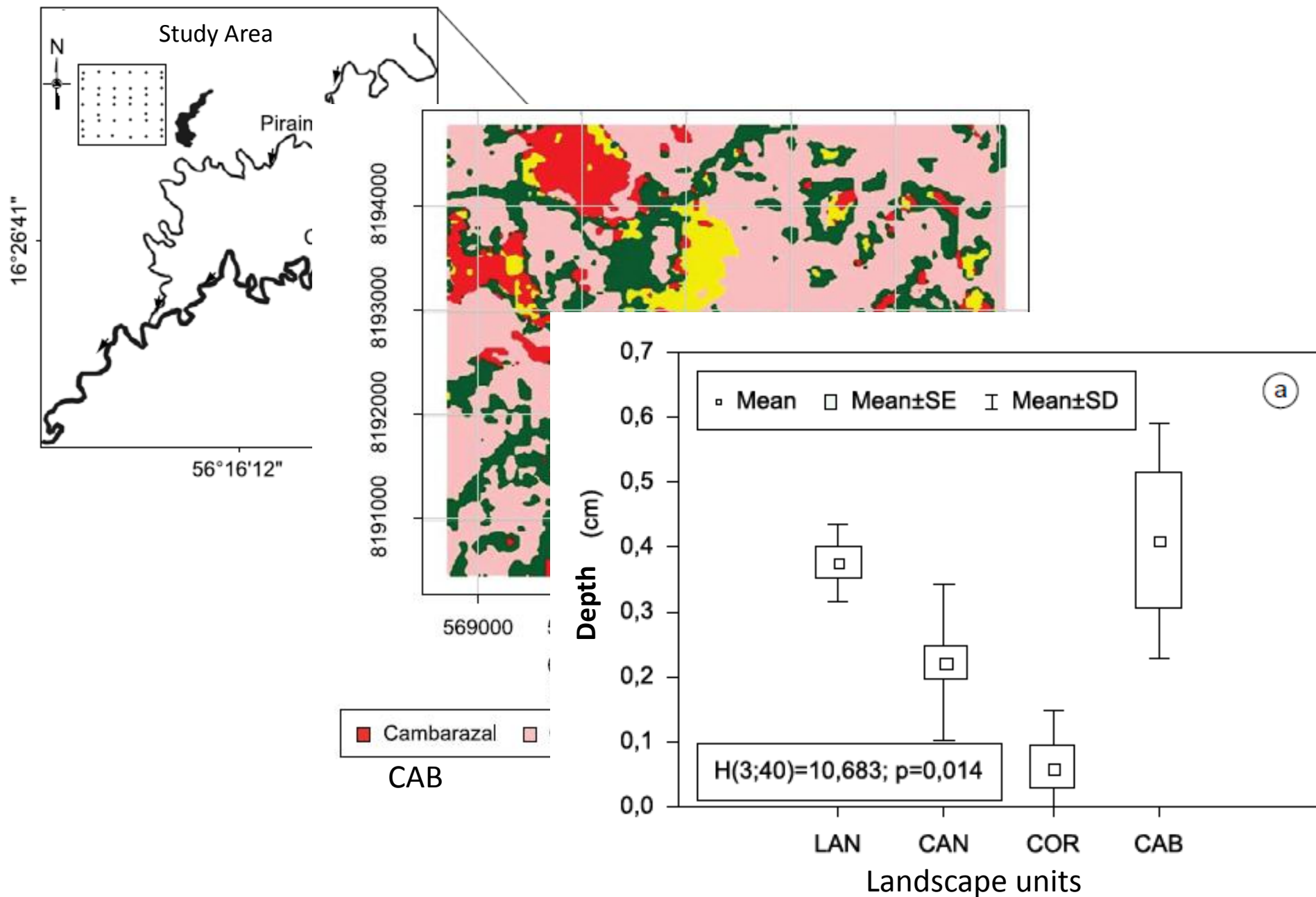


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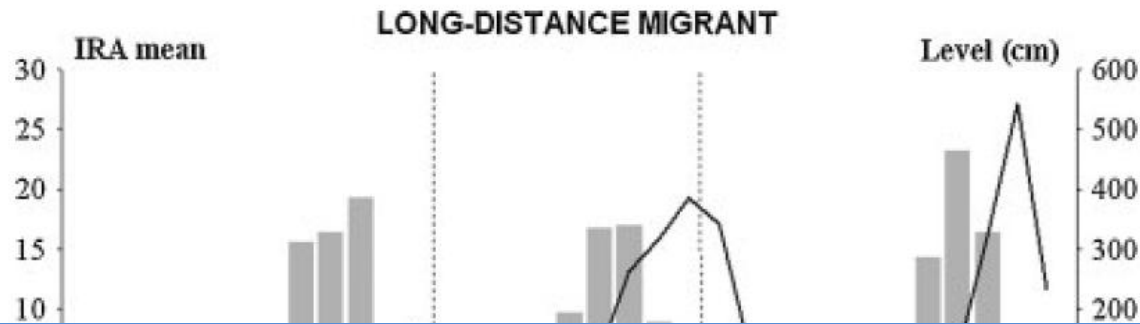


