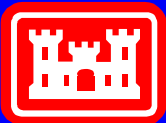


Ecosystem Services and the Corps of Engineers – Now that We've Looked, What Do we Do?

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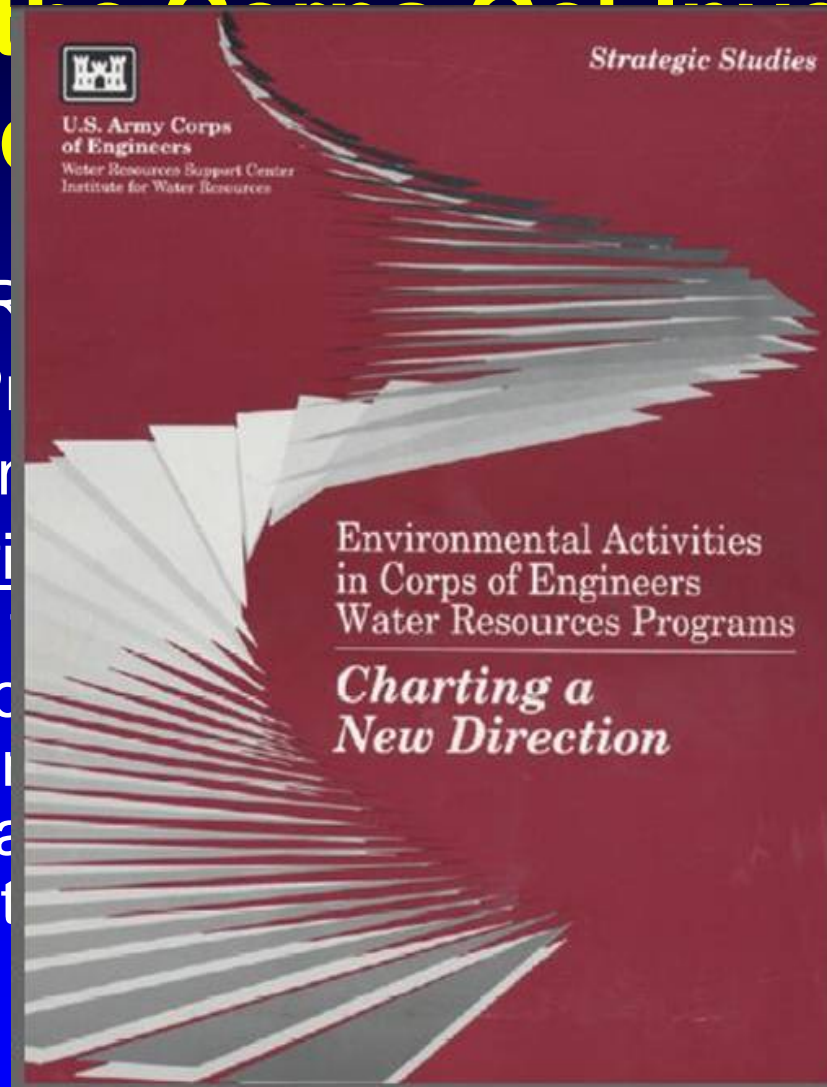
What I'll cover here

- How the Corps got involved with Ecosystem Services
- Ecosystem Services Affected by the Corps
- What Do We Do?

How Did the Corps Get Involved With Environmental Activities?

- Sec 1135 WR
- Completed P
- New Direction

Project Modification
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How to get to the New Direction

- Section 907 (33 U.S.C. 2284) Benefits and Costs Attributable to Environmental Measures, the benefits attributable to environmental quality, including improvement of the environment and fish and wildlife enhancement, shall be deemed equal to the costs for measures to produce those benefits.
 - Outputs and Outcomes
 - Evaluation and Alternative Selection
 - Ecological outputs include many different physical, chemical, and biological manifestations of ecosystem processes; most prominently, the abundance and renewal rates of desired species, sequestering and export of various water transported materials, and biological integrity of ecosystems.
- “Environmental measures, whether for mitigation or for ecosystem restoration, must still be justified, with consideration given to both non-monetary and monetary benefits and costs. At this time, traditional benefit cost analysis are not utilized because benefits from environmental measures are generally not quantified in dollars. “

What are we Supposed to Be Doing in Ecosystem Restoration?

