



Linking New Information with Future Decision Making

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**"SCIENCE PROGRESSES BEST WHEN
OBSERVATIONS FORCE US TO ALTER
OUR PRECONCEPTIONS." - VERA
DOURMASHKIN RUBIN (1911-1985)**

Overview

- Adaptive Management Activities 6-9
- CERP Decision Making Process
- Points of Stakeholder Engagement
- Examples from Other Programs
- Setting Targets and Decision Criteria
- Feeding Information to Decision Makers
- Taking Action

Adaptive Management Activities 6-9

- Activity 6 – Monitoring
 - Develop and implement monitoring plan
 - Link monitoring with decision making in management options matrices
- Activity 7 – Assessment
 - Verify data has ability to detect CERP performance
 - Assess data and determine restoration progress
 - Prepare performance report identifying any issues requiring response

Monitoring & Assessment Plan (MAP)
Activity 6

- Comprehensive system-wide monitoring and assessment plan
- Develop/refine hypotheses, conceptual models and sampling design
- Collect data and ensure link between monitoring, performance measures , and Interim Goals

CERP Project-level Monitoring



Principal Investigator Annual Reports
Activity 7

- Compile monitoring data (CERP & non-CERP) and assess annually
 - Evaluate sampling design and ensure data quality
- Provide initial analysis at the monitoring component level



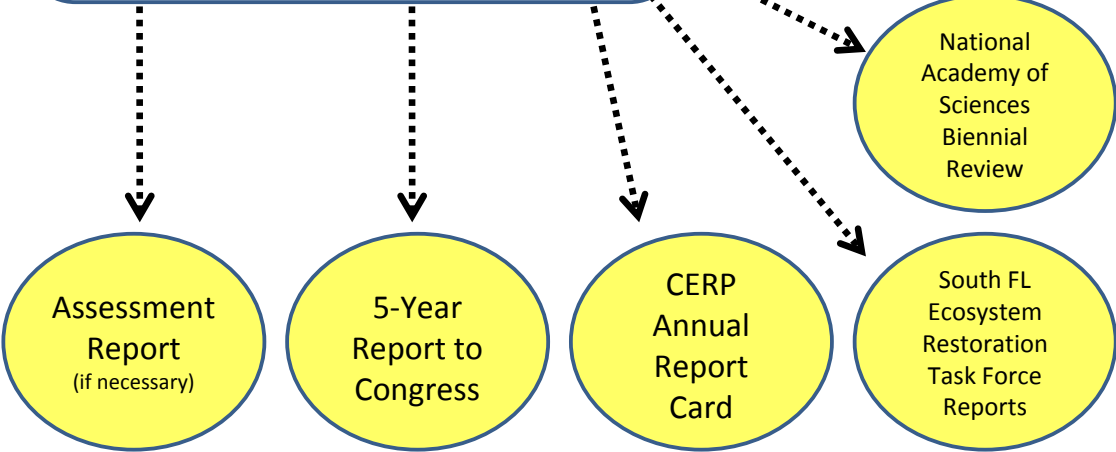
Biennial System Status Report (SSR)*
Activity 7

- Integrate PI Annual Reports regionally (by MAP module)
- Provide system-wide assessment of hypotheses, performance measures and Interim Goals
 - Identify unexpected results
- Review progress toward achieving restoration goals and objectives

**Every 5 years, the SSR is submitted as the RECOVER Technical Report*

Other Reports

- South FL Environmental Report
- Regional Environmental Monitoring and Assessment Program (REMAP)
- South FL Wading Bird Report



AM thought

- Baseline monitoring is much easier than change detection
 - Projects often have small hydrologic changes which may have small or large changes to the environment

