Research into Incorporating Ecosystems Goods and Services into Restoration Planning: Establishing Principles and Best Practices

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based on work of Elizabeth Murray, Janet Cushing and Lisa Wainger

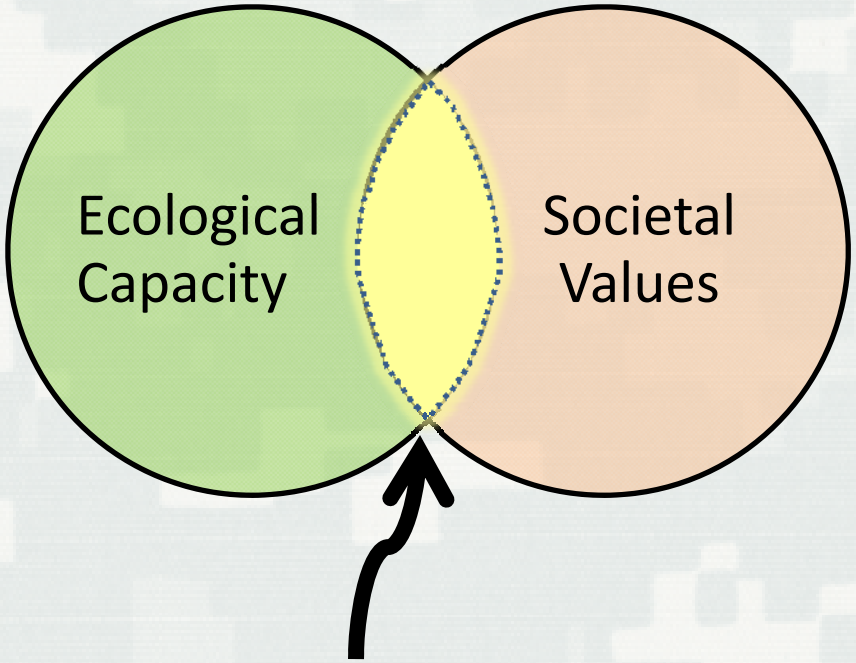
Overview of Work Unit:

- Why Research this?
- How can it benefit the Corps' water resource project planning and management?

Potential Benefits of EGS Consideration

- Foster better communication with cost share partners and other stake holders
- Allow a formal consideration of a broader array of benefits in formulation and alternatives analysis, if appropriate
- Account for broader array of benefits of final selected alternative, including those the Corps is not allowed to formulate on
- Allow more transparent consideration of trade-offs in sustainable planning

Working Towards Sustainability



Sustainability is achieved when actions fall within the realm of societal values AND ecological capacity. Planning with an ecosystem services approach helps to achieve two outcomes:

1) functionally healthy ecosystems, and
2) benefits to society.

Figure modified from Maser (1994)

Objectives

Investigate the utility of using Ecosystem Goods and Services (EGS) assessment in Planning for Corps' Ecosystem Restoration projects

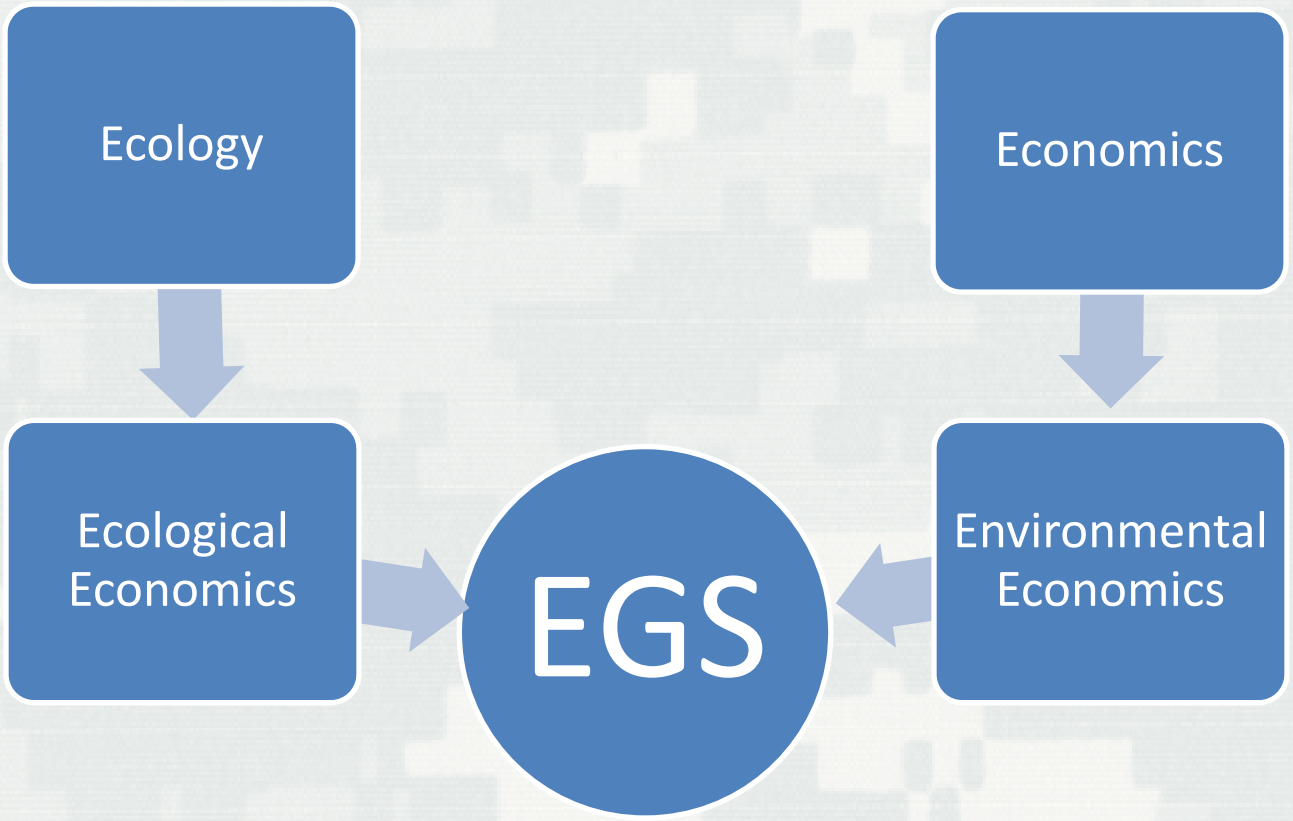
- Review literature to determine state of the science and best practices
- Review policies and practices used by the Corps and other federal agencies
- Utilize Corps Planners and Academics working in the EGS field
- Provide EGS tools and methods to advance Corps capabilities to capture the full range of relevant benefits and losses resulting from Corps projects

