Does the Everglades Still Exist?

Restoring an Iconic Ecosystem or Intervening in a Novel One?

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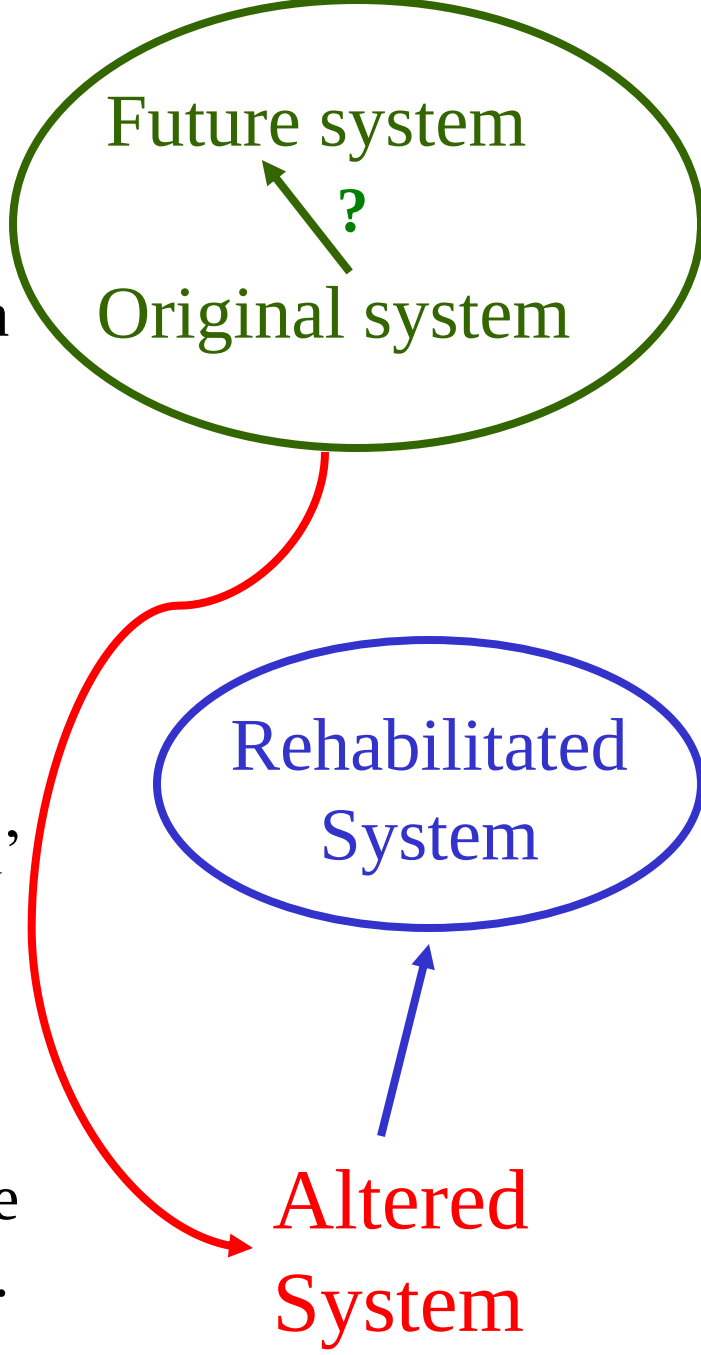
Restoration Ecology?

- The discussion on restoration goals is often focused on extremely degraded systems;
- Using the concept of alternative stable states, many have pointed out that it may not be possible to 'restore' past ecosystem structure or function;
- Some have suggested replacing 'restoration' with terms like 'rehabilitation' to describe management of 'novel' ecosystems;
- Also, the dynamic nature of ecosystems challenges our ability to divine the future state of systems if no human intervention occurred.



Targets at Regional Scales

- Goals for restoration should be linked to the level of degradation at the start (strip mine versus over-dried wetland);
- Regional ecosystems (large area that includes multiple systems) may include areas with a diversity of levels of degradation and possibly areas with a diversity of human uses;
- Thus, some portions may be amenable to a restoration ethic while others are better described by rehabilitation

Iconic Ecosystems Management and Restoration

- Society has identified some ecosystems for special protection based on their character, uniqueness, or aesthetics and placed them in the public trust;
- In the US, the 1964 Wilderness Act is a powerful law providing the highest level of protection for such lands;
- The public has determined that management should strive to sustain the character that led to their protection… even though definitions of characteristics such as ‘wilderness’ are problematic.

Targets Practical and Ideal

- Humans dominate most ecosystems world-wide, few examples of un-impacted systems exist
- Even when restoration of historical ecosystem functions or structure may be feasible, may but not practical (cost) or desirable (alternative uses for land)
- Multiple targets may be desirable:
  - 'natural system' target illustrates what has been lost and what is possible
  - 'alternative futures' illustrate what is attainable under different levels of investment and constraint

Restoration of Regional Ecosystems

The Everglades: A Novel Ecosystem?

- Is the Everglades a 'novel ecosystem'?
- How do we set targets for Everglades restoration?

Restoration Ecology
THE JOURNAL OF THE SOCIETY FOR ECOLOGICAL RESTORATION INTERNATIONAL

OPINION ARTICLE

The Semiglades: The Collision of Restoration, Social Values, and the Ecosystem Concept

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Abstract

Defining success targets in restoration and how social values affect them are two commonly discussed issues in restoration today. We believe that how success is commonly defined—with vague terms such as "healthy ecosystem" or cited as a return to a previous, historic state—needs to be reevaluated. With the increasing number of novel ecosystems, there is an increasing conflict between the ecosystem concept, social values, and restoration. This arises from the fact that ecosystems are defined by the values of the scientists describing them, necessarily constraining the ecosystem to a generally static concept. It is not directly the concept, but how it is perceived through our filter of social values that represses the creativity and innovation needed in restoration today. Within restoration, we feel that the ecosystem concept does a disservice by ignoring the increasing number of novel systems, and that hinders real progress in a time when hesitation can be costly. To best illustrate this, we offer the example of restoration of the Florida Everglades and how it has become a novel system in pattern and process. We suggest renaming the Everglades "The Semiglades" in hopes of opening a dialog to expose social/ecosystem biases and include novel landscapes in management and planning.

