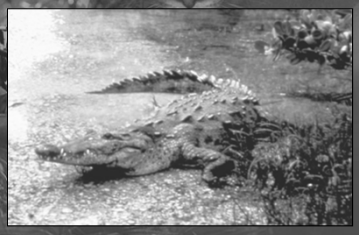
Restoration Partnering

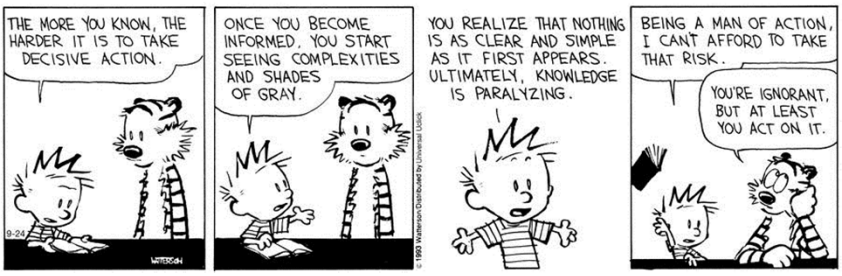


19 – Monitoring planning and success, Decision Criteria, Targets Adaptive Management, Everglades Restoration example

Steve Traxler [1] and Al Rizzo [2], Senior Biologist and complex manager
[1] South Florida Ecological Services, U.S. Fish and Wildlife Service
[2] Project Leader Coastal Delaware NWR Complex

Todays talk

- Types of Monitoring
- Everglades examples
- Funding
- AM reviews
- Pitfalls to avoid
- Primehook monitoring

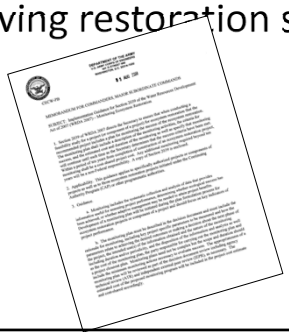


Monitoring

- Why Monitor ?
  - To determine if project is meeting performance standards
  - To detect changes in the system and benchmarks when to employ adaptive management strategies
- Where to monitor?
- When to monitor?
  - Temporal considerations such as spawning seasons
  - Growing season
  - Minimize wildlife harassment
  - Episodic events such as storm surges

Adaptive Management Defined

- **structured management** approach for addressing *uncertainties* by testing <u>hypotheses</u>, linking science to decision making, and adjusting implementation, as necessary, to improve the probability of achieving restoration success



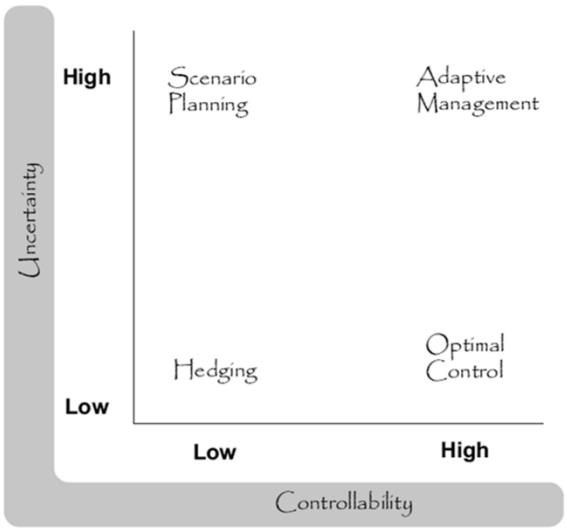
"…treat management as an adaptive learning process where management activities themselves are viewed as the primary tools for experimentation..."

(C.J. Walters 1986)

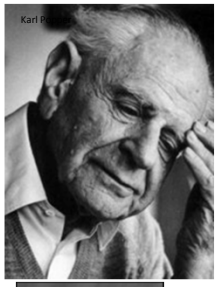
"…plans…designed from the outset to test clearly formulated hypotheses about…the system being changed…"

(Lee 1993)

When to use AM



To Communicate Complicated Scientific Knowledge to a variety of audiences you need to "tell the story"



- "It is one of the novelties of human language that it encourages story telling and thus creative imagination. Scientific discovery is akin to explanatory storytelling, to myth making and to poetic imagination."

