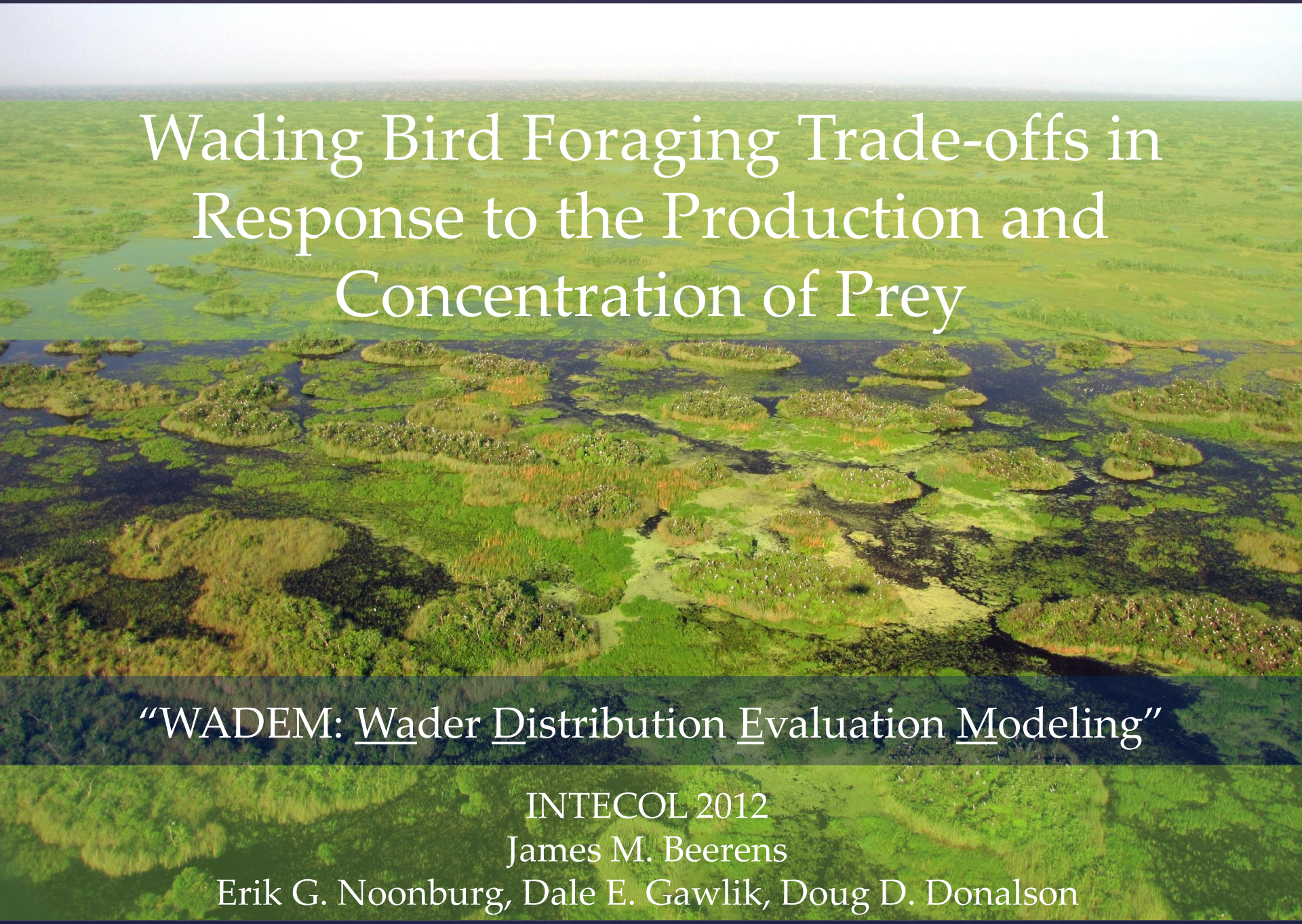


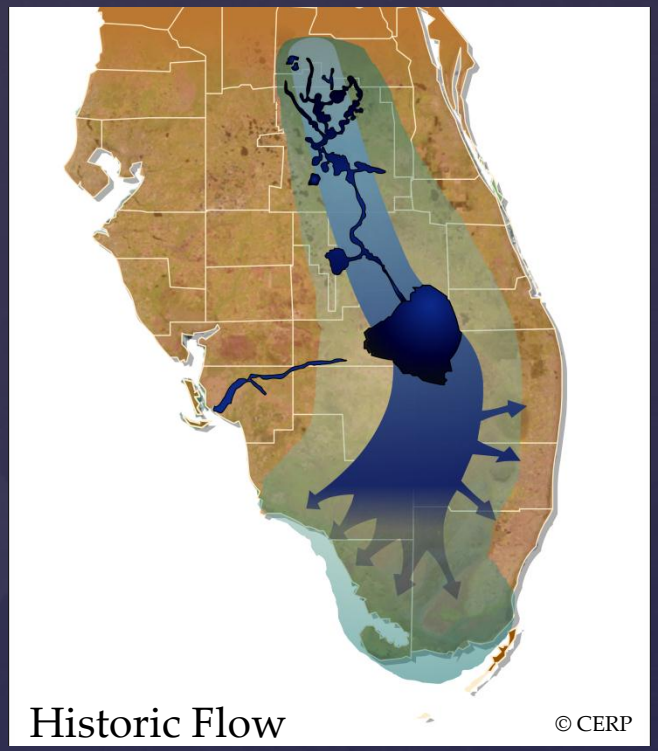
Wading Bird Foraging Trade-offs in Response to the Production and Concentration of Prey

"WADEM: Wader Distribution Evaluation Modeling"

