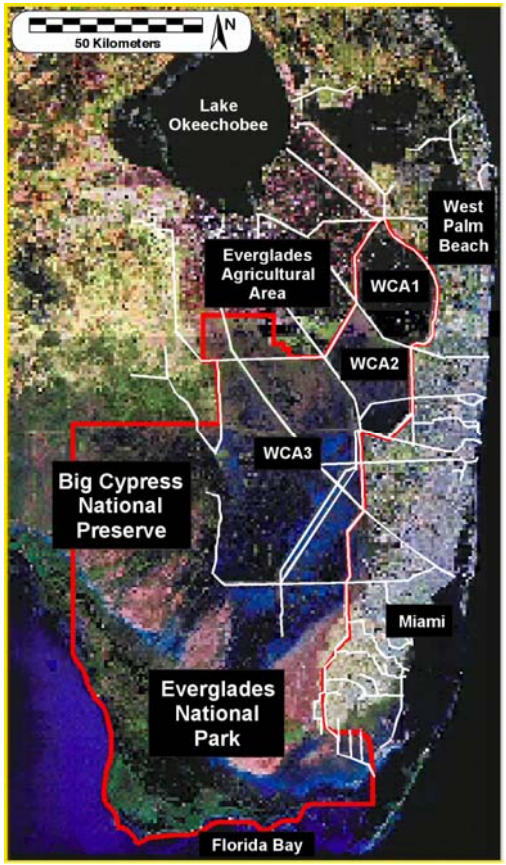
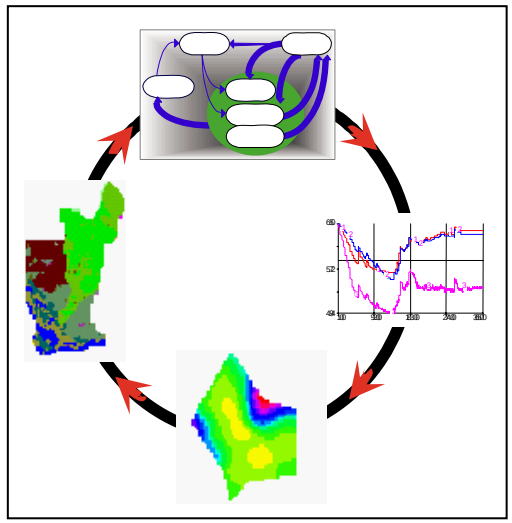
Integrated Ecological Assessment
using the
Everglades Landscape Model



Model Application Support Unit

Hydrologic & Environmental Systems Modeling Department

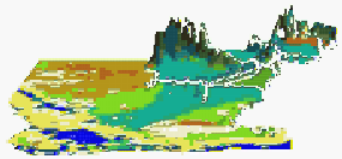
South Florida Water Management District



Independent Peer Review
August 1-2, 2006

A Model Perspective of the Everglades Landscape:

Regional & Subregional Applications of ELM



ELM outputs: regional, 1-km scale grid 20-yr summaries

Colors = habitats (red = cattail)
Mountains = surface water phosphorus

Regional_wca2_wca1.avi

ELM v2.4.3/v2.5.0

Presentation:

1. **What is ELM?**
2. How can it be applied?
3. How well does it work?
4. Will it be applied?

ELM Goals:

Develop a modeling tool for integrated ecological assessment of water management scenarios for Everglades restoration

- **Integrate hydrology, biology, and nutrient cycling in spatially explicit, dynamic simulations**
- **Synthesize these interacting hydro-ecological processes at scales appropriate for regional assessments**
- ***Understand and predict the relative responses of the landscape to different water and nutrient management scenarios***
- **Provide a conceptual and quantitative framework for collaborative field research and other modeling efforts**

ELM Objectives (Application Niche): Specific Performance Measures

Approved[1] Performance Measures

Current ELM version, regional evaluations of:

- **Phosphorus: concentration in surface water**
- **Phosphorus: accumulation in ecosystem**

Upcoming ELM version, regional evaluations of:

- **Soils: accretion, phosphorus content**
- **Periphyton: community type, biomass**
- **Macrophytes: community type, biomass**