Floodpulse vs plants & animals





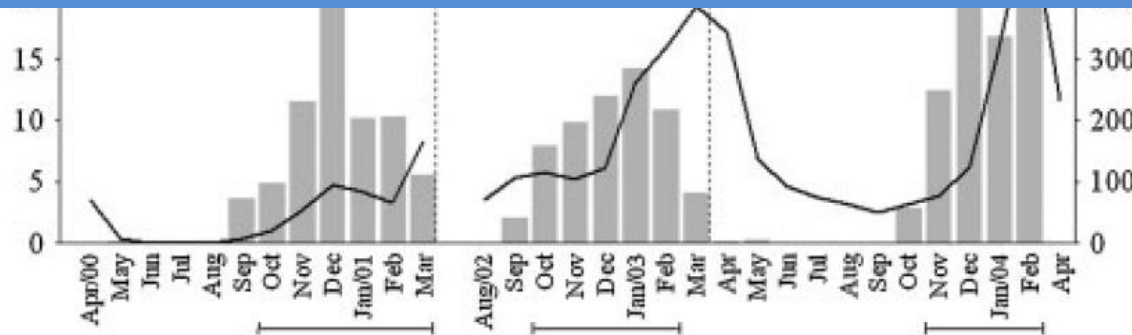
Flood regime vs fish reproduction



Fish – hydrology relationships matters:
Value of recreational fishing

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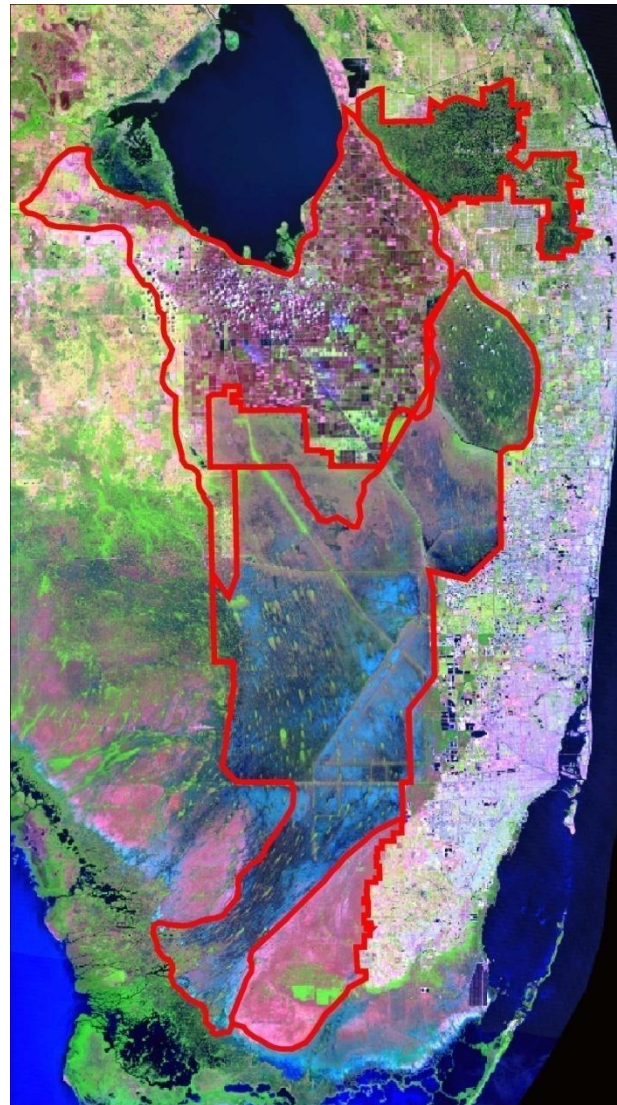
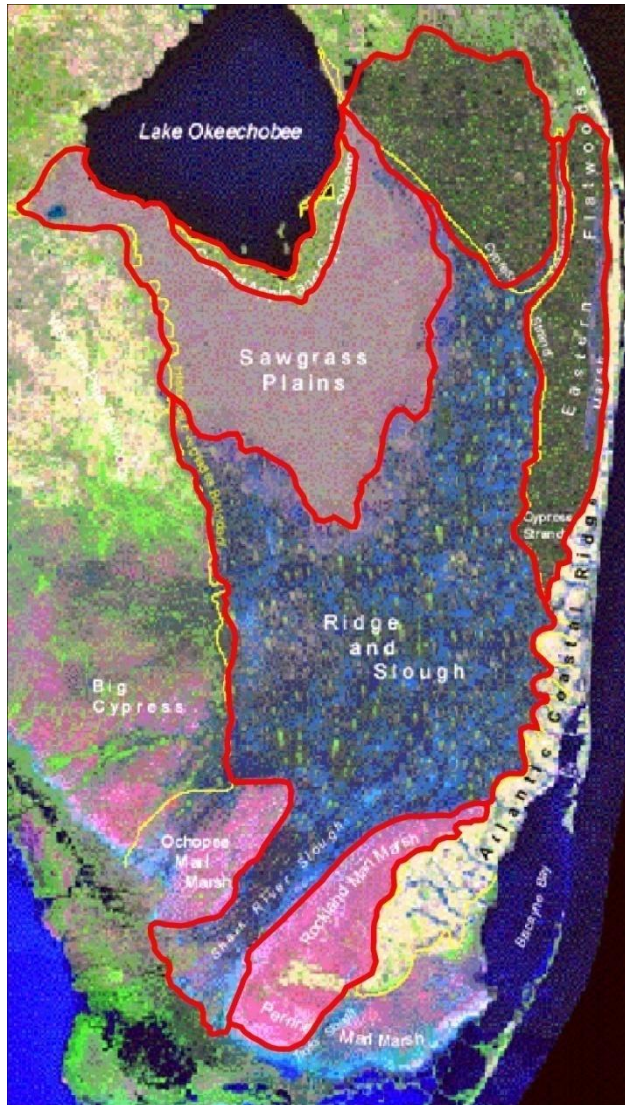
\$54 – 86 millions /year



Everglades



Changes in Everglades habitats



Eastern Flatwoods
70% loss

Swamp Forests
100% loss

Sawgrass Plains
83% loss

Ridge and Sloughs
28% loss

Southern Marl Prairies
23% loss

Pre-Drainage System (1850's)

Current

Heterogenous hydrologic conditions caused by compartmentalization (levees-canals)