Tasks and Approach

Focus Areas:

1. EGS principles & best practices (Fed's / NGO's / Academia) with implications for the Corps
2. Corps policy review and analysis
3. Case studies of previous attempts within the Corps and possibly outside Corps
4. EGS data analysis and analytical tools
5. Interagency coordination
6. EGS Framework development for incorporating into Corps Planning Process

Ecosystem Goods and Services



Definitions in the Literature

For instance, in the **9 definitions of Ecosystem Services** presented in the literature review of the Technical Report…

- 5 use the term Nature or Natural.
- 7 use the term Process or Ecosystem Process.
- 5 use the term Function.
- 5 use the term Well-being.
- 9 use the term **Ecosystem.**
- 9 use the term **Human.**

Definitions in the Literature

Terms like Nature are vague, and Ecosystem can include everything from highly degraded or altered states to relatively pristine systems.

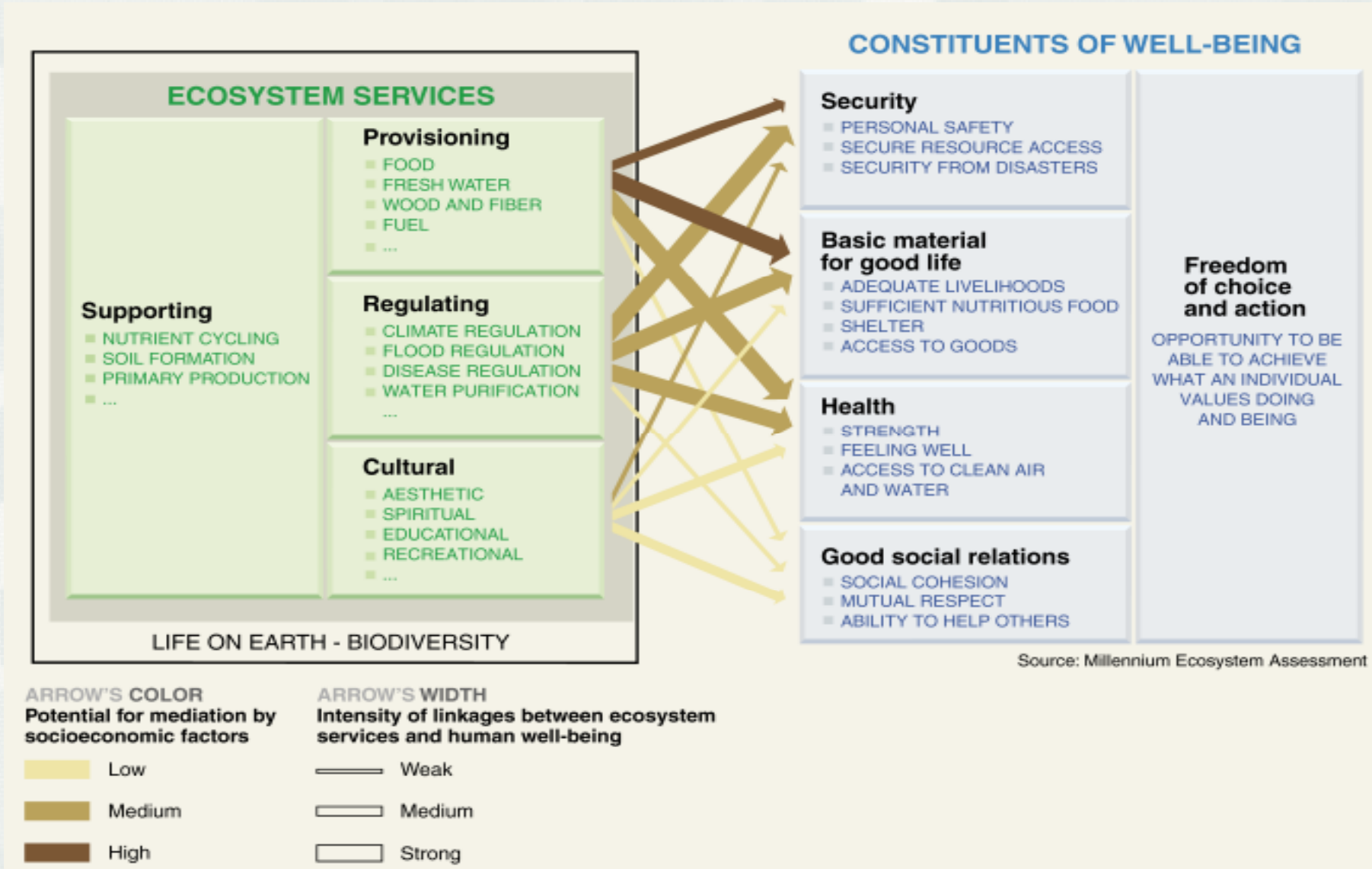
The 9 definitions also vary significantly on how narrowly they define services. Some restrict services to only direct, final services, and others appear to include all aspects of ecosystem condition as a service.

