

# Ecosystem Services Approaches and Tools for Contaminated Site Cleanup

---

Jewel Lipps, Biology graduate student at Georgetown University

former EPA ORISE Research Participant at the Office of Superfund  
Remediation and Technology Innovation

# Webinar Objectives

---

1

Understand the relevance of ecosystem services at site cleanups.

2

Overview of two tools for quantification of ecosystem services at remediation projects to inform mitigation and revitalization decisions.

3

Discuss ecosystem services with EPA Region site teams who pilot tested the approach and tools at their site.

Ecosystem services are nature's contributions to human well-being.

---



## The Classic Ecosystem Services Example: New York City's Long-Term Watershed Protection for Clean Water Supply

“A filtration plant large enough to clean the City's water supply would cost approximately \$6 billion to build and another \$250 million annually to maintain. Preserving the watershed, conversely, was estimated at \$1.5 billion, just over a dime invested on ecological preservation for every dollar that would have been spent on a filtration plant.”  
– Alice Kenny, The Ecosystem Marketplace

<http://www.ecosystemmarketplace.com/articles/ecosystem-services-in-the-new-york-city-watershed-1969-12-31/>



## Bureau of Land Management

### An Ecosystem Services Approach to Sage-Grouse Conservation: Upper Green River Conservation Exchange Program (2014)



VIEW PDF



Describes a collaborative effort to protect habitat for sage-grouse in advance of the species' potential listing by the Fish and Wildlife Service under the Endangered Species Act.

## U.S. Department of Agriculture

### Assessing Pollinator Habitat Services to Optimize Conservation Programs



VIEW PDF



Describes how pollination services have received increased attention over the past several years, and protecting foraging area is beginning to be reflected in conservation policy. Includes prospects for doing so in a more analytically rigorous manner, by quantifying the pollination services for sites being considered for ecological restoration.

## U.S. Forest Service

### Integrating Ecosystem Services Into National Forest Service Policy and Operations (2017)



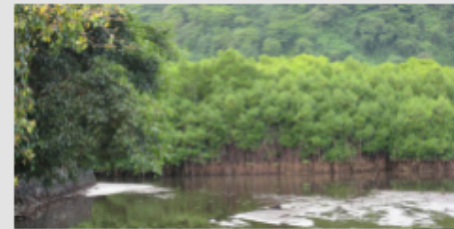
VIEW PDF



Describes Forest Service efforts to integrate ecosystem services in planning, performance and partnerships.