The purpose of Civil Works ecosystem restoration activities is to *restore significant ecosystem function, structure, and dynamic processes that have been degraded*. Ecosystem restoration efforts will involve a comprehensive examination of the *problems contributing to the system degradation*, and the development of alternative means for their solution. The intent of restoration is to *partially or fully reestablish the attributes of a naturalistic, functioning, and self-regulating system*" (Headquarters, US Army Corps of Engineers 1999).

PROGRAM ASSESSMENT

PROGRAM

[View Assessment Details](#)

Aquatic Ecosystem Restoration

The Corps Aquatic Ecosystem Restoration program focuses on restoring degraded ecosystem processes to a more natural condition. Projects restore aquatic resources such as wetlands, rivers and estuaries. The primary focus is on large hydrologically complex projects. Non-Federal partners share the cost and maintain projects.

RATING

[What This Rating Means](#)

NOT PERFORMING

Results Not Demonstrated

- **The Corps has revised its measures and has baselines for two annual and one efficiency measure.** Targets have been developed for the revised measures, except for the new efficiency measure. The number of acres restored annually, the percentage of the four year total that is nationally significant, and the cost per acre to restore nationally significant acres will be among the metrics measured.
- **Individual projects receive extensive review but the program as a whole has**

IMPROVEMENT PLAN

[About Improvement Plans](#)

We are taking the following actions to improve the performance of the program:

- Increasing focus on project effectiveness through environmental benefit assessment research. Increased project effectiveness will contribute to increased program effectiveness.
- Database development will provide new information about the projects and habitats restored. This will aid in answering questions about outputs and may assist with evaluation of program performance.
- Identifying the most effective means to obtain independent program evaluation. Specific criteria will be developed to be considered in a program review by building on previous and ongoing reviews.

Ecosystem Services Affected by the Corps

- Water Supply and Regulation
- Erosion Regulation/ Sediment Management
- Water Purification and Waste Treatment
- Natural Hazard Regulation
- Biodiversity Maintenance
- Recreational Opportunities
- Food
- Fiber, Fuel, and Other Raw Materials
- Climate Regulation
- Clean Air
- Science and Education
- Maintain Cultural Diversity
- Spiritual and Inspirational
- Aesthetics

Components of Nature and Natural Processes

One viewpoint is that ecosystem services are strictly the *natural components of nature--natural structures and functions of an ecosystem* “directly enjoyed, consumed, or used” Natural structures and functions result in provision of food and genetic resources to provide biodiversity and the regulation of extremes of nature, e.g. flood, disease, weather (Boyd and Banzhaf 2006).

Natural Components to Fulfill Human Demands

“conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life” (Daily 1997)

Benefits to Humans, Anthropogenic Functions Performed by Ecological Outputs

It is not just the changes in function, structure, and dynamics that are important, but human judgments are used to evaluate the outcomes as ecosystem services that are important, significant, and of value for humans.

Studies and the Three Categories

Components of Nature and
Natural Processes

Natural Components to
Fulfill Human Demands

Benefits to Humans,
Anthropogenic Functions
performed by Ecological Outputs

Boyd and Banzhaf 2006
Ecological Society of
America 1997

Costanza 1997

Daily 1997
Stakhiv et al 2003

Millennium Ecosystem
Assessment 2005
Upper Miss (Lubinski et al.)
David Evans and Asso.-
Lent's Watershed

Ecosystem Service	Explanation / Definition	Corps' Influence on Service
Water Supply and Regulation	Abundance, distribution, frequency, and duration for domestic, industrial, agricultural., and ecological responses	Management and operations, including ground/surface infiltration and recharge
Erosion Regulation/ Sediment Management	Protection of infrastructure through natural channel design and other measures to achieve a balance among sediment transport, distribution, and land development	Operations, changes in hydrology, channel use
Water Purification and Waste Treatment	Retention, recovery, and removal of excess nutrients, other pollutants as well as other water parameters	Water management, ecosystem restoration

Ecosystem Service	Explanation / Definition	Corps' Influence on Service
Natural Hazard Regulation	Management of coastal storm protection , fire management, flood damage, disease outbreaks, landslides	Alteration of hydrology, landform, plant communities
Food	Commercial and subsistence fisheries, crops	Impact on fisheries habitat, fish behavior. Provisions of habitats, including invasive species management
Fiber, Fuel, and other Raw Materials	Production of woody and other vegetation products.	Subsidence prevention. ecosystem improvements

