

Expanding tools and perspectives to consider ecosystem service concepts in Superfund site management decisions

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Outline

- What are we talking about when we talk about ecosystem services (ES)?
- Why are we talking about them in the context of contaminated site management?
- What are the obstacles to including ecosystem services in contaminated site decisions?
- How are we changing that?

**Clean
Air for
Public
Health**

**Clean &
Plentiful
Water for
Drinking,
Fishing,
and
Swimming**

**Biodiversity
Conservation**

**Food,
Fuel, &
Materials**

**Natural
Hazard
Mitigation**

**Climate
Stabilization**

**Recreation,
Culture, &
Aesthetics**

Ecosystem Services/Benefits from Nature

What do we mean by benefits from nature?

- Benefits from nature can also be referred to as “ecosystem services” (ES)
 - Ecosystem services are the benefits humans gain from the environment and its ecosystems
 - Humans are part of the ecosystem and ES help describe how we fit in
- Considering these benefits promotes decisions about natural elements of a project that support community interests and needs
- Humans are impacted by the environment in which they live in innumerable ways, by considering these impacts up front, we aim to support more informed and intentional choices
- Environmental management decisions involve economic, social, and environmental trade-offs
- The concept of ecosystem services allows decision makers to better understand and include the benefits humans receive from the environment

Final Ecosystem Goods and Services (FEGS)

“biophysical components of nature, directly enjoyed, consumed, or used to yield human well-being” (Boyd & Banzhaf 2007)

Who?



Birdwatchers

Where
?



Wetlands

What?



Charismatic
Fauna

Examples of Ecosystem Services: Where, What, How, Who

Typical
starting place



Ask the ES
questions



More relevant metrics for
assessing benefits

Improved
Biodiversity at
a Former
Landfill

What?

Increase in pollinators

Where?

In and around the landfill site and adjacent farms

For whom?
or
For what?

For farmers and home gardeners

FEGS Metrics Report
Practical Strategies Report
NESCS Plus

Practical Strategies Report
FEGS Scoping Tool
NESCS Plus

Implement,
Monitor, & Review

Clarify Decision
Context

FEGS Scoping Tool
Practical Strategies Report

Eco-Health Relationship Browser
Practical Strategies Report
FEGS Metrics Report
FEGS Scoping Tool
NESCS Plus

Evaluate Trade-
offs & Select

EPA's ES Tools

Define Objectives

Eco-Health Browser
EnviroAtlas
EcoService Models Library
CADDIS
VELMA
EPA H₂O
Rapid Benefit Indicators

Practical Strategies Report

Estimate
Consequences

Develop
Alternatives

Contaminated Site Management

- Efforts to remediate, restore, revitalize, and redevelop contaminated lands
- Ultimate goal of protecting human health and the environment by eliminating unacceptable risk from exposure to contaminants
- Resource-intensive
 - In FY 23 the Superfund program spent \$1.1B on site clean up activities
- Economically valuable
 - Superfund cleanups result in 19-24% increases to neighboring property value
 - Remediation work supporting \$15B in economic activity annually

ES & Contaminated Sites

- ES arise from the connections between the environment and human communities
- Identifying these connections allows managers to consider the full suite of potential benefits arising from remediation and redevelopment processes
- Inclusion of ES concepts can lead to:
 - Restoration of the natural environment
 - Reduced operations and maintenance costs
 - Increased site resiliency
 - Increased consideration of stakeholder interests in management decisions
 - Improved communication with communities