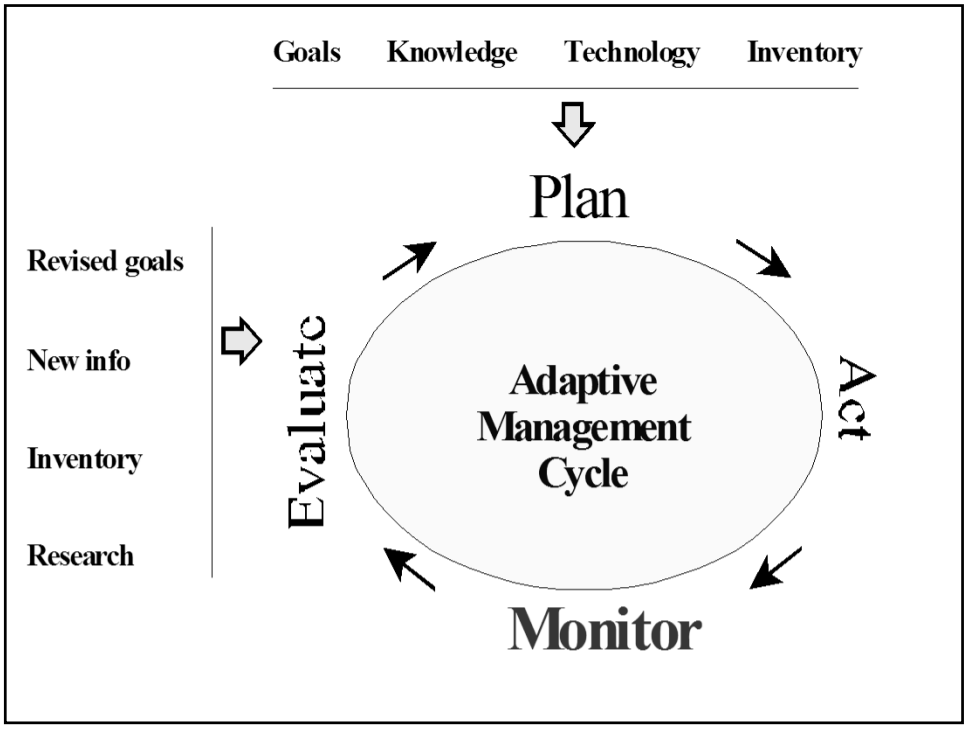
The Right Question

"Great data, <u>wrong</u> question"

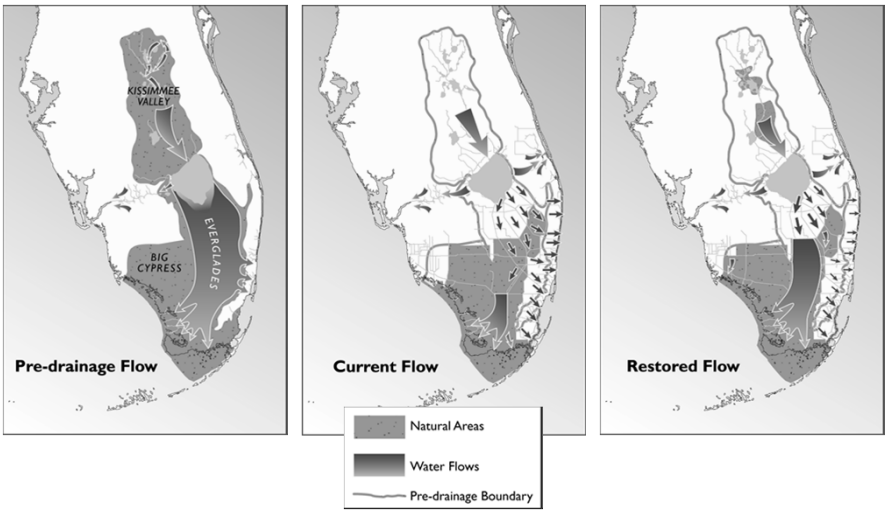
(*NRC* 1995)

"Good science usually comes of *learning to ask* good questions"

(*Civilization* Feb/Mar 2000)