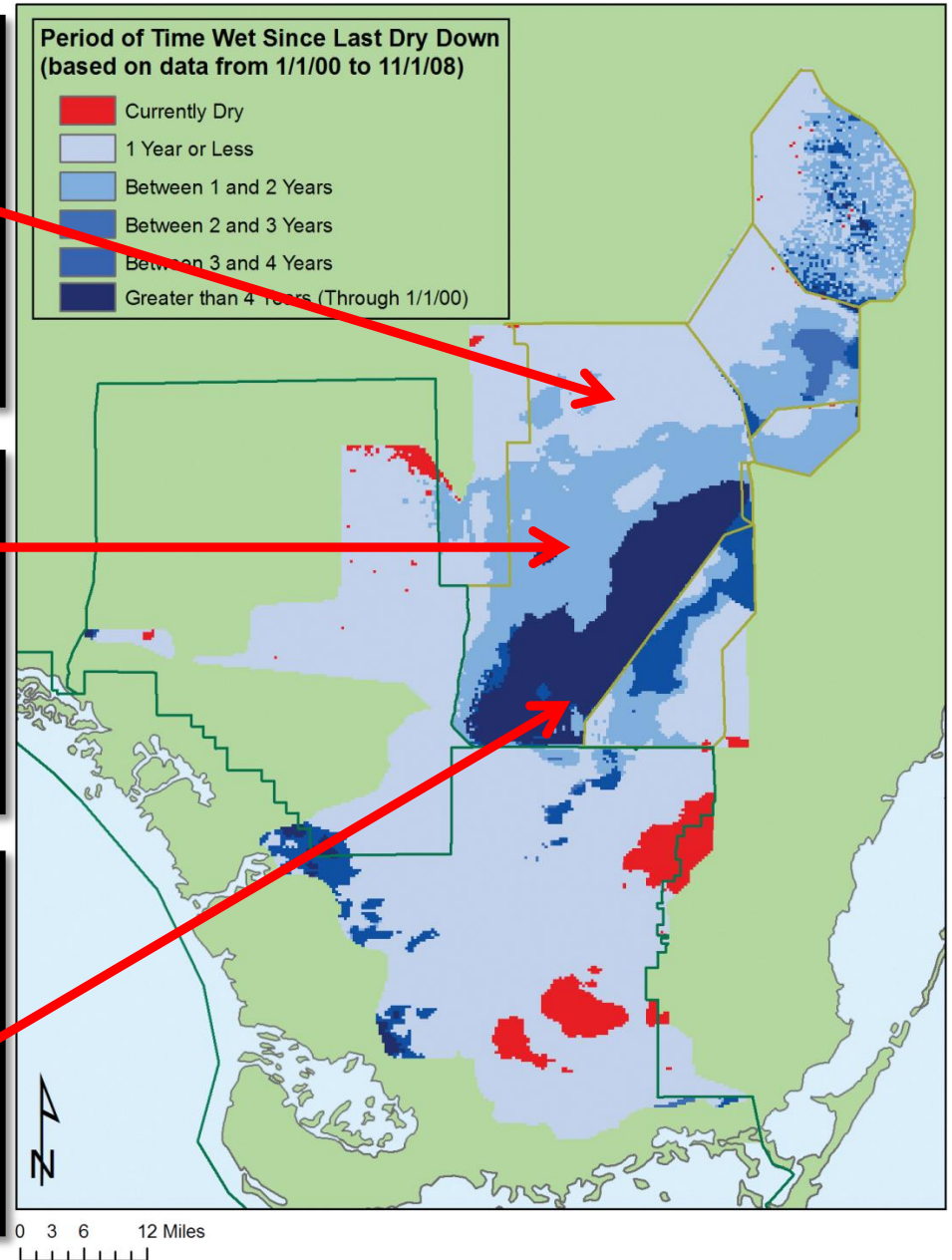
“Drier than normal”