Ecosystem Goods and Services

Recommended Army Civil Works Definition:

Ecosystem goods and services are socially valued aspects or outputs of ecosystems that depend on self-regulating or managed ecosystem structures and processes.

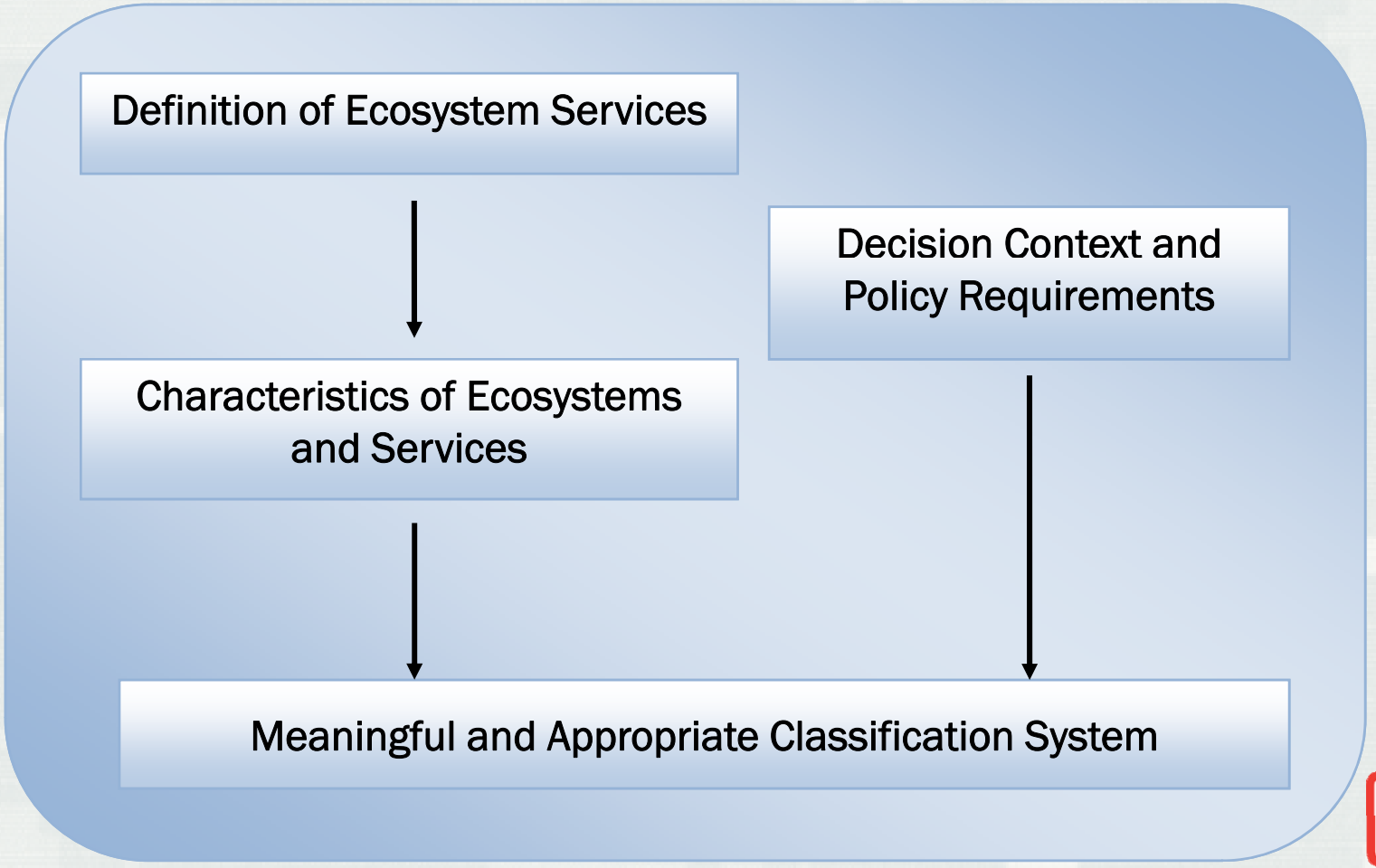
Ecosystem Services as Defined by Millennium Ecosystem Assessment (MA)



