Lessons in Adaptive Management and Adaptive Governance

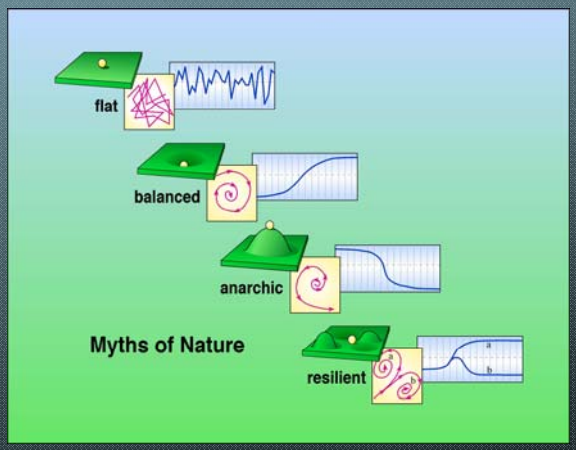
Topics

- Theory of adaptive environmental assessment and management (AEAM) and adaptive governance (AG)
- History of successes and failures of AEAM
- Challenges for implementation of Adaptive Ecosystem management

What is Adaptive Management?

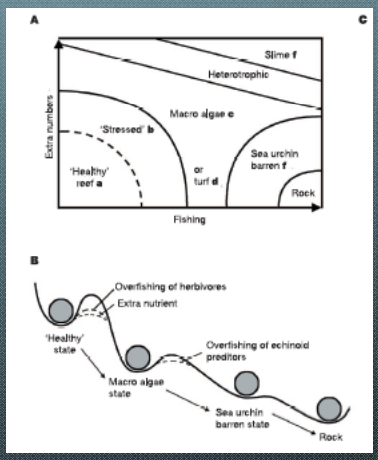
- Adaptive Environmental Assessment and Management- 1970's
- Complex systems
  - Surprises are the rule
  - Partial understanding
- Management of Uncertainty
  - Different types of uncertainty
  - Focus on Learning

How do theories, myths, mental models, paradigms provide foundations for management ?



Holling, CS. 1978. *Adaptive Environmental Assessment and Management*. Blackburn Press

Coral Reefs



'slippery slope to slime'

Management Approaches

UNCERTAINTY	LOW CONTROLLABILITY	HIGH CONTROLLABILITY
HIGH	Scenario Planning	Adaptive Management
LOW	Hedging	Optimal Control

Peterson, et al., 2003

What is Adaptive Management?

Passive Adaptive Management :

- -Use information on system to iteratively update, evaluate policy
- -Actions related to system state and historical constraints
- -Robust to uncertainties
- -Fails due to conservatism in face of uncertainty

Active Adaptive Management :

- -Deliberate experimentation (perturb system for response)
- -Requires trade-off between objectives and learning
- -Requires ability to control actions, partition factors
- -Adequate design (controls and replication)

