Overview of the CERP Adaptive Management Program

A Management Approach for Achieving Restoration Success

July 2008
“…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)
DOGBERT THE QUANTIFIER

HOW CAN I QUANTIFY THE BENEFITS OF MY DEPARTMENT?

TRY MAKING ABSURD CLAIMS OF VALUE WHILE HOPING THAT NO ONE ASKS QUESTIONS.

DOES THAT WORK?

I HOPE SO. HERE'S MY INVOICE.
Overview

- Describing AM
- Background and History
- Benefits of AM
- Determining When to Apply AM
- Applying AM to CERP (project and program-level)
- Next Steps and challenges
Habitat Restoration and Ecosystem Management

Restore natural hydrology quality, quantity, timing, distribution

Restore and maintain biodiversity of the natural communities
WATER FLOW PATTERNS

Historic Flow

Current Flow

The Plan Flow
CERP

- 68 components
- ~30 projects
- 35 years to build

Reuse Wastewater
Seepage Management
Aquifer Storage & Recovery
Surface Water Storage
Stormwater Treatment Areas
Removing Barriers to Flow
Operational Changes
Intent of Adaptive Management

- To make learning part of the action, i.e., "a structured process of learning by doing"

- and using the results to adjust the action

- e.g., North American waterfowl management; fisheries in Australia, British Columbia

- see WEB Journal: Conservation Ecology
What is Adaptive Management?

- **Alternative management approach to achieve success**
- **Formal process to enable informed decision-making**
- **Ability to act confidently in the face of uncertainty**
- **Stakeholder engagement and collaboration**
- **“Learning by Doing” NOT “Trial and Error”**
History

- **Adaptive management**
  - poorly understood concept
  - haphazard or inconclusive application
  - regulatory constraints (e.g., NEPA)
  - institutional resistance

- **Monitoring**
  - good research but wrong question
  - lack of statistical rigor and quality control
  - inconsistency in methods and data collection
  - no (or weak) link to decision making
CERP AM Background and History

- December 2000 - Congress Authorized AM for CERP
- November 2003 - CERP Pro Regs required development of AM program
- January 2004 - CERP AM Monitoring and Assessment Plan
- April 2006 - CERP AM Strategy Published by RECOVER
- August 2006 - NRC endorses the CERP AM program
MAP 2004
- CERP/Yellow Book
- Applied Science Strategy
- CEMs, Hypotheses, & PMs
- NRC (CROGEE)
- Draft IGs

ACRONYMS
AM - Adaptive Management
IGs - Interim Goals
WS/FP – Water Supply/Flood Protection
PLM - Project-level Monitoring
SSR - System Status Report
MISP - Master Implementation Sequencing Plan
IDS - Integrated Delivery Schedule

MAP 2008

IMPLEMENTATION
- QRB, DCT & RLG
- USACE/SFWMD Budgets
- Other Agency Budgets
- Sequencing (MISP/IDS)
Proposed Implementation

Process of MAP 2008

MAP Module Refinement
RECOVER-wide Perspective
MAP 2008 "Workshop Series"
IG update
Update inventory of all monitoring

PM refinement
MAP Monitoring Component Refinement

Science Influence
Management Perspectives

MAP 2008
Management Influences
Benefits of AM

- Improved probability of restoration success
- Addresses decision-limiting questions (uncertainty)
- A forum for dialogue between scientists and managers
- Ability to adjust restoration implementation
- Long-term collaboration with stakeholders
PLANNING

Much work remains to be done before we can announce our total failure to make any progress.

www.despair.com
<table>
<thead>
<tr>
<th>CURRENT SYSTEM</th>
<th>FUTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EFFORT</strong></td>
<td><strong>ATTRIBUTE</strong></td>
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<tr>
<td>RECOVER</td>
<td>Evaluation PMs</td>
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<td>Evaluation</td>
<td>Assessment PMs</td>
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<tr>
<td>RECOVER</td>
<td>Evaluation Indicators</td>
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<td>Assessment</td>
<td>Assessment Indicators</td>
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<tr>
<td>Interim</td>
<td>Evaluation PMs</td>
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<td>Goals and Targets</td>
<td>Assessment PMs</td>
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<tr>
<td>Project Level</td>
<td>Benefits PMs</td>
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Consolidation into an evaluation methodology with complementary performance metrics.
PROPOSAL

Develop an Evaluation Methodology using the CEM-based attributes that the CERP will monitor.