Classification schemes found in the literature are designed for different purposes

Decision Context	Description	Characteristics	Classification Approach	Example
Understanding & Education	Promote understanding and educate the public about the services and benefits that results from healthy, functioning ecosystems	Complexity Public-Private Good Aspects	Divides services into bundles and illustrates the relationships to each other and to human well-being.	MA 2005
Cost-Benefit Analysis or Natural Resource Damage Assessment	Where the goal of classification is economic valuation of ecosystem services. Avoids double counting unlike the MA classification—e.g., nutrient cycling and water flow regulation both contribute to usable water for recreation; it would be inappropriate to count both. It should help determine which benefits are amenable to monetization and which are not.	Complexity Benefit Dependence	Divides services into intermediate and final services and shows relationships to benefits	NAS 2012 Turner et al. 2008
Landscape Management (including wetland mitigation or permitting decisions)	Where it is important to manage the flow of services across the landscape—water regulation services from watershed protection upstream, benefiting users down stream	Spatio-temporal dynamics Public-Private Good Aspects Benefit Dependence	Describe relationship between where service production occurs and where the benefits are realized.	Costanza 2008; Boyd and Wainger 2003
Public Policy and Social Equity	Address economic externalities and distributional issues. One person's timber harvest is another's lost hunting opportunity. Impacts often disproportionally affect the disenfranchised. Provide information on the extent to which human needs and valued benefits are being meet in a given spatial context.	Spatio-temporal dynamics Public-Private Good Aspect Benefit Dependence	Starts with basic needs (e.g., adequate resources) and other categories of human benefits; then link to services, then to processes.	Wallace 2007

Making a classification that can be operationalized by the Corps

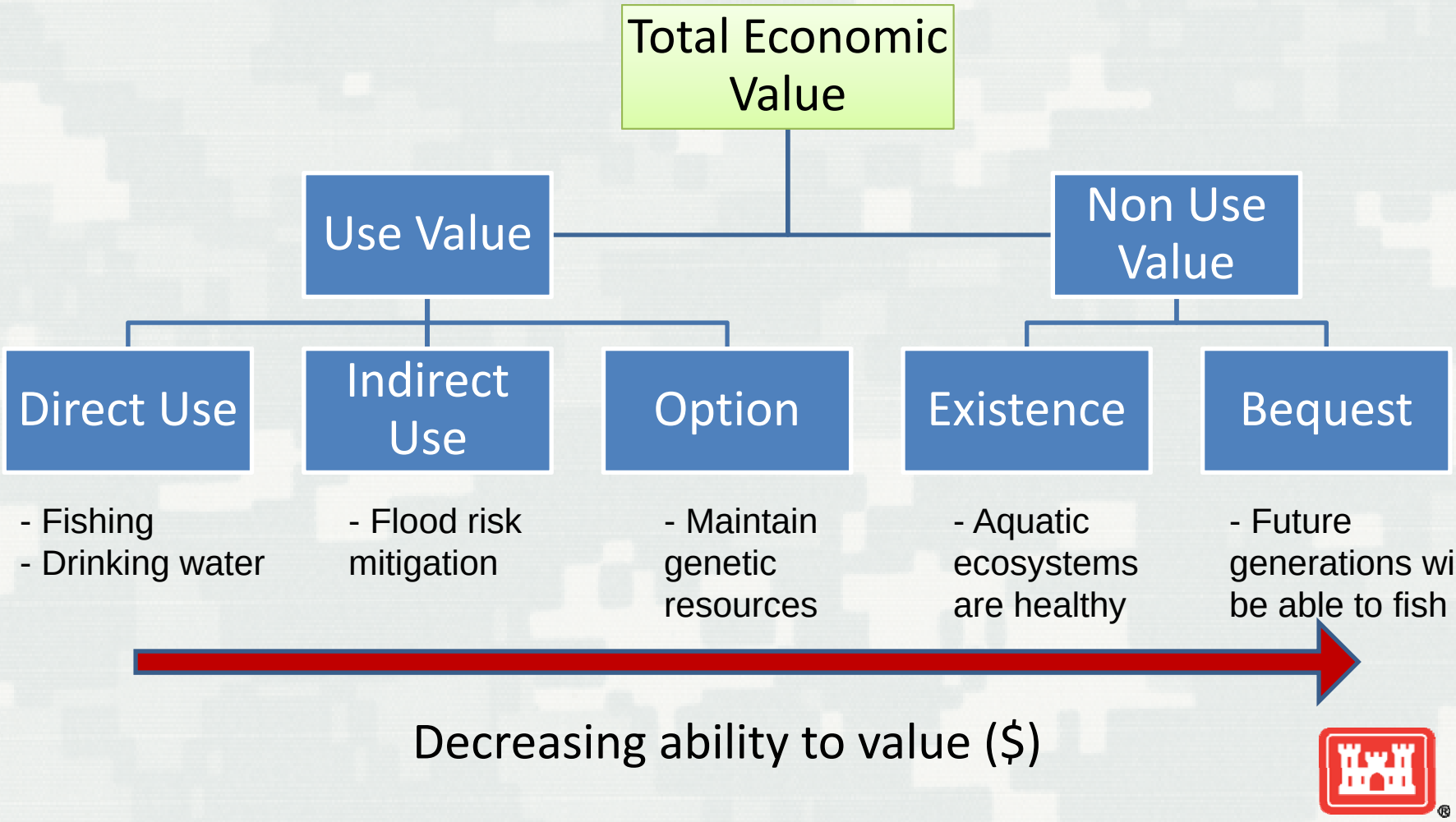


What are the purposes for which the Corps might use EGS?