CURRENT SYSTEM

FUTURE

EFFORT

ATTRIBUTE

**RECOVER
Evaluation
RECOVER
Assessment**

Evaluation PMs
Assessment PMs

**Interim
Goals
and
Targets**

Evaluation Indicators
Assessment Indicators

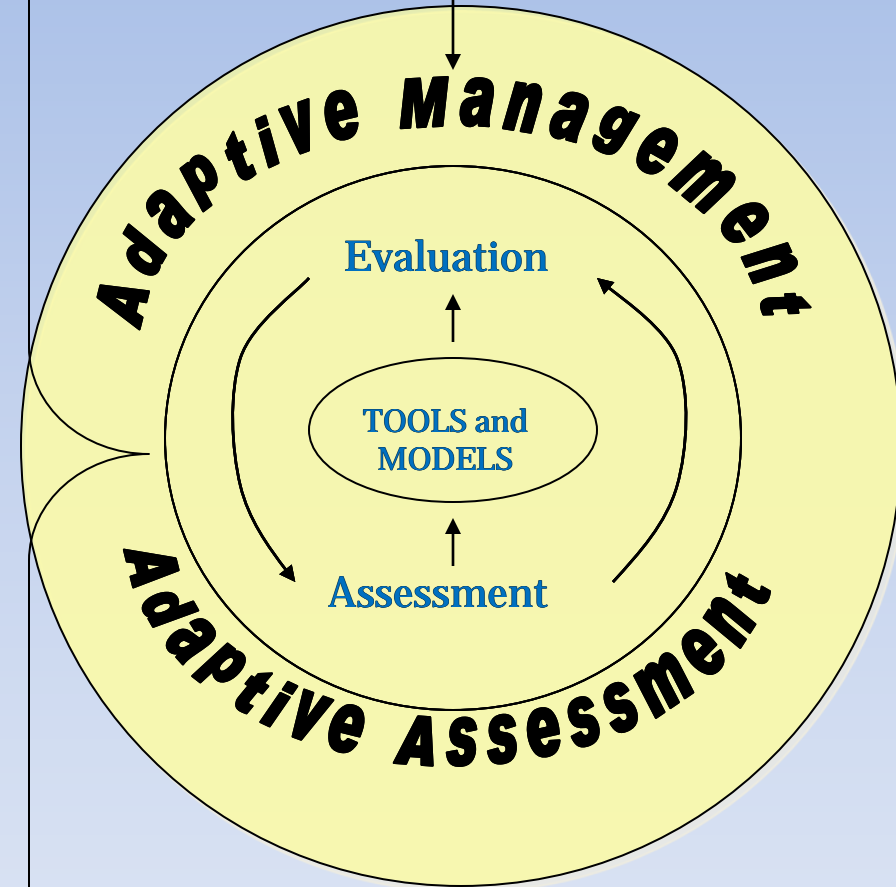
**Project
Level**

Evaluation PMs
Assessment PMs

**Benefits
Methodology**