Build needed tools with MAP results – if already developed, use MAP results to refine tools.

As we monitor, we’ll improve our ability to make ecological predictions.

As a result, when it’s time to adaptively manage, we’ll have a higher probability of planning appropriately and reaching success!
Example: Testing Sedimentation from Road Development/Maintenance

<table>
<thead>
<tr>
<th>Mgmt Objective</th>
<th>Test (and monitoring)</th>
<th>Management Trigger Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimize sediment delivery to streams (from roads)</td>
<td><strong>H$_0$</strong>: Sediment delivery does not differ from (model) predictions (<strong>H$_1$</strong>: it does differ)</td>
<td>Estimate expected amount of sediment delivery (from action) Measure in tons (of sediment) per year (applying sampling design)</td>
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(Plum Creek HCP: www.fws.gov/r1srbo/SRBO)
Proposed Adaptive Management Plan for Oysters

<table>
<thead>
<tr>
<th>Stressor metric</th>
<th>Target</th>
<th>Management Action</th>
<th>Management Action</th>
<th>Management Action</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>OPTION 1</td>
<td>OPTION 2</td>
<td>OPTION 3</td>
</tr>
<tr>
<td>Salinity</td>
<td>Salinity range of 10-25 ppt</td>
<td>Change operations</td>
<td>Change operations</td>
<td>Change operations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to meet flows</td>
<td>to meet flows</td>
<td>to avoid too much</td>
</tr>
<tr>
<td>Substrate</td>
<td>Acres of suitable habitat</td>
<td>Add oyster shell</td>
<td>Try different substrate</td>
<td>Print text here</td>
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<tr>
<td></td>
<td></td>
<td>cultch</td>
<td>(e.g., concrete)</td>
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<tr>
<td>Recruitment</td>
<td>Presence/absence adults and larvae</td>
<td>Stock larvae</td>
<td>Stock adults</td>
<td>Change operations</td>
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<td>to avoid too much</td>
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<td>or too little flow</td>
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<td></td>
<td>in key months</td>
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<tr>
<td>Disease</td>
<td>Elimination</td>
<td>Operate flows to</td>
<td>Lower salinity</td>
<td>Excessive predation</td>
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<td>maintain salinity</td>
<td>threshold and</td>
<td>may require salinity</td>
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<td></td>
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<td>below maximum</td>
<td>adjust operations</td>
<td>adjustments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>threshold</td>
<td>accordingly</td>
<td>through operations</td>
</tr>
<tr>
<td>Juvenile growth and</td>
<td>Attain natural levels of growth and mortality</td>
<td>If flow/salinity</td>
<td>Adjust flows to</td>
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<tr>
<td>mortality</td>
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<td>events are</td>
<td>attain salinities</td>
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<td>affecting</td>
<td>similar to</td>
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<td>growth or</td>
<td>creeks similar to</td>
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<td>mortality, adjust</td>
<td>oyster growth is</td>
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<td>minimize events</td>
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**OPTION 1**
- Change operations to meet flows
- Change operations to maintain salinity below maximum threshold
- If flow/salinity events are affecting growth or mortality, adjust operations to eliminate or minimize events
- Adjust flows to attain salinities similar to creeks where oyster growth is optimal

**OPTION 2**
- Try different substrate (e.g., concrete)
- Stock larvae
- Stock adults
- Lower salinity threshold and adjust operations accordingly

**OPTION 3**
- Dredge muck
- Change operations to avoid too much or too little flow in key months
- Excessive predation may require salinity adjustments through operations
Project Level AM Application

- AM is not appropriate for all projects.
  - AM should be applied if there is uncertainty about:
    - (1) natural system structure and function;
    - (2) The most effective design and operation; and
    - (3) The desired endpoints