- Assessing changes in EGS based on an activity (e.g. restoration, impact, project alternative) relative to a no-action baseline
- EGS don't necessarily have to be monetized, but they do have to be sensitive enough to distinguish among alternatives
- The EGS used should be based on Federal and stakeholder interest

Total Economic Value

Sum of use and non-use values



Characteristics of Intermediate vs. Final Goods & Services

Ecosystem Structure or Function	Intermediate Good or Service	Final Good or Service
•Nutrient cycling •Sedimentation rate •Water depth •Biodiversity	•Quality of water •Water supply capacity •Species preservation	•Drinking water supply •Flood risk management •Commercial fisheries •Aesthetics
•Often quantifiable •Often academic	•Often elusive •Often intuitive	•Often quantifiable •Often recognizable
•Components of intermediate or final services	•Components of final services	•Contributes to society
•Independent of demand	•Relation to potential demand	•Relation to or reliant on demand

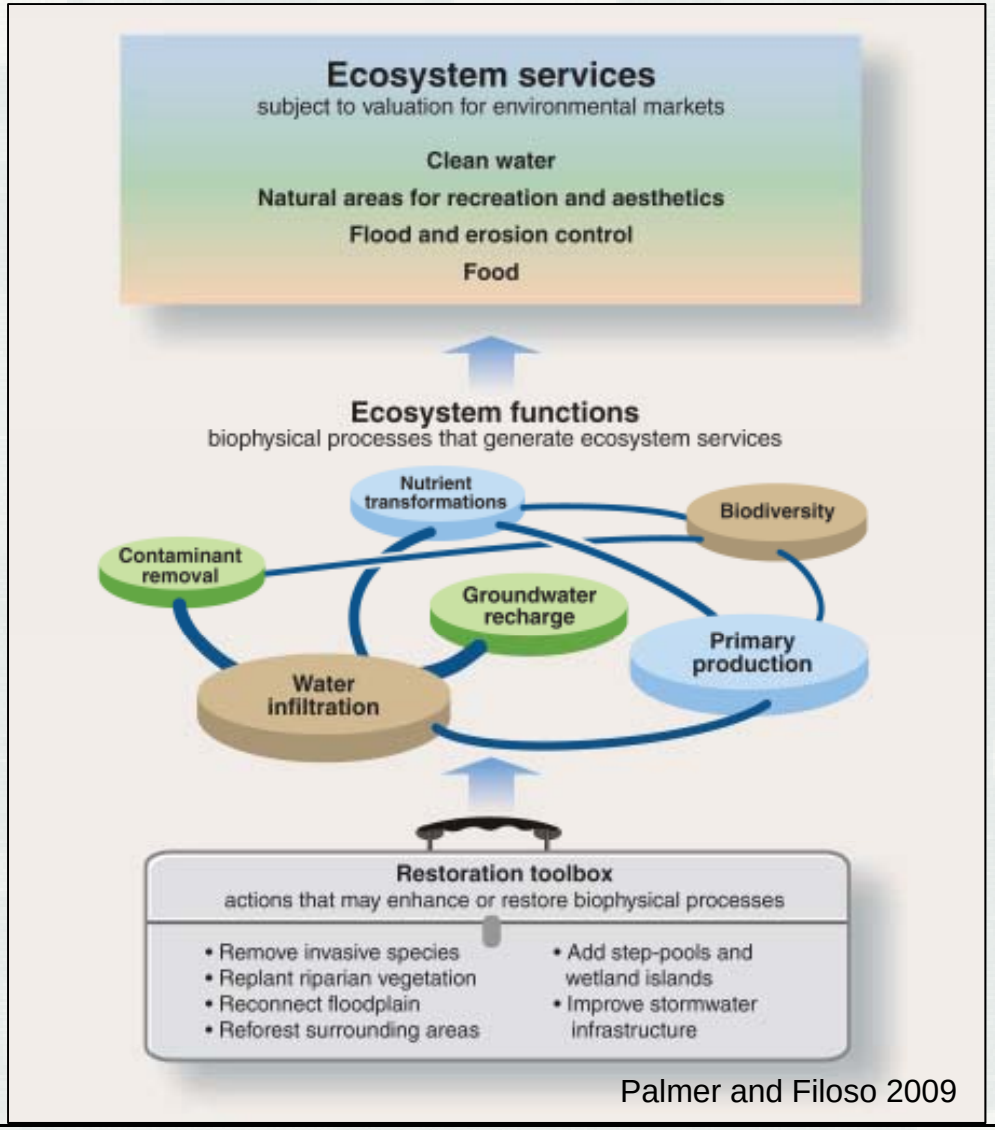
Ecosystem Service	Corps' Influence on Service
Water Supply and Regulation: distribution and reliability	Management and operations, including ground/surface infiltration and recharge
Natural Hazard Regulation: Flood attenuation	Alteration of hydrology, landform, plant communities
Natural Hazard Regulation: Storm Surge attenuation	Alteration of hydrology, landform, plant communities
Natural Hazard Regulation: Erosion/sedimentation reduction	Operations, changes in hydrology, channel use, alterations of plant community
Navigation	Distribution of dredge material
Food Provisioning: Wild foods (fish, game, grains) and aquaculture	Impact on fisheries habitat, water supply agriculture
Raw Materials: Fiber, Fuel, sand	Subsidence prevention, ecosystem improvements
Water Purification and waste treatment	Ecosystem restoration
Climate Regulation	Ecosystem restoration
Human Health	Pathogen and contaminant processing and dilution via wetland and river restoration
Ecosystem Sustainability/Habitat	Ecosystem impacts and restoration
Recreational	Alteration of water and land resources
Cultural, Spiritual, Education	Change in opportunities, effects on culturally-important resources (plants, animals) and sites
Aesthetics	Design, construction, operation, access