Key words: Everglades, novel system, social values, success targets.

Introduction

Restoration is currently a popular topic of conversation in ecological and conservation literature (Miller & Hobbs 2007; Seastedt et al. 2008). Two commonly discussed issues are how to define restoration success or targets and how social values affect restoration. We believe the difficulty of defining success often hinders the restoration process and needs to be addressed with innovative concepts. Success is often described as re-establishing a "healthy" ecosystem or restoring ecosystem "integrity" (Davis & Slobodkin 2004); employing vague, value-laden terms instead of specifically defining success criteria. Recognizing how social values interact with ecological theories and ultimately affect restoration is critical and we illustrate these issues using Florida Everglades restoration. This highly politicized project is an excellent example of the collision of novel landscapes, social values, and the ecosystem concept (Fig. 1).

The concept of the ecosystem has been debated for decades, with scientists arguing over its utility as a solid ecological a convenient approach to organizing thought. . . [that] takes these impossibly complex phenomena and focuses on a small subset: the average or integrated properties of all populations within a specified spatial area" (O'Neill 2001). One early criticism was the failure to include dynamics (O'Neill 2001), but the ecosystem concept has evolved over time to address this and other criticisms. However, we feel that this evolution of concept has remained largely in theory and is rarely applied in restoration. In practice, an ecosystem is defined by static, a priori assumptions (O'Neill 2001) that are often fundamentally violated in a restoration scenario, particularly when the intensity of disturbance has created a novel situation. This, coupled with an outdated, static view of ecosystems, contributes to difficulties in restoration.

The term "novel ecosystem" was first used (Chapin & Starfield 1997) to refer to the response of an ecosystem to current and future climatic events, and has been recently discussed in terms of restoration and management (Seastedt et al. 2008). A novel ecosystem is simply an assemblage of species and environmental conditions that have never before

Wetlands
DOI 10.1007/s13157-012-0291-y

BOOK REVIEW

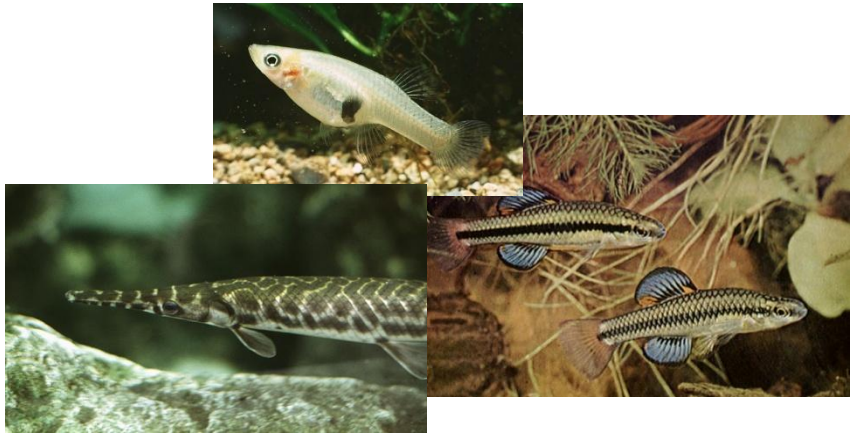
Landscapes and Hydrology of the Predrainage Everglades

McVoy, C., W. Park Said, J. Obeysekera, J. VanArman, and T. Dreschel. 2011. *Landscapes and Hydrology of the Predrainage Everglades*. University Press of Florida, 576 pp. US$85.00 (hardcover). ISBN 9780813035352.

Vic Engel

What makes the Everglades an iconic ecosystem?

Marjory Stoneman Douglas is famous for starting her book, River of Grass, with the claim that there is ‘no other Everglades’ in the world.

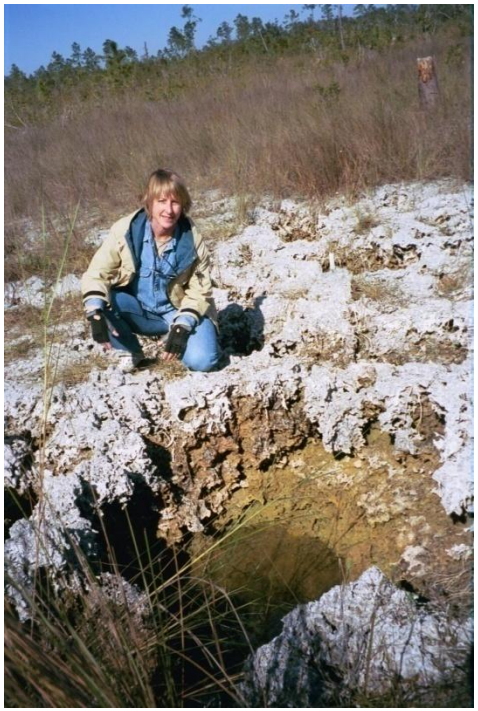


Everglades National Park

- Created in 1947, over 1,500,000 acres in size
- Over 90% is Federally designated Wilderness
- International Biosphere Reserve, World Heritage Site and a Wetland of International Importance
- Includes over 50% of remaining Everglades

What makes the Everglades an iconic ecosystem?