## National Oceanic and Atmospheric Administration

### Operationalizing and Leveraging an Ecosystem Services Framework for Habitat Conservation: Coastal Blue Carbon (2014)

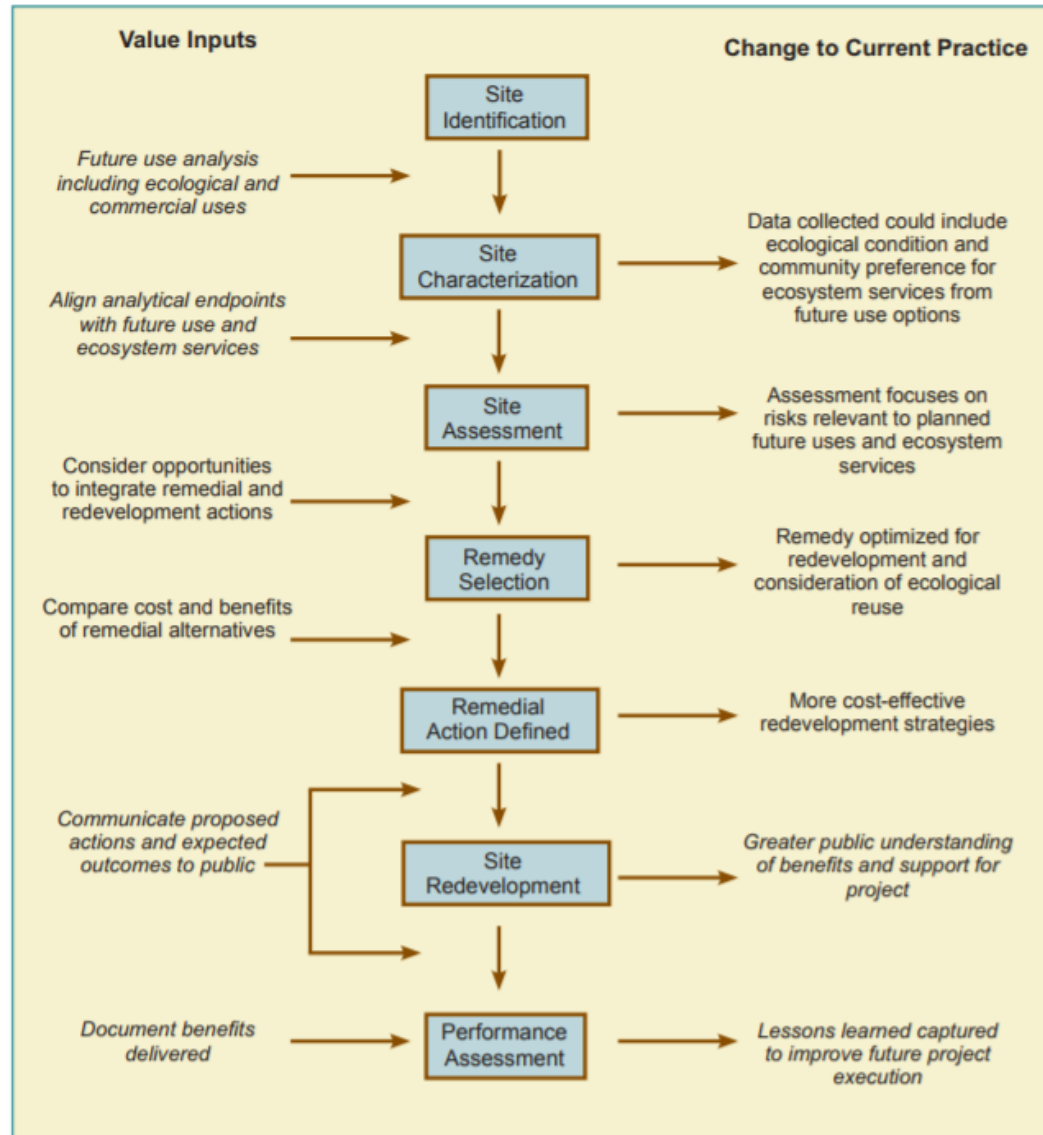


VIEW PDF



Describes NOAA's efforts to support the scientific, policy, and economic framework needed to increase use of information on coastal wetland's carbon sequestration potential in coastal management.

Figure 5: Integration of valuation information with the traditional remediation and redevelopment process



# Science Advisory Board

EPA  
United States  
Environmental Protection  
Agency

EPA-SAB-09-012 | May 2009 | www.epa.gov/sab

# SAB

**Valuing the Protection of  
Ecological Systems and Services**  
A REPORT OF THE EPA SCIENCE ADVISORY BOARD

Science Advisory Board  
Office of the Administrator



Are there ecosystem services at contaminated sites?

And... what does this have to do with site cleanup?



Ecological considerations at site cleanups



EPA/100/F15/005  
July 2016  
www.epa.gov/osa

**Generic Ecological Assessment Endpoints (GEAEs)  
For Ecological Risk Assessment:  
Second Edition With  
Generic Ecosystem Services Endpoints Added**

Risk Assessment Forum  
U.S. Environmental Protection Agency  
Washington, DC 20460