Comprehensive Everglades Restoration Plan Goal

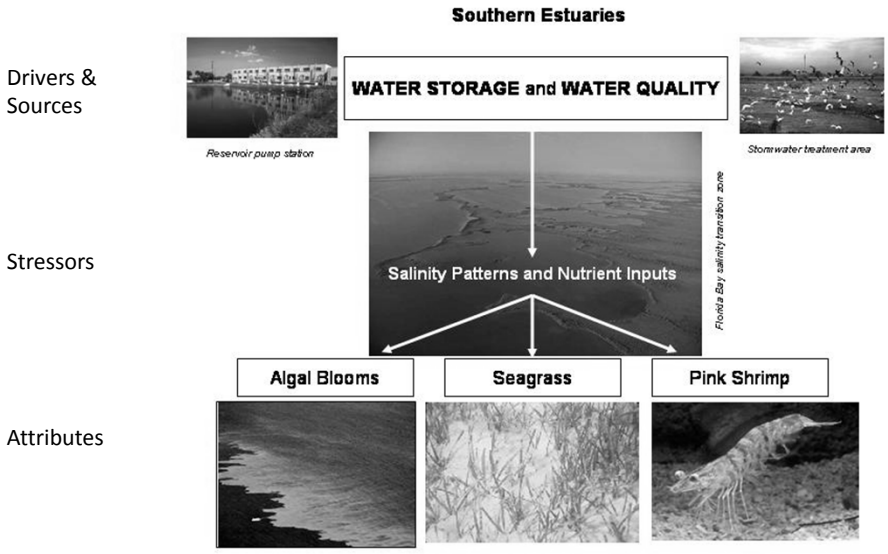


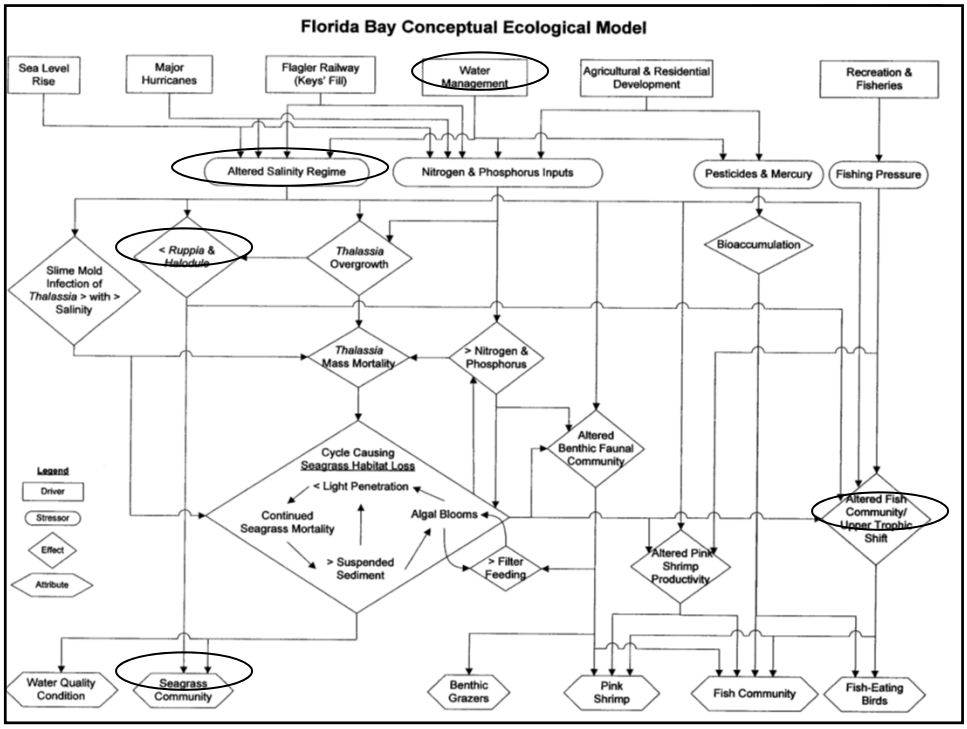
www.evergladesplan.org

Initial AM program

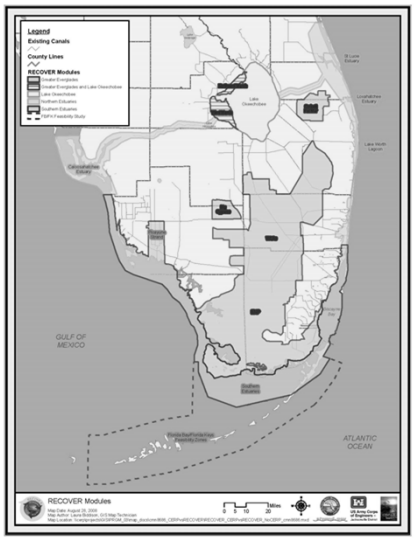
- $100 million for 10 years
  - How to keep this going?
  - How long do you need to monitor?
- Focus on Modeling, monitoring, and research
- RECOVER
  - System wide team
  - 6 teams, including evaluation and assessment
  - Still on-going