- From the perspective of aquatic ecology:
  - History of ecosystem, biogeography
  - Large size
  - Wet-dry season hydrology
  - Oligotrophic



- These factors come together to explain why this ecosystem historically sustained large populations of wading birds and all are under threat

What makes the Everglades an Iconic Ecosystem

- Oligotrophic
  - The key limiting nutrient is low relative to requirements
  - Limestone basement rock binds with P, tends to be associated with oligotrophic ecosystems… Everglades is predictably oligotrophic, similar to other Caribbean systems

Targeting Ecosystem Features for Conservation: Standing Crops in the Florida Everglades

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Abstract: *The Everglades in southern Florida, U.S.A., is a major focus of conservation activities. The freshwater wetlands of the Everglades do not have high species richness, and no species of threatened aquatic animals or plants live there. We have, however, identified a distinctive ecological feature of the Everglades that is threatened by canal construction, draining, and nutrient enrichment from agricultural runoff. Compared to values reported from other freshwater systems, standing stocks of periphyton in relatively undisturbed areas of the Everglades were unusually high, and standing stocks of invertebrates and fish were unusually low. Averaging data gathered from nine sites and five sampling periods spanning 1 year, we found that periphyton standing crop was 88.2 g/m² (ash-free dry mass), invertebrate standing stock was 0.64 g/m² (dry mass), and fish standing stock was 1.2 g/m² (dry mass of large and small species combined). We found that fish standing stocks were much higher in phosphorus-enriched sites than in nearby reference sites but that invertebrate standing stocks were similar in enriched and reference sites. Our results support the notion that oligotrophy is at least partially responsible for the low standing stocks of fish, but they also suggest that species interactions and a paucity of deep-water refugia are important. Anthropogenic eutrophication in Everglades marshes will lead to the loss of distinctive ecosystem features. A focus on species richness and "hot spots" of threatened species provides no basis for conservation of ecosystems like the Everglades. If oligotrophic ecosystems often have low species richness, they will be underrepresented in preservation networks based on some common criteria for establishing conservation priorities.*

La Conservación Enfocada a las Características del Ecosistema: Productividad en los Everglades de Florida

Resumen: *Los Everglades en el sur de los Estados Unidos constituyen un importante centro de actividades de conservación. Los humedales dulceacuícolas de los Everglades no tienen una riqueza de especies alta, y ninguna especie animal o vegetal amenazada vive ahí. Sin embargo, hemos identificado un rasgo ecológico distintivo de los Everglades que esta amenazado por la construcción de canales, el drenado y el enriquecimiento de nutrientes por actividades agrícolas. En comparación con los valores reportados para otros sistemas dulceacuícolas, la productividad del perifiton en áreas relativamente no perturbadas fue inusualmente alta, mientras que la productividad de invertebrados y peces fue inusualmente baja. El promedio de datos obtenidos en nueve sitios y durante cinco periodos de muestreo a lo largo de un año mostró que la productividad de perifiton fue de 88.2 g/m² (peso seco sin cenizas), la de invertebrados fue de 0.64 g/m² (peso seco) y la de peces fue de 1.2 g/m² (peso seco de especies pequeñas y grandes combinadas). Encontramos que la productividad de peces fue mayor en sitios enriquecidos que en sitios de referencia cercanos, pero la productividad de invertebrados fue similar en sitios enriquecidos y de referencia. Nuestros resultados apoyan la idea de que la*

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Paper submitted December 23, 1997; revised manuscript accepted November 4, 1998.

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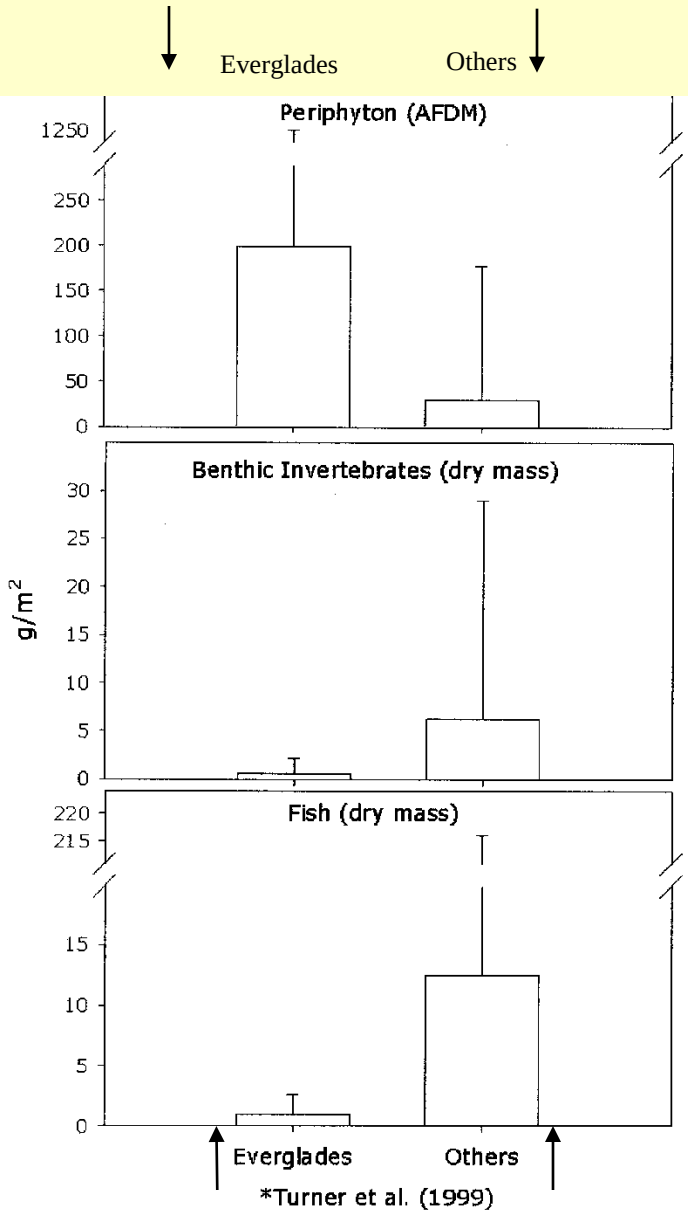
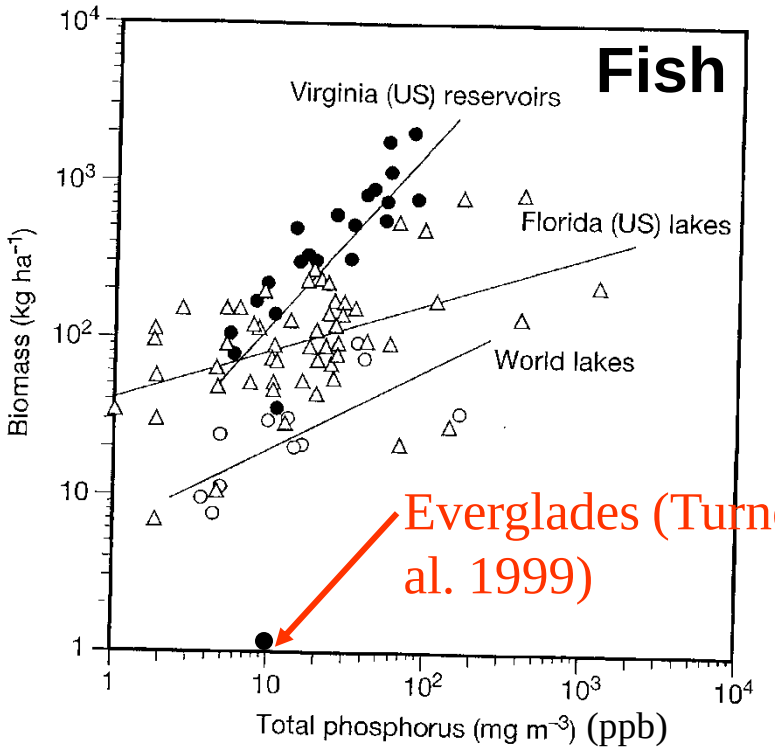
Volume 13, No. 4, August 1999