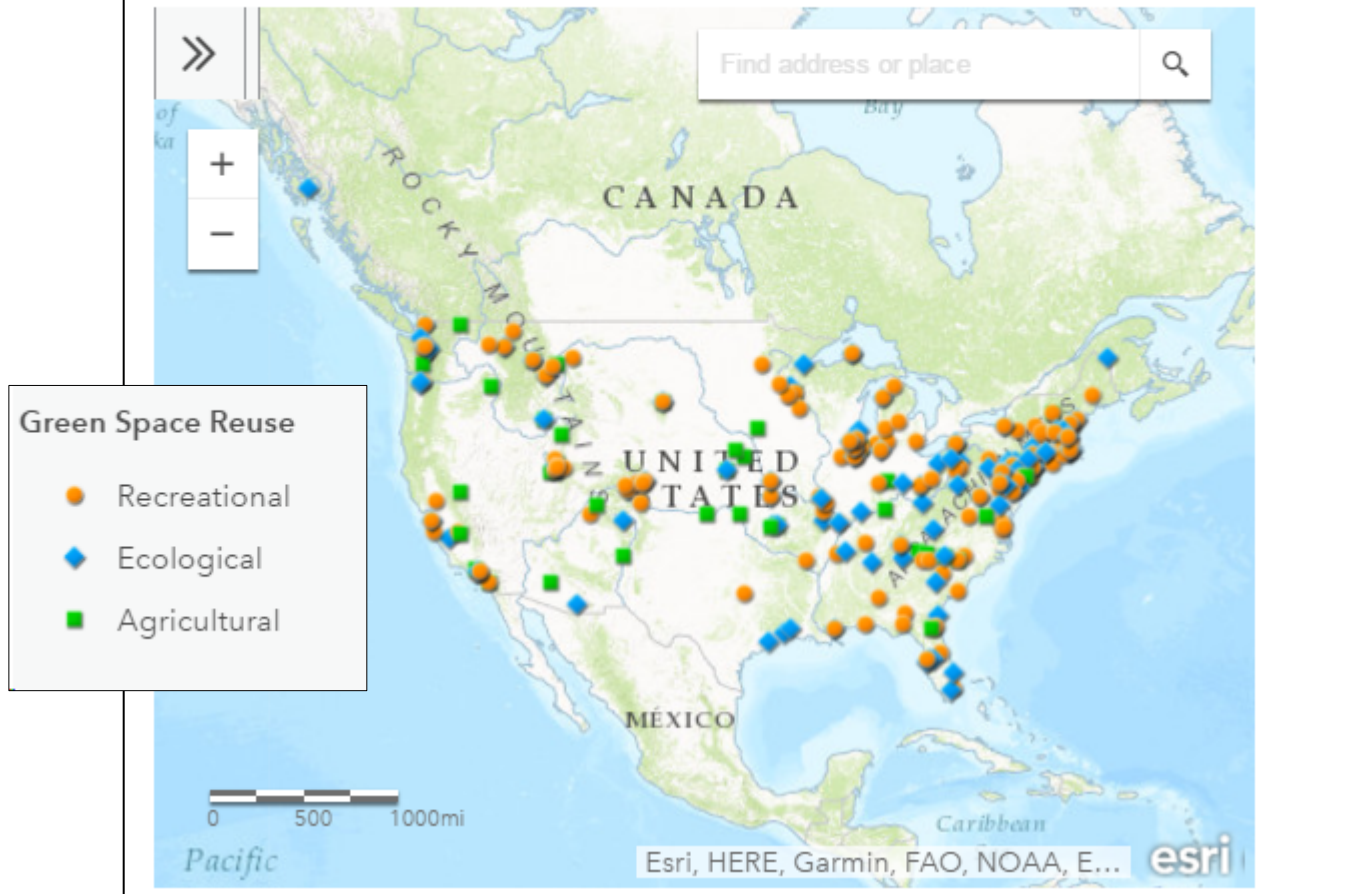
# Ecological Risk Assessment

## Case Study Illustration

Stressor	Case Study Ecological Assessment Endpoint	Potential Ecosystem Service Assessment Endpoint	Societal Benefit
chemicals	•aquatic invertebrate survival, growth, and reproduction	•biomass of harvestable fish •recreational opportunity	•changes in food supply •recreation experiences

# Find Sites with Green Space Reuse

Click the points on the map for site-specific reuse information.



# Superfund Redevelopment Initiative



MILLTOWN RESERVOIR SEDIMENTS SITE

## Methodology for Understanding and Reducing a Project's Environmental Footprint

February 2012

U.S. Environmental Protection Agency

Office of Solid Waste and Emergency Response

Office of Superfund Remediation and Technology Innovation

Sponsored by the Technical Support Project  
Engineering Forum

[www.cluin.org/greenremediation/methodology](http://www.cluin.org/greenremediation/methodology)