Performance Measure Scales

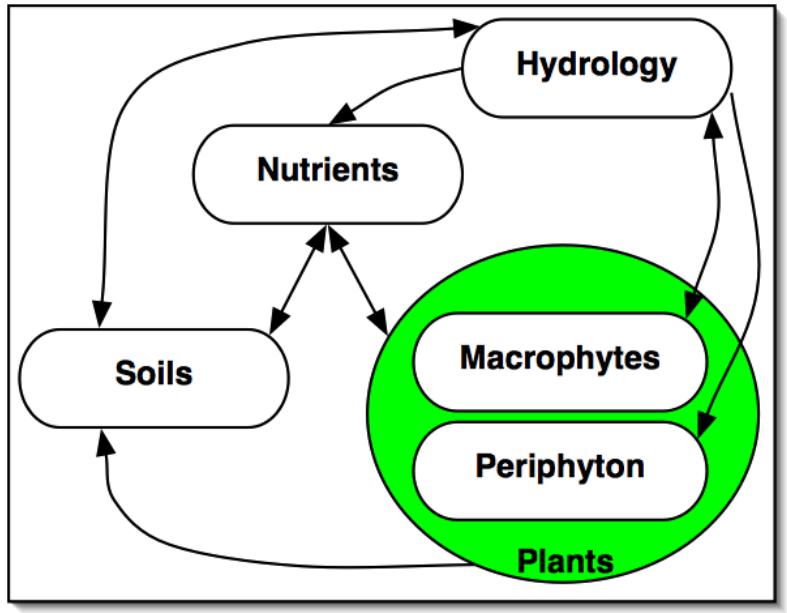
Temporal: Annual trends over decadal time scales

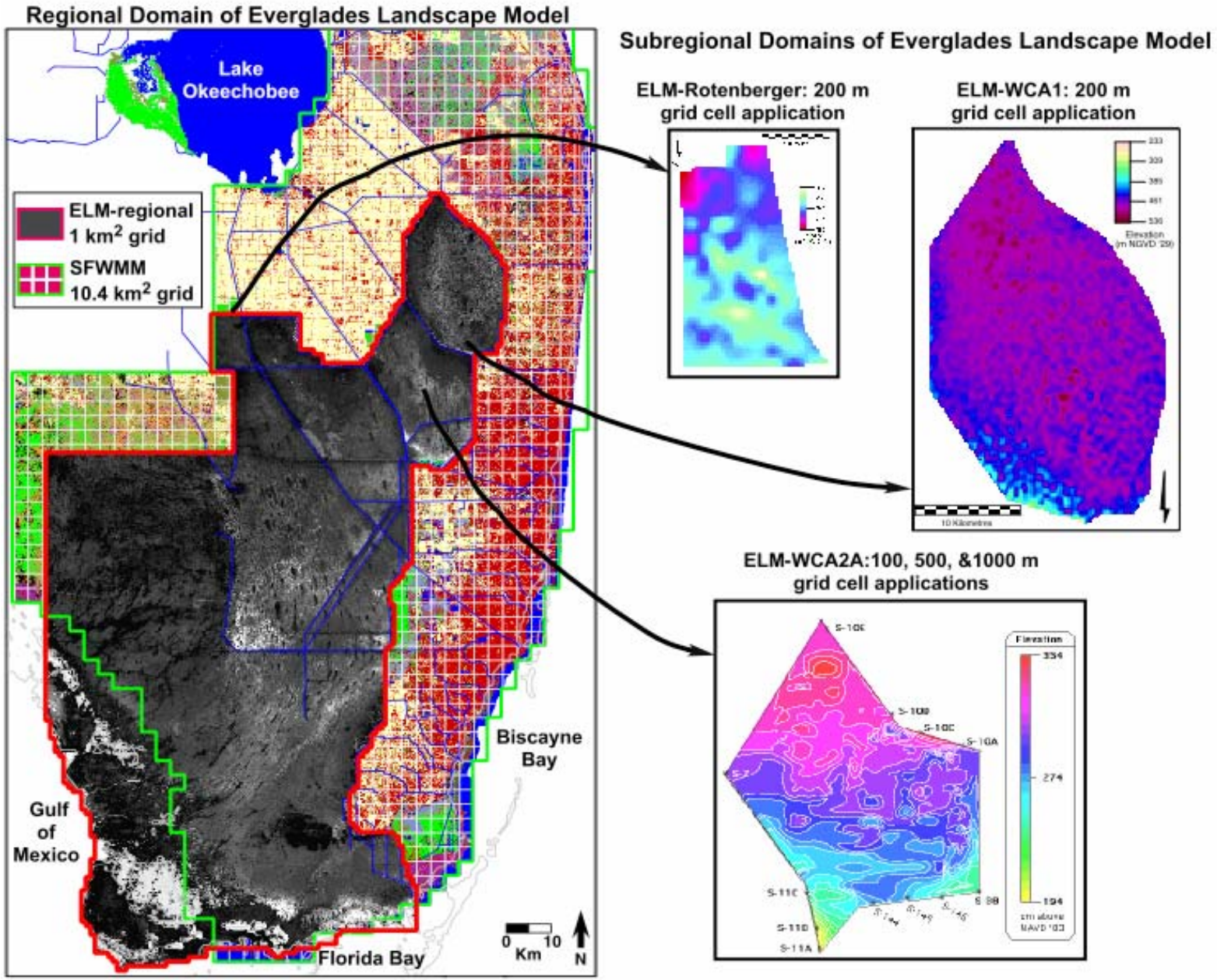
Spatial: 1-km resolution gradients across tens of km