The Everglades has an Unusual Pattern of Biomass

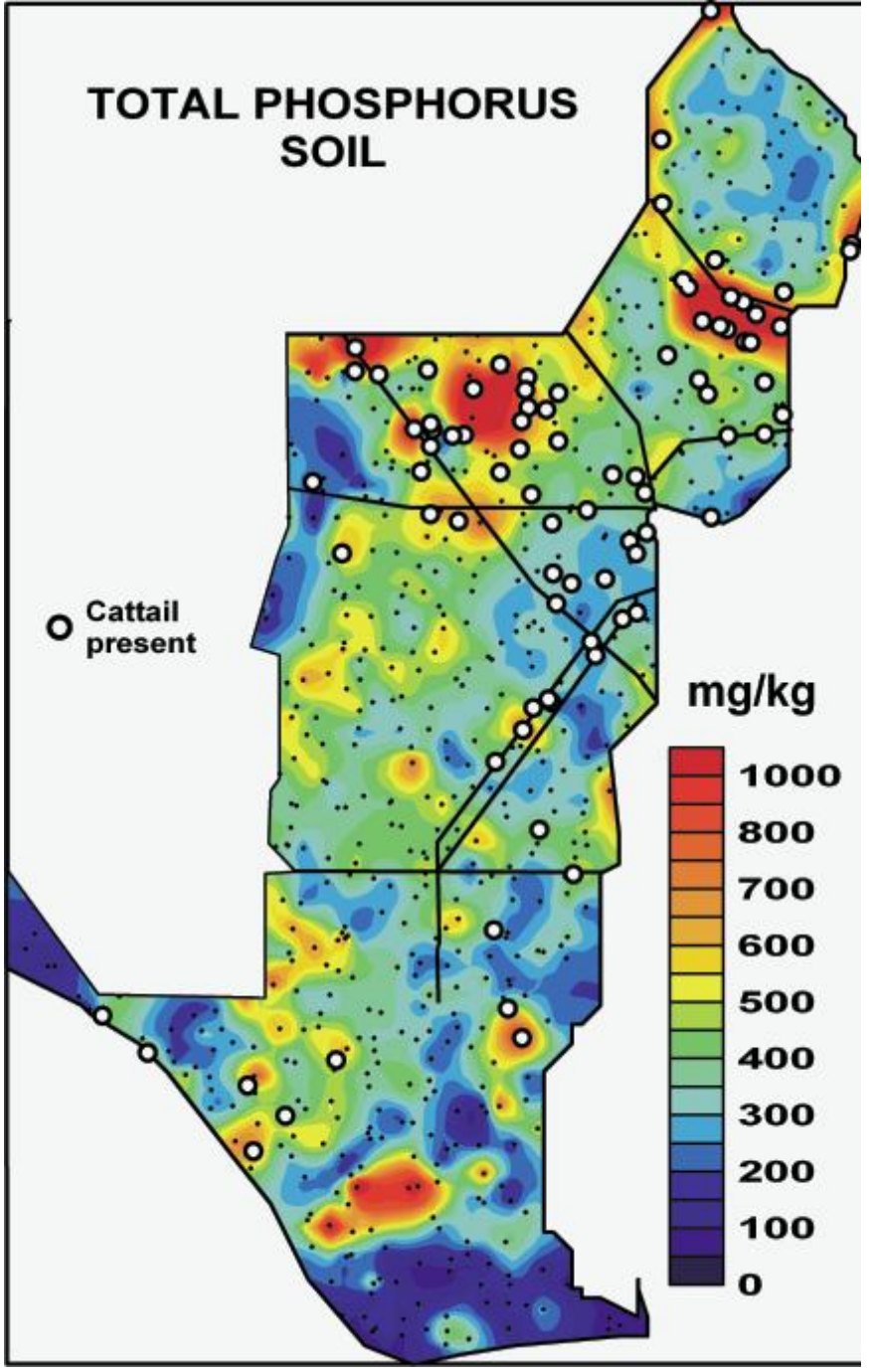




This figure from a common textbook (Kalf, J. 2002. Limnology. Prentice Hall, NY) illustrates that our results from the Everglades stand out. Also, reporting biomass is a standard ecological technique for making comparisons.

Oligotrophy - Eutrophy

- Adding nutrients to Everglades triggers a sequence of events:
- P in system accumulates;
- Periphyton mats disappear;
- Vascular plant communities change;
- Aquatic animal communities initially increase in abundance;
- Ultimately get cattail monoculture, usually following a fire;
- Eutrophication leads to low DO, loss of animal productivity;
- Takes very long time to eliminate P once it is added.