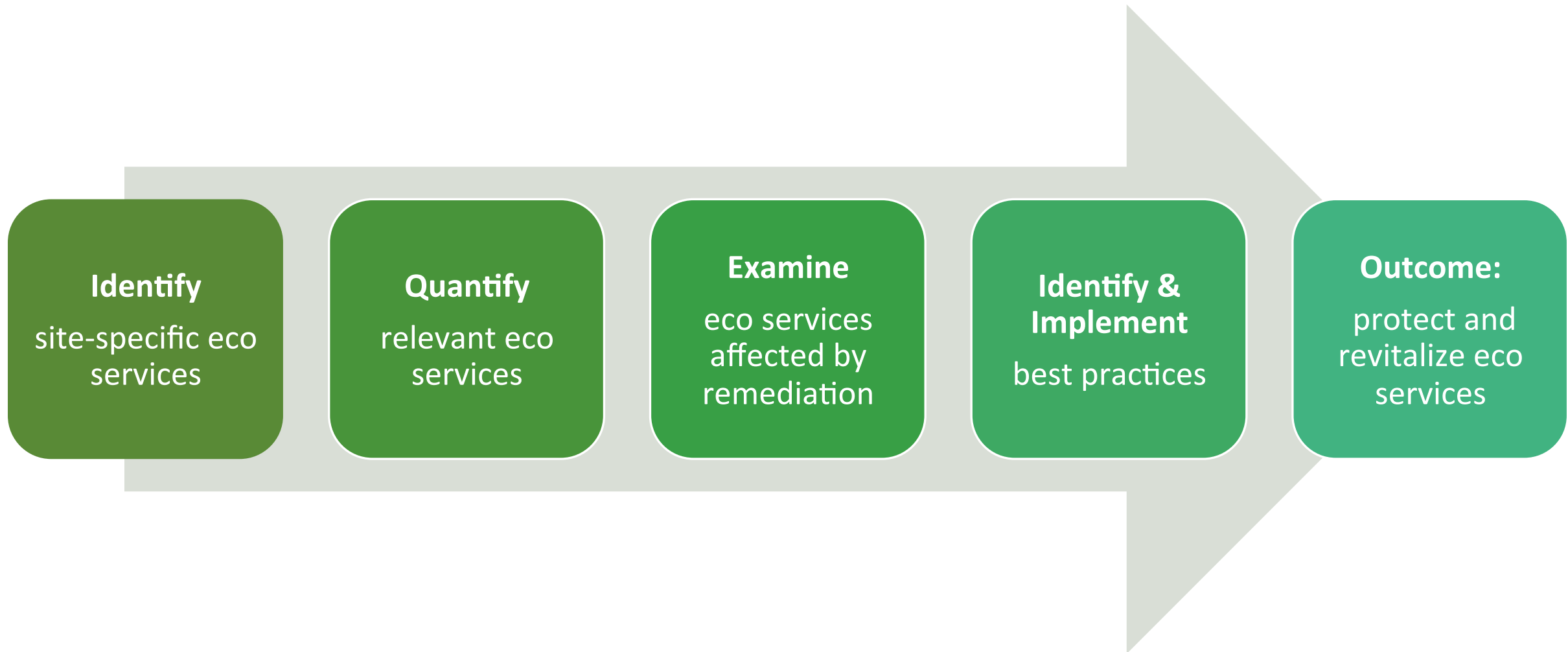
# Greener Cleanups





How do we know which ecosystem services are affected by cleanup activities?

And... what can we do about it during cleanup?



# Evaluation Framework

# Examples of Evaluations and Tools

---

## Hypothetical “Casual” Evaluation: EPA EnviroAtlas

- Raleigh Street Dump in Tampa, Florida
- Limitation: Data is available for a subset of U.S. communities

## “Rigorous” Evaluation: Service Providing Area (SPA) Maps created with spatial modeling software

- St. Louis River Bay Area of Concern (AOC), Minnesota and Wisconsin border

## Example 1: “Casual” Evaluation with EnviroAtlas for Raleigh Street Dump

### Raleigh Street Dump PH

The 10-acre Raleigh Street Dump Superfund site is located in Tampa, Florida. Various parties dumped wastes such as battery casings, furnace slag, as well as trash and construction debris on site from 1977 to 1991. In 1988, the Hillsborough County Environmental Protection Commission received complaints that Tampa Fiberglass improperly disposed of waste at the site. EPA added the site to the National Priorities List (NPL) in 2009. Cleanup activities included the removal and disposal of contaminated soils, addition of clean soils, planting of grass seed, wetlands restoration, groundwater monitoring and limits on future site uses. Fiberglass production is ongoing on the southern portion of the site. Potentially responsible parties (PRPs) expanded the previously existing wetlands habitat, creating a wildflower and native grass meadow on the upland area. PRPs installed nesting boxes for small birds and created habitat brush piles. PRPs also installed a bat box to provide habitat to native Florida bats and planted two milkweed gardens to provide habitat for Monarch butterflies. At the 2015 Wildlife Habitat Council’s annual conservation conference, a PRP contractor accepted the “Rookie of the Year” award for ecological restoration efforts at the site on behalf of the PRPs. EPA also recognized the PRPs with its 2016 Excellence in Reuse award.