[1]CERP RECOVER, not final

ELM Design:
Integrating ecological interactions

1. **Boxes change in response to each other**
2. **Arrows denote simple model "mechanisms" of WHY things change**
3. **Using simple "WHYs", model is not restricted to statistical "fits" of past behavior**
4. **Thus, apply understanding to predict relative performance of future restoration scenarios**




Regional Domain of Everglades Landscape Model
Lake Okeechobee
ELM-regional 1 km² grid
SFWMM 10.4 km² grid
Biscayne Bay
Gulf of Mexico
Florida Bay
0 10 Km
N
Subregional Domains of Everglades Landscape Model
ELM-Rotenberger: 200 m grid cell application
ELM-WCA1: 200 m grid cell application
ELM-WCA2A:100, 500, &1000 m grid cell applications
Elevation
334
274
194

Presentation:

1. **What is ELM?**
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3. **How well does it work?**
4. **Will it be applied?**

Example Application:
What might have happened if clean water had entered the Everglades in the past?

(hypothetical example)

Historical scenario, 1981-2000:

- **actual flows**
- **actual (historical) phosphorus inflow concentrations**

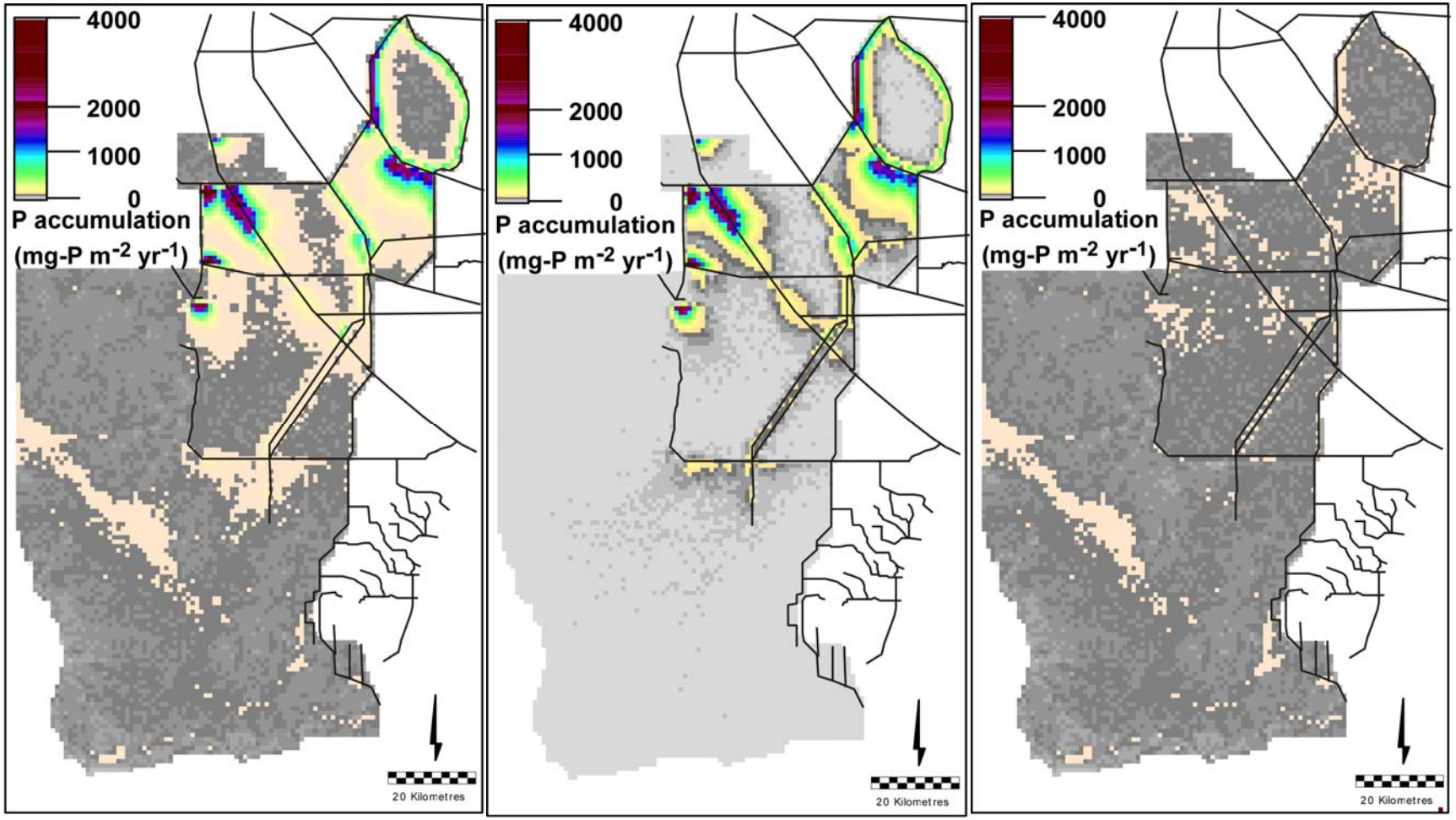
Hypothetical scenario, 1981-2000:

- **actual flows**
- **10 ug/L (ppb) phosphorus inflow concentrations**

Use model to indicate the likely spatial reduction in phosphorus impacts across the Greater Everglades, with lower inflow phosphorus concentrations

Example Application:

What might have happened if clean water had entered the Everglades in the past?



ELM v2.5.0

Presentation:

1. What is ELM?
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How well does ELM work?

Water Quality:

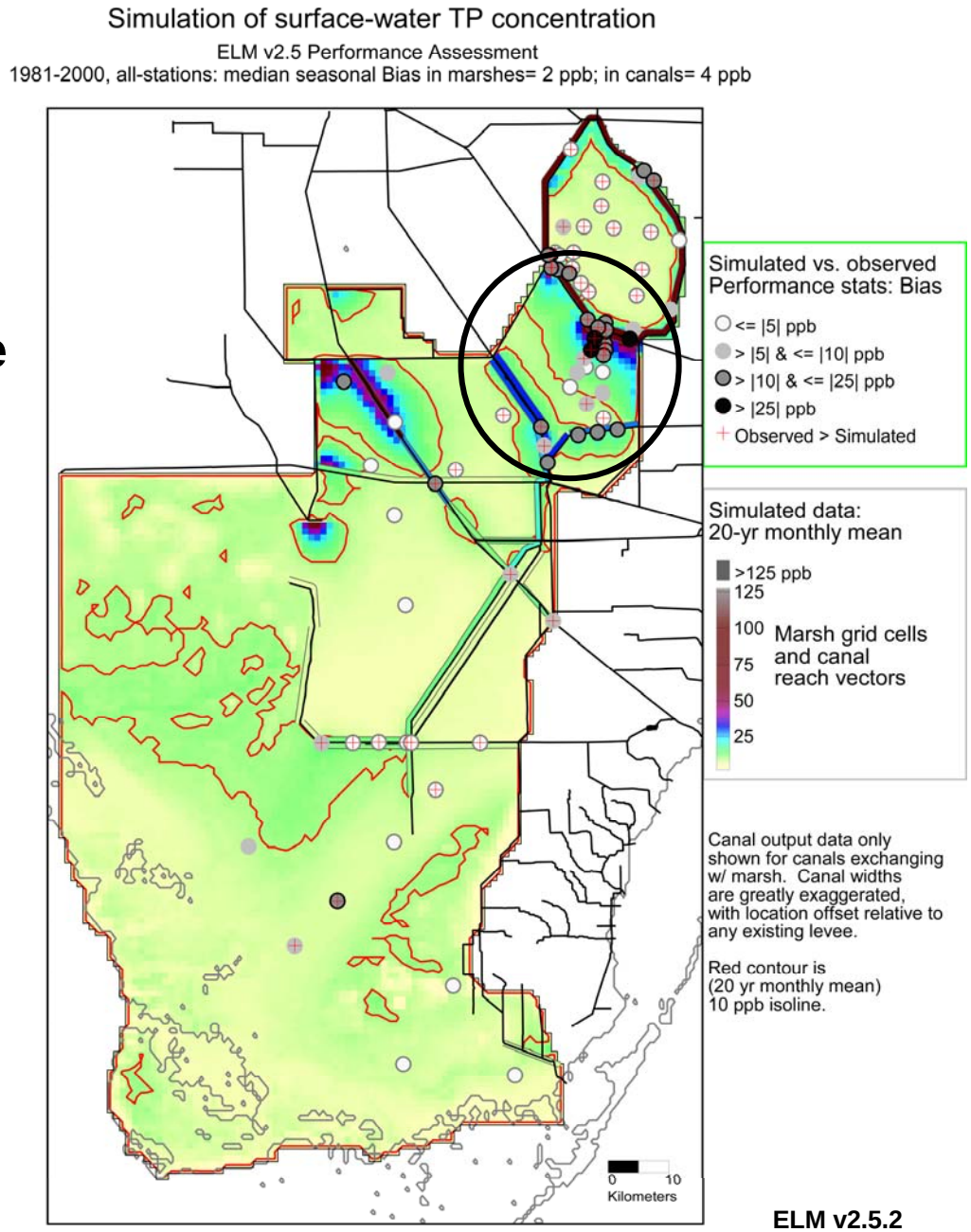
Regional analysis of surface water phosphorus (TP) concentration

(Planning Application Performance Measure)

median bias of predictions:

marsh = 2 ppb of TP

canals = 4 ppb of TP

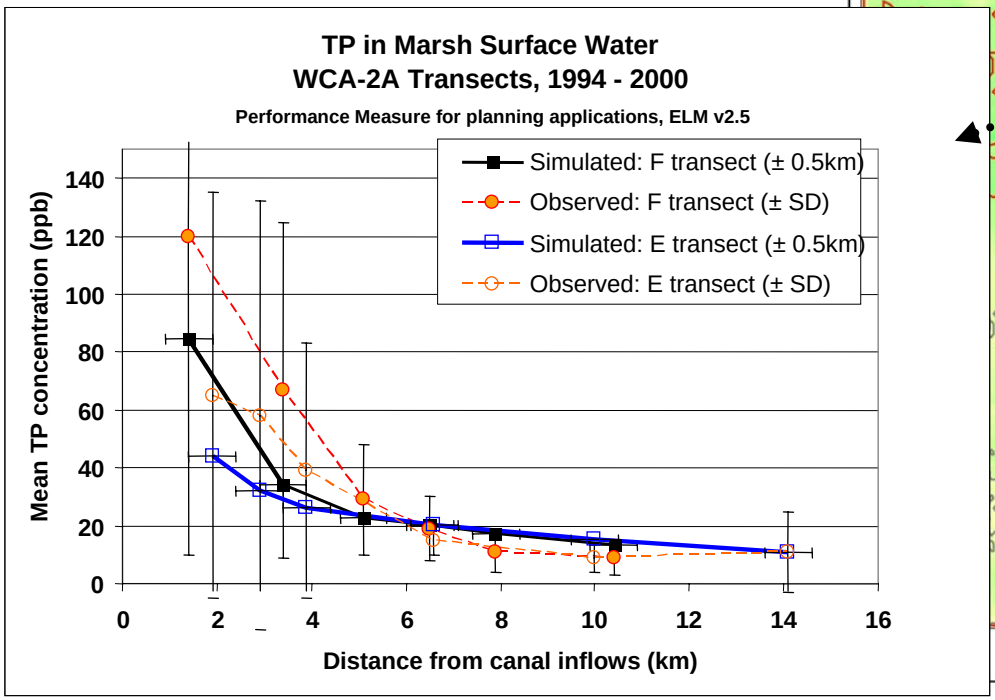