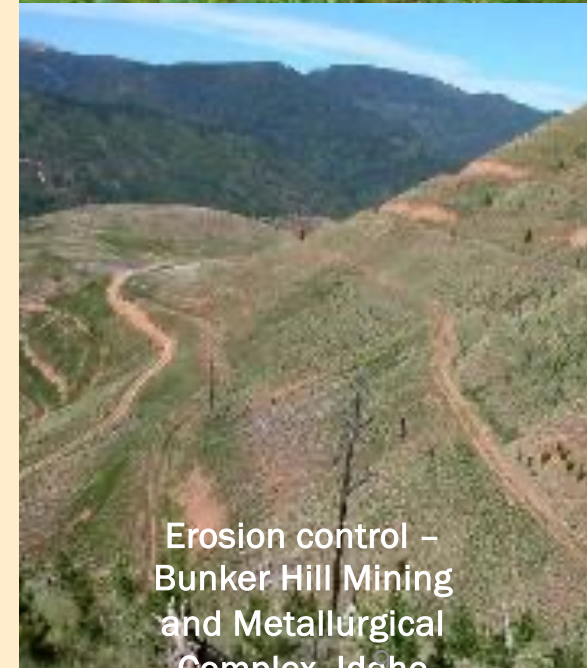
Cultural heritage –
Indian Island, California



Timber production –
Black Butte Mine,
Oregon



Pollinator habitat –
Palmerton Zinc Pile,
Pennsylvania



Erosion control –
Bunker Hill Mining
and Metallurgical
Complex, Idaho

ES and Contaminated Site Obstacles

- There is broad recognition of the value of ES inclusion and high-level support for it
- However...
- Superfund work is legislatively and regulatorily prescribed
 - Focus is on risk reduction
 - Legalistic approach to cleanups
 - Superfund managers cannot require responsible parties to do more than is legally required
- Superfund managers have their plates more than full already
 - Incorporating new concepts and tools into their work requires time, capacity, and resources

Bridging the Gap

- Efforts have been ongoing since 2009, this presentation focuses on work done over the last few years
- To address these obstacles, researchers and managers took a collaborative, iterative, and interactive approach
- Multiple, interrelated components
- Addressing different aspects of the problem
- Focused on the same end goal

Collaboration – What & When

Ecological Risk Assessment Forum Workgroup

- Standing workgroup
- Meeting regularly since 2021

Translational Science Workshops

- Series of internal workshops
- Spring 2021 – January 2022

Superfund Technical Liaison Research Workshop

- Paired webinars and workshop
- November 2021 (webinars) and February 2022 (workshop)

Collaboration – Tool-side Participation

Ecological Risk Assessment Forum Workgroup

- Ecosystem service researchers and tool developers from across EPA's Office of Research and Development

Translational Science Workshops

- Ecosystem service researchers and tool developers from across EPA's Office of Research and Development

Superfund Technical Liaison Research Workshop

- Ecosystem service researchers and tool developers from across EPA's Office of Research and Development

Collaboration – Decision-side Participation

Ecological Risk Assessment Forum Workgroup

- Ecological risk assessors from multiple EPA Regions

Translational Science Workshops

- Contaminated site managers from EPA's Regions and Offices of:
 - Land and Emergency Management
 - Superfund Remediation and Technology Innovation
 - Brownfields and Land Revitalization
 - Enforcement and Compliance Assurance

Superfund Technical Liaison Research Workshop

- Ecological risk assessors and project managers from:
 - all 10 EPA Regions
 - Regional Brownfields project officers
 - Superfund On-Scene Coordinators
 - Community Involvement Coordinators
- Scientists from Offices:
 - Superfund Remediation and Technology Innovation
 - Land and Emergency Management
 - Enforcement and Compliance Assurance

Collaboration – Actions and Outcomes

Ecological Risk Assessment Forum Workgroup

Translational Science Workshops

- Shared understanding of both ES concepts and management processes
- Logic model identifying concrete steps for moving toward the shared goal

Superfund Technical Liaison Research Workshop

**Framework
for Moving
Forward**

“Theory of
Change” Logic
Model

To accomplish
these long-
term
outcomes...

ES are delivering
benefits on multiple
cleanup sites

Considering ES
becomes routine in a
cleanup operation

Demonstrate at least
one long-term focused
example

Work
towards
short-
term
outcomes
& ...