Benefits PMs

**Consolidation into
an evaluation methodology with
complementary performance
metrics**

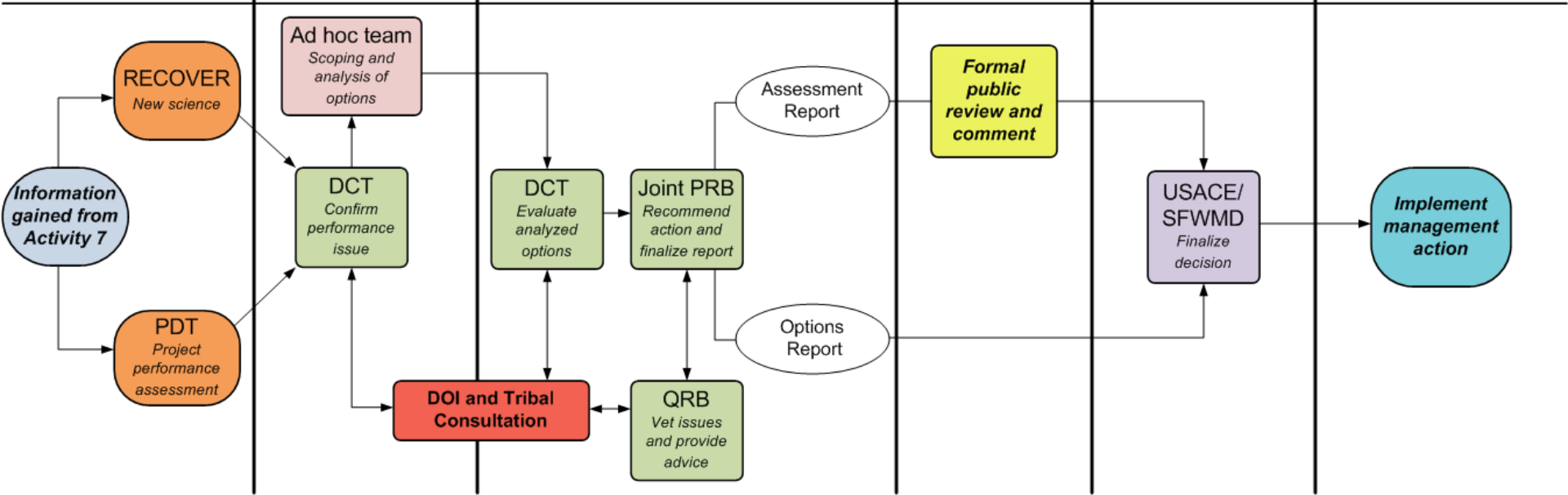


Adaptive Management Activities 6-9

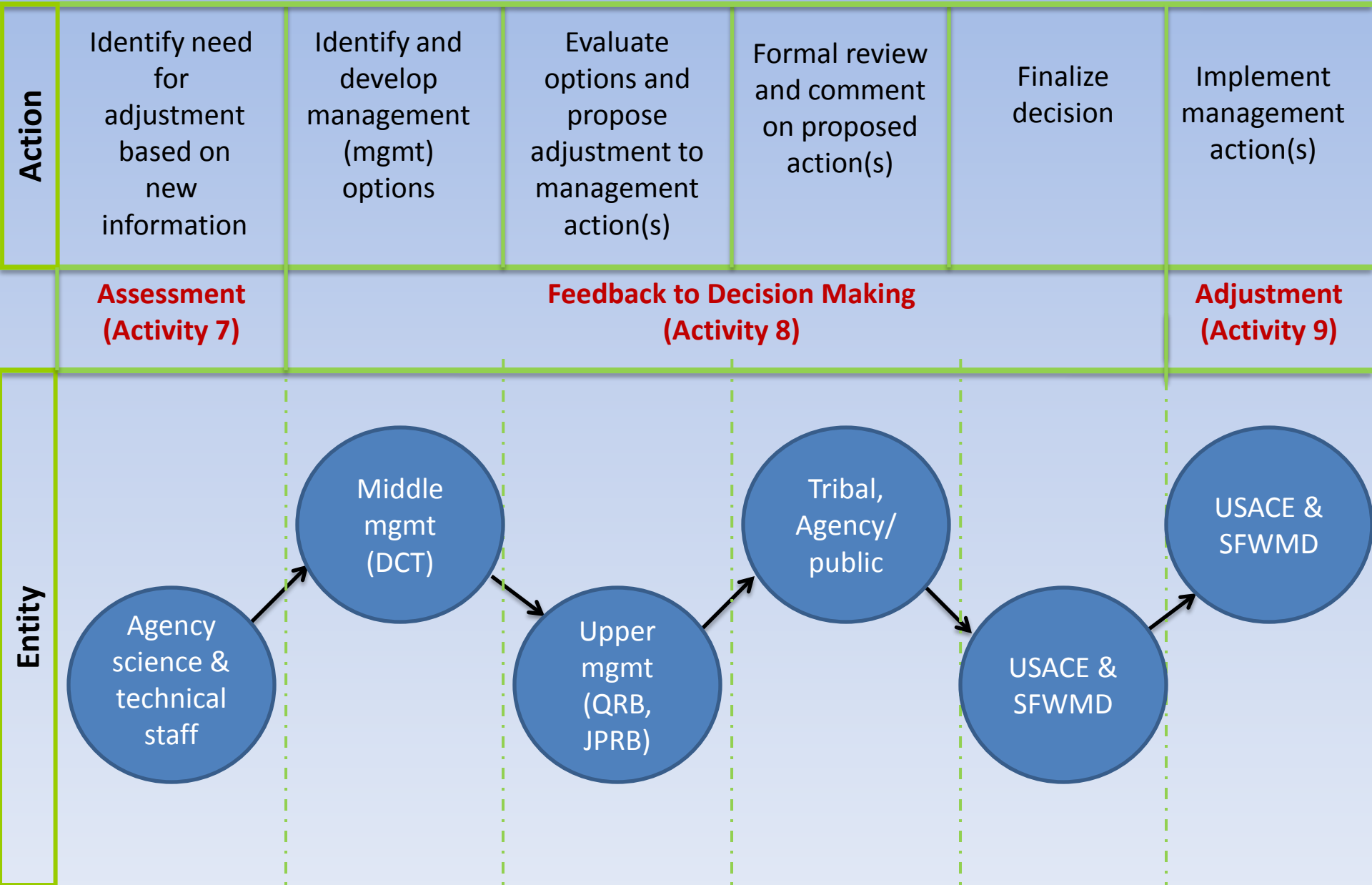
- Activity 8 – Feedback to Decision Making
 - Scientists and managers discuss performance issues
 - Develop, analyze, and recommend options for adjustment
 - Non-governmental feedback on options to address performance issues
- Activity 9 – Adjustment
 - Implement adjustment to plans, sequencing, or operations
 - Continue monitoring and assessment
 - Modify goals, objectives and/or endpoints as appropriate