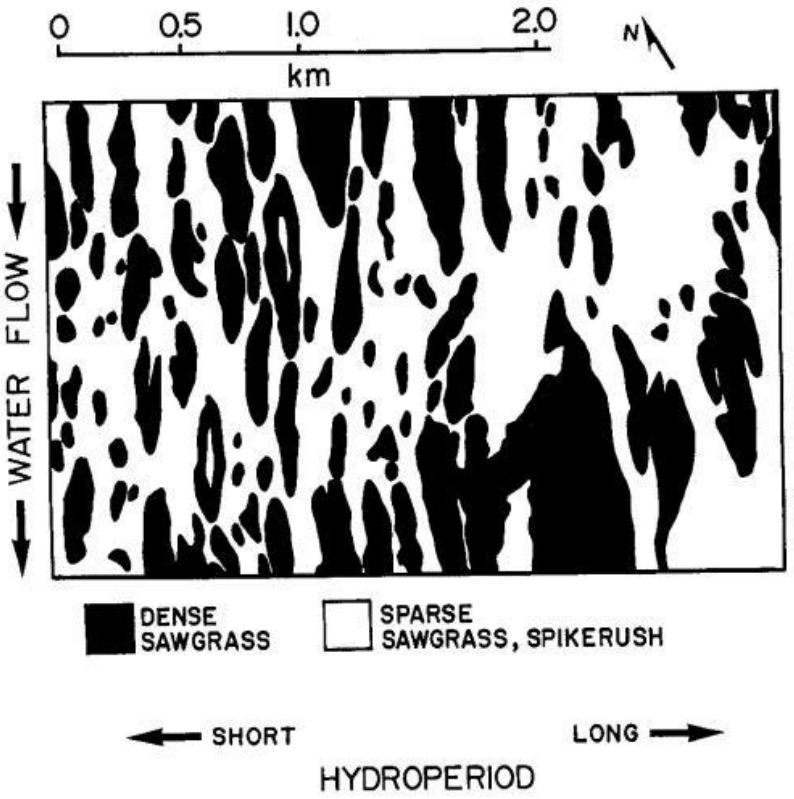
Scheidt, D.J., and P.I. Kalla. 2007. Everglades ecosystem assessment: water management and quality, eutrophication, mercury contamination, soils and habitat: monitoring for adaptive management: a R-EMAP status report. USEPA Region 4, Athens, GA. EPA 904-R-07-001. 98 pp.

What makes the Everglades a Iconic Ecosystem?

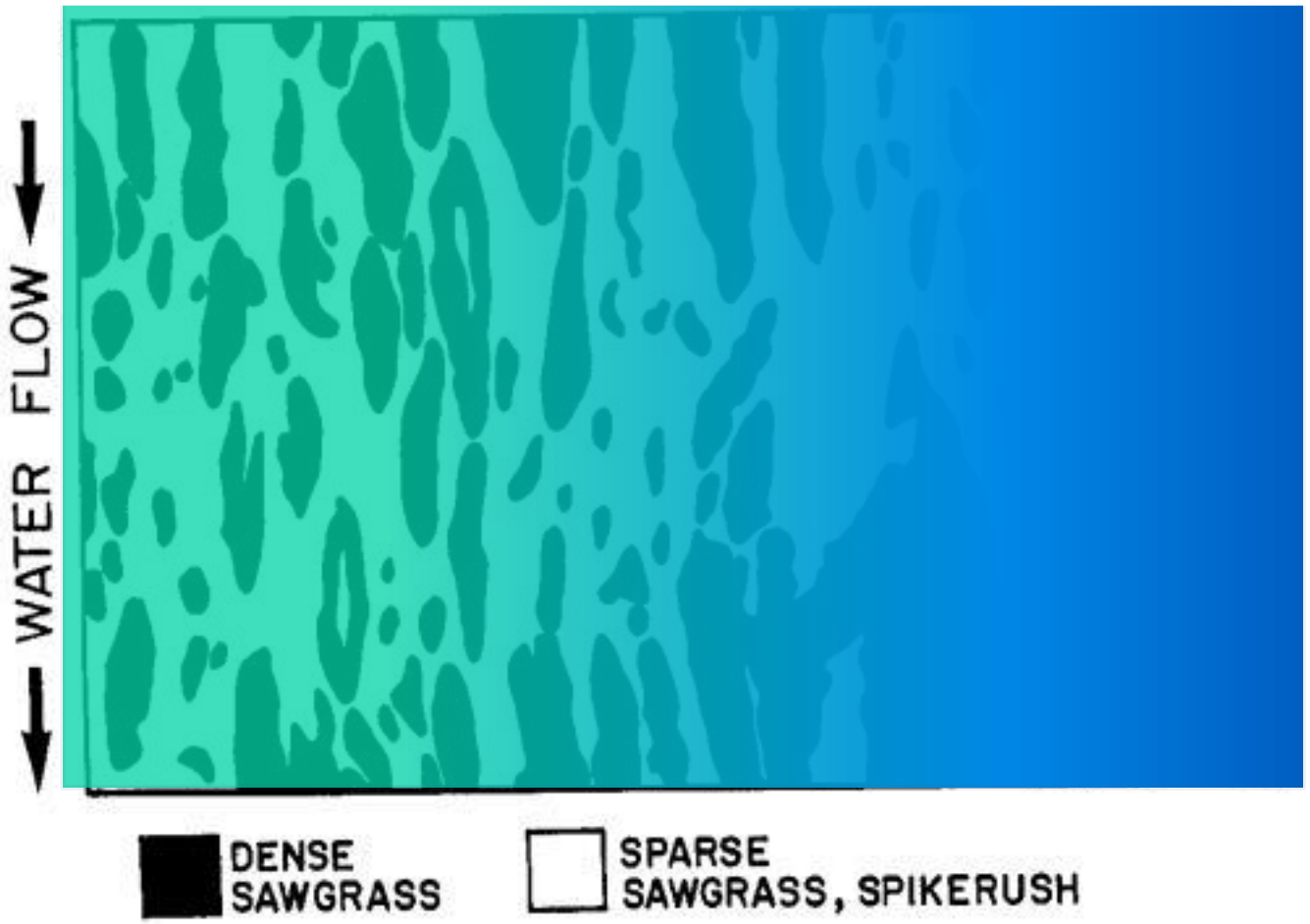
- Historically sustained large populations of wading birds
- How can an oligotrophic ecosystem do this?
- Answer brings together all of the distinguishing features

How can the Everglades sustain large populations of wading birds?