Conceptual Ecological Models





Monitoring Assessment Plan (MAP) Structure



- Organized by geographic area
  - **Lake Okeechobee**, **Northern Estuaries**, **Greater Everglades**, **Southern Coastal Systems**
- Includes ~35 monitoring components
- Acknowledges incorporation of non-funded supportive monitoring
- Monitoring components are linked to performance measures

Wait to develop monitoring plan until management actions have been identified

Link evaluation models to assessment results

– Model targets should be the same as what is monitored(i.e. if the model output is seagrass acres, density and species than seagrass acres, density and species should be monitored before and after the project is completed). Both should be linked to the management activity for a specific objective.

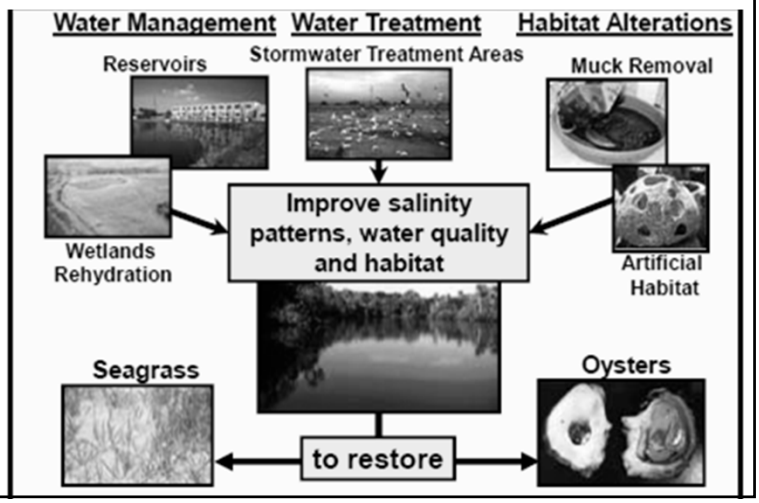
Identify and Prioritize Uncertainty

- Goals and Objectives (performance measures)
- Constraints (Water Supply, Water Quality, Flood Risk Management)
- Priorities – Confidence, Risk, and Relevance.

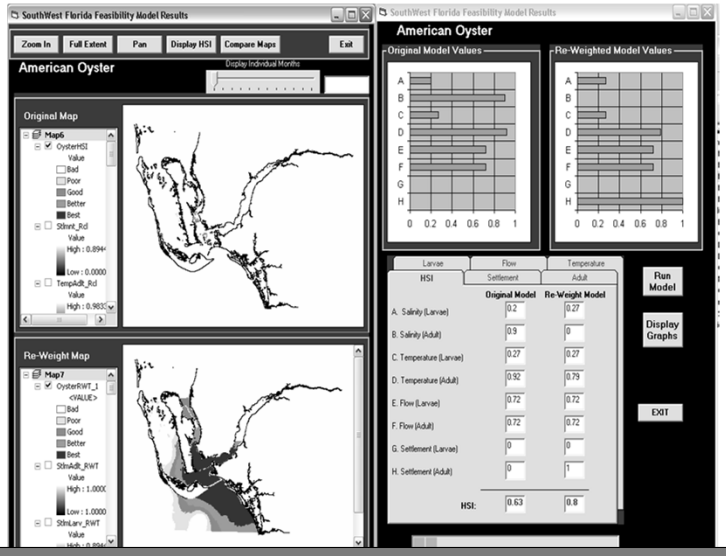
Risk	Knowledge	Relevance	Tier
High	Low	High	High
Med	Low	High	High
High	Low	Med	High
High	Med	High	High
High	Med	Med	Med
Med	Med	High	Med
High	High	High	Med
High	High	Med	Med
Med	High	High	Med
Med	Low	Med	Med
Low	Med	Low	Low
Med	Med	Low	Low
Low	Med	Med	Low
Med	High	Med	Low
Med	High	Low	Low
Low	High	Med	Low
Low	High	Low	Low