INTECOL 2012
James M. Beerens
Erik G. Noonburg, Dale E. Gawlik, Doug D. Donalson

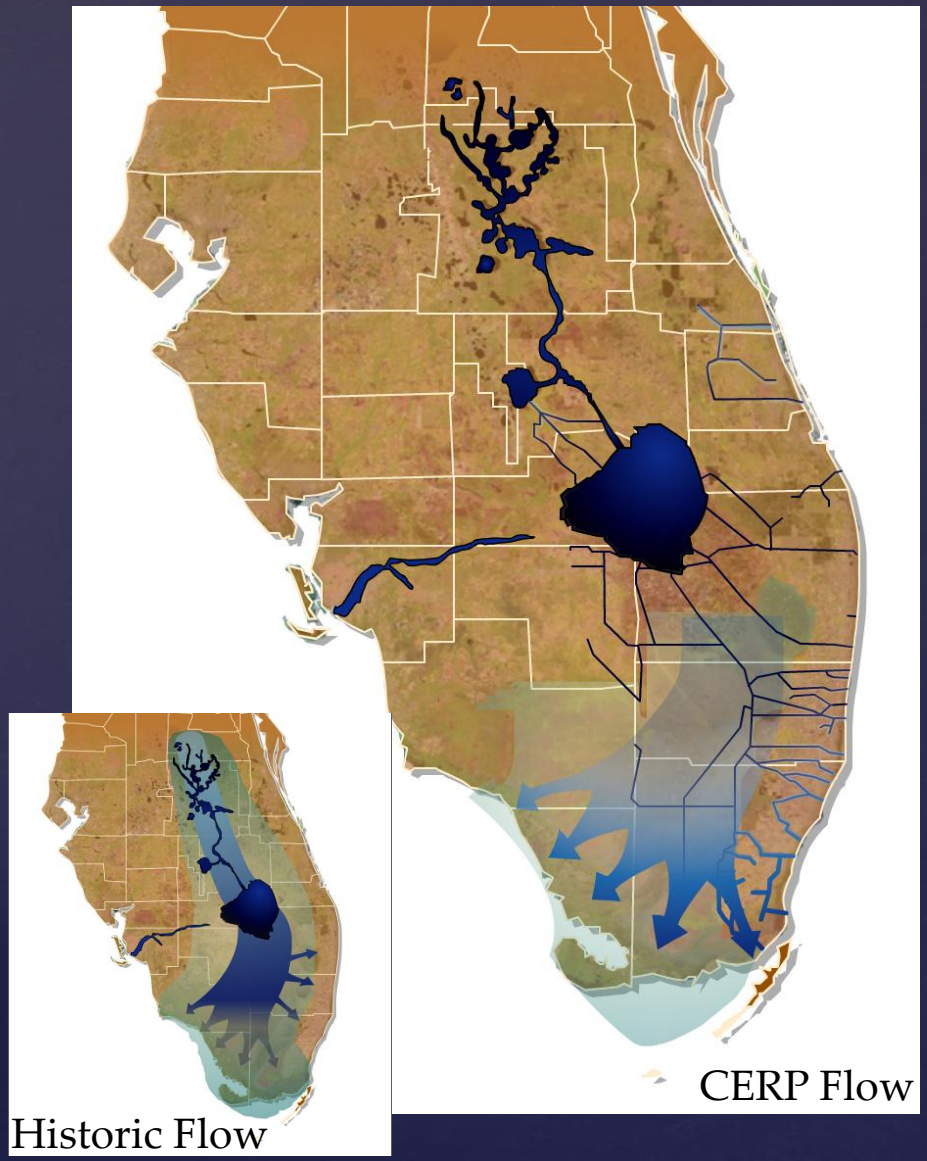
Drainage and Human Interest

- Loss of short hydroperiod wetlands
  - diverse habitats converted to agriculture



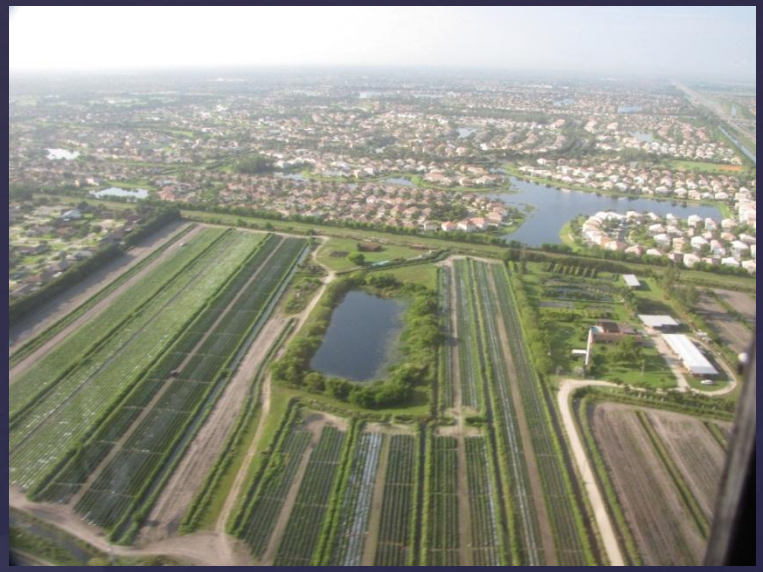
- Loss of sheet flow
  - more drainage
  - ponding
  - reduced flow to Florida Bay
- Nutrient overload (P)
  - changes in vegetative patterns
  - habitat structure

Everglades Restoration Plan (CERP)

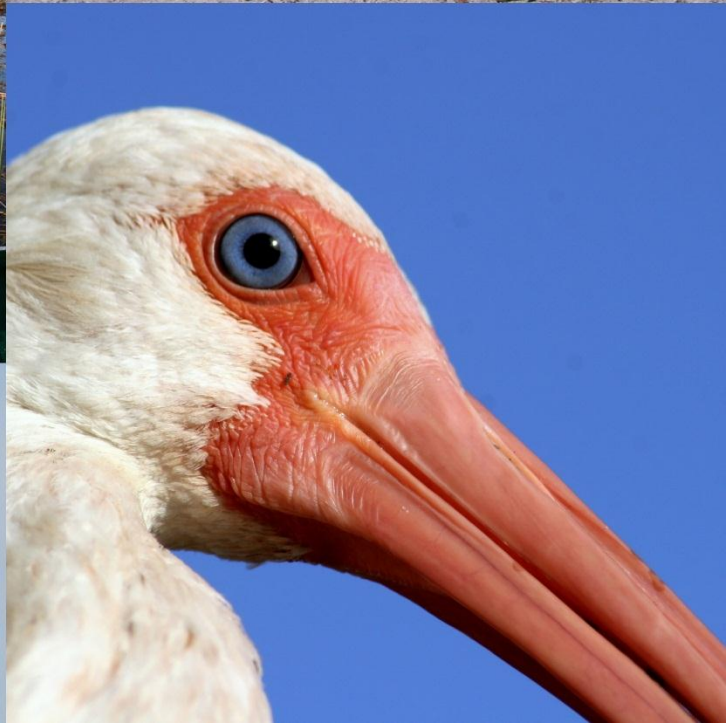


- World's largest ecosystem restoration effort
- More than 60 major components
- Removes barriers to sheet flow
- Improved water deliveries to the Everglades and Florida Bay

But…there is a new normal



- The ecological effects of ‘restored hydrology’ are unknown
- Limited funding
- Shifting priorities
- How can we evaluate the payoffs from restoration projects?



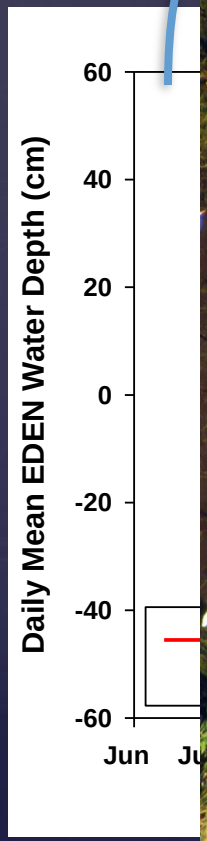
Wading bird responses are documented

- First & most visible sign of degradation
- Decline in nesting populations
- Relocation of nesting colonies
- Differing population trends among species
- Delayed Wood Stork nest initiation
- Increased interval between large breeding aggregations of White Ibis
- ALL LINKED TO FORAGING DEPENDENT ON HYDROLOGY

Hydrologic cycles, topography, and prey

Prod

hs



Prey Production + Concentration (in shallow depths) = Birds

Components of prey availability (Gawlik 2002)

- Occur over different spatial and temporal scales

Prey density		Prey vulnerability
Longer	Temporal Scale	Shorter
Homogenous, Large	Spatial Scale	Heterogeneous, Local
Days since drydown, hydroperiod	Variables	Water depth, recession, reversal