- Use AM if decision-making is limited by these issues

- Projects can evaluate benefits of AM vs. Costs and Challenges
Determining When To Apply AM (Program-Level)

- CERP has applied AM principles stated in the CERP AM Strategy (2006)

- The following program activities apply AM for CERP:
  - Yellow Book
  - MAP – Conceptual Modeling and Hypotheses
  - Performance Measures and Interim Goals
  - Future Assessment Report
  - System Operating Manual
  - Integrated Delivery Schedule
  - Comprehensive Plan Modification Report
Nine Activities to Apply AM for CERP

Activity 1: Engage Stakeholders and Collaborate with Agencies

Activity 2: Establish or Verify Program Goals and Objectives

Activity 3: Identify and Prioritize Unanswered Questions

Activity 4: Use Conceptual Models, Hypotheses, and Performance Measures

Activity 5: AM Integration into Restoration Plan

Activity 6: Monitoring

Activity 7: Assessment

Activity 8: Decision-Making

Activity 9: Implementation and Refinement
STAKEHOLDERS

- NGOs
- Decision Makers (agency and others)
- End users
Why Monitor?

- Detect changes in:
  - species abundance, condition, population structure
  - habitat amount, condition
  - management actions

- Support management needs (primary reason)
  - provide early warning
  - measure species response to mgmt or other factors
  - provide basis for adjusting/modifying the action

- Other reasons:
  - improve information base – most commonly used
Role in Adaptive Management

- Provide knowledge of the manner in which the system is likely to respond to possible management alternatives.

- Provide periodic assessment of the system’s state... at decision points in management process.

- Provide insights into cause-effect relations between stressors and responses.

How will you ever know?
Addressing Uncertainty

- AM means identifying and acknowledging uncertainty
  - recognize uncertainty as an attribute of management
  - use management (and monitoring) as a tool to reduce uncertainty

Risk?
Determining What to Monitor

- What’s your information need?
  - to improve your knowledge (baseline information)
  - to detect change in status or trends (species, habitat, threats)
  - to identify how the action was implemented
  - to understand effects of an action (on species or habitat)
  - to identify relations between observed trend and action

- Important to the type of monitoring needed
  - does your need relate to the management objectives?
  - can you quantify (what you need)? measure?
  - can you link results to possible decisions?
DECISION MAKING

- Annual Meetings
  - Interdisciplinary
  - Gray Beards

- MCDA or other methods
Logic for setting ‘thresholds’

- Agreed safety margin based on uncertainty and risk aversion
- Best technical estimate of the level of indicator where irreversible change occurs

**Source:** B. Scholes
Next Steps

- AM Briefings and Training
- Explore Options for Project-level AM Application
- Continue to Integrate AM Into Program Activities
Future Challenges

- Re-authorization of AM program
  - Keeping the monitoring money flowing
  - Linking the scientists and the project planners
- Data management for the assessment
- Building the decision methodology
- AM champion
- Completing ecological models for assessment and evaluation
  - Relating this to Management measures
- IAR and planning at a reasonable level
Questions?

- For more information, please contact:

  - **AT Chairs:**
    - Patti Sime, South Florida Water Management District (psime@sfwmd.gov);
    - Greg Graves, South Florida Water Management District (ggraves@sfwmd.gov);
    - Steve Traxler, U.S. Fish and Wildlife Service (Steve_Traxler@fws.gov).

  - **RLG members**
    - Dave Tipple, U.S. Army Corps of Engineers (Dave.A.Tipple@usace.army.mil);
    - Bruce Sharfstein, South Florida Water Management District (bsharfs@sfwmd.gov);
    - Agnes McLean, National Park Service (Agnes_McLean@nps.gov); or
    - Lorraine Heisler, U.S. Fish and Wildlife Service (Lorraine_Heisler@fws.gov).

- Additional information can be found at the following website:
  [http://www.evergladesplan.org/pm/program_docs/adaptive_mgmt.aspx](http://www.evergladesplan.org/pm/program_docs/adaptive_mgmt.aspx)