Adaptive Management Options

- CEPP: Operational Improvements of LO, Storage
- Several Options for Everglades Projects

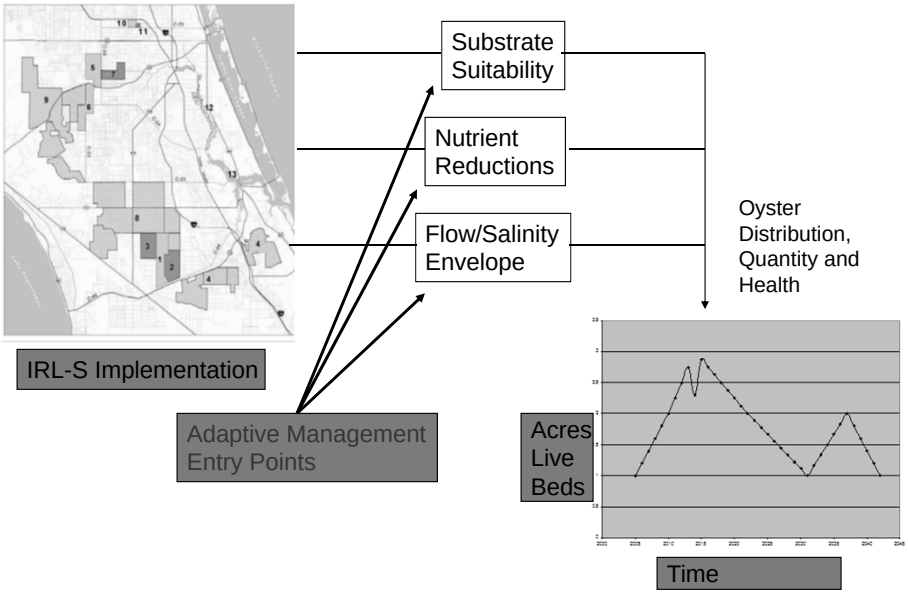


Example: Oysters a Key Indicator



Using HSI to **predict** the suitable Oyster Habitat based on differing flow/salinity scenarios which will occur as an outcome of a suite of alternative implementation actions (based on MISP and defined in five year increments as dictated by Interim Goals)

AM Example: Oyster Performance Measure



Monitoring designed to **assess** the predictions or "success of implementation" over time

Example: Testing Sedimentation from Road Development/Maintenance

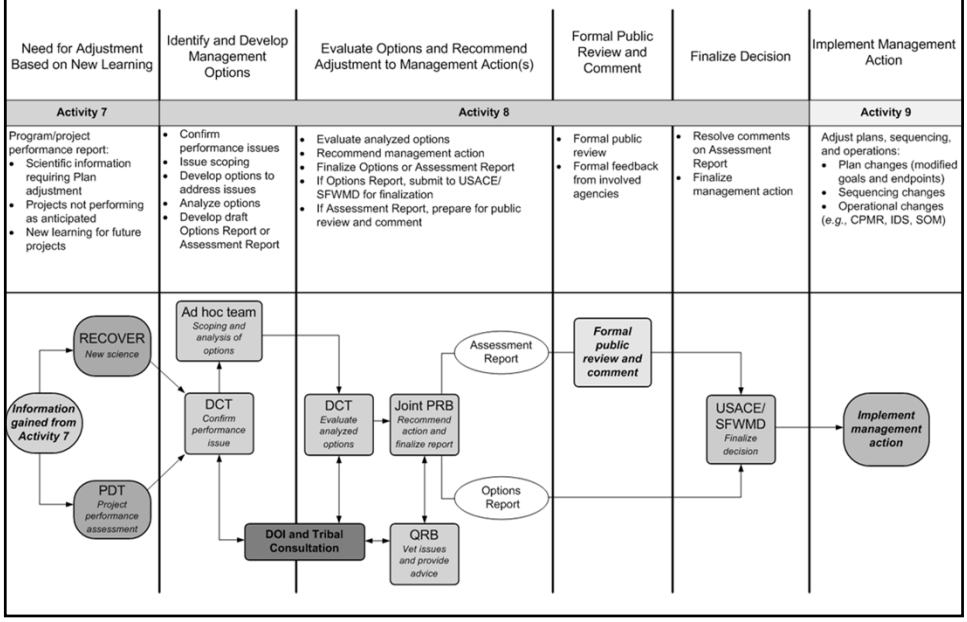
Mgmt Objective	Test (and monitoring) Hypothesis	Outcome	Data	Management Trigger	Response
Minimize sediment delivery to streams (from roads) Use model to set targets	H_0: Sediment delivery does not differ from (model) predictions (H_1: it does differ)	Estimate expected amount of sediment delivery (from action)	Measure in tons (of sediment) per year (applying sampling design)	Net increase does not exceed 49% (if exceeds 49%)	Revise practices Modify rules