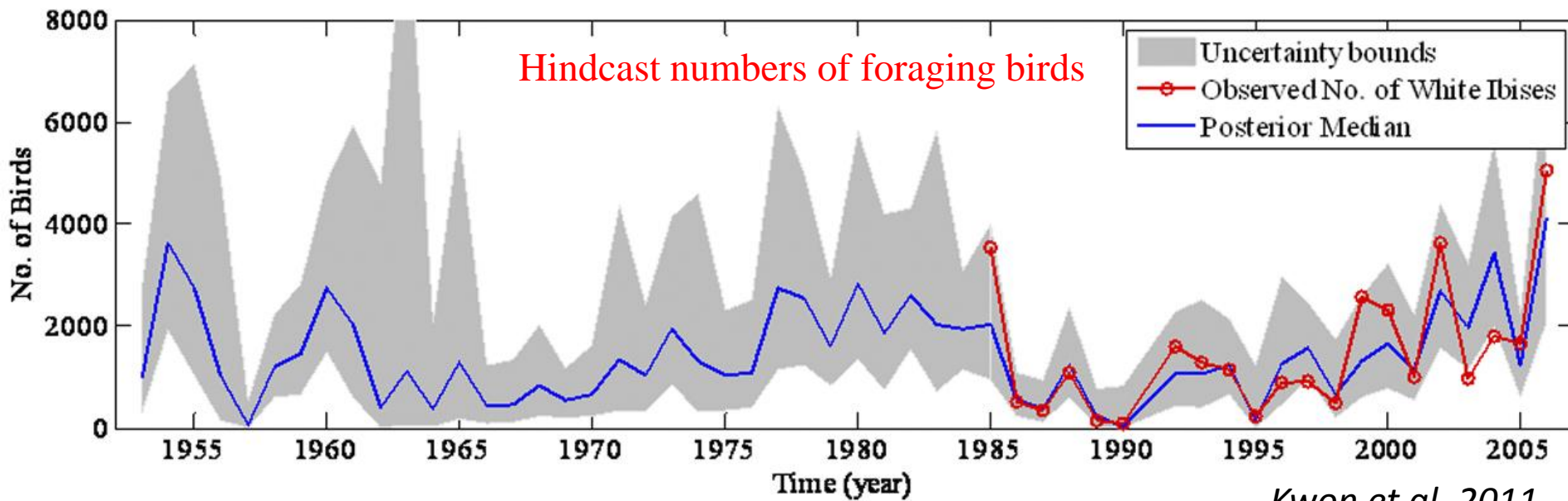
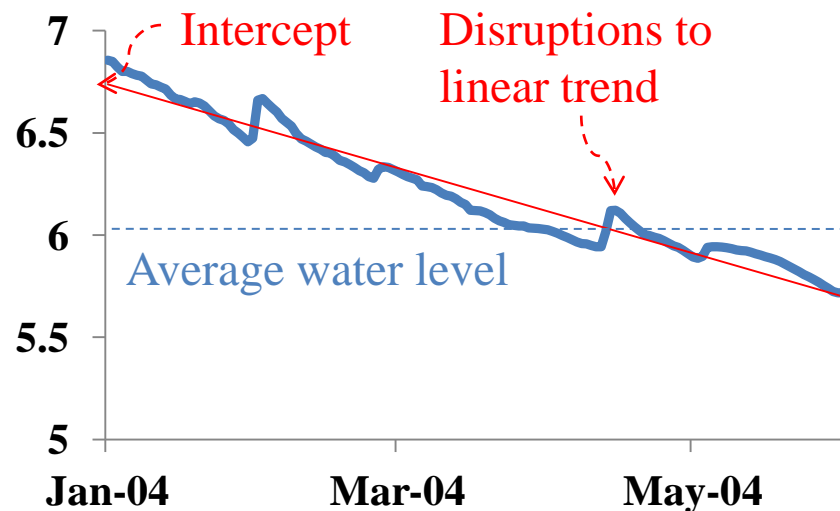
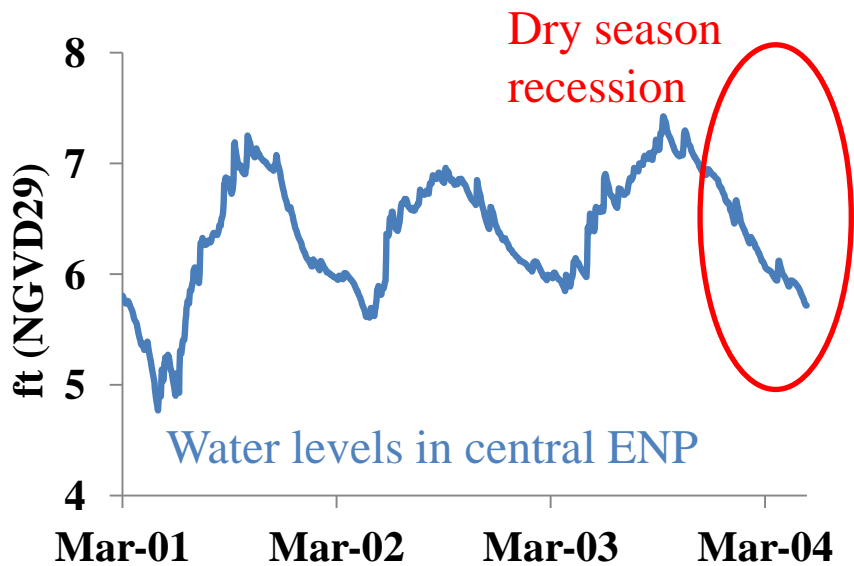
Natural