Cleanup staff & upper
management see value in ES &
how it can improve remediation
outcomes & community relations

Cleanup staff are technically
capable and have the
resources to incorporating
ES into cleanups

Cleanup staff aware
& understand ES

ES language is considered as
one evaluation factor in
selecting cleanup contractors

Legal sideboards are
understood and not a
barrier to ES consideration

Demonstrate at
least one short-term
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Framework for Moving Forward
 "Theory of Change" Logic Model

To accomplish these long-term outcomes...

ES are delivering benefits on multiple cleanup sites

Considering ES becomes routine in a cleanup operation

Demonstrate at least one long-term focused example

Work towards short-term outcomes & ...

Cleanup staff & upper management see value in ES & how it can improve remediation outcomes & community relations

Cleanup staff are technically capable & have the resources to incorporating ES into cleanups

Cleanup staff aware & understand ES

ES language is considered as one evaluation factor in selecting cleanup contractors

Legal sideboards are understood and not a barrier to ES consideration

Demonstrate at least one short-term focused example

Focus on possible outputs & activities

Training & guidance

"Guidebook" describing ES tools; how used; how incorporate into community engagement; how protect human health & environment

Sample contractor language

Case studies & pilots

Translational ES report & fact sheet

EPA Tools Portal & ES Web Table

Literature on successes

Management sanction & memo on legal clarity

Collaboration – Actions and Outcomes

Ecological Risk Assessment Forum Workgroup

- Identified specific next steps based on workshop findings and recommendations
- Create opportunities for taking those steps
- Take advantage of communication and information dissemination opportunities on an ongoing basis

Translational Science Workshops

- Shared understanding of both ES concepts and management processes
- Logic model identifying concrete steps for moving toward the shared goal

Superfund Technical Liaison Research Workshop

Moving Things Forward

- The translational science workshop found that ES training needed to be tailored for specific audiences and work processes
 - ES for contaminated sites is insufficiently specific and leaves potential users to do too much of the heavy lifting on their own
- The work group developed and found funding for informational webinars and a workshop designed to fill information gaps and find nexus points between ES and *ecological risk assessments for hazardous sites*

Collaboration – Actions and Outcomes

Ecological Risk Assessment Forum Workgroup

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Translational Science Workshops

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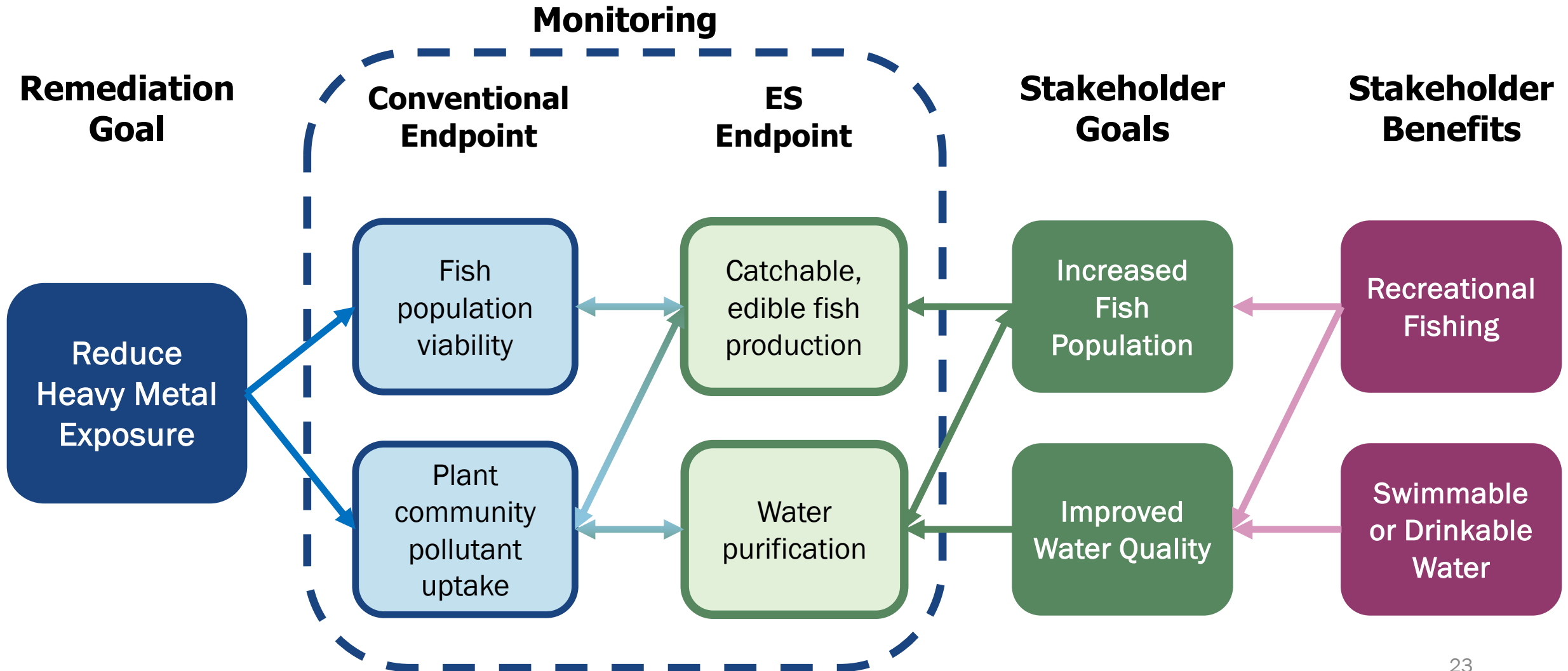
Superfund Technical Liaison Research Workshop