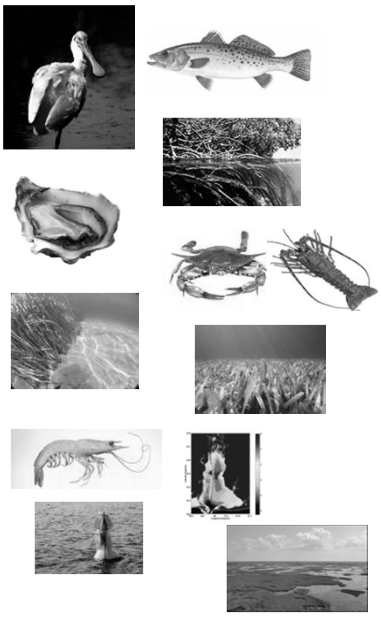
(Plum Creek HCP: www.fws.gov/r1srbo/SRBO)

Activity 6 (Monitoring [Decision Framework])

Stressor Metric	Target	Management Action OPTION 1	Management Action OPTION 2	Management Action OPTION 3
Seepage Control	**Maintain stages in Taylor Slough**	**Increase Frog Pond Stages**	**Increase Aeroject Canal Stages**	**System-wide/Regional performance issue (need additional water)**
Salinity	**Taylor River (0-9ppt) L. Madeira Bay (12-22 ppt) Terrapin Bay (12-26ppt)**	**Adjust operations**	**Increase C-111 Stages**	**System-wide/Regional performance issue (need additional water)**
Seagrass Species and Area (SAV performance measure)	**Seagrass Species and Area Increase Ruppia and Halodule species presence**	**Adjust operations to even salinity range transition and decrease salinities**	**Adjust Water Quality Source Control Measures**	**Targeted Seagrass Plantings**
Wetland macro vegetation	**Narrow mangrove fringe along shoreline; graminoid marsh inland from mangrove**	**Provide a more natural fire regime to promote and maintain graminoid marsh community**	**Physically remove forested wetland vegetation to promote growth and establishment of graminoids**	

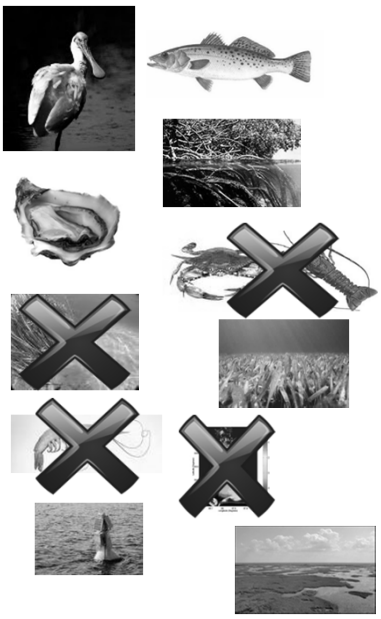
Decision-Making





SCS - FY11

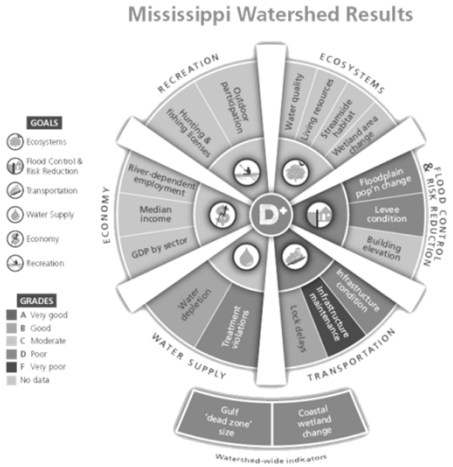
- Wading Birds/Aquatic Fauna in Biscayne Bay
- Juvenile Sportfish in Florida Bay
- Oysters in the Ten Thousand Islands
- Biscayne Bay Mangrove Fish
- Biscayne Bay Nearshore SAV
- Biscayne Bay Epifauna Communities
- Fish & Invertebrate Network
- South Florida FHAP
- Biscayne Bay Salinity Monitoring
- Hydrology & Salinity in Ten Thousand Islands
- Water Quality, Circulation & Salinity Monitoring
- Coastal Gradients