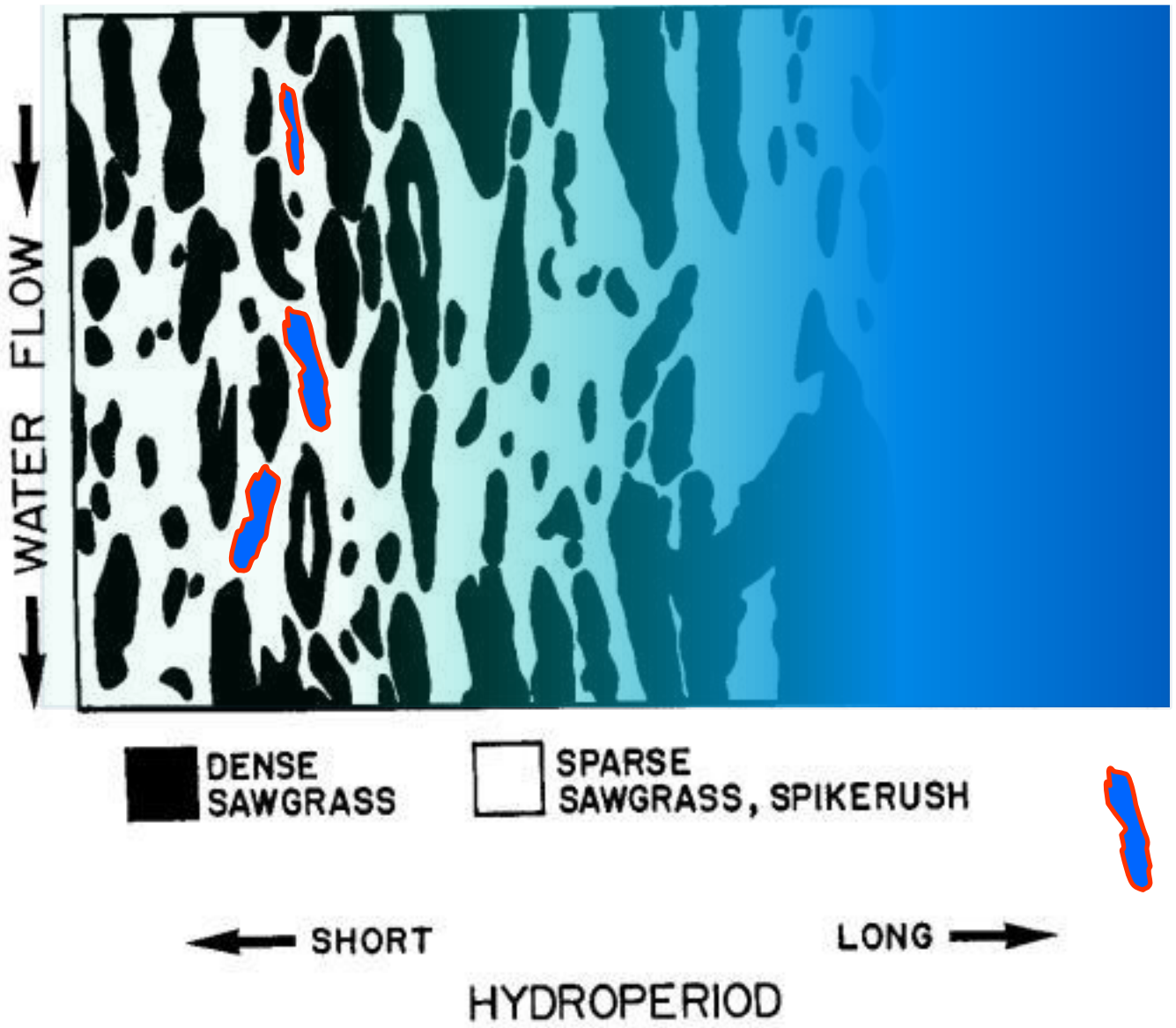
- The Everglades dries from the edges toward the center over the dry season.
- Ridge and Slough relief runs roughly perpendicular to the direction of drying;
- Water recession strands aquatic animals in short-lived drying pools