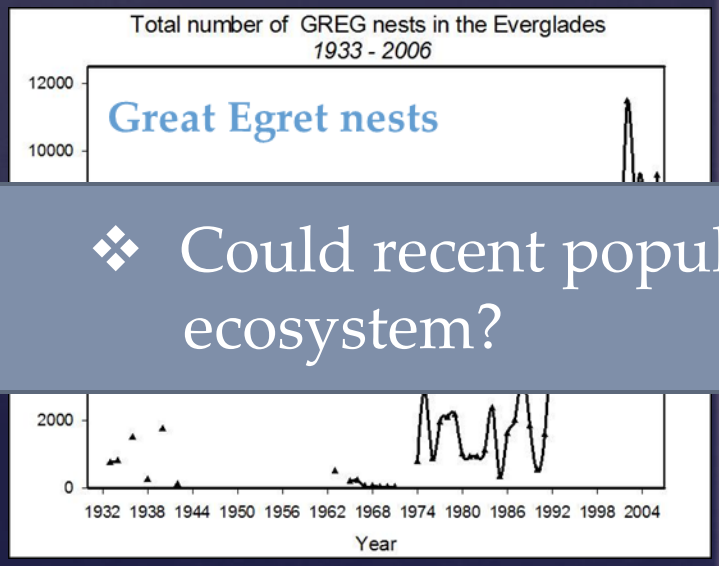
- Species may respond to different components/scales

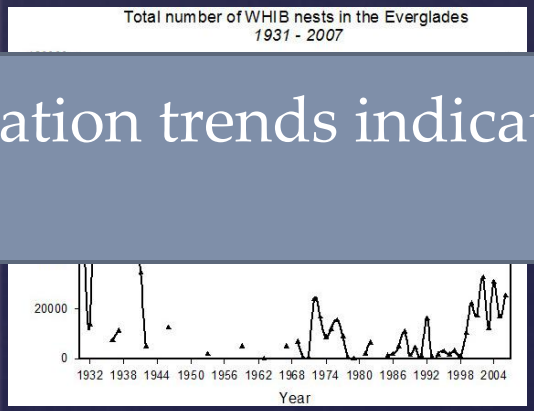
Wading birds & foraging strategies

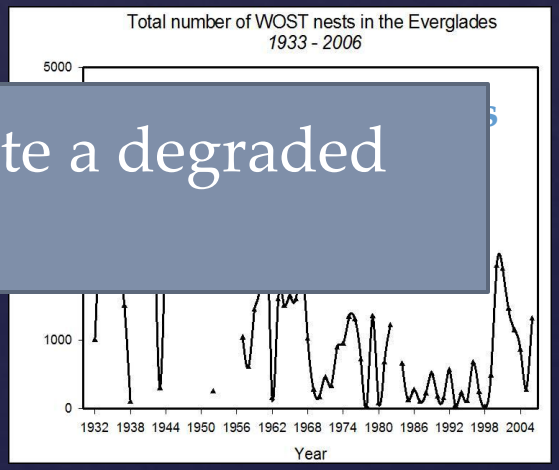
- How have foraging responses interacted with historic water management to shape species-specific population trends?

- "Exploiters"
  - Visual foraging

- "Searchers"
  - Tactile foraging
  - Requires higher prey densities







- Could recent population trends indicate a degraded ecosystem?

Foraging ecology will guide new models

OBJECTIVES:

Represent three different foraging strategies
- Great Egret, White Ibis, Wood Stork daily distributions (SRF)

1) Model the length of reproductive cycle (prebreeding – fledging)

2) Model habitat selection over a representative gradient of hydrological conditions

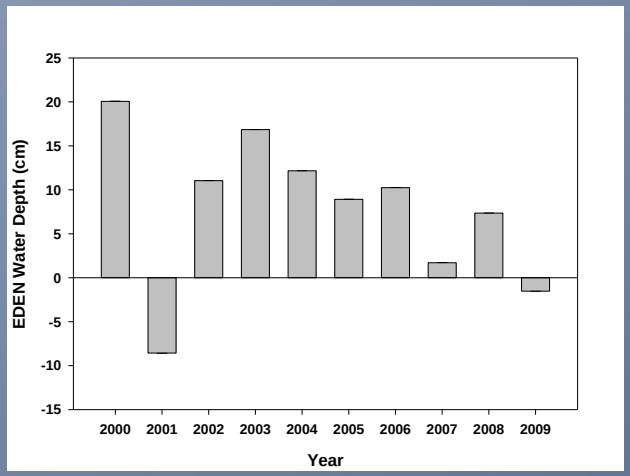
3) Where do trade-offs occur?
   - response to hydrological predictors at differing temporal scales
   - prey production vs. prey concentration
   - are trade-offs different among species?

4) Missing non-hydrological predictors?
   - time, space, landscape configuration

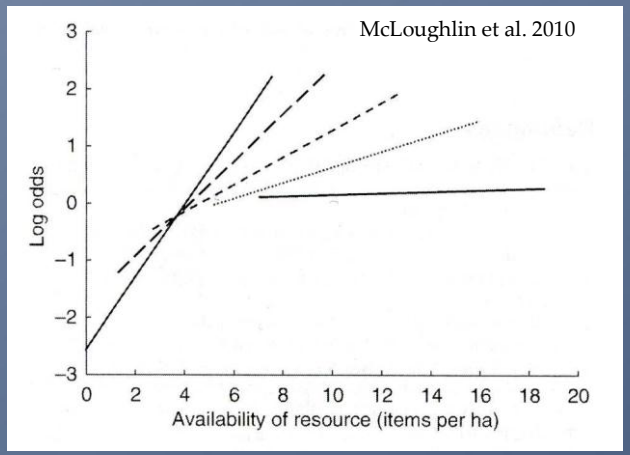
Modeling flexible habitat selection

Temporal Foraging Conditions Model

- Incorporate a representative gradient of hydrological conditions (2000-2009)

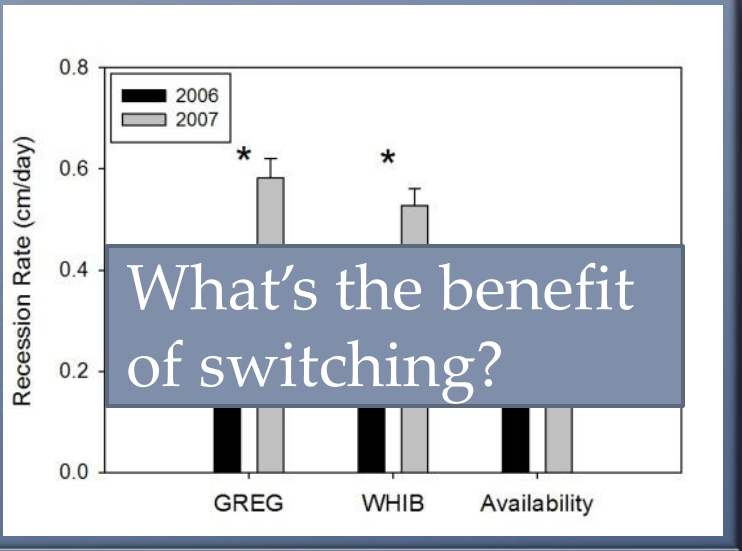


- Habitat selection response depends on availability of resources



- "Resources" are prey density (DSD use), concentration (recession use), and availability (depth use)