Walters, C.J. (1986) *Adaptive Management of Renewable Resources*

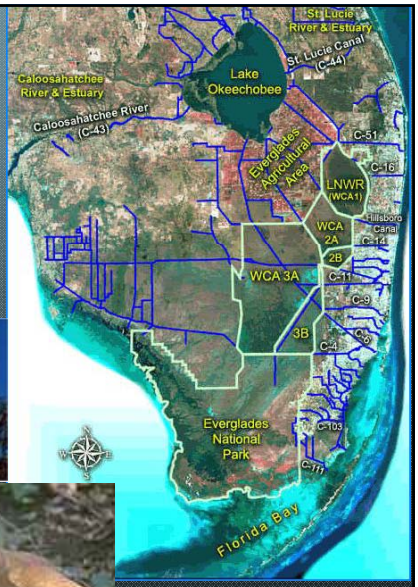
Lessons from AEAM

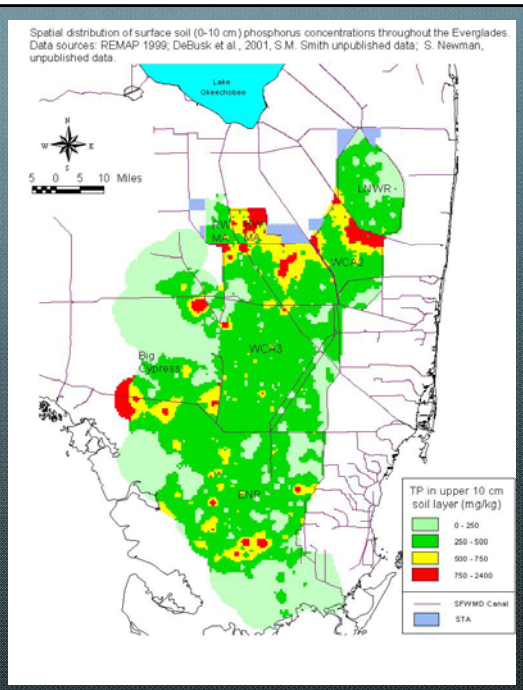
Grand Canyon
Colorado River

Everglades

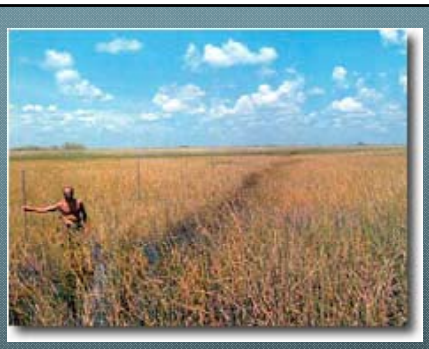
Everglades Issues

- Endangered Species (20)
- Decline in Wading Bird Nesting
- Water supply
  - (urban, agriculture, ecosystem)
- Water quality
  - (agriculture runoff)





Soil Phosphorus Concentrations (in 2000)



Sawgrass Marsh

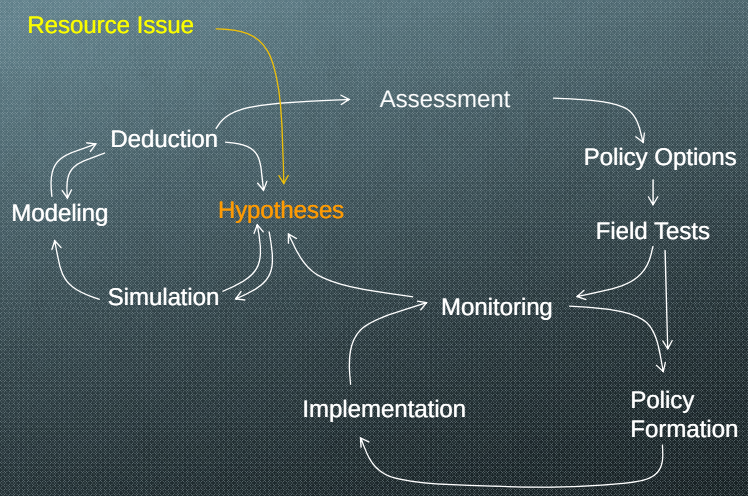
Loss of ecological resilience

Soil Phosphorus
Disturbances (fire,drought)

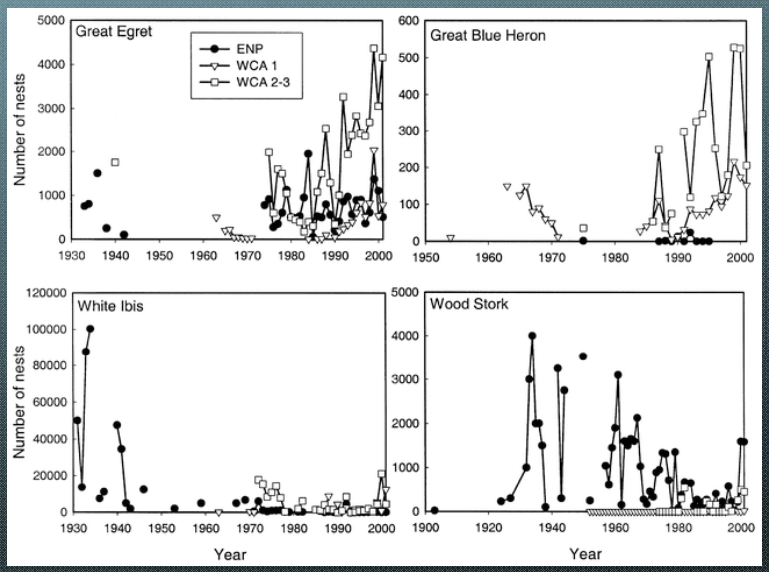
????