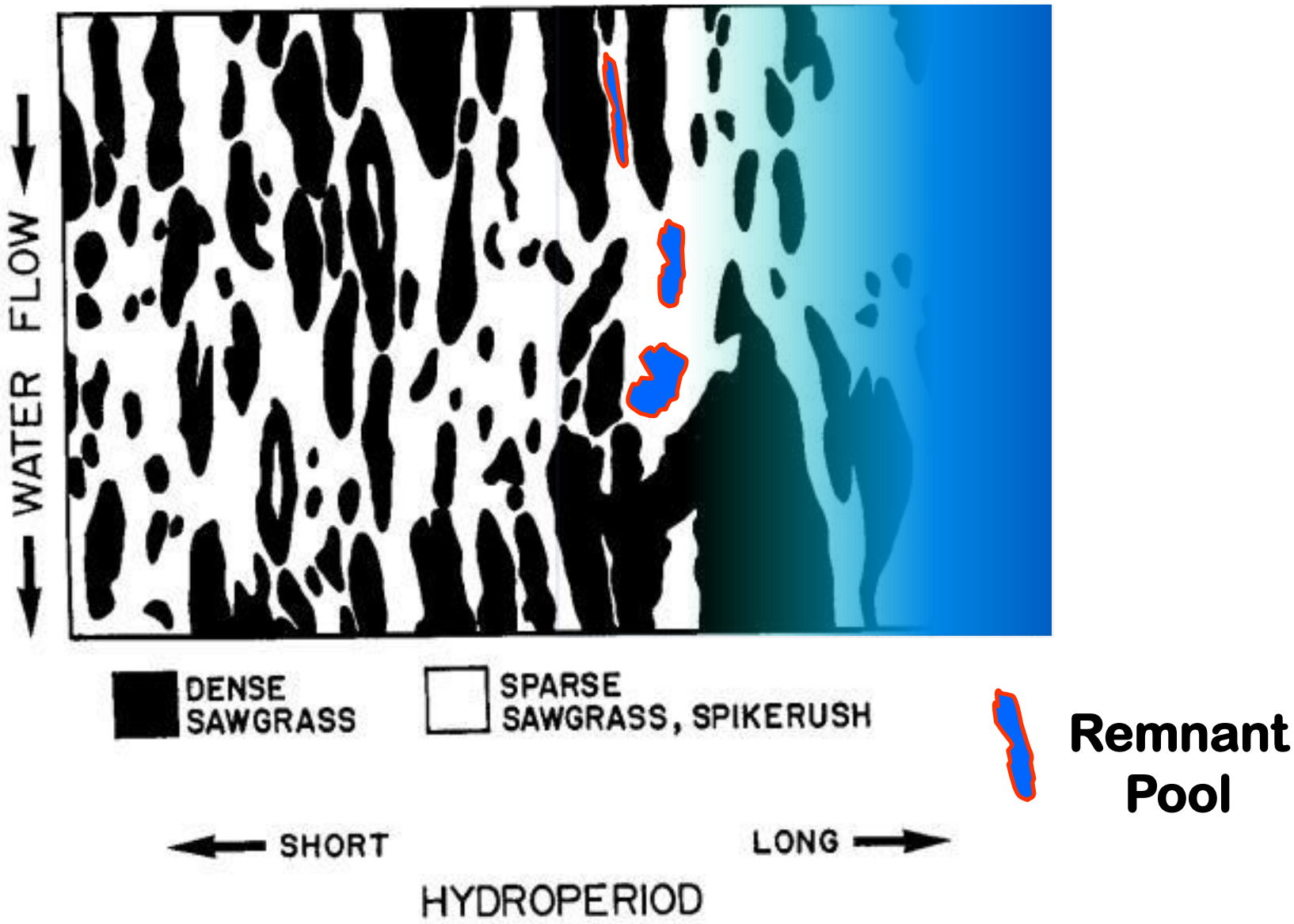
December


WATER FLOW
DENSE SAWGRASS
SPARSE SAWGRASS, SPIKERUSH
SHORT
LONG
HYDROPERIOD

February


WATER FLOW
DENSE SAWGRASS
SPARSE SAWGRASS, SPIKERUSH
Remnant Pool
SHORT
LONG
HYDROPERIOD

April


WATER FLOW
DENSE SAWGRASS
SPARSE SAWGRASS, SPIKERUSH
Remnant Pool
SHORT
LONG
HYDROPERIOD

How does the Everglades sustain large populations of wading birds?

- Everglades fishes move across to sustain populations and locate dry-season refuges, but many fail and are stranded in drying pools
- Drying pools hold 2 to 5 times higher density of small fish and crayfish than wet-season sloughs
- Ridge-slough topography and hydrology create opportunity of wading birds

Flow as Important as Size

- Sustains ‘landscape’ scale hydrological and biogeochemical processes
  - Flowing system
    - Physical process shapes and sustains ridge-and-slough topography; tree islands;
    - Moves flocculent material (POM);
    - Movement (flushing) of POM shapes landscape via biogeochemical processes
  - Habitat Connectivity
    - Aquatic animals move across landscape during periods of high water (wet season) to locate refuges during low water (dry season)… or become stranded in places where available for consumption
    - May also contribute to nutrient distribution through animal movement and death

Human Interactions with Ecosystem

- Ecosystem size reduction and loss of habitats;
- Local drying and general changes in timing and delivery of water at regional scales;
- Nutrient enrichment;
- Flow and connectivity;
- Non-native species;
- Mercury pollution

Four Factors Necessary for Restoration to be Successful

Water is the key to reviving a dying ecosystem.

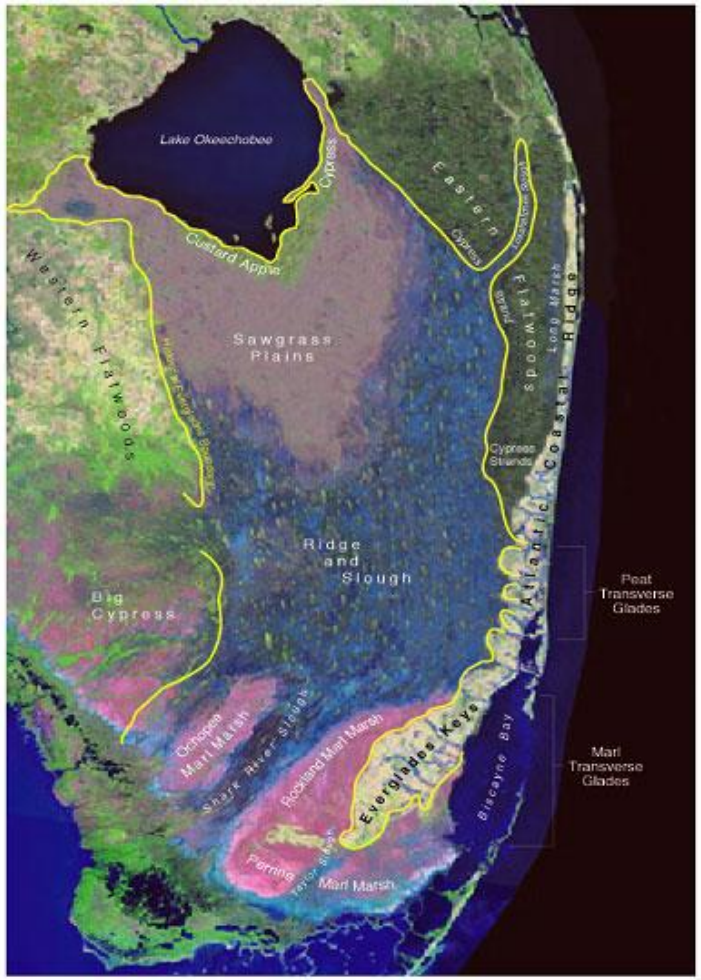
1. **Quantity**: Increase the total spatial extent of natural areas
2. **Quality**: The quality of the water must be healthy for the environment.
3. **Timing**: The timing of water held and released into the ecosystem will be modified to mimic natural flow patterns.
4. **Distribution**: Water will be captured to distribute to the ecosystem, as well as urban and agricultural users in the future.