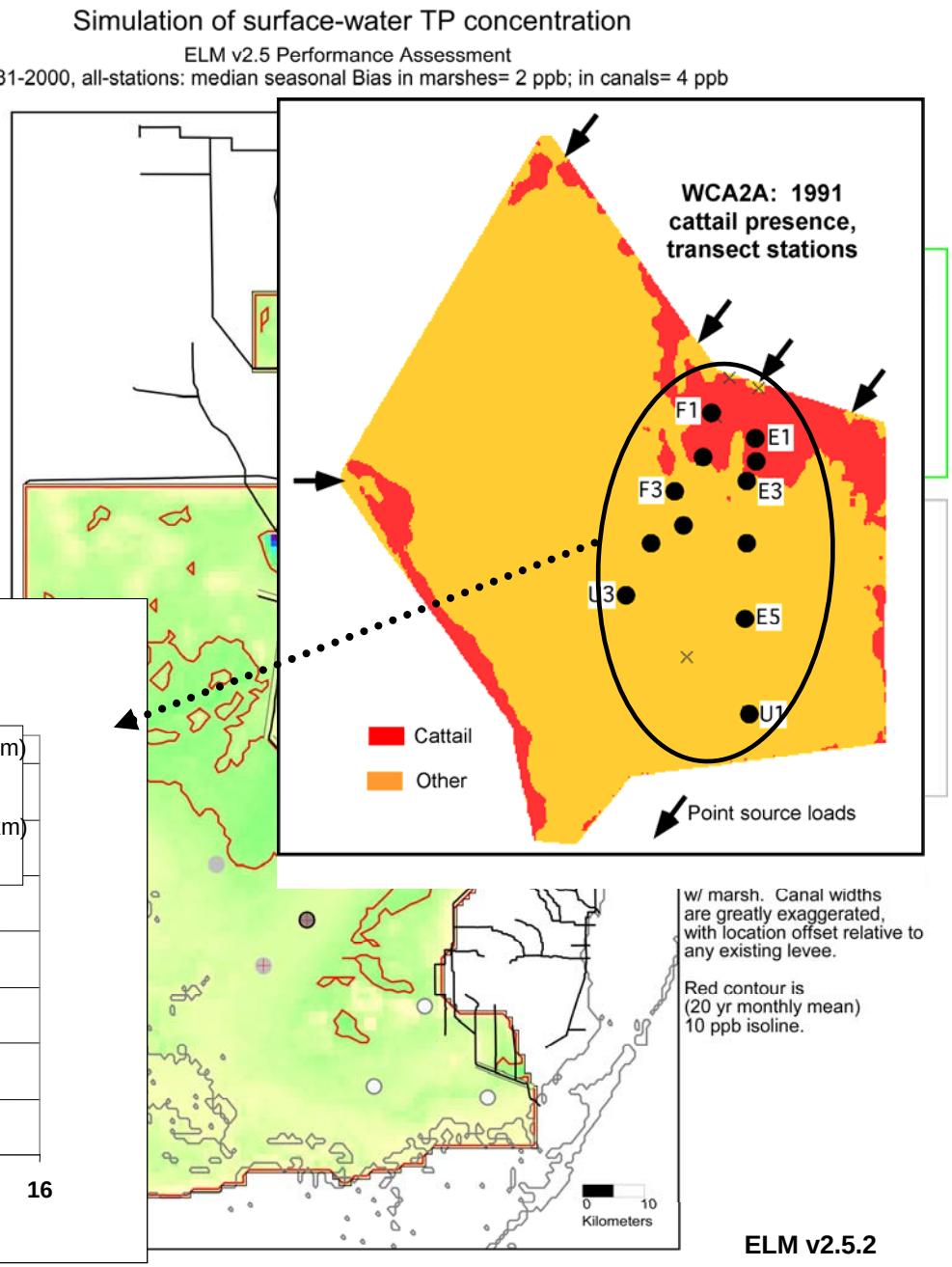
How well does ELM work?