Current Feedback to Decision-making Process

Need for Adjustment Based on New Learning	Identify and Develop Management Options	Evaluate Options and Recommend Adjustment to Management Action(s)	Formal Public Review and Comment	Finalize Decision	Implement Management Action
Activity 7	Activity 8				Activity 9
<p>Program/project performance report:</p> <ul style="list-style-type: none"> Scientific information requiring Plan adjustment Projects not performing as anticipated New learning for future projects 	<ul style="list-style-type: none"> Confirm performance issues Issue scoping Develop options to address issues Analyze options Develop draft Options Report or Assessment Report 	<ul style="list-style-type: none"> Evaluate analyzed options Recommend management action Finalize Options or Assessment Report If Options Report, submit to USACE/SFWMD for finalization If Assessment Report, prepare for public review and comment 	<ul style="list-style-type: none"> Formal public review Formal feedback from involved agencies 	<ul style="list-style-type: none"> Resolve comments on Assessment Report Finalize management action 	<p>Adjust plans, sequencing, and operations:</p> <ul style="list-style-type: none"> Plan changes (modified goals and endpoints) Sequencing changes Operational changes (e.g., CPMR, IDS, SOM)



Current Feedback to CERP Decision Making Process

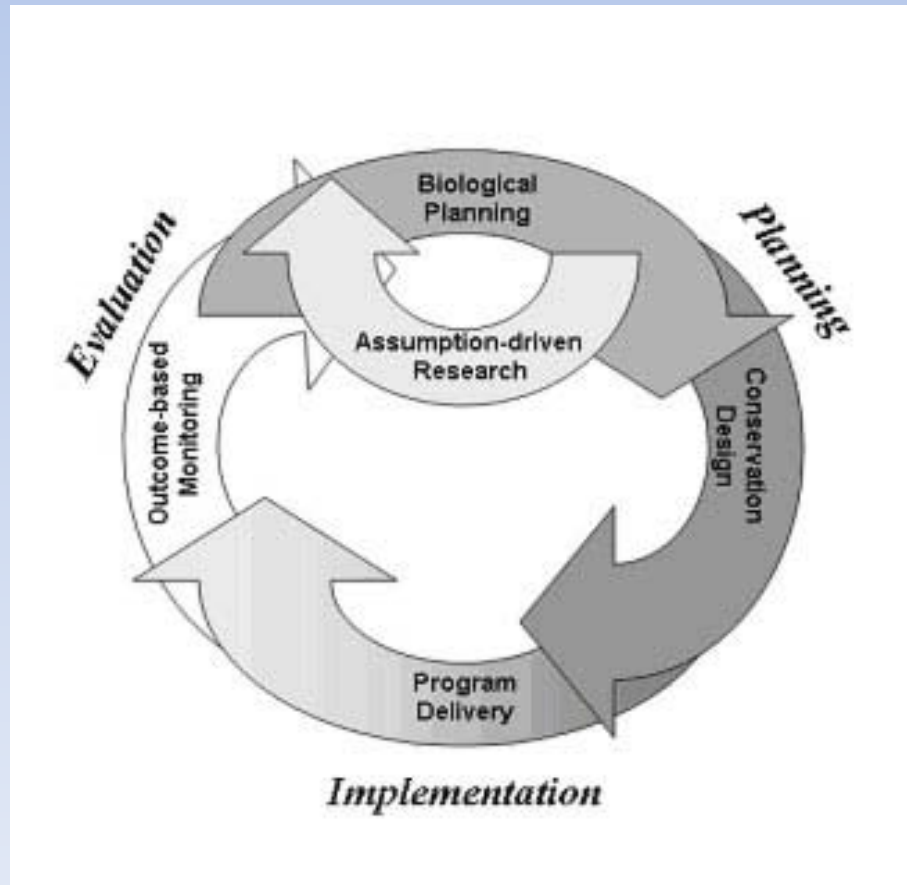


Points of Stakeholder Engagement

- Development of management options matrix
- Development of monitoring plan
- Development of performance reports and identification of issues needing attention
- Development of options to address issues
- Review of proposed options outside existing scope
- Consultation during implementation of adjustment

Examples from Other Programs

- USFWS Strategic Habitat Conservation Framework



Examples from Other Programs

- Adaptive Harvest Management of Waterfowl
 - Process for setting annual regulations for hunting waterfowl
 - Response of waterfowl populations to hunting regulations in one year can be assessed in time to inform regulation setting in the following year

Examples from Other Programs

- Missouri River Recovery Program
 - Monitor performance of numerous projects constructed to improve propagation of pallid sturgeon and nesting success for least tern and piping plover
 - Effectiveness of management action alternatives is incorporated into annual work plans to prioritize future projects
 - Structured decision-making process under development
 - Improving opportunities for stakeholder input

Examples from Other Programs

- Platte River Recovery Program
 - Developed adaptive management program and governance structure prior to program implementation
 - Involves independent review and advisory panels
 - Structured decision-making process defined
- Adaptive management has never been applied at the scale and complexity of CERP