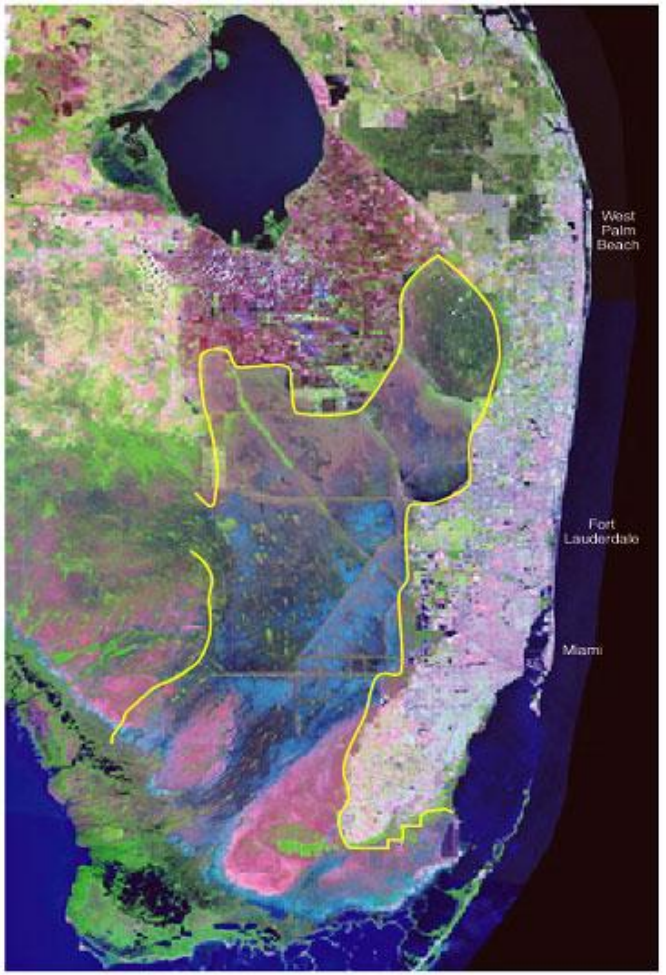
Restoring or Intervening?

- Hobbs has suggested that restoration is limited to systems with limited alteration to biotic and abiotic components

What Remains to Restore?

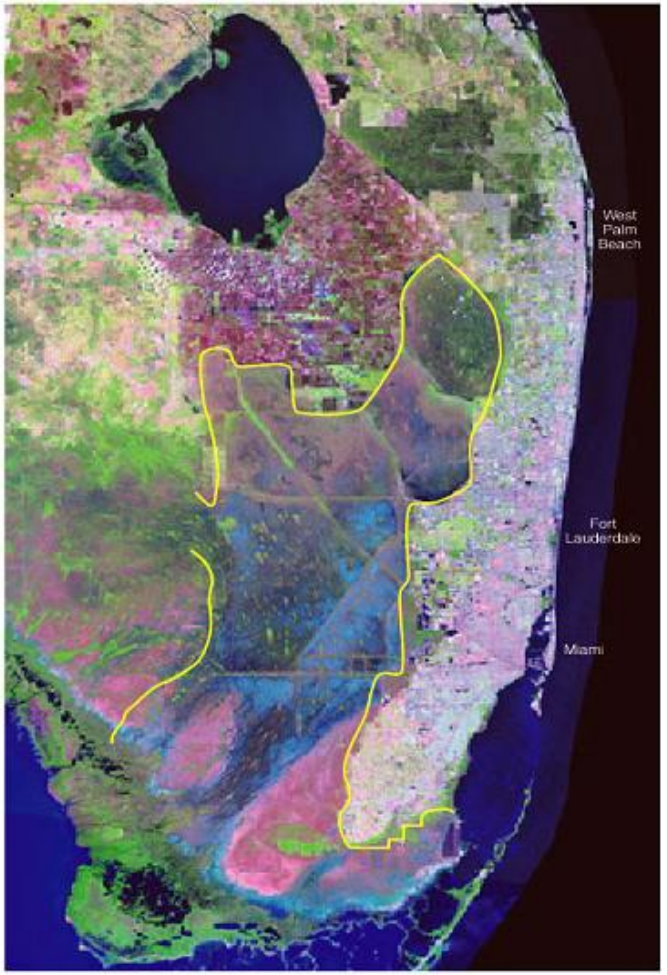
- Habitats under EAA are lost
  - Pond apple marsh
  - Sawgrass plain





Prospects and Conclusions

- Some areas are already treated as ‘novel’ systems: EAA, and much of WCA 2A
- Southern WCA 3A, Shark River Slough and Taylor Slough (ENP) remain in a restorable state if definitions are based on NSM
- Loxahatchee NWR and WCA 3B are debatable and depend on political will.



Prospects and Conclusions

- The Everglades is a national treasure and an internationally important ecosystem
- Though its size is reduced and it has experienced many changes because of human activity, it still supports wading birds and a unique ecological system.
- Restoration efforts are ongoing that seek to maintain these ecological values and recover at least some that have been lost

Conclusions

- Conversion of an Iconic Ecosystem to a Novel One is a Tragedy
- Identification as a ‘novel system’ is semantic in many cases, no single threshold for ecosystem character – novel vs not novel
- Focus should be on ecosystem functions and societal values that led to identification as an Iconic Ecosystem

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Miami's public research university

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Florida Coastal Everglades
Long Term Ecological Research