Ecosystem Service	Explanation / Definition	Corps' Influence on Service
Biodiversity Maintenance	Opportunities for future generations; keystone for other services	Ecosystem impacts and restoration (improve resiliency), habitat quality, and diversity
Climate Regulation	Source and sink of greenhouse gases	Ecosystem management
Clean Air	Storage and processing of pollutants. Support for alternative fuel productions, transportation, energy production.	Increase or decrease

Ecosystem Service	Explanation / Definition	Corps' Influence on Service
Science and Education	Ecosystems provide opportunity for science, education, and public outreach	Increase or decrease opportunities
Maintain Cultural Diversity	Certain cultures defined by the ecosystem they are developed in. Ex. New Orleans, Chesapeake Watermen	Influence: locations, structures, cultural remains, plants affected
Spiritual and Inspirational	Source of inspiration; many cultures attach spiritual and religious values to ecosystems	Locations, structures, cultural remains, plants affected
Aesthetics	Attractive landscape attributes for the five senses; experiencing the five senses.	Design, construction, operation, access

Components of Nature and Natural Processes	Natural Components to Fulfill Human Demands	Human Benefits, Anthropogenic Functions
Biodiversity Maintenance	Water Supply and Regulation	Science and Education
Climate Regulation	Erosion Regulation/ Sediment Management	Maintain Cultural Diversity
Clean Air	Water Purification and Waste Treatment	Spiritual and Inspirational
	Natural Hazard Regulation	Recreational Opportunities
	Food	Aesthetics
	Fiber, Fuel, and Other Raw Materials	

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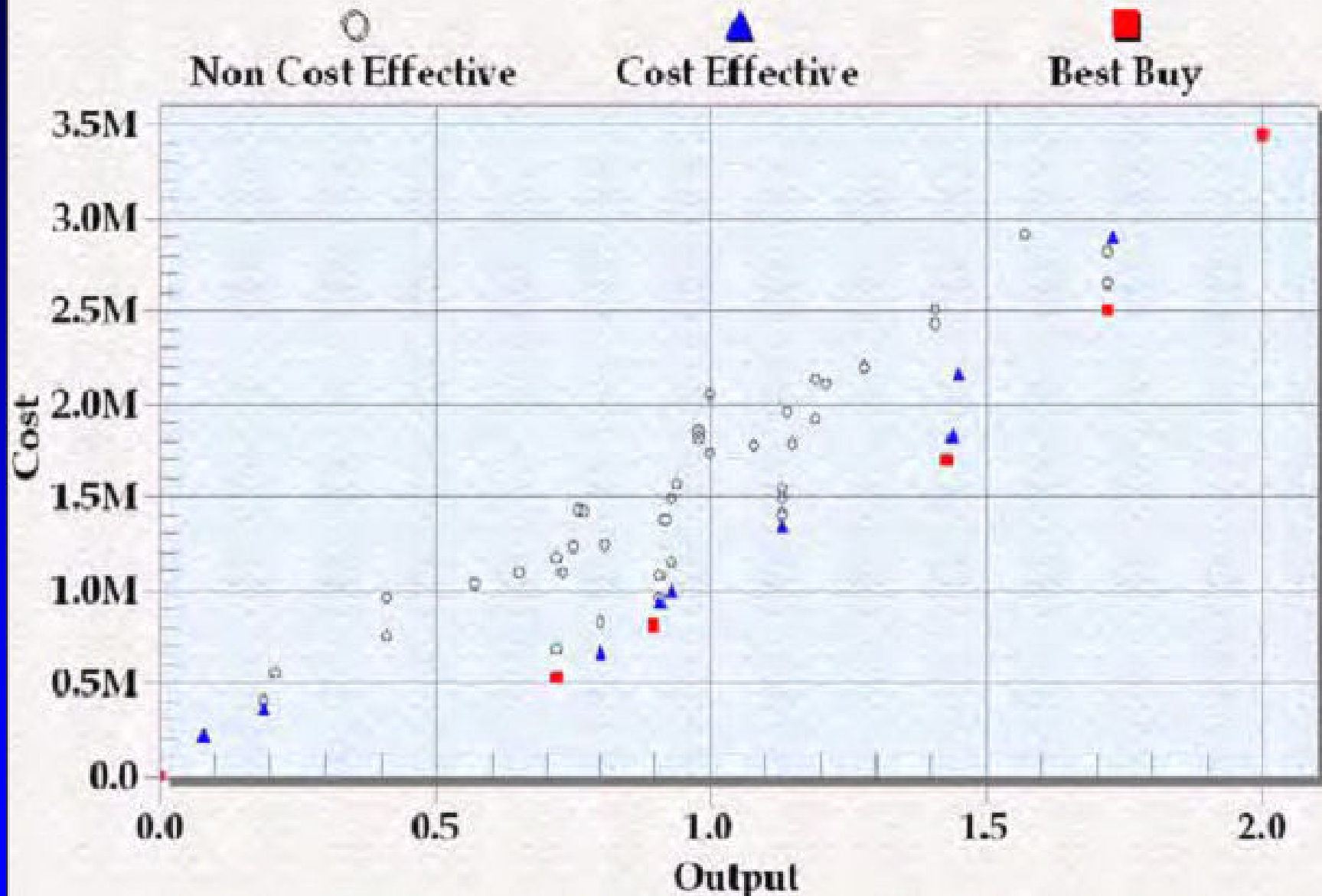
- Development and Application of a Biodiversity Metric
- Risk and Uncertainty Tools for Ecosystem Restoration
- Techniques for Normalizing Ecosystem Outputs
- Protocols for Using Best Professional Judgment
- Annualization of Ecosystem Outputs
- Ecosystem Services Related to Corps ER Projects