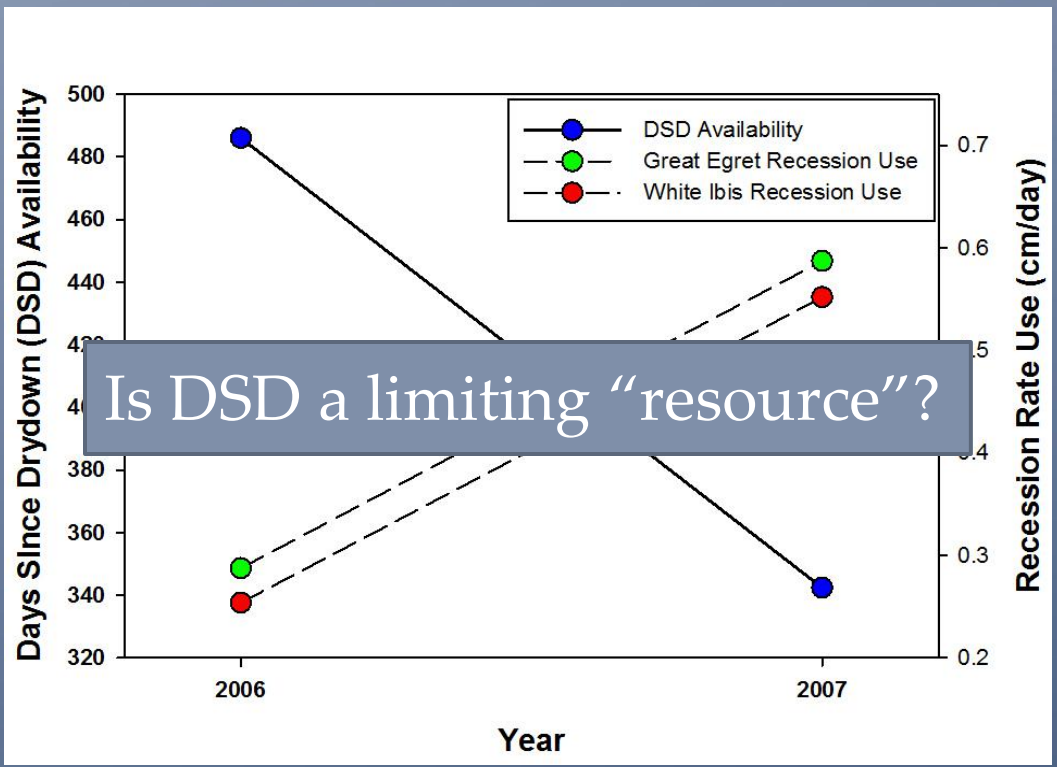
Foraging in context (Beerens et al. 2011)



What's the benefit of switching?

- ~ 200 radio-tagged Great Egrets & White Ibis

2006	2007
High DSD, Low Recession Use	Low DSD, High Recession Use

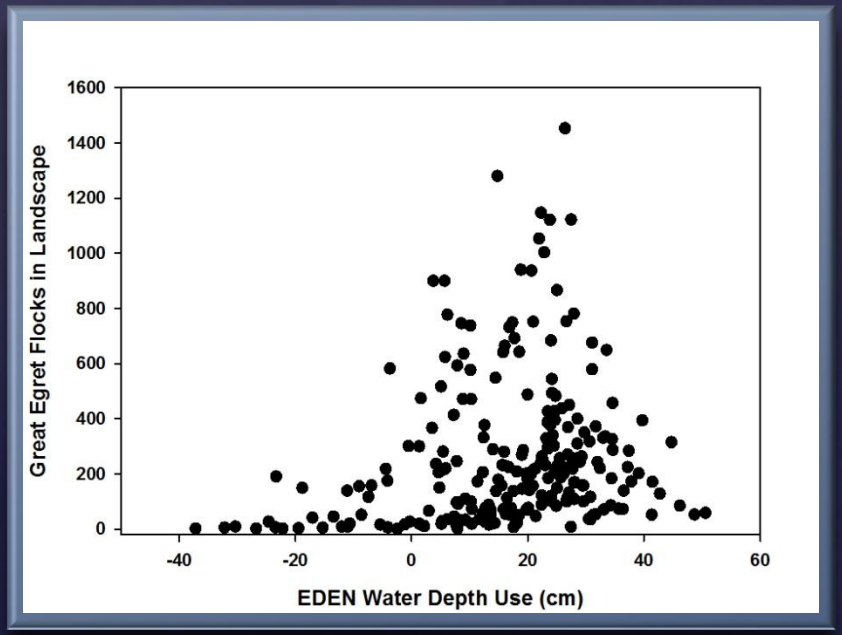


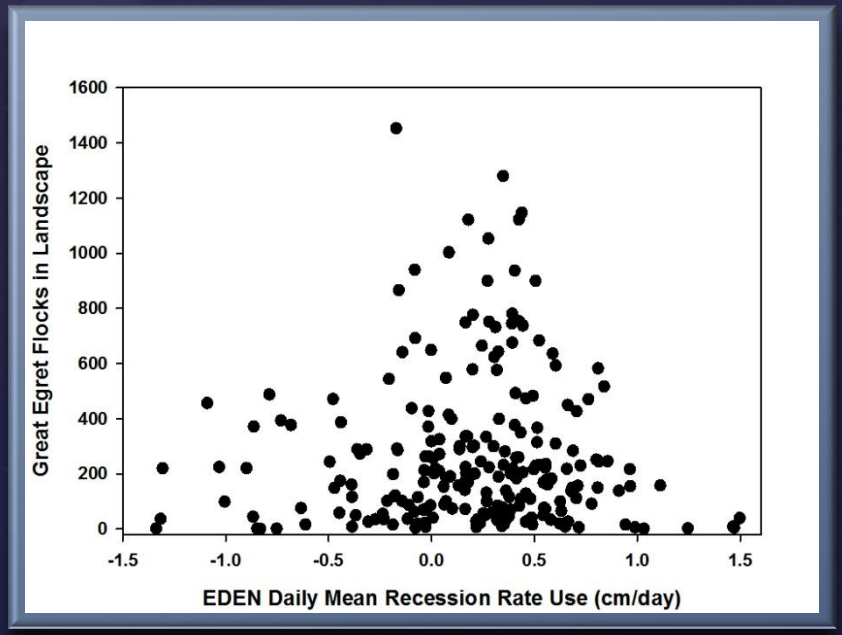
Is DSD a limiting "resource"?

- "Recession selectivity model"
  - In 2006 (good yr), no selection
  - In 2007 (poor yr), <u>selected recession</u>

Model: Temporal Foraging Conditions

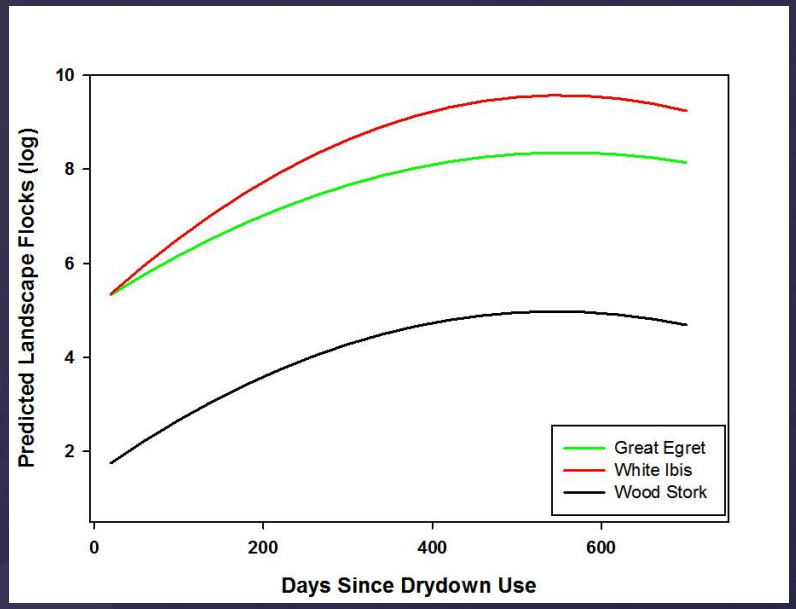
- Predicts how daily system-wide hydrology (depth, recession, and DSD) affects daily habitat suitability through the mechanism of habitat selection
- Evaluates resource use to predict the daily abundance of flocks in the Everglades system

