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Improving Hazardous Waste Site Remediation & Restoration Decisions Using Ecosystem Services

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Overview

- Hazardous waste site management in the US
- Objectives of assessments that inform decisions
- Challenges of current approach
- Better decisions using ecosystem services
- Developing generic ecosystem service endpoints

Hazardous Waste Site Management

- Primary management goals
  - remediation of contaminated media
  - restoration of injured natural resources & compensation of public for services lost
- Remediation decisions informed by ecological risk assessment (ERA)
- Restoration & compensation decisions informed by natural resource damage assessment (NRDA)

Assessment Objectives under CERCLA

- Ecological Risk Assessment
  - identify & characterize current & potential threats from hazardous substance releases
  - identify cleanup levels protecting natural resources from additional adverse effects
- Natural Resource Damage Assessment
  - return natural resources to their uninjured (baseline) condition through restoration or replacement
  - compensate public for service losses occurring until injured resources are restored

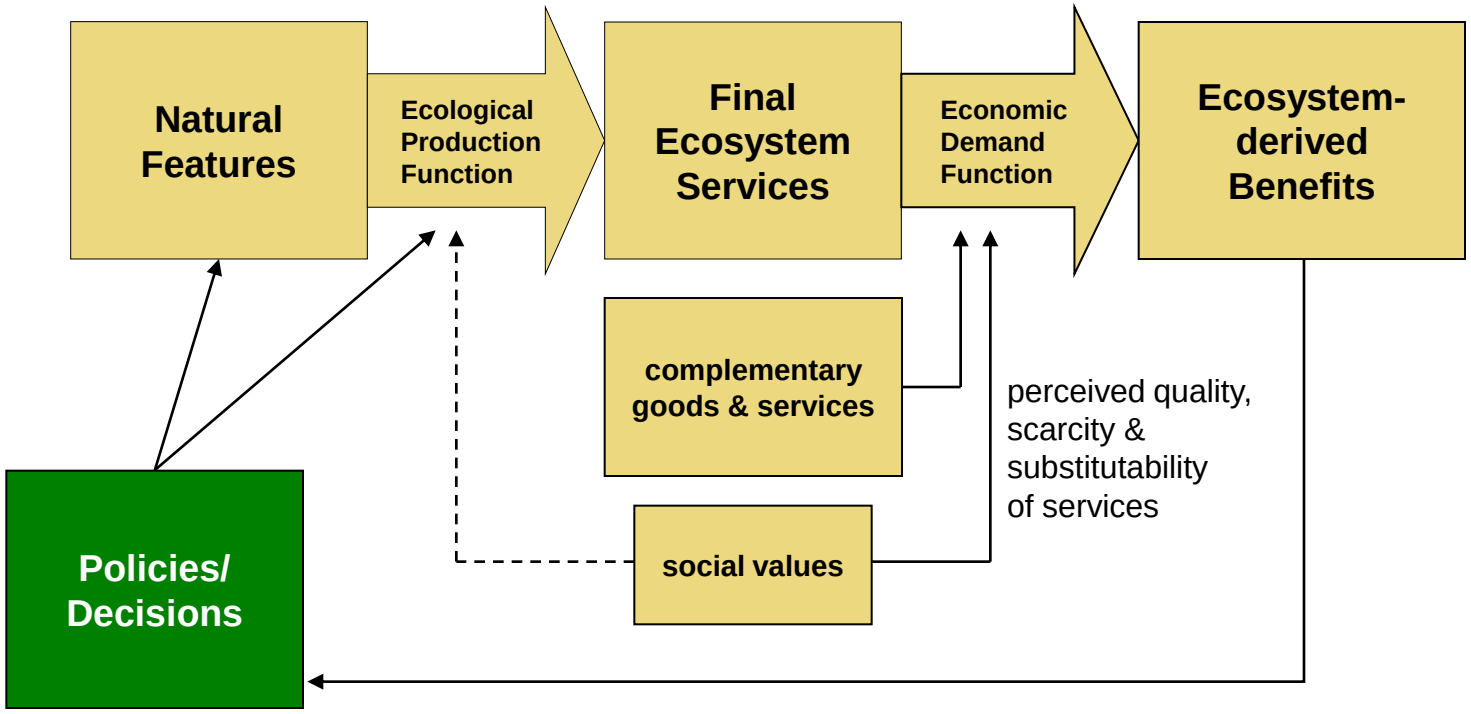
Challenges to Effective Decisions

- ERA & NRDA largely conducted independently, by different entities with varying objectives
- Usually consider different ecological receptors, levels of biological organization & time horizons
- ERA might not inform NRDA comprehensively
- Resulting decisions often lack coherence

Bridging Objectives: Ecosystem Services

- Functioning ecosystems contribute to well-being of ecological & social components of larger environmental system
- Structural components & processes interact functionally to support all life within the system
- Contributions of ecosystems to vitality of human & non-human species can be considered *ecosystem services*

Ecosystem Services Informing Decisions



evolved from: Wainger & Boyd (2009). Valuing ecosystem services. In: Ecosystem-Based Management for the Oceans, McLeod & Leslie (eds.), Island Press.

Advantages of Ecosystem Service Endpoints

- More complete assessment of composite values of ecosystems & tradeoffs associated with alternative decisions
- Decreased likelihood of unintended consequences
- Enhanced clarity & communication of decisions & rationale
- Quantitative input to benefit-cost analysis

Propositions

- Decisions benefit from shared ecosystem service endpoints
  - enhanced societal relevance
  - greater coherence of assessment information & resulting decisions
  - greater transparency in decision making
- ERA endpoints linked explicitly to needs of NRDA will enhance likelihood that ERA informs both remediation & restoration

Toward Improved Decision Making

- Generic ecological assessment endpoints
  - broadly described ERA assessment endpoints (US EPA 2003)
  - applicable in a variety of environmental management contexts
- 15 originally described to guide planning of ERAs based on:
  - usefulness in informing EPA decisions
  - practicality of their measurement
  - clarity with which they can be defined
- Several already responsive to needs of NRDA

Improving Information for Waste Site Decisions

- Generic endpoints focused on ecosystem services
  - responsive to NRDA needs at local & national scales
  - enhance translation of ecological risk to ecosystem service losses
  - in application, tailored to decision needs of individual sites
- EPA Risk Assessment Forum effort underway

US EPA Risk Assessment Forum Technical Panel

- Providing rationale for ecosystem service endpoints
- Preparing guidelines for use in ERA
- Describing linkages among traditional endpoints & ecosystem services
- Offering generic ecosystem service endpoints for use in ERA, NRDA & other assessments

Example Ecosystem Service Endpoints

Generic Ecosystem Service	Traditional Assessment Endpoint	Measurement Endpoint	Benefit
Food production	Fish population vitality	Fish abundance Size structure Species number	Nutrition Recreation Income Enjoyment
Recreational opportunity	Bird species diversity	Bird abundance Species number	Recreation Enjoyment Nutrition Income