Raleigh Street Dump

**Qualitative understanding of ecosystem services for this type of site:**

1. Wetlands provide many ecosystem services, thus wetland restoration is beneficial.
2. Pollinator habitat supports pollinators, therefore this supports pollination of local food crops.
3. Bird habitat and nesting boxes support songbird species viewed by outdoor recreationalists and birdwatchers.
4. Natural green space in urban areas have positive impacts on human health and well-being.

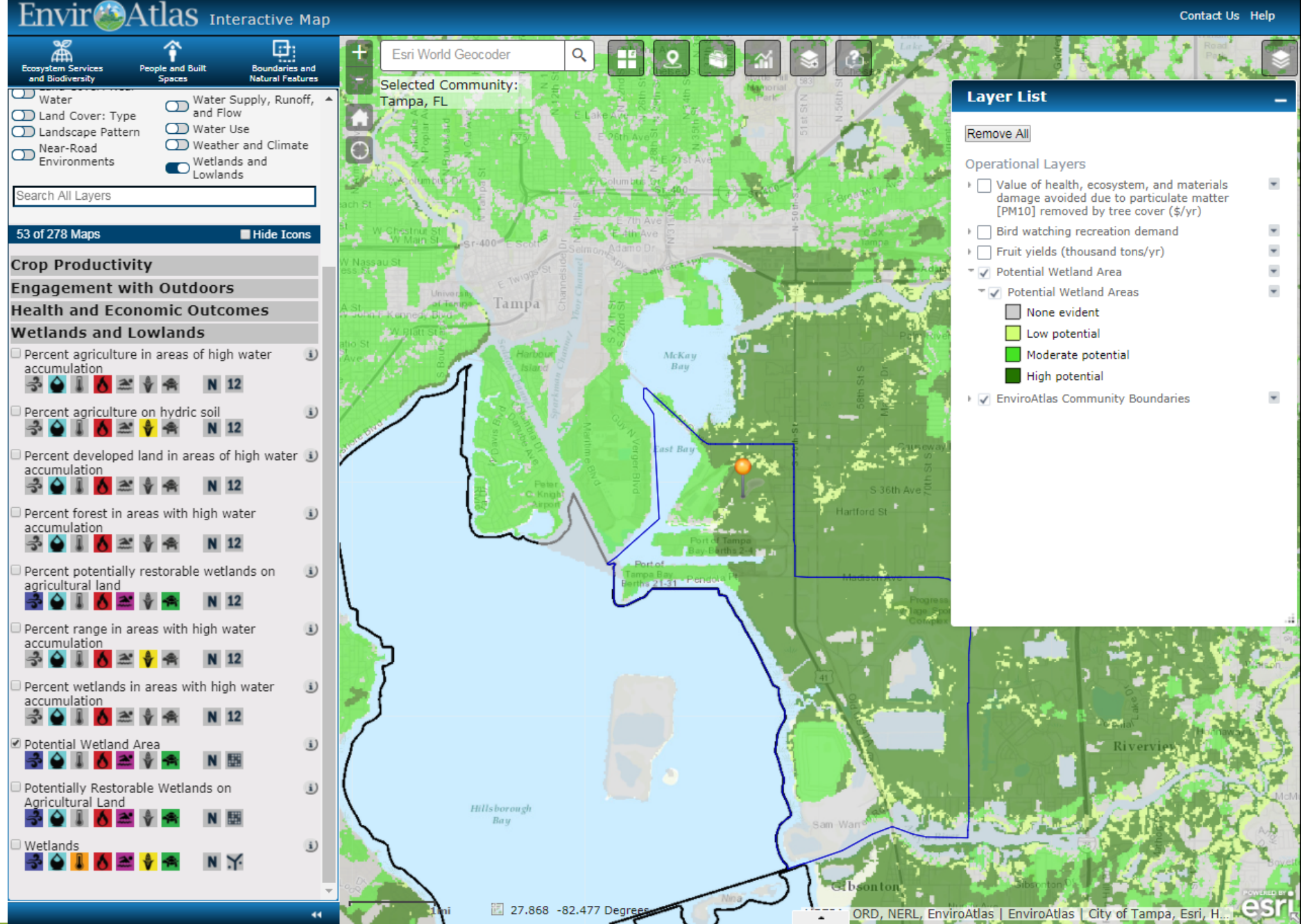


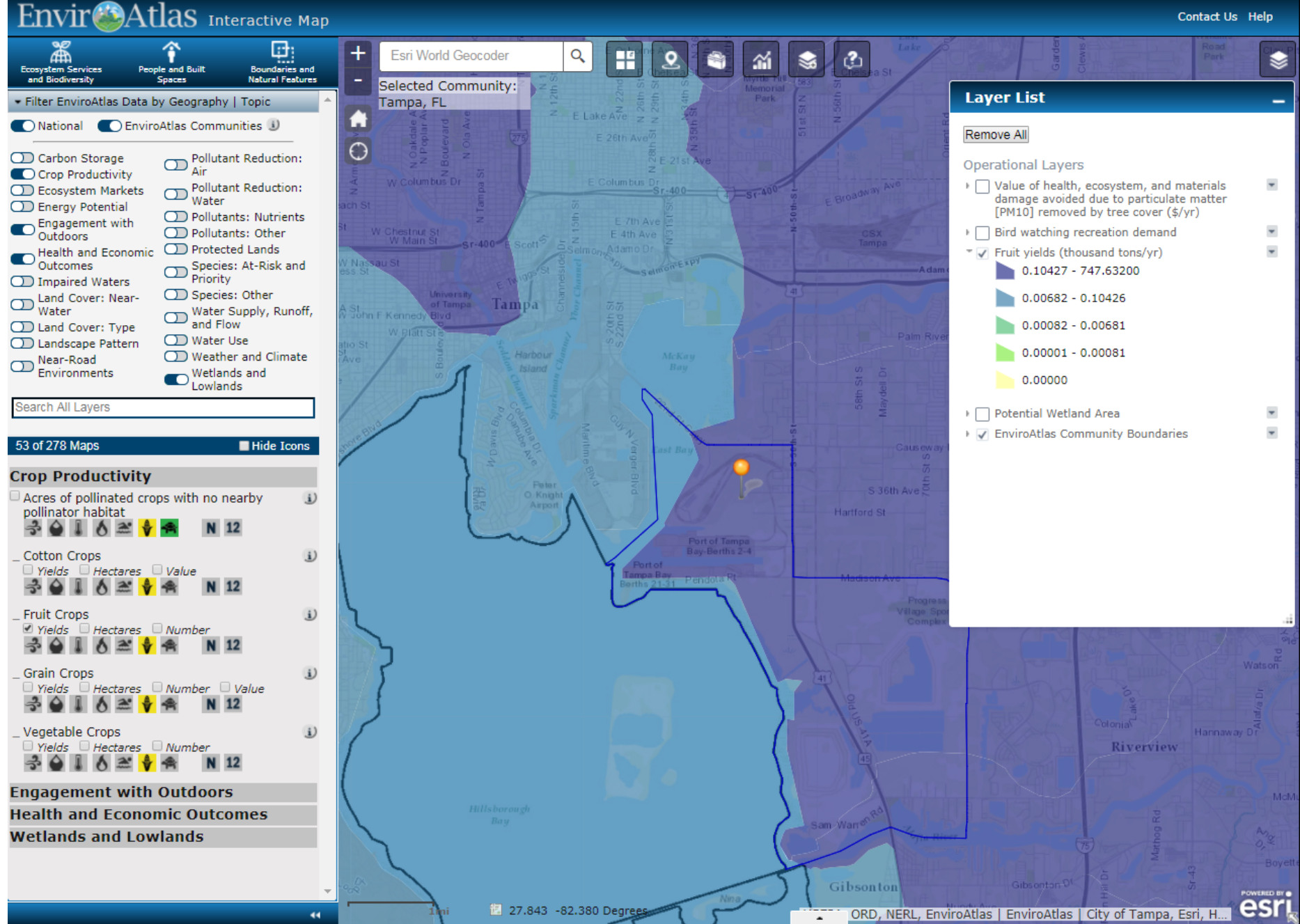
*Example 1: "Casual" Evaluation with EnviroAtlas for Raleigh Street Dump*

Site Consideration:  
Restore wetland habitat.

Qualitative: Wetlands provide numerous ecosystem services. Wetlands should be restored.

Quantitative: This part of Tampa has high potential for wetland areas.