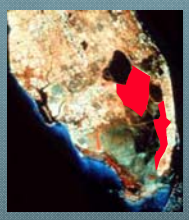
Cattail Marsh

Adaptive Environmental Assessment and Management --1970's



Issue: Everglades Wading Bird Nesting Trends





Missing Landscapes

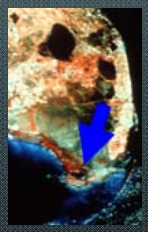
Disrupted Timing

Distant Magnet

Hypotheses of Wading Bird Nesting Decline

Shrunken Solar Collector

Parasites



Loss of Estuarine Productivity

Everglades Adaptive Management

- Assessment Workshops
  - 3 years, 8 workshops (1989-1992)
  - 60-80 persons involved
  - Transformation of Understanding
  - Led to Restudy Process
- Avoiding Management Trials
  - For more than a decade, have planned, but not acted.
  - Suggests that the social system is very resilient

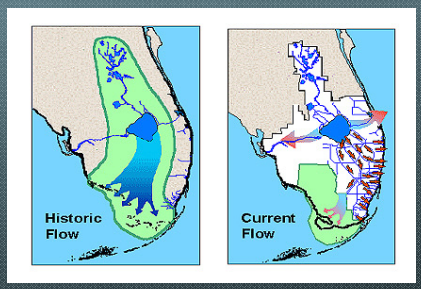
Restoration Efforts

Everglades

8 billion US$

authorized in 2000

30 year time horizon



Grand Canyon Resource Issues

Sand for Beaches
Endangered plants and animals
Recreational Use- Fishing, Rafting, Camping, Hiking
Power Generation
Non-native plants and animals
Cultural History-Claims
Water Allocations/ Deliveries