- Targeted informational webinars for participants with different roles in the ecological risk assessment (ERA) process
- Crosswalk of ES tools and the ERA process
- Interactive, hypothetical example of ES tool use in a hazardous site ERA
- Shared understanding of the value of ES and what is needed to support their inclusion

Framework for ES Incorporation

ERA Phases	Decision Questions	Potential ES Tools
Planning & Scoping	Who are the stakeholders? How are they impacted? Are there connections between the community and the site that had not been considered?	EnviroAtlas FEGS Scoping Tool NESCS Plus
Problem Formulation	What are the community's priorities? What do we know about this site and the surrounding area?	EnviroAtlas FEGS Scoping Tool NESCS Plus
Analysis	How can we quantify the current and future status of the site? How can we value potential changes to the site?	EnviroAtlas EcoService Models Library
Risk Characterization	How can we compare the costs and benefits of different scenarios? How can we describe what those changes mean to different stakeholders?	EnviroAtlas EcoService Models Library
Risk Communication	How can stakeholder perspectives be incorporated into decisions? How can decision-makers best communicate with a range of audiences?	FEGS Scoping Tool NESCS Plus

Framework for ES Incorporation



Outcomes

- Broad agreement on the value of considering EGS in ecological risk assessments
- But to use the tools, participants needed additional resources:
 - Guidance on tool selection
 - Training on tool use
 - Technical support
 - Specific examples

Continuing Collaboration

EPA's Ecosystem Services Tool Selection Portal

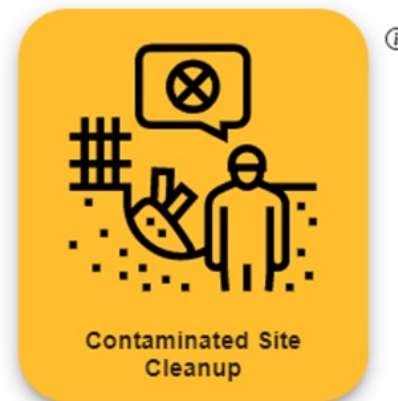
Ecosystem services assessment tools help you describe, quantify, and sustain the benefits nature offers humans and weigh the impact of decisions. This tool portal helps select the best tools for your scenario. Choose a path below to find the tools that match your needs.

I'm looking for help with...