Water Quality:

Match gradients of surface water TP concentration

(Planning Application Performance Measure)



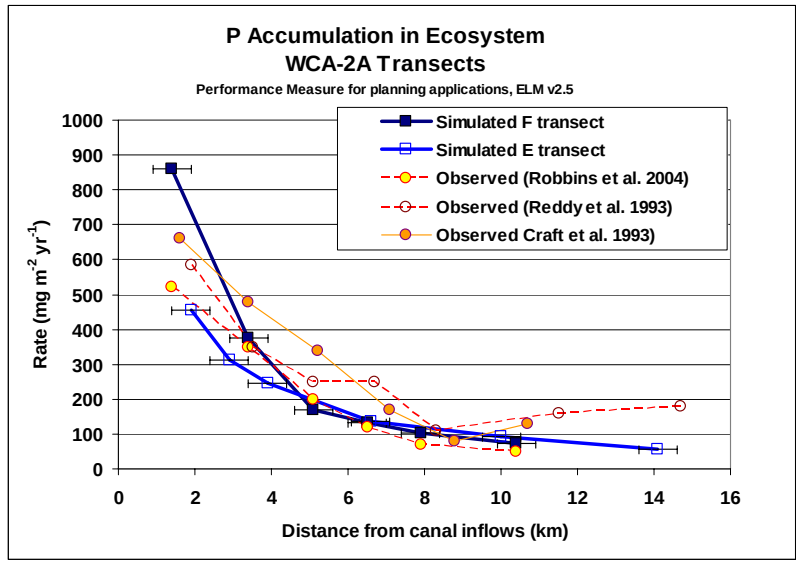


ELM v2.5.2

How well does ELM work?

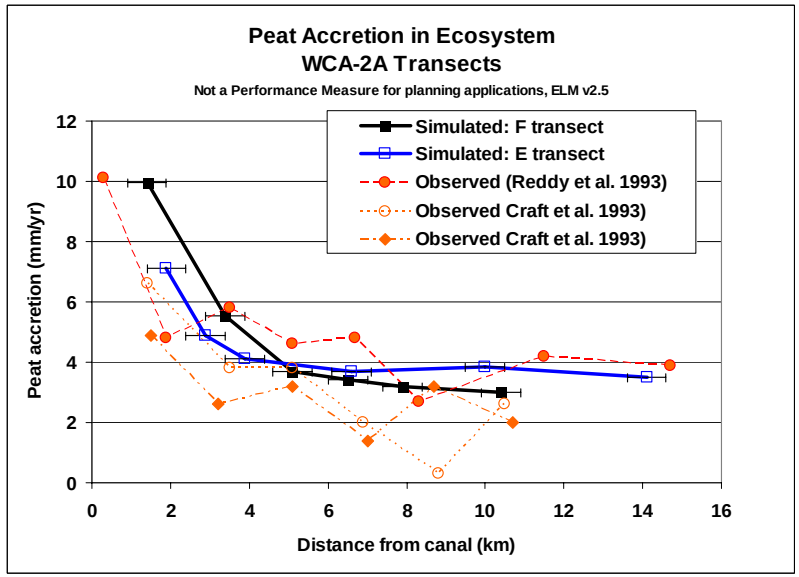
Ecology:

Match gradients of phosphorus accumulation (Planning Application Performance Measure)



Ecology:

Match gradients of soil peat accretion

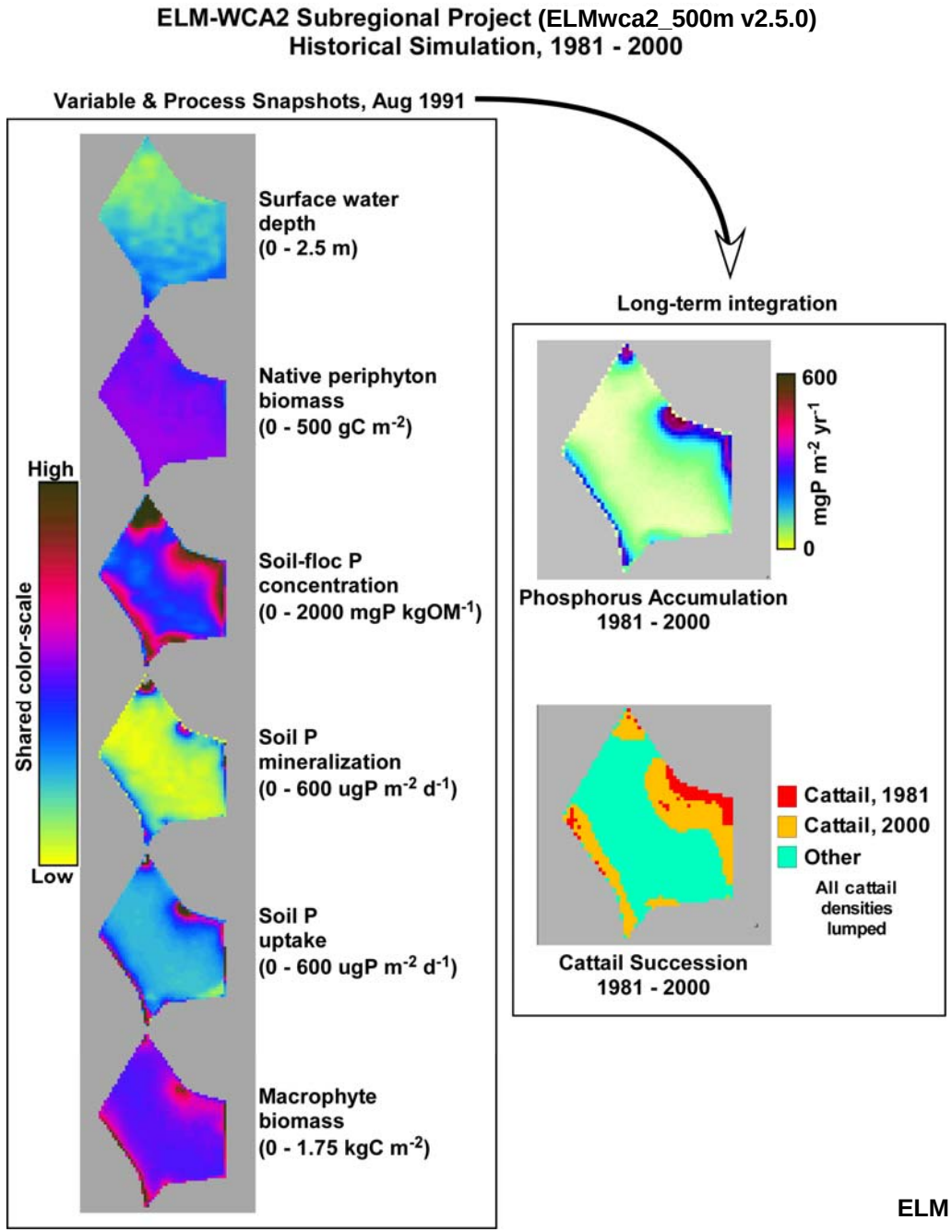


ELM v2.5.2

How well does ELM work?

Ecology:

Check patterns of other ecological variables



ELM v2.5.0

How well does ELM work?

Hydrology

- Regional calibration/validation performance comparable to SFWMM

Water Quality

- Effectively predict long term trends in phosphorus gradients
  - 2 ppb = median bias of TP concentration in canals & marsh surface water, across region over a 20 year period

Ecology

- Effectively predict long term trends in ecological gradients:
  - Long-term phosphorus accumulation gradient is good match to observed
  - Other gradients and patterns of important ecological variables evaluated for consistency with available data

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Documentation & Review

Existing Documentation

- Description of Everglades, objectives and conceptual model
- Verbal, mathematical, and graphical description of algorithms
- All source code functions & variables documented (automated)
- All input data documented, including "metadata"
- Numerical & graphical summaries of calibration/validation
- Comprehensive sensitivity analysis, aspects of uncertainty
- User's Guide

Peer Review

- Peer-reviewed science publications, 1996 - 2006
- Multi-agency review, 2002
- Independent peer review, July 2006 – January 2007
  - Facilitated by V. Bierman, Limno-Tech/HydroQual
  - Expert Panel: L. Band, C. Cerco, W. Mitsch (chair)

taking The Long Way Around[1]...

2003 - 2006

towards enhanced collaboration

2006...

[1]Song title from controversial Dixie Chicks