Corps-relevant ways to classify these Ecosystem Goods and Services

- By ecosystem/habitat (EGS likely supported by ecosystems in which the Corps commonly works)
- By Principles and Guidelines accounts: National Economic Development, Environmental Quality, Regional Economic Development, and Other Social Effects
- By spatial/temporal scale (both at which the service is produced as well as valued)
- By Corps mission area(s)
- Different classifications might be useful at different stages of the process

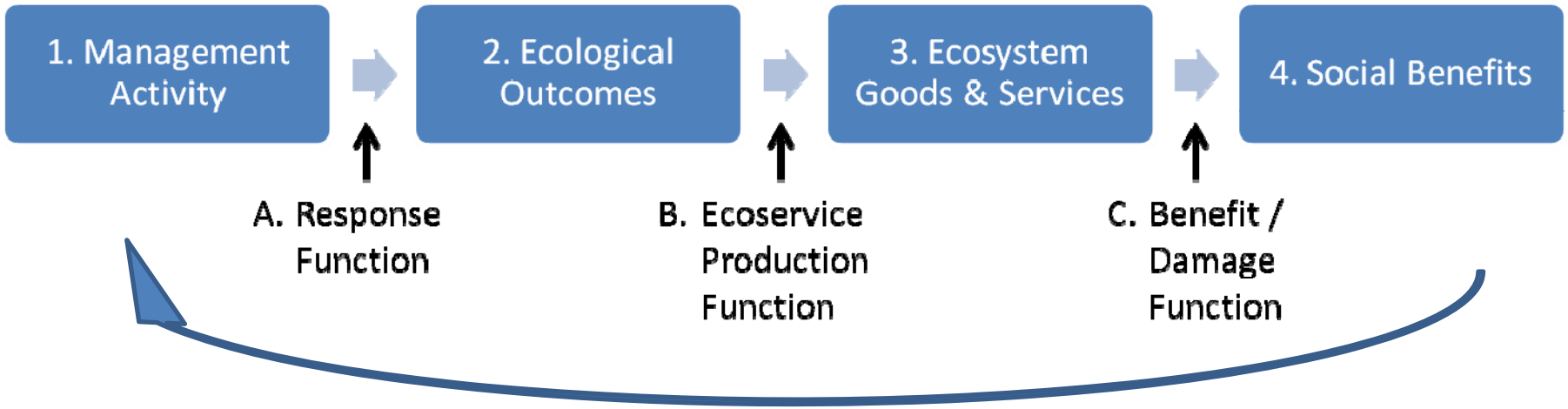
Linking Ecosystems to Human Welfare

Conceptual models link changes in the ecosystem resulting from restoration activities to Ecosystem Services that benefit humans.