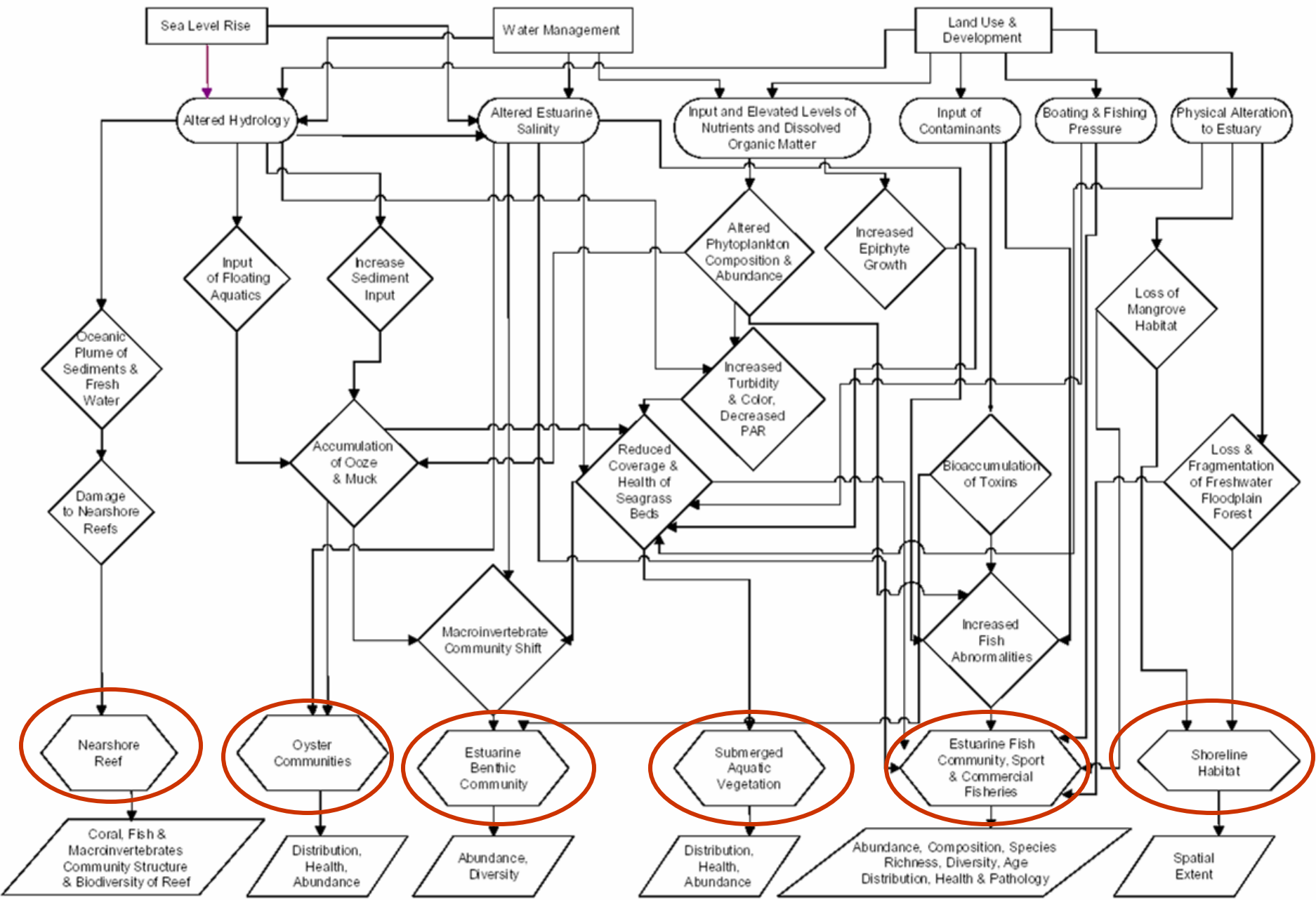
Setting Targets and Decision Criteria

- Restoration targets
 - Defined for each stressor/attribute
 - Set using predictive models, analysis of historical data sets or best professional judgment
 - Assessed in interim or long-term timeframes
- Decision criteria
 - Targets used to develop thresholds (= decision criteria) for when success has been met or adjustments are needed
 - Thresholds are set using predictive models, statistical models, or best professional judgment
- How do we fill these gaps?

St. Lucie Estuary and Indian River Lagoon

Conceptual Ecological Model

October 2003



Example: Forest Management Plan

Monitoring Objectives	System Model			Monitoring Question Metrics	Analysis/Reporting		
	Action Indicator	Stressor			Thresholds	Decision	
Determine: 1-if permit terms are being correctly applied and followed 2-if expected change in resource has occurred	Timber Harvest	Habitat removal	Snag retention Nest sites	Have conifer snags been retained in the mgmt unit to the specified level? Have x number of nest sites been maintained in mgmt unit?	1.2 snags/a c at least 17in. dia. (related to # snags)	At least 95% (if Violate)	Leave additional snags Modify snag rules

(NW Forest Plan Compliance Monitoring Program 2000)