SCS - FY12

- Wading Birds/Aquatic Fauna in BB -**36%**
- Juvenile Sportfish in Florida Bay -**0%**
- Oysters in the Ten Thousand Islands -**0%**
- Biscayne Bay Mangrove Fish -**24%**
- ~~**Biscayne Bay Nearshore SAV**~~
- ~~**Biscayne Bay Epifauna Communities**~~
- ~~**Fish & Invertebrate Network**~~
- South Florida FHAP **-36%**
- Biscayne Bay Salinity Monitoring -**43%**
- Hydrology & Salinity in Ten Thousand Islands -**19%**
- ~~**Water Quality, Circulation & Salinity Monitoring**~~
- Coastal Gradients -**57%**

Mississippi River Watershed Report Card



- Six main goals integrated both ecosystem and human based indicators
- Large complicated system like the Everglades

Developing a Report Card for the Everglades

- Kick-off workshop March 2017, three more workshops Summer 2017 completion early 2019
- Work closely with regional coordinators and PIs to develop the report card collaboratively
- Report card summarizes data and gives the status of the Everglades
- Further integrate and synthesize data to give a clear picture of Everglades ecological health
- Can be used in the 2020 Report to Congress and as a high level communication tool

References

- Walters 1999
- Gregory et al. 2006
- DOI AM guide

- AM success example: Ducks, setting duck targets/allocations for north America. Very powerful partnership

Snippets of wisdom

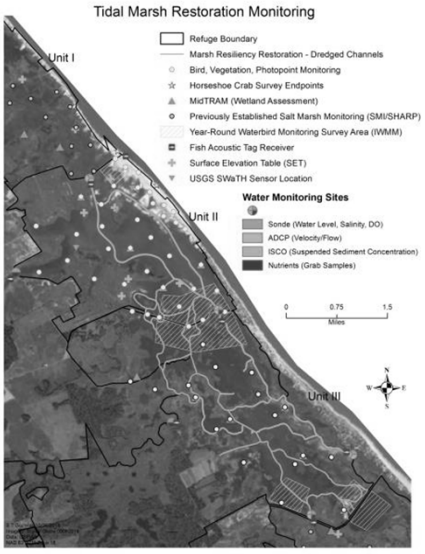
1. Link goals/objectives to monitoring
2. Develop a realistic decisional framework before analysis process
3. Make sure modeling, monitoring and research are incorporated into the process
4. Identify your key uncertainties
5. Incorporate learning
6. Develop long-term funding stream
   - Operational changes will require continued monitoring
7. Identify clear targets and a clear vision of what success will look like
8. Change detection takes more sampling sites not less
9. Data Managment

Monitoring our Progress with Partners

- Delaware Department of Natural Resources and Environmental Control (DNREC)
  - Coastal Programs / DNERR
  - Wetland Assessment
- University of Delaware
  - Chris Sommerfield, Tom McKenna, Greg Shriver, Chris Williams
- USFWS Maryland Fish & Wildlife Conservation Office
- USFWS Northeast Regional I&M and LMRD staff
- Refuge staff
- USGS
- Rutgers University

Biological Monitoring Overview

- 15-20 Bird & Vegetation Survey Points in each unit
- Unit I (north) and Unit IV (south) serve as reference areas
- Fish survey locations varied, focused at WCS and in channels
- Compiled into a Monitoring Plan as a "living document"



Water Monitoring Network

METHODS

- Network of EXO2 sondes
  - Water level, salinity, temperature, pH, dissolved oxygen
  - Continuous data, every 15 minutes
  - 3 sites included on real-time online StormCentral website
  - Maintained by *DNREC/DNERR and Refuge Staff*
- Sediment Flux study *(Dr. Chris Sommerfield, Univ of Delaware)*
  - Isco for discrete sampling (SSC, backscatter calibration)
  - ADCP / ADV for continuous sampling (flow, backscatter)
- Nutrient monitoring
  - Monthly grab samples taken by *Refuge Staff*
  - Analysis coordinated by *DNREC/DNERR*

