How to Apply Adaptive Management for CERP

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What is Adaptive Management (AM)?

Adaptive management (AM) provides an alternative management approach for designing and effectively implementing programs and projects that manage and/or restore spatially, scientifically and socio-politically complex natural systems. Recognizing there were many uncertainties associated with the Comprehensive Everglades Restoration Plan (CERP), Congress authorized the development of an AM program for CERP in the 2000 Water Resources Development Act. Through AM, uncertainties could be addressed and restoration goals are more likely to be achieved.

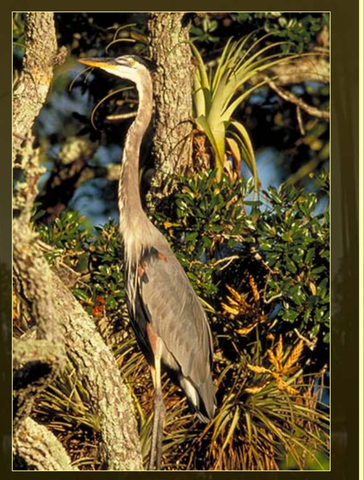
Traditional water resource management project planning for infrastructure such as dams, reservoirs and canals, depends upon high levels of both predictability with respect to the performance of alternative plans, as well as agreement on project goals. Predictions of plan performance are usually generated using numerical models to characterize the results of management actions at discrete spatial scales, and to define program/project goals. For ecosystem restoration projects, however, comparatively few numerical models exist that can accurately predict ecosystem responses This results in uncertainty as to which management decision should be made; disagreement regarding the most effective routes for achieving project objectives, and questions regarding which quantitative restoration targets should be adopted.

What are the Benefits of AM?

- Improved probability of restoration program and project success
- Use of the precautionary approach to act in the face of uncertainty
- Long-term engagement with stakeholders to strengthen institutional ties, and to build trust and support for moving programs/projects forward
- A forum for dialogue between scientists and managers that facilitates timely discussion of management issues
- Development of robust alternatives that have the performance-based versatility needed to address a range of potential future conditions, and achievement of restoration goals and objectives

How Does It Work?

The CERP AM Strategy's scientific method was developed to address scientific and engineering uncertainties by generating new information through assessments of monitoring results compared to expected project and operation effects. The strategy allows for incremental adjustments to projects and operations to facilitate restoration benefits at the earliest point possible. Nine AM activities are suggested for implementing the AM Program for CERP at both the program and project management levels.



Nine Adaptive Management Process Activities

Nine AM Activities for CERP

1. **Stakeholder engagement and interagency collaboration:** Stakeholders should be identified and engaged throughout the project/program implementation.
2. **Establishment of restoration goals and objectives:** Once the restoration problem is clearly understood, goals and objectives can be identified to address the problem and the fundamental knowledge gaps.
3. **Identification of unanswered questions:** Key scientific and engineering questions should be addressed by the AM scientific process.
4. **Use of conceptual modeling, hypotheses and performance measures:** AM requires the development of models that depict how the natural system is likely to respond to management actions. These conceptual models can be used to develop hypotheses that can be tested by management actions and performance measures to provide the results needed to address scientific unanswered questions.
5. **AM integration into restoration planning:** Project design should include robust alternatives capable of responding to various potential scenarios; the AM process will test hypotheses, provide learning benefits, and allow for adjustments to improve restoration projects and programs.
6. **Monitoring ecosystem response:** A well designed monitoring program is implemented to provide feedback against performance expectations.
7. **Assessment of ecosystem response:** Scientists and managers assess monitoring results against predicted ecological response to determine whether adjustments are required.
8. **Decision-making:** Scientists, managers and stakeholders evaluate management options to address performance issues to ensure restoration goals and objectives are met.
9. **Implementation and refinement:** Restoration programs and projects are adjusted based on management decisions to improve restoration performance.

When Should AM be Applied?

CERP agencies developed an AM program that includes: (1) System-wide and project-level predictive modeling to select the best plans; (2) system-wide monitoring and assessment by the CERP Monitoring and Assessment Program (MAP) to ensure restoration results and performance issues are reported to managers; and (3) a scientific/management forum to convey performance issues to managers and to evaluate options to adjust projects and operations to ensure restoration goals are achieved. Use of AM is essential for achieving program/project objectives in any situation where there are comparatively high levels of uncertainty and/or disagreement about:

- How complex ecosystems function
- The most effective design and operation to achieve program/project goals
- The desired endpoints for defining program/project success

Adaptive Management Related GEER Presentations

Monday Morning, Jon Cline: Application of a Multi-Modeling Framework to Linking Ecosystem Pattern and Process Across Scales: Implementation of a Decision Support Tool for Adaptive Ecosystem Management in the Everglades Mangrove Zone

Wednesday Morning, Matt Harwell: What Managers Need to Know About System-wide Science to Improve Restoration Planning and Maximize Adaptive Management

Thursday Afternoon, Adaptive Management Workshop

- **Steve Traxler:** CERP AM Program Implementation
- **Andrew LoSchiavo:** System-wide Planning for CERP: Lessons Learned from Band 1Model Run Evaluation
- **Robert Doren:** Ecological Indicators for System-wide Assessment of the Greater Everglades Ecosystem Restoration Program
- **Rachel Pawlitz:** Data Communication and Decision Support Tools in Everglades Restoration
- **Matt Harwell:** AM in a Learning Environment - A Case Study of Hydrology and Water Quality at Loxahatchee NWR
- **Lynn Wingard:** Restoration and Sea-Level Rise: The Role of Paleoecologic Data in Incremental Adaptive Management Strategies
- **Eric Bush:** CERP Project Implementation - Incremental Analysis and Justification of a Comprehensive Plan
- **John Ogden:** The Yellow Book Nine Years Later - Unanticipated and Unresolved Issues