Management Options Matrix

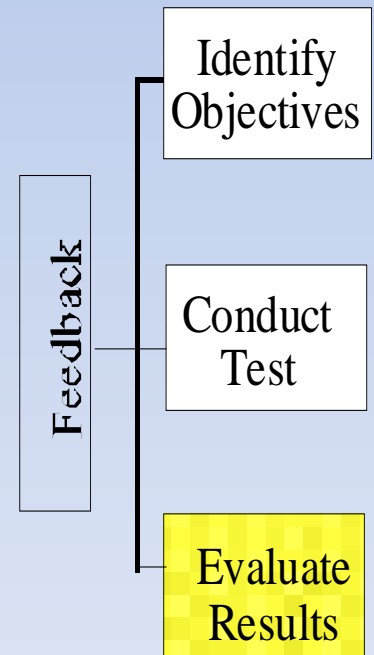
Stressor/Attribute Metric	Target (Timeframe)	Management Action Option 1	Management Action Option 2	Management Action Option 3
Salinity (operational tests may be required to achieve balance between multiple project objectives, e.g., seagrass, oysters, water quality)	<ul style="list-style-type: none"> 10–25 psu range from shoreline to 100 meters offshore 20 psu average monthly bottom target in zone 250 and 500 meters from shore during dry and wet seasons respectively (1-2 years) 	Change operations (more pumping) to meet flow requirements to achieve salinity range and zones	Increase flow from North to	Evaluate additional factors affecting flow
Water Quality Sedimentation	No increase or reduced sedimentation (2-3 years)	Dredge muck	Adjust flows to minimize increases in sedimentation	
Water Quality Nitrogen/Phosphorus	No increase or reduced TN and TP concentrations of 0.005 and 0.8 mg/L respectively (2-3 years)	Decrease flow rates through coastal wetlands	Implement best management practices (BMPs)	Increase STA acreage in BBCW PIR 2
Seagrass	Increase biomass and range of Halodule seagrass (2-5 years)	If water quality targets have not been met, address first	If desired salinity range is met, change operations to adjust flows based on new hypothesis	Implement seagrass plantings in coordination with state, DOI and National Oceanic and Atmospheric Association (NOAA)
Fish and Macro-Invertebrates	Increase abundance and diversity of fish and macro-invertebrates (5-10 years)	If Halodule seagrass biomass and range has not increased, focus on operations to support seagrass growth	If Halodule seagrass has increased, but oyster reefs have not, focus on operations and oyster restoration activities.	If Halodule seagrass and oyster reefs have increased, but fish have not, reevaluate hypotheses, consider other factors such as fishing pressure

Step 3: Informing the Decision Process

- a. Evaluate monitoring results
 - compare observed to predicted outcomes

- b. Use the results to assess the predicted management responses
 - determine the optimal response
 - identify information gaps and uncertainties

- c. Make recommendations
 - to adjust the plan (or the next test)



Feeding Information to Decision Makers

- How do we combine the abundance of information into something useable for managers?
 - SSR report
 - Stoplight reports
 - Use color coding to communicate assessment results and decision criteria
 - Decision Analysis Models
 - Scientists/managers link project/operations actions to predicted/actual outcomes, uncertainty, risks, and potential options
 - Decision-making by managers also includes costs, legal, and values issues

Taking Action

- Conundrums
 - Unanticipated results will occur and there will be a need to implement adjustments quickly
 - Current process does not facilitate quick adjustments
 - Can we develop triggers for certain indicators that activate adjustments in a timely manner?
 - What if half the indicators go up and half go down? What if the all the indicators go up slightly but one drops by 50%?
 - What if indicators that have dropped cause an option that could potentially decrease performance of those indicators that improved?

Hazards

There is an island of opportunity in the middle of every difficulty. Miss that, though, and you're pretty much doomed.