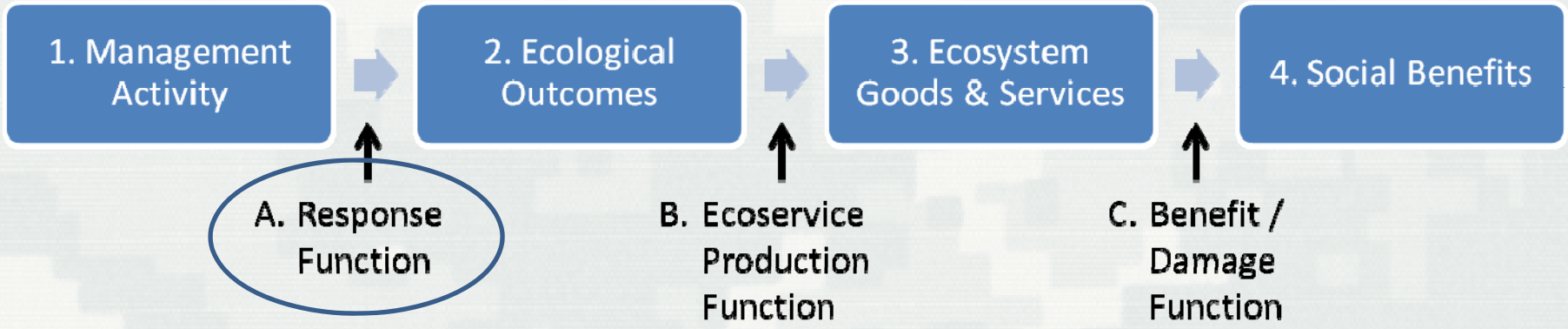


Palmer and Filoso 2009

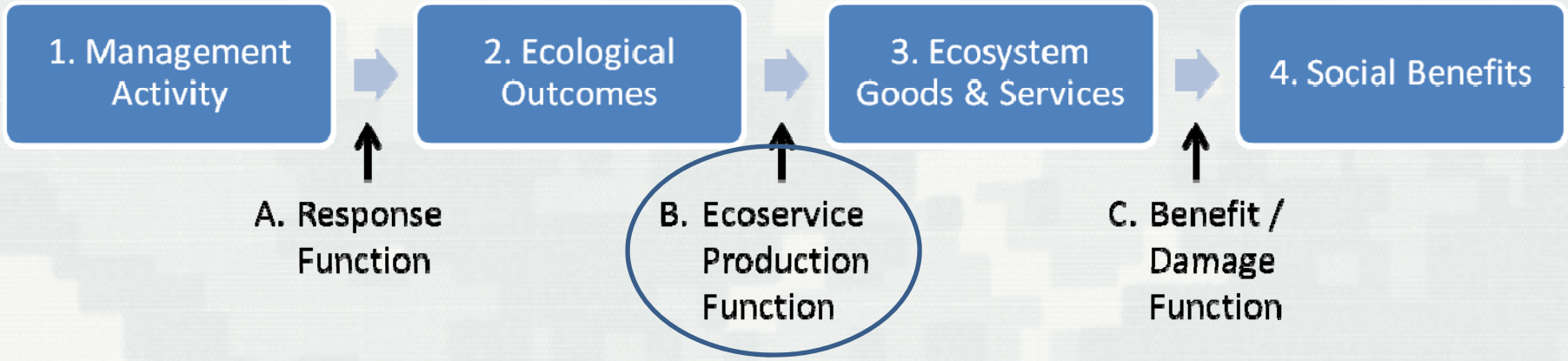
Measuring Ecosystem Service Benefits Requires Integrating Ecology & Economics



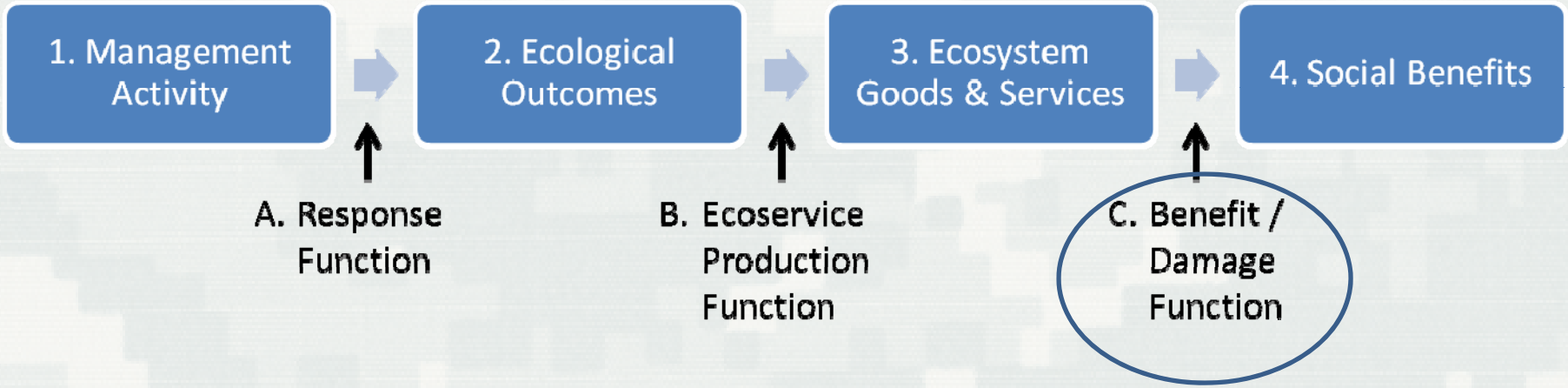
- ES approach does not require monetization of ecosystem outcomes
- Usually includes consideration of multiple outcomes



The *Response Function* estimates the expected changes in ecological outcomes when conditions and stressors change. How might the change in flow regime affect fish movement and productivity downstream? How might restoring a wetland slow floodwaters? Significant data and information gaps must be identified and addressed (NRC 2005).



The *Ecoservice Production Function* determines whether services are produced. Does the change determined by the *Response Function* result in greater recreational opportunities such as boating and fishing? Does the slowing of water result in actual protection of flooding to downstream towns or crops.



The *Benefit/Damage Function* determines the value of the change in services. While the Ecosystem Goods and Services might be additional angler days per mile of river, or a houses outside the 5-year floodplain, the Social Benefits are the monetary value of those services. As long as the EGS incorporates a human perspective, monetizing is not always necessary or even desirable.