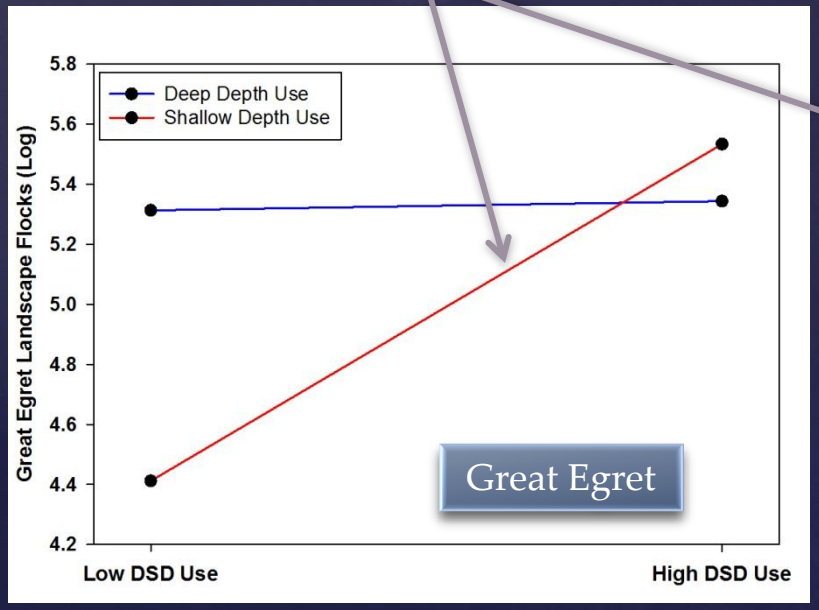


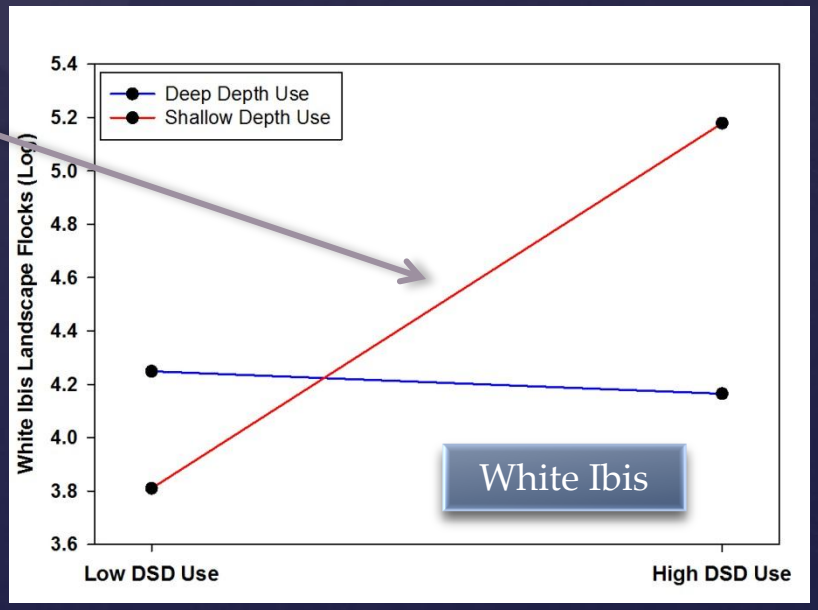


Results: Temporal Foraging Conditions

- Abundance increases with increasing DSD use for all species
- But only detected when birds are using shallow depths