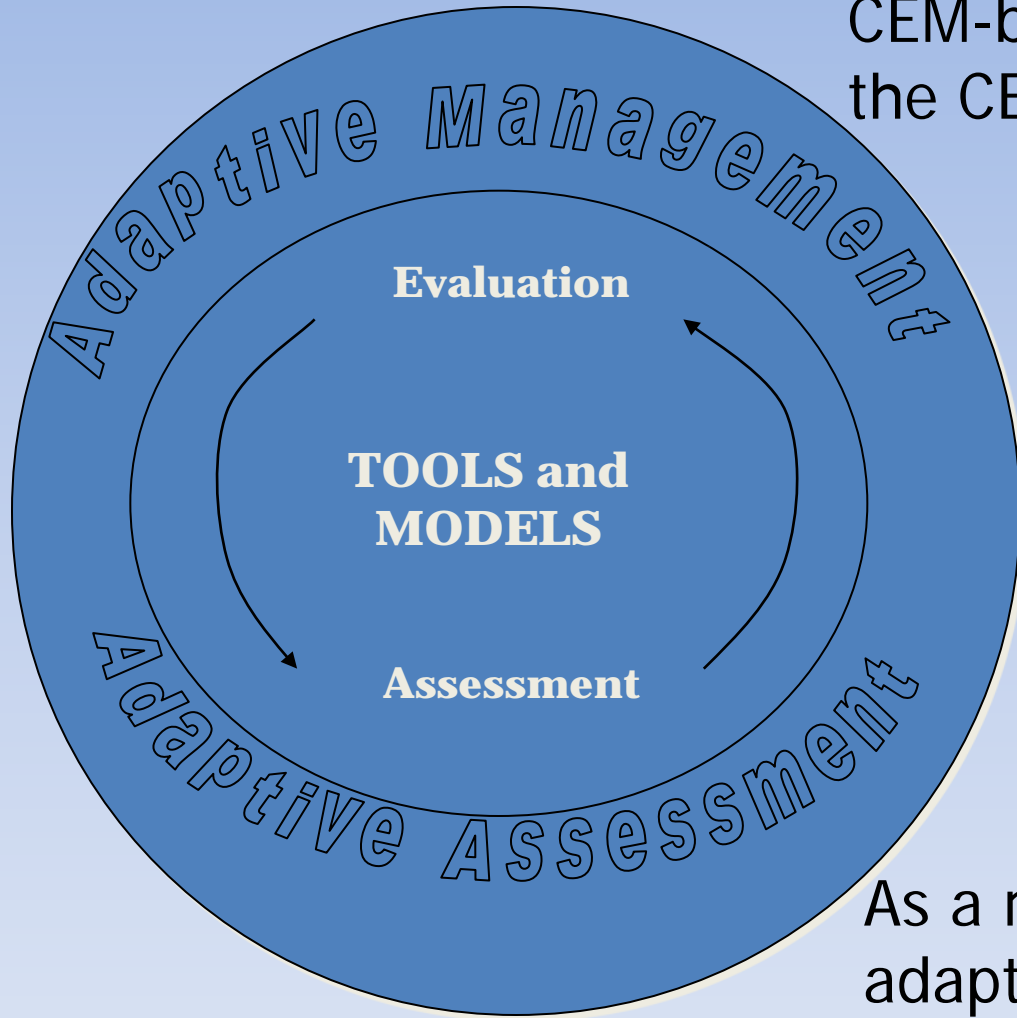
PROPOSAL

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!**



Other options

Third party/Science/stakeholder assessment team- annual meetings

DOI acting as the assessment team for the resource

MCDA-assessment software to help in decision making

Less indicators, each tied to a management action, more sampling resolution

Take home points

- CERP has a decisional framework
 - There may be some additional steps that will make the framework more responsive
 - Stakeholder engagement is critical to the process and should be significantly increased
 - Aligning evaluation and assessment indicators needs to happen now
 - Targets need to be developed
 - Additional assessment tools that will facilitate decision making need to be developed
 - Human dimension/socioeconomic science needs to be incorporated into the process



Questions?

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