Choose this path if you are:

- Evaluating the possible impact of environmental stressors such as chemicals, disease, or invasive species.
- Predicting the likelihood of future effects.
- Using an Ecological Risk Assessment in Remedy Decisions.
- Preparing and/or reviewing Ecological Risk Assessments.



Choose this path if you are:

- Doing a preliminary assessment or investigation of a contaminated site.
- Planning or engaged in cleanup or reuse of a contaminated site.
- Working with a Contaminated Site process or model.



Choose this path if you are:

- Working towards a goal that isn't ecological risk assessment or contaminated site cleanup (for example, natural resource management, park and recreation planning, habitat restoration, and stormwater management).
- Have a general interest in ecosystem services.

Step 1

Step 2

Step 3

Matching Tools

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Rapid Benefit Indicators

Planning &
Scoping

Problem
Formulation

Analysis

Risk
Characterization

Risk Communication

EnviroAtlas
CADDIS
VELMA
Eco-Health Browser
FEGS Metrics Report
FEGS Scoping Tool

NESCS Plus
Practical Strategies Report
EPA H₂O
EcoService Models Library
Rapid Benefit Indicators

Coordinated Case Studies

- Focused on ES tool use in ecological risk assessment on Superfund fund-lead sites
- Six sites, both prospective and retrospective
- Three goals
 - Develop specific, realistic examples that interested managers can refer to
 - Tool knowledge and competence for participating risk assessors and site managers
 - Superfund-specific guidance for application of the tools in their existing processes

Take Aways

- Organizational changes require collaborative effort
 - Demonstrating the value of the change
 - Working to understand the obstacles and being willing to adapt to them
- Organizational changes require long-term commitment
 - Individual activities can achieve progress, but that progress can dissipate
 - Team members may change, but an active team can maintain forward momentum
- We've achieved recognition of the value of ES concepts and tools, now we're working on getting them used
 - Each step forward was responsive to the previous step
 - Each step forward involved new people taking an active role
 - Each step forward increased the interest in and the support and capacity for using ES tools in the management of contaminated sites

Resources

- Ecosystem Services Tool Selection Portal:
 - <https://www.epa.gov/eco-research/ecosystem-services-tool-selection-portal>
- NESCS Plus:
 - Report and web tool: <https://www.epa.gov/eco-research/national-ecosystem-services-classification-system-nescs-plus>
- EcoService Models Library:
 - Fact sheet and online database: <https://www.epa.gov/eco-research/ecoservice-models-library>
- FEGS Scoping Tool:
 - Downloadable tool and user manual: <https://www.epa.gov/eco-research/final-ecosystem-goods-and-services-fegs-scoping-tool>
 - Journal article on prioritization criteria: Sharpe, L. M., Harwell, M. C., & Jackson, C. (2021). Stakeholder prioritization for environmental management. *Journal of Environmental Management* (<https://pubmed.ncbi.nlm.nih.gov/33413974/>)
 - Book chapter on tool: Sharpe, L., Hernandez, C., & Jackson, C. (2020). Prioritizing stakeholders, beneficiaries and environmental attributes: A tool for ecosystem-based management. In T. O'Higgins, M. Lago, & T. H. DeWitt (Eds.), *Ecosystem-based management, ecosystem services and aquatic biodiversity: Theory, tools and applications* (pp. 189–212). Amsterdam: Springer.
- FEGS Metrics Report:
 - U.S. Environmental Protection Agency. 2020. Metrics for national and regional assessment of aquatic, marine, and terrestrial final ecosystem goods and services. EPA645/R-20-002. U.S. Environmental Protection Agency. <https://www.epa.gov/eco-research/national-ecosystem-services-classification-system-nescs-plus>
 - Santavy, D. L., C. L. Horstmann, L. M. Sharpe, S. H. Yee, and P. Ringold. 2021. What is it about coral reefs? Translation of ecosystem goods and services relevant to people and their well-being. *Ecosphere* 12(8):e03639. 10.1002/ecs2.3639