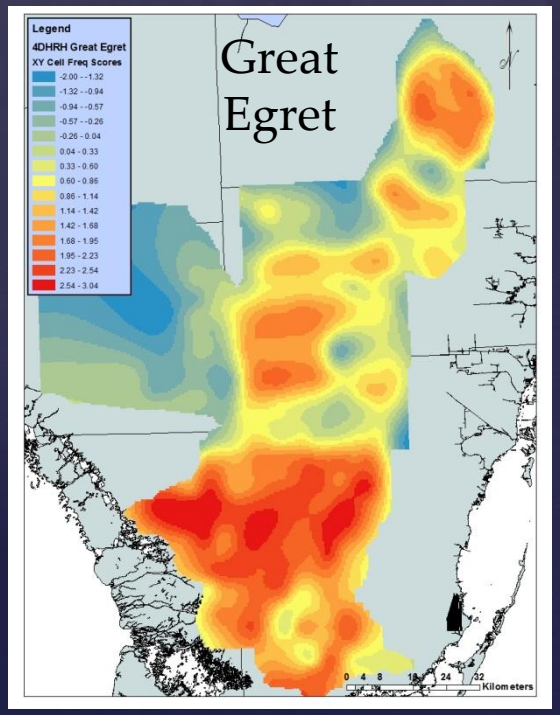


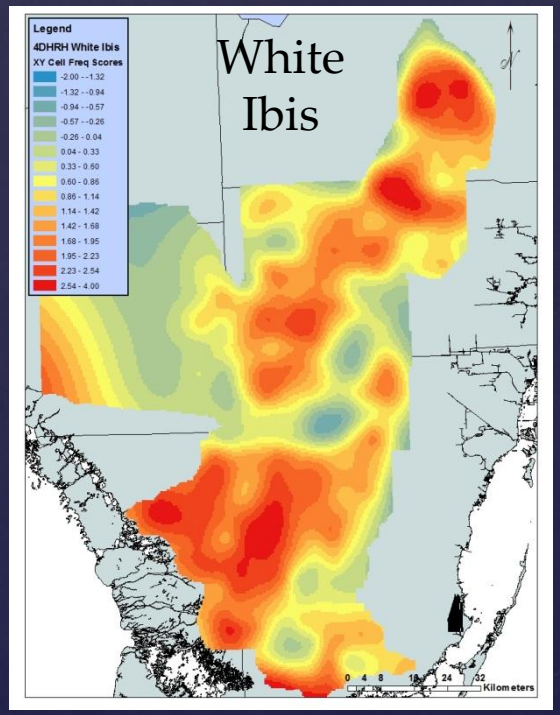


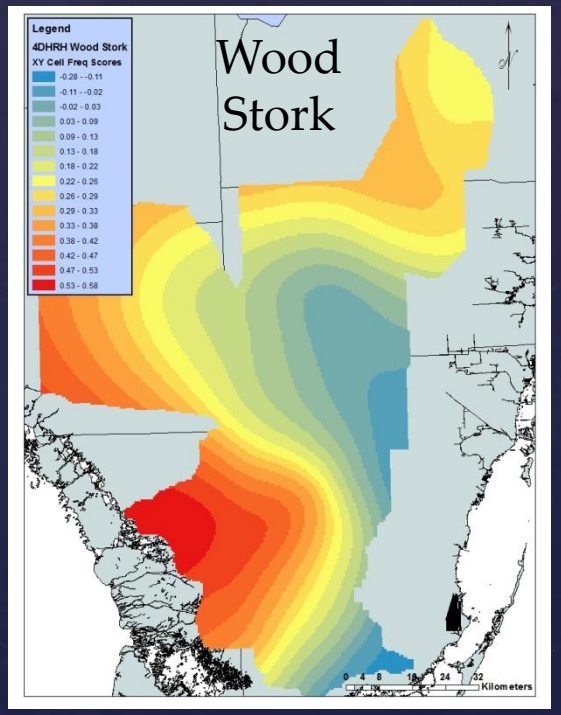


Model: Spatial Foraging Conditions

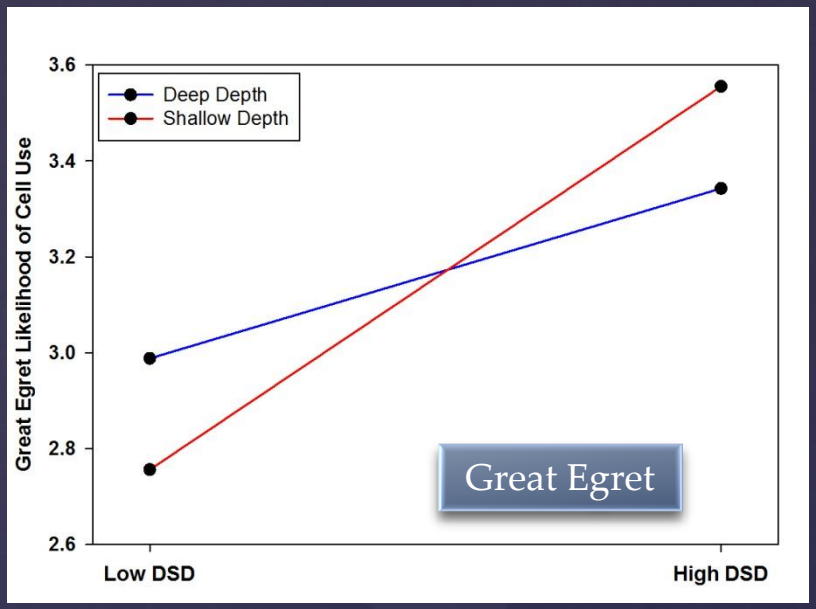
- Predicts the daily likelihood of cell use based on the hydrological characteristics of cells and how often they are used over time
- Provides a surrogate for landscape suitability including unaccounted for spatial variables.

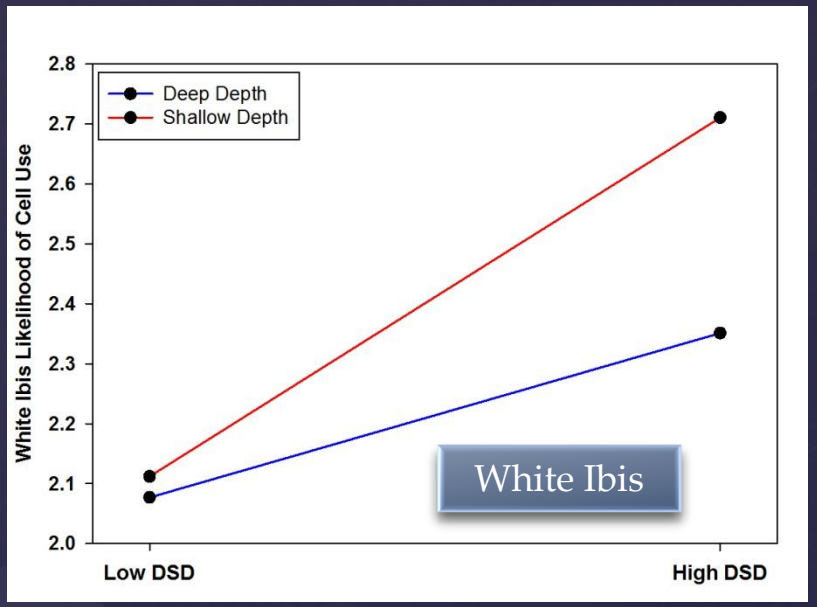




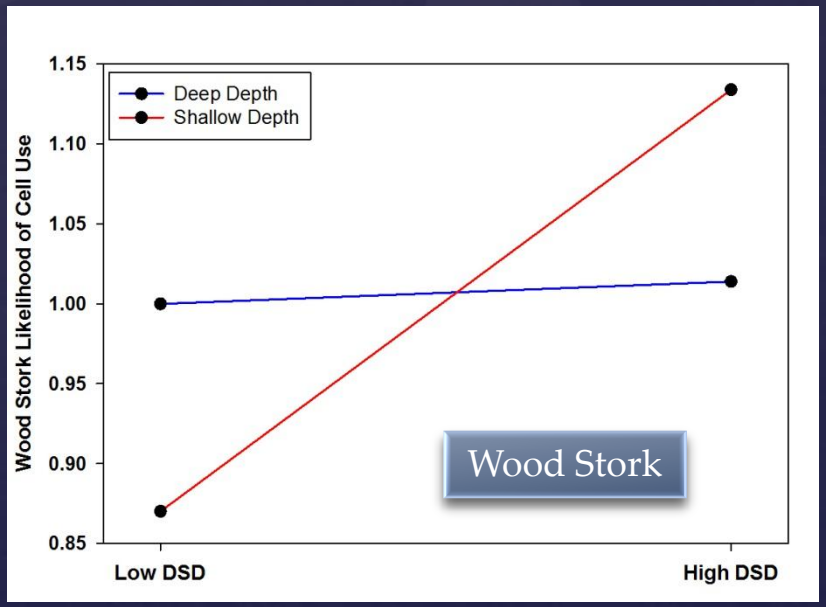


Gradient of responses: Depth & DSD



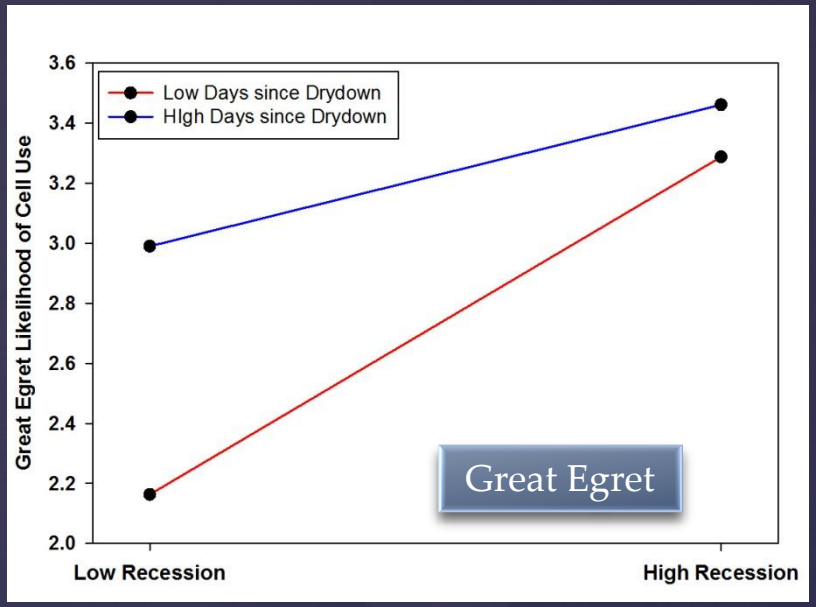


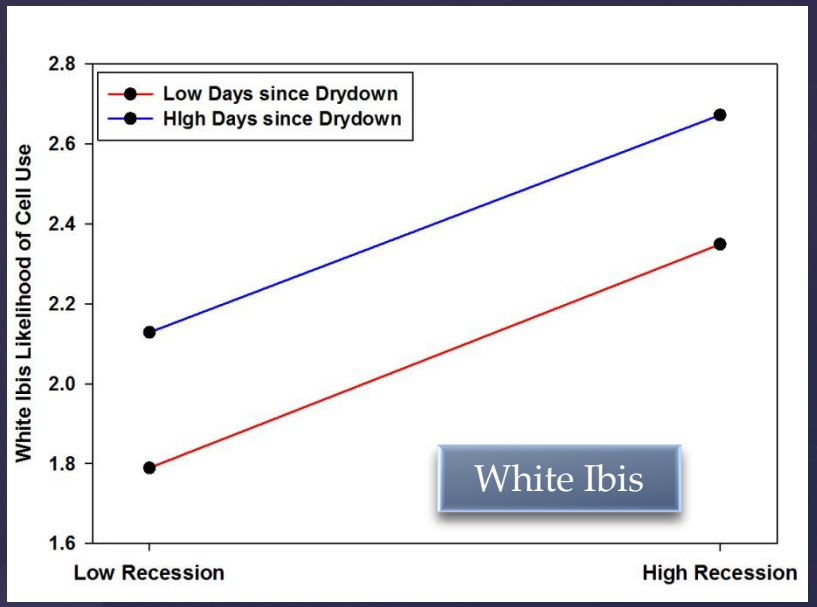
Once again, response is highest when high DSD is concentrated in shallow depths