Vegetation Community Response

METHODS

- Salt Marsh Integrity (SMI) and Saltmarsh Habitat and Avian Research Program (SHARP) *(Univ of Delaware; Refuge Staff)*
  - 50-meter radius around bird survey points
  - Community cover types and dominant species
  - Point-intercept transect (100 meters long)
  - Photopoints (North, East, South, West)
- Mid-Atlantic Tidal Rapid Assessment Method (MidTRAM)
  - Habitat Attribute: Bearing capacity, horizontal vegetation obstruction; Also - biomass, RTK elevation *(DNREC)*
- ormalized Difference Vegetation Index) *(USFWS I&M)*
  - en Water : Vegetated Marsh ratio from imagery

Bird Community Response

METHODS

- Salt Marsh Integrity (SMI) and Saltmarsh Habitat and Avian Research Program (SHARP) *(Univ of Delaware)*
  - 15-20 bird survey points per unit (including adjacent salt marsh units as reference)
  - 5-minute passive point count followed by secretive marshbird callback sequence
  - 3 visits per year (usually)
  - Ultimately… Tidal Marsh Obligate (TMO) analysis
- Integrated Waterbird Management & Monitoring (IWMM)
  - Year-round routine roadside surveys by *Refuge staff*
- Beach nesting birds
  - Routine beach surveys in partnership with *Refuge volunteers and DNREC staff*
  - Nest monitoring and protection

Bird Community Response

RESULTS / HIGHLIGHTS – Beach-nesting Birds

Most "robust" least tern (LETE) colony in the state for years

American oystercatchers (AMOY) nested but were not successful

First ever documented Piping Plover nest on the refuge in 2016

Already 4 active PIPL nests this year

Horseshoe Crab Response

RESULTS / HIGHLIGHTS – Horseshoe Crab Spawning

Surveys conducted by **Refuge staff** per DE Bay Horseshoe Crab Survey protocol

More horseshoe crabs than expected in first year!

Pre-restoration surveys were done in area just north (Unit I), serves as benchmark for comparison

Fish Community Response

METHODS

- Seasonal fish community surveys (Spring, Summer, Fall)
- Fyke nets, Seine nets, Clover traps (varied as restoration progressed)
- Acoustic tags deployed to see how diadromous fish are using the system prior to, during, and after restoration
- 8 receiver sites (11 in 2015)
- Tag data downloaded seasonally, data comes from other researchers in the network as well

Fish Community Response

RESULTS / HIGHLIGHTS – Fish Community Surveys

- Results thus far still being summarized
- Species that increased:
  - White perch
  - Sheepshead minnow
  - Black drum
- Species caught 2016 not detected previously:
  - Atlantic croaker
  - Diamondback terrapin
- Species that decreased:
  - Common carp
  - Killifish spp
  - Silverside spp
  - Mummichog

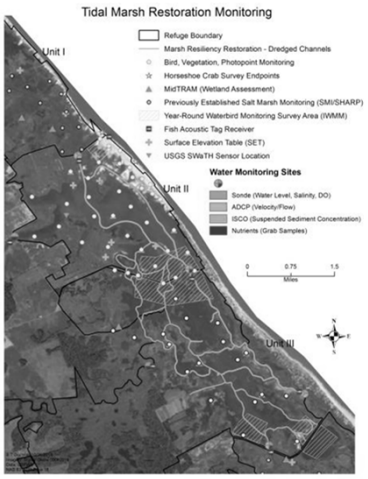
Elevation Monitoring

METHODS

- Surface Elevation Tables
  - 6 in Unit II, 3 in Unit I, 3 in Unit IV
  - Read twice per year by *Refuge Staff*
  - Includes feldspar plots

– Shoreline Position (1D) *(Refuge Staff; Rutgers Univ assisting)*
  - Conducted with National Park Service protocol
  - Spring and Fall

– Shoreline Topography (2D/3D)
(Refuge Staff; Rutgers Univ assisting)
  - Conducted with National Park Service protocol
  - 2D Spring and Fall; 3D in Spring

Ongoing Monitoring

- Post-restoration monitoring will continue
- Key monitoring partnerships funded through 2022!! ☺
- Some monitoring will be the “new order of business” for refuge biology program