“Wetter than normal”



Density of foraging birds modeled as function of hydrology



Wildlife- hydrology relationships really matter!

**Value of “non-
consumptive”
wildlife recreation
(e.g. bird watching)
in Florida
Everglades:**

**\$1.43 billion
per year***



Other Changes to the Ecosystem

- Hyper salinity conditions on the coast
- Salt water intrusion into freshwater marshes
- Invasive exotic plants and animals
- Extreme peat-burning fires



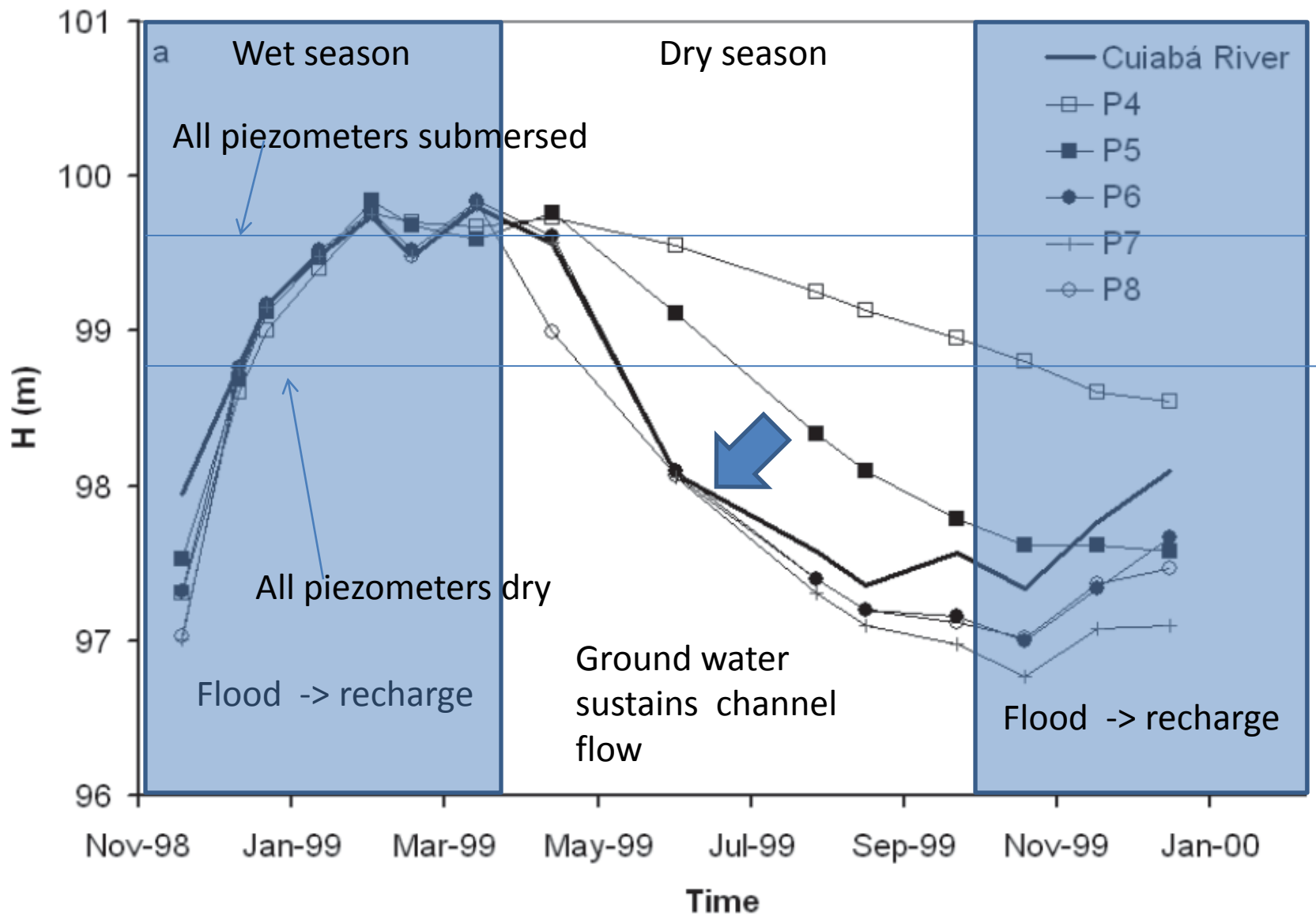
Concluding remarks

- Pantanal, represents a unique source of information on wetland hydro-ecological functioning that may assist in the development of hydrologic targets for Everglades restoration.
- Everglades' habitat responses to human disturbances may provide field-based metrics for assessing the more recent human impacts in the Pantanal