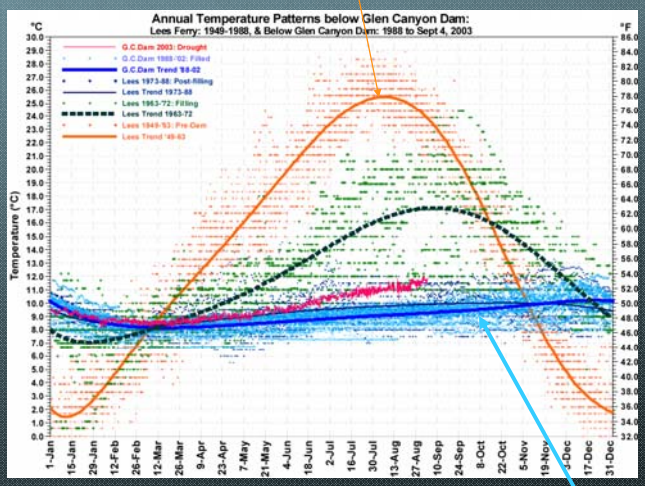
Glen Canyon Dam
Northern Arizona

Loss of Sediment

1952

1995

River Temperature pre dam



River Temperature Post dam

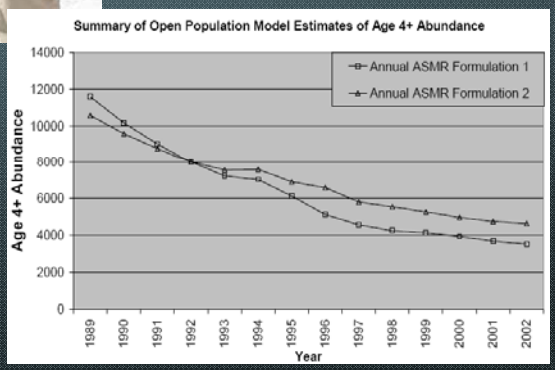
Humpback Chub

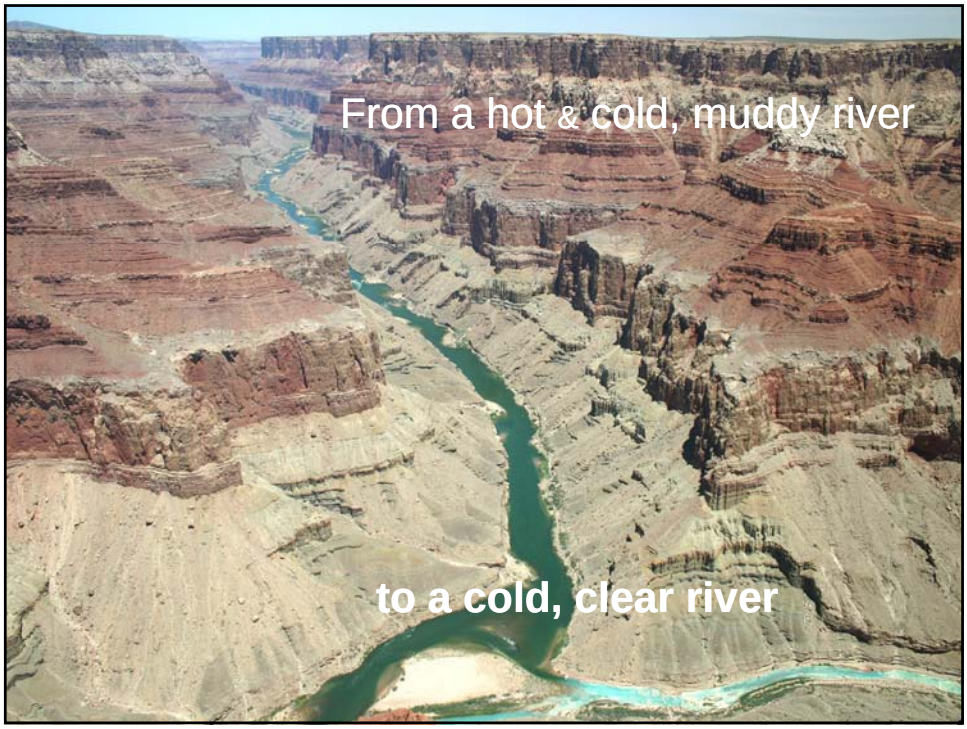
Native Fish

4 species extinct

3 endangered

Population estimates





Managing Ecological Regimes

- **Maintain desired regime**
  - Focus on thresholds
  - Enhance ecological resilience
- **Restore to more desirable regime**
  - Reversibility/hysteresis
  - Sufficient resources to experiment
  - willingness to experiment
  - ecological resilience may be intentionally degraded

Adaptive Management Experiments

- 1996 + 2004 +2008 - FLOW EXPERIMENTS
  - Sediment, Beaches, Biology?
- 2002 Predation Control
  - Salmonid (trout) control for Humpback Chub

Results of 1996 high flow test

- 1-week duration of 45,000 cfs
- Dramatically rebuilt sand bars using sand from existing channel eddy deposits
- Lack of sediment from tributary inputs in ensuing years has depleted many of the rebuilt bars
- Experiments in 2004 to rebuild sand bars

Lessons-Everglades

- **Sufficient water resources for experimentation**
- **Resilience identified in key ecosystem components**
- ***No* adaptive management experiments**
- **Risks of failure unacceptable**
- **Unresolved power issues**
- **Seeking spurious certitude**
- **Piecemeal science - correct answer/wrong problem**

Lessons-Grand Canyon

- Water release experiments
  - Changed understanding of sediment dynamics
  - Need for more sediment
  - Little or no influence on T&E species.
- No long term experimental design
  - Inability to control treatments
- Predator control experiments
  - Preliminary results positive for T&E
- Experiments are costly
  - Demonstrated loss of power revenue
- Learning and Leadership key ingredients

What is Adaptive Governance?

- Organic, bottom-up institutions developed in response to failures of top-down bureaucracies (*Ron Brunner et al.*)
- Governance that facilitates Adaptive Assessment and Management (*Gunderson, Folke, Olsson*)

Examples of adaptive governance

- Glen Canyon AMP
  - Sediment Experiments
  - Predator Control

- Great Barrier Reef Rezoning
  - Buffer against climate change
  - Increase in protected area

GC Adaptive Management & Governance

Adaptive Governance

- Bridges existing structures
  - Polycentric Institutions
    - Temporary and permanent
  - Epistemic communities
  - Creates space for political discourse
    - Can challenge boundaries
    - Can challenge power relationships
- Context for Adaptive Management

Governance Transitions

- Navigate the Transitions
  - Prepare for change
  - Develop shared views of alternative futures
  - Shared, integrative views
- Design flexible processes
  - Discourses and collaborations, not fixed structures.
  - Focus on new ideas, solutions
- Recognize opportunities
  - Variation in climate = opportunities for experimentation
  - Win-win arrangements

Questions/Comments?