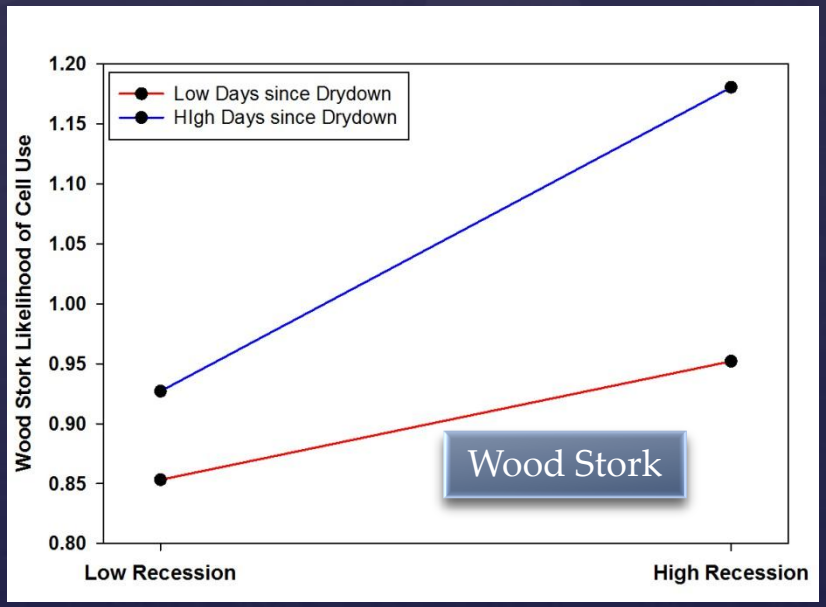
Slight increase with DSD in deeper depths for egrets, ibis, but not storks

Gradient of responses : Recession & DSD





Blue line – <u>increasing</u> benefit of recession when DSD is high

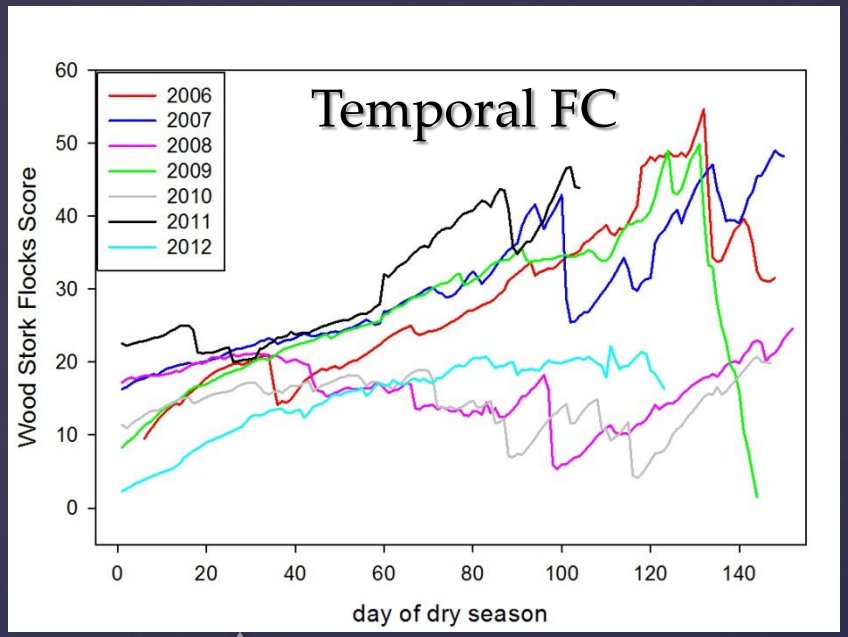


Red line – <u>decreasing</u> benefit of recession when DSD is low

Water capital versus interest

- Period of inundation provides water "capital"
- Annual drydown provides "interest"
- Higher capital is always good, but wading birds have a variable interest rate!
- When capital is low, Great Egrets have the highest interest rate
- When capital is high, Wood Storks have the highest interest rate, however…
- Storks are the biggest loser because low capital = low interest rate
- Landscape responses indicate whether "capital" or "interest" are driving the ecosystem