- Methods and research approaches developed in the Everglades for this purpose are likely to contribute to the elaboration of appropriate research strategies that will yield the needed information in the Pantanal.



Thank you!





Modified from Girard et al, 2003. doi:10.1016/S0022-1694(03)00235-X

Why spend money to compare Pantanal and Everglades?

- Both wetlands provide valuable ecological services and parks were established to conserve wildlife and crucial ecological functions for society
- **Human interventions in the Everglades have substantially modified the original landscape.**

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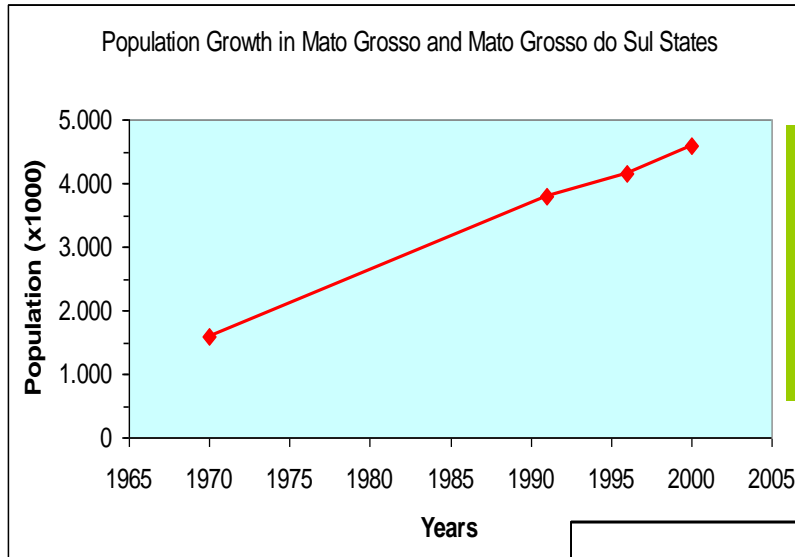
- **The Pantanal is relatively pristine**