*Example 1: “Casual” Evaluation with EnviroAtlas for Raleigh Street Dump*

**Site Consideration:**  
Revegetate using native plants and pollinator habitat.

**Qualitative:** Pollinators are necessary for local food crop production.

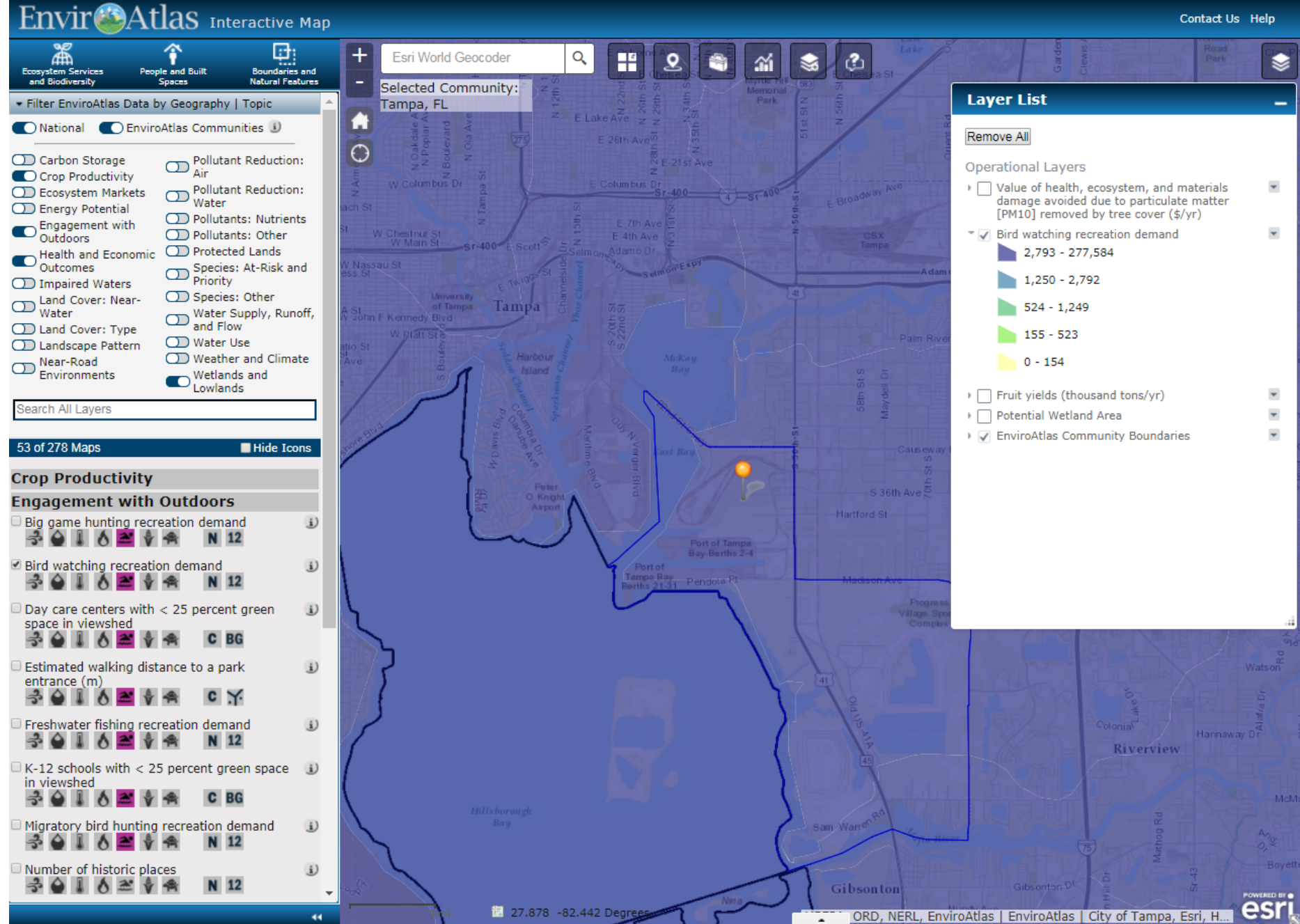
**Quantitative:** In this part of Tampa, fruit crop yields are between 0.1 and 748 thousand tons per year.

*Example 1: “Casual”  
Evaluation with  
EnviroAtlas for  
Raleigh Street Dump*

Site Consideration:  
Provide habitat and  
nesting for songbirds.

Qualitative: People enjoy  
watching songbirds.

Quantitative: The  
demand for birdwatching  
in this part of Tampa is  
over 2,700 people,  
potentially up to 278,000  
people.