Real-time management applications



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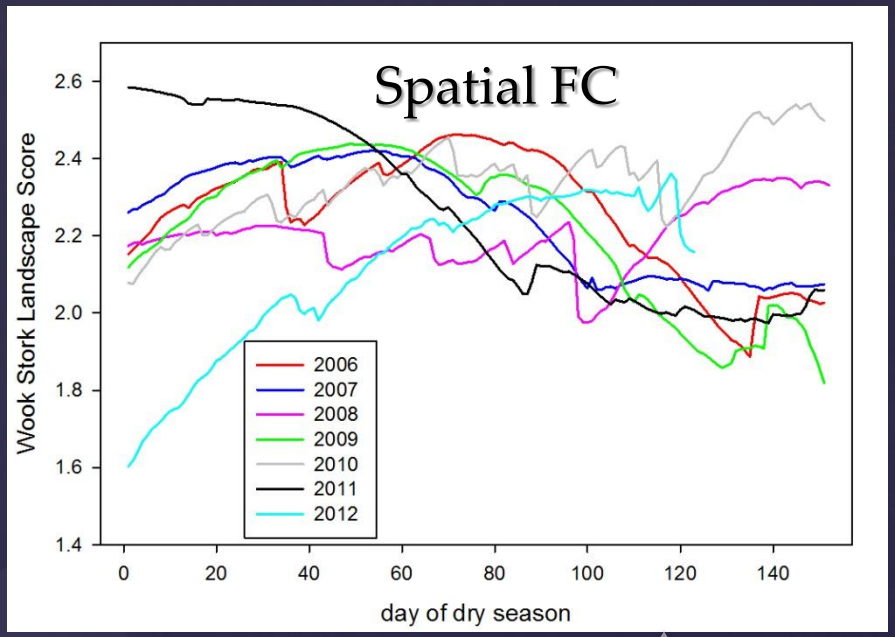
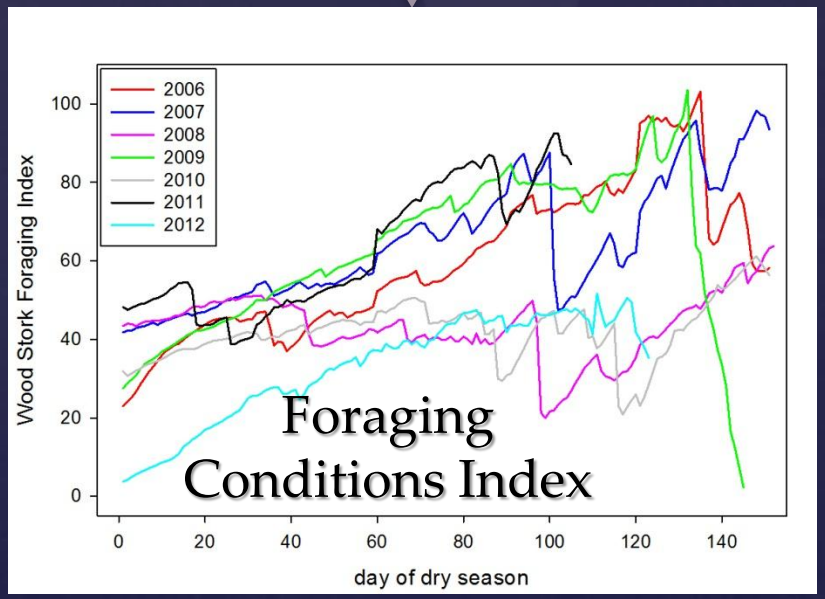
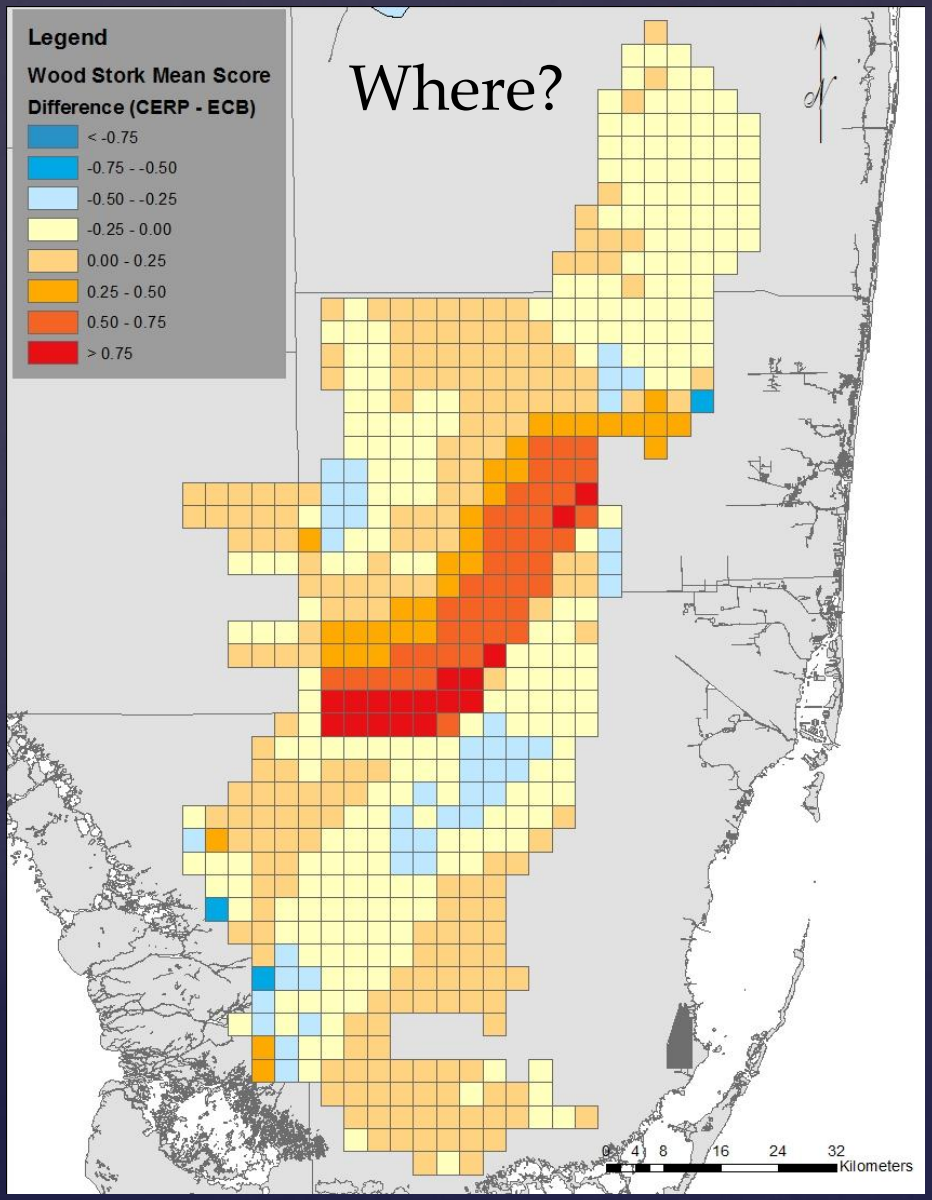


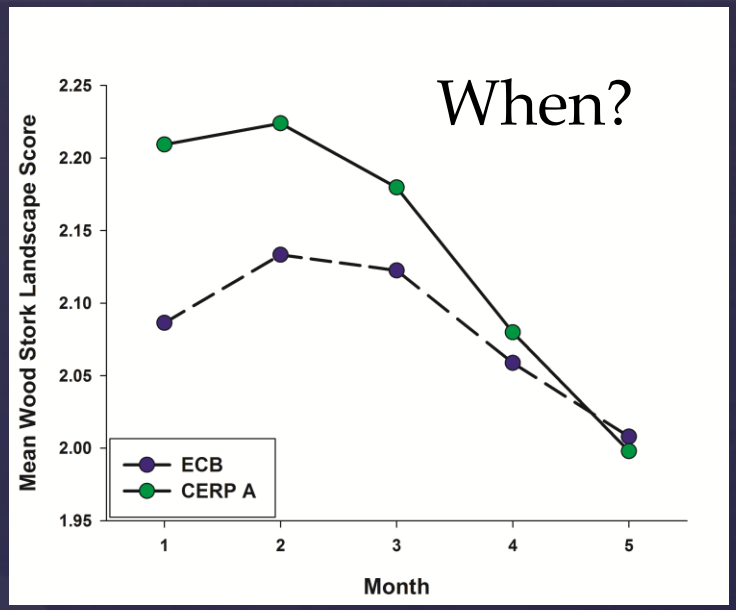
Models habitat quality within foraging depths…

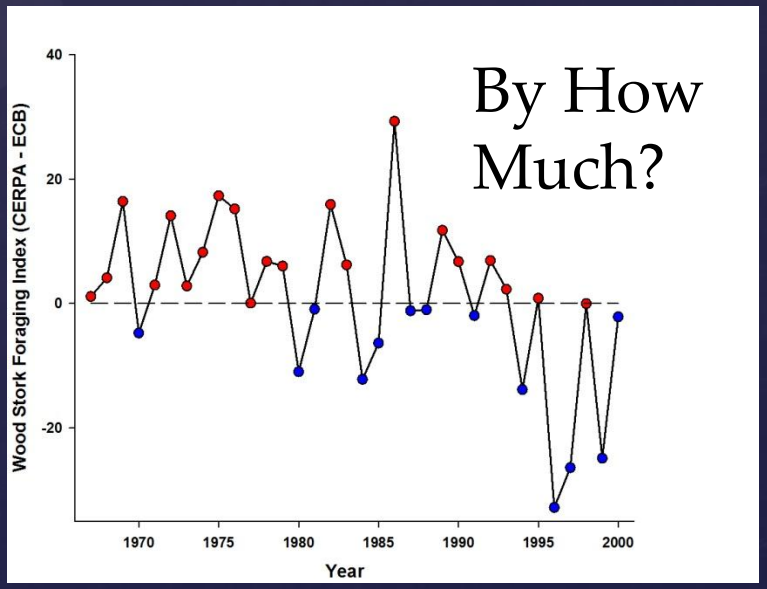


While accounting for landscape habitat suitability

Restoration applications







Acknowledgements

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