Benefit Functions

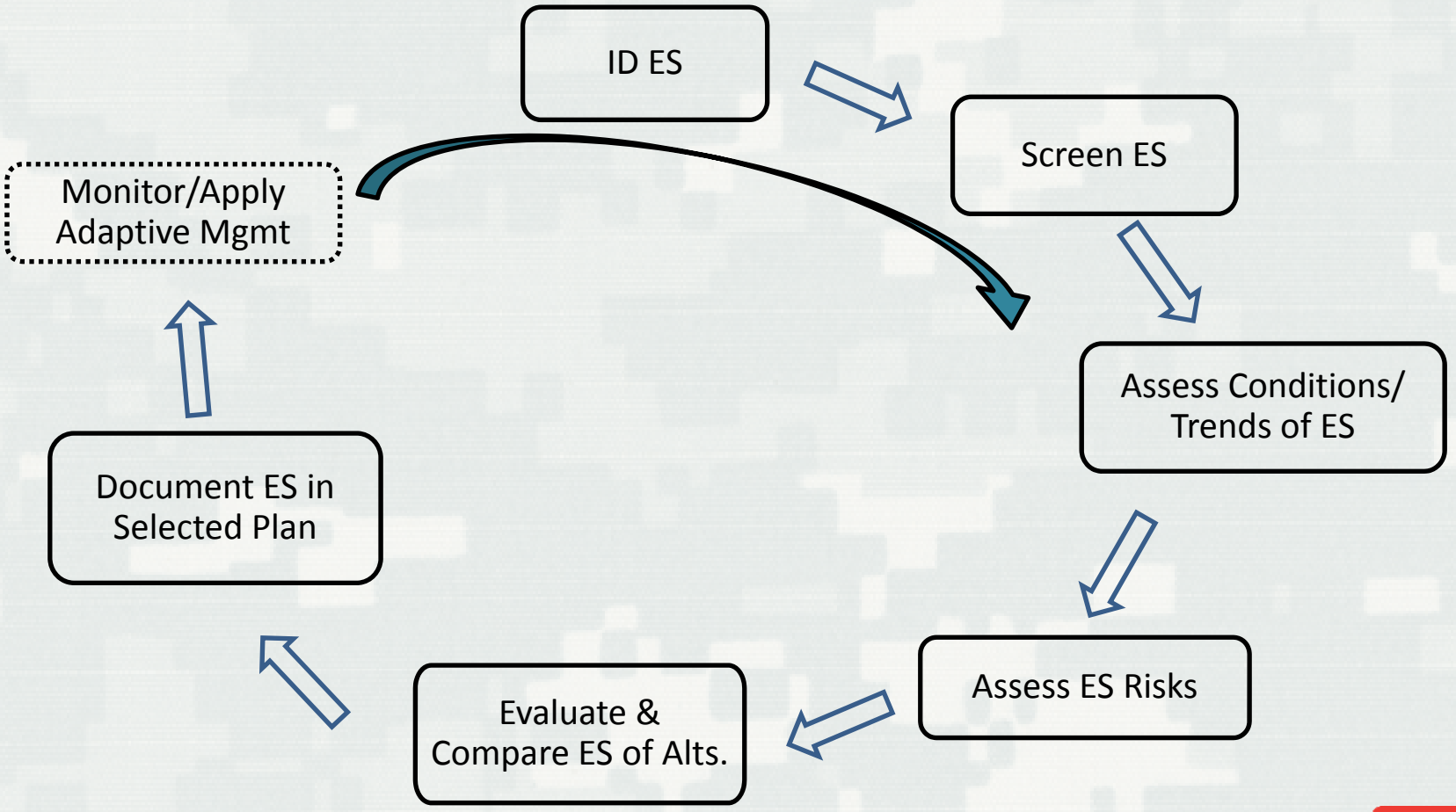
- **Market Goods**
  - Production Function Approach:

  "the biological resource or ecological service is treated as an 'input' to the economic activity, and like any other input, its value can be equated with its impact on the productivity of any marketed output." (NRC 2004 citing Barbier 1994)
- **Non-market goods**
  - Revealed Preference (averting behavior, referendum votes)
  - Stated Preference (surveys to assess statements of value)
  - Cost-based Methods (damage costs avoided, replacement costs)

Connection between an EGS Approach and the 6-Step Process

Corps Planning	Problems & Oppor-tunities	Inventory & Forecast	Formulate Plans	Evaluate Plans	Compare Plans	Select Plan
EGS Steps	Identify Affected EGS	Model EGS changes without project	Model alternatives and apply results, if appropriate			Report EGS benefits of selected plans

Potential Ecosystem Services Framework



Sample Evaluation Matrix

Benefit	Federal Interest / Non-Federal Interest
Economic	Flood risk reduction Commercial fisheries Navigation
Environmental	Biodiversity Water treatment
Social	Recreation use Social vulnerability

EGS in Corps Decision Making

- Starting with Restoration projects
  - Consistent with the 6-step planning process for restoration projects
  - Hope to make it general enough that it can be extrapolated to other business lines (NEPA documentation, etc.)
- Has the potential to help us justify our restoration projects
- Has potential to change some decisions among alternatives (if applied that way)
- Has potential to foster cooperation (leverage funding) with partners whose interests lie in the EGS we are not able to prioritize
- Midway through research effort

Status

Focus Areas:

1. EGS principles & best practices (Fed's / NGO's / Academia) with implications for the Corps (In Press)
2. Corps policy review and analysis (In Final Review)
3. Case studies of previous attempts within the Corps and possibly outside Corps (In Prep)
4. EGS data analysis and analytical tools (Data Base Complete, Report in Prep)
5. Interagency coordination (Ongoing)
6. EGS Framework development for incorporating into Corps Planning Process (In Early Prep)

Questions?

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