How do the Issues affect the Corps?

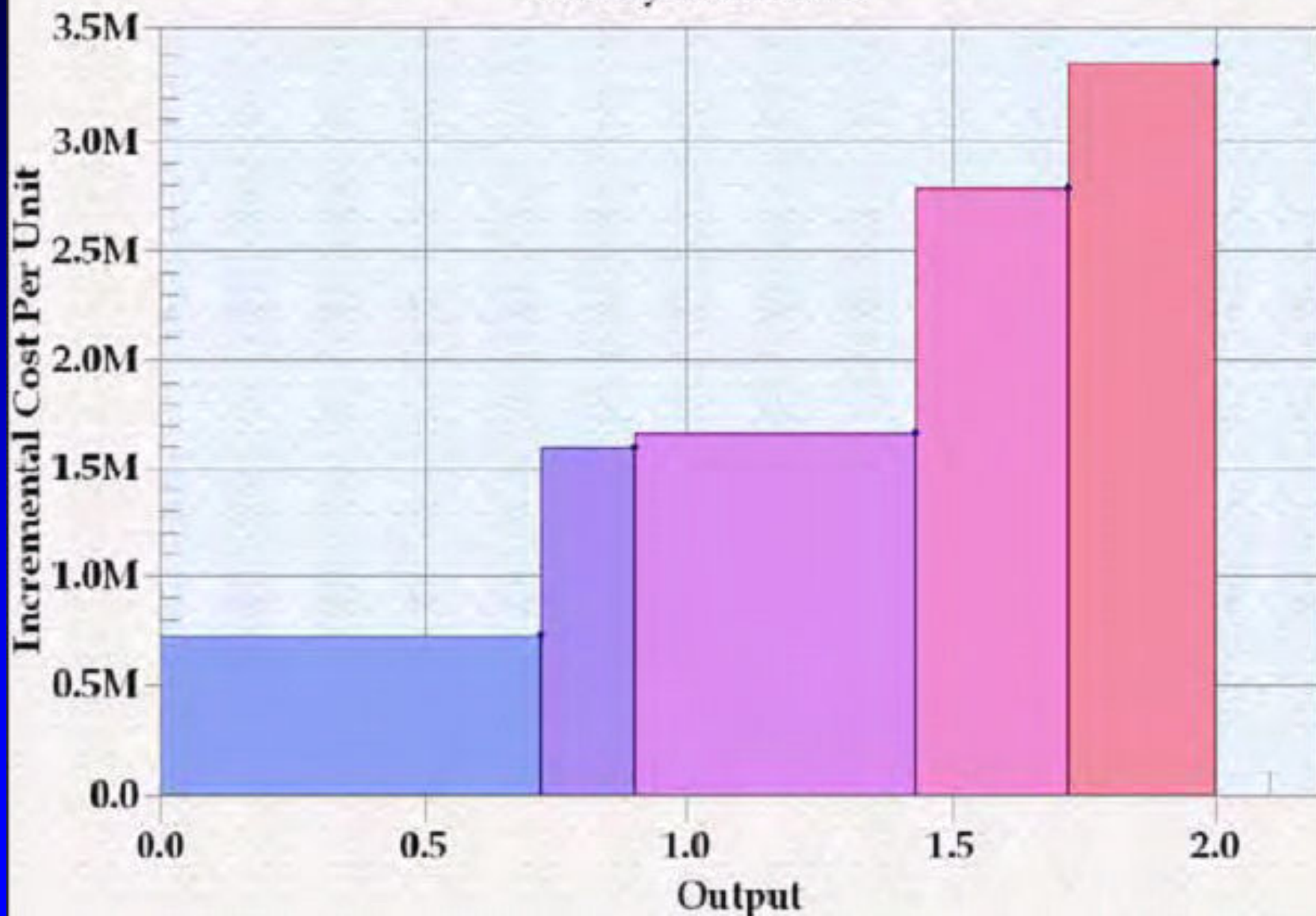
- Ecological – restore hydrology, sediment, and then what?
- Geographic
- Socioeconomic
- Institutional
- Communications across disciplines, and across stakeholders
- Stakeholder expectations and communications
- Understanding the relationships among services and across political and geographic boundaries