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- **Lessons learned in the Everglades maybe useful in the Pantanal -> orient research in an objective way**
- **Pantanal may provide “targets” for the restoration of the Everglades (provided we understand enough about the Pantanal ecohydrology)**



Plateau booming Economy



Agriculture: habitat conversion
Erosion/sedimentation
Fertilizers/biocides

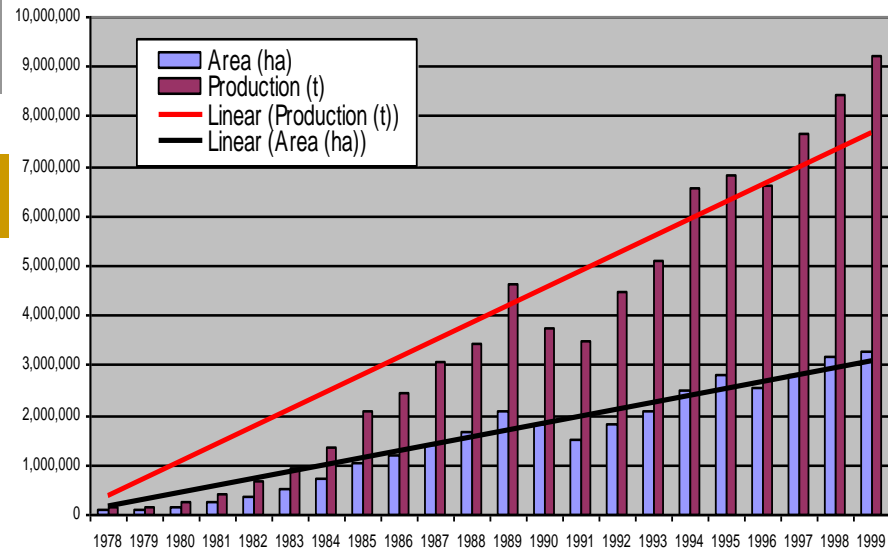
Energy: Large and small dams for hydropower

Transport: Hidrovia, roads; railways

Urbanization: sewage

Industries: food processing, mining

Area and Amount of Agricultural Production (soybean, maize and cotton) in Mato Grosso State, Brazil



Environmental Pressures

GEF-ALTO PARAGUAI - ANA MMA OAS www.oas.org/usde/ALTOPARA/PRESa.HTM

- **Water:** Contamination of superficial and underground water; alteration of the flood pulsing (dams);

- **Fishing:** contamination, over-fishing, change in species composition;

- **Urbanization and Industrialization**

- **Soil degradation:** Estimated in 300 tons/km²/ano at the superior sub-basin; wet-land draining, agroindustry.

- **Wet-lands:** Decline in diversity of species in terrestrial flora; decline in number of animal species

Commercial values of the Pantanal

Aquatic

Fishes

Other aquatic animals

Aquatic crops

Recreation and tourism

Fluvial transport

Hydroelectric energy

Terrestrial

Cattle and other domestic animals

Terrestrial game animals

Terrestrial crops

Recreation and tourism

Timber

Non-commercial values and services of the Pantanal

Water storage

Buffering of water level fluctuations

Water purification

Buffering of local and regional climate (temperature, air humidity)

Maintenance of biodiversity

Scenic beauty

High quality of life for local people

Negative: Water born diseases and pests

Mean values of “natural capital” of different ecosystems: sum of commercial and non-commercial values

(Constanza et al. 1997).

Wetlands and rivers:	US\$ 8.498 ha ⁻¹ yr ⁻¹
Forests	US\$ 969 ha ⁻¹ yr ⁻¹
Grasslands	US\$ 232 ha ⁻¹ yr ⁻¹