Applied Science and Adaptive Management in Everglades Restoration

Matt Harwell, USFWS
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Andy LoSchiavo, USACE
Agnes McLean, NPS
Steve Traxler, USFWS
Overview

- CERP Overview
- CERP Applied Science Strategy
- CERP Adaptive Management Overview
- CERP AM Integration Example
  ★ Challenges of Implementing CERP AM
  ★ Avoiding AM Pitfalls
- DOI AM activities of interest
### Players in Everglades Restoration
*(in no specific order)*

<table>
<thead>
<tr>
<th>Federal:</th>
<th>State:</th>
<th>Others:</th>
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<tbody>
<tr>
<td>USACE</td>
<td>SFWMD</td>
<td>Miccosukee Tribe</td>
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<td>FWS</td>
<td>FDEP</td>
<td>Seminole Tribe</td>
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<td>NPS</td>
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Aquifer Storage & Recovery

Surface Water Storage Reservoir

(STAs) Stormwater Treatment Areas

Reuse Wastewater

Seepage Management

Removing Barriers to Sheetflow

Operational Changes
CERP Applied Science Strategy

- Societal Values
- Goals and Objectives
- Research and Modeling
- Conceptual Ecological Models
- Alternative Plan Evaluations
- Performance Measures
- Monitoring Plan & Assessments

Comprehensive Plan

http://www.evergladesplan.org/pm/recover/recover.aspx
Effective Use of Science

Effective Science
- Content
- Quality

Effective Use of Science
Institutional process where science is:
- Generated
- Evaluated
- Applied

A structured process of learning & doing

Image from: Nyberg, 1999
Adaptive Management Activities for CERP

Plan Formulation ➔ Design/Construction ➔ Operations

Activity 1: Engage Stakeholders and Interagency Collaboration

Activity 2: Establish/Refine Goals and Objectives

Activity 3: Identify and Prioritize Uncertainties

Activity 4: Apply CEMs, Develop Hypotheses, and Performance Measures

Activity 5: Integrate AM Principles into Plan Design and Implementation

Activity 6: Monitor Ecosystem Response

Activity 7: Assessment

Activity 8: Decision-Making

Activity 9: Adjustment
### CERP AM Integration Process

#### USACE Six Step Planning Process

<table>
<thead>
<tr>
<th>Step 1: Identify Problems and Opportunities</th>
<th>Activity 2: Establish or Refine Restoration Goals and Objectives</th>
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<tbody>
<tr>
<td>Step 2: Inventory and Forecast Conditions</td>
<td>Activity 3: Identify and Prioritize Uncertainties</td>
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<tr>
<td>Step 3: Formulate Alternative Plans</td>
<td>Activity 4: Develop And Apply CEMS, Hypotheses, Performance Measures</td>
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<td>Step 4: Evaluate Alternative Plans</td>
<td>Activity 5: Integrate AM Into Restoration Plan</td>
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<tr>
<td>Step 5: Compare Alternative Plans</td>
<td>Activity 6: Monitor</td>
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<tr>
<td>Step 6: Select Plans</td>
<td>Activity 7: Assess</td>
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<td>Project Life-Cycle: Design</td>
<td>Activity 8: Decision-Making</td>
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<td>Project Life-Cycle: Construct</td>
<td>Activity 9: Implementation and Refinement</td>
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<tr>
<td>Project Life-Cycle: Operation and Maintenance</td>
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#### Nine AM Activities For CERP

- Activity 1: Stakeholder Engagement and Collaboration
- Activity 2: Establish or Refine Restoration Goals and Objectives
- Activity 3: Identify and Prioritize Uncertainties
- Activity 4: Develop And Apply CEMS, Hypotheses, Performance Measures
- Activity 5: Integrate AM Into Restoration Plan
- Activity 6: Monitor
- Activity 7: Assess
- Activity 8: Decision-Making
- Activity 9: Implementation and Refinement
Integrating AM into Existing Processes

Water Management
- Reservoirs
- Wetlands

Water Treatment
- Stormwater Treatment Areas
- Muck Removal
- Artificial Habitat

Habitat Alterations
- Improve salinity patterns, water quality and habitat
- Oysters

Seagrass

to restore
Oysters – Example

Monitoring designed to assess the success of implementation over time.
HSI to predict suitable Oyster Habitat based on differing flow/salinity scenarios that will occur as an outcome of implementation.
<table>
<thead>
<tr>
<th>Stressor metric</th>
<th>Target</th>
<th>Management Action OPTION 1</th>
<th>Management Action OPTION 2</th>
<th>Management Action OPTION 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salinity</td>
<td>Salinity range of 10-25 ppt</td>
<td>Change operations to meet flows</td>
<td>Stock adults</td>
<td>Operations to avoid too much or too little flow in key months</td>
</tr>
<tr>
<td>Recruitment</td>
<td>Presence Absence adults and larvae</td>
<td>Stock larvae</td>
<td>Try different substrate e.g., concrete</td>
<td>Dredge muck</td>
</tr>
<tr>
<td>Substrate</td>
<td>Acres of Suitable habitat</td>
<td>Add oyster shell cultch</td>
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</table>
Challenges of Implementing CERP AM

- Clarifying roles for implementation, decision-making, refinement
- **Stakeholder engagement** and collaboration with non-agency stakeholders
- Establishing clear ecosystem restoration goals and objectives (**endpoints**) at multiple scales
- Integrating **applied science**; science tools
- **Science momentum**: funding; targets; start/end
- Achieving **institutional change** that embraces AM principles
Avoiding AM Program Pitfalls

- Governance Model
  - Establish while developing AM strategy; Legislative mandate
  - Scientists alone cannot create effective AM program

- Effective Use of Science
  - Directly inform management actions; secure monitoring $

- Stakeholder Engagement
  - Develop strategies up front for different levels

- Management/Policy Buy In
  - Work at all levels, especially budget decision levels

- Flexible AM designs
  - Different types of AM plans for different types of projects
Conducting Ecosystem Restoration …
.... one meeting at a time*

*Disclaimer: The opinions expressed herein do not necessarily reflect those of DOI.
ADAPTIVE MANAGEMENT:
The U.S. Department of the Interior Applications Guide

Adaptive Management Working Group
Chair: Olivia Barton Ferrier

Lead Authors
Byron K. Williams, Eleanor D. Brown, and Carl D. Shapiro

Thematic Writing Teams

Climate Change
Mary Boasman - Lead
Dorina Brundt
Sarah Converse
Greg Eckert
Kristin Heuer
Kurt Johnson
Harold Laszewski
Don Lepofsky

Energy
Jim Wurts - Co-Lead
Liamme Bals - Co-Lead
John Cragun
Joy Hanstock
Linda Nelson
Margaret Van Gilder

Interests in Natural and Human Systems
Bruce Peacock - Lead
John Dennis
Maria Etxe
Carmen Feltz
Melinda Kimmich
Kerstan Levens
Clinton Moore

Other Contributors
Ellen Benn, Bernard Bormann, Elise Drum, Fred Johnson, Conner McGowan, James Nichols, Jonathan Salo
Strategic Habitat Conservation & AM

Substitute Restoration for Conservation

Landscape Conservation Cooperatives are vehicle for Implementing SHC Principles
Landscape Conservation Cooperatives (LCCs)

Public-private partnerships applying a networked approach to conservation — holistic, collaborative, adaptive and grounded in science

http://www.doi.gov/lcc/index.cfm