Upstream + Downstream Benefits (Avg Estimate)

All Alternatives

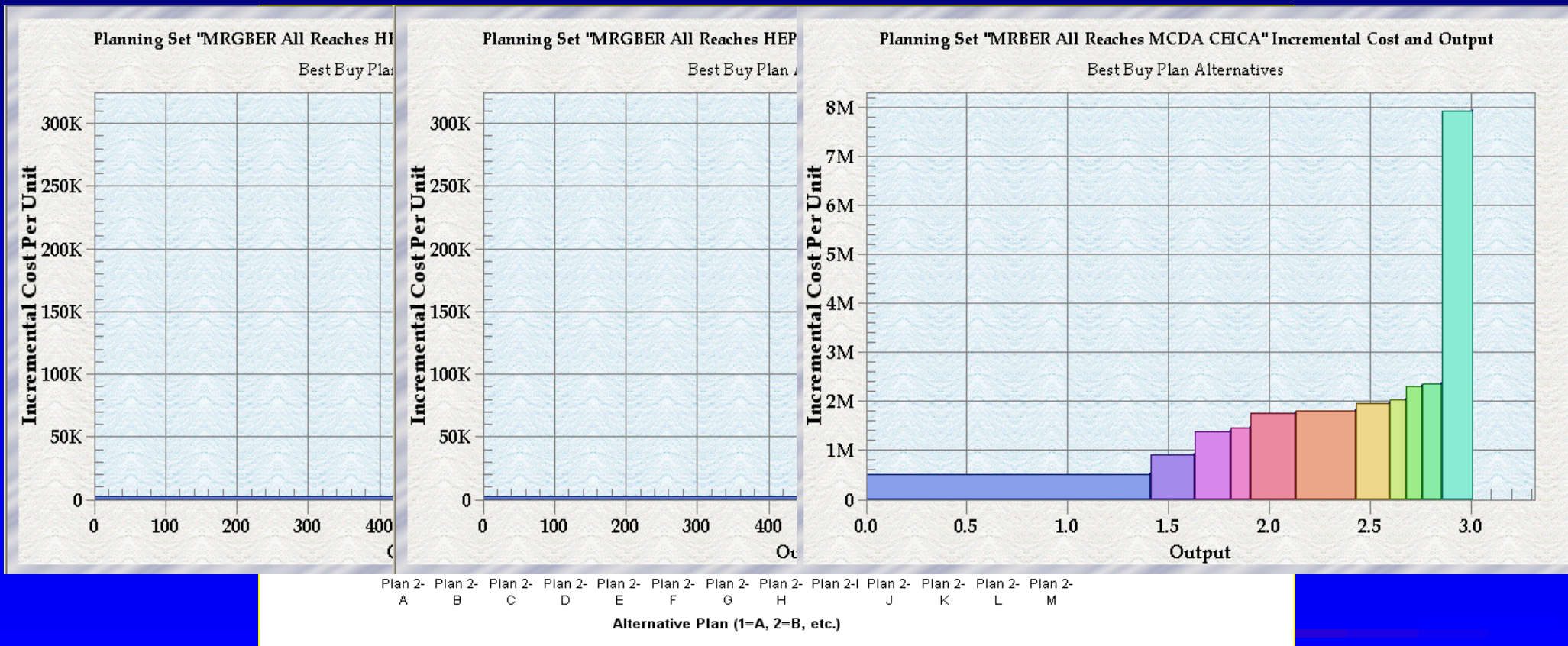


Best Buy Alternatives

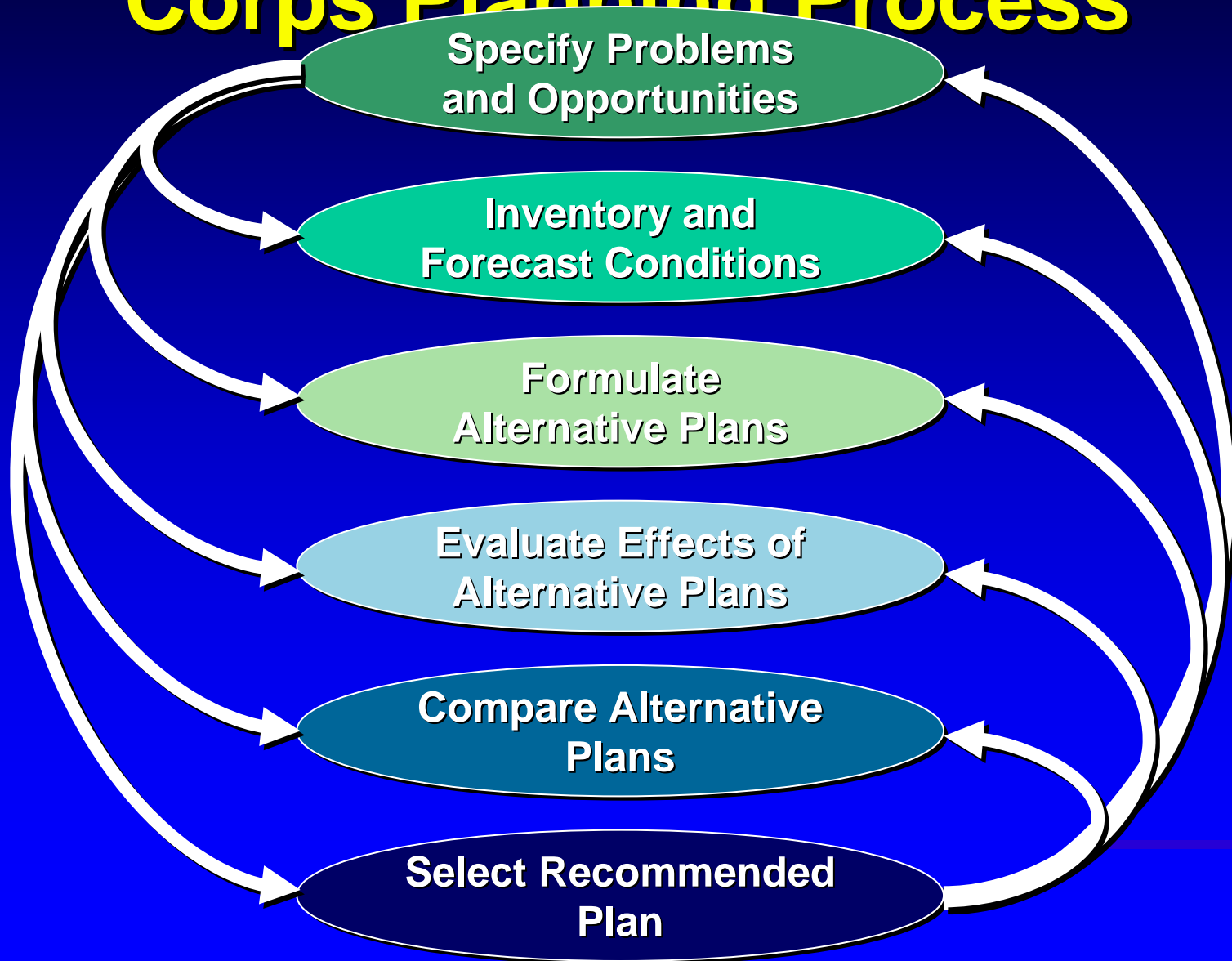


Using MCDA to Trade-off Outputs

Outputs filtered with Multi-criteria Decision Analysis (MCDA) =
A New Recommended Plan



Corps Planning Process



Conclusions

- Ecosystem Services offer a vehicle to better explain the effects of Corps restoration
- Institutional considerations make it difficult to incorporate ecosystem services into planning and evaluation
- As the uncertainty is reduced in the relationships of restoration and the effects valued by the public, it should be easier to incorporate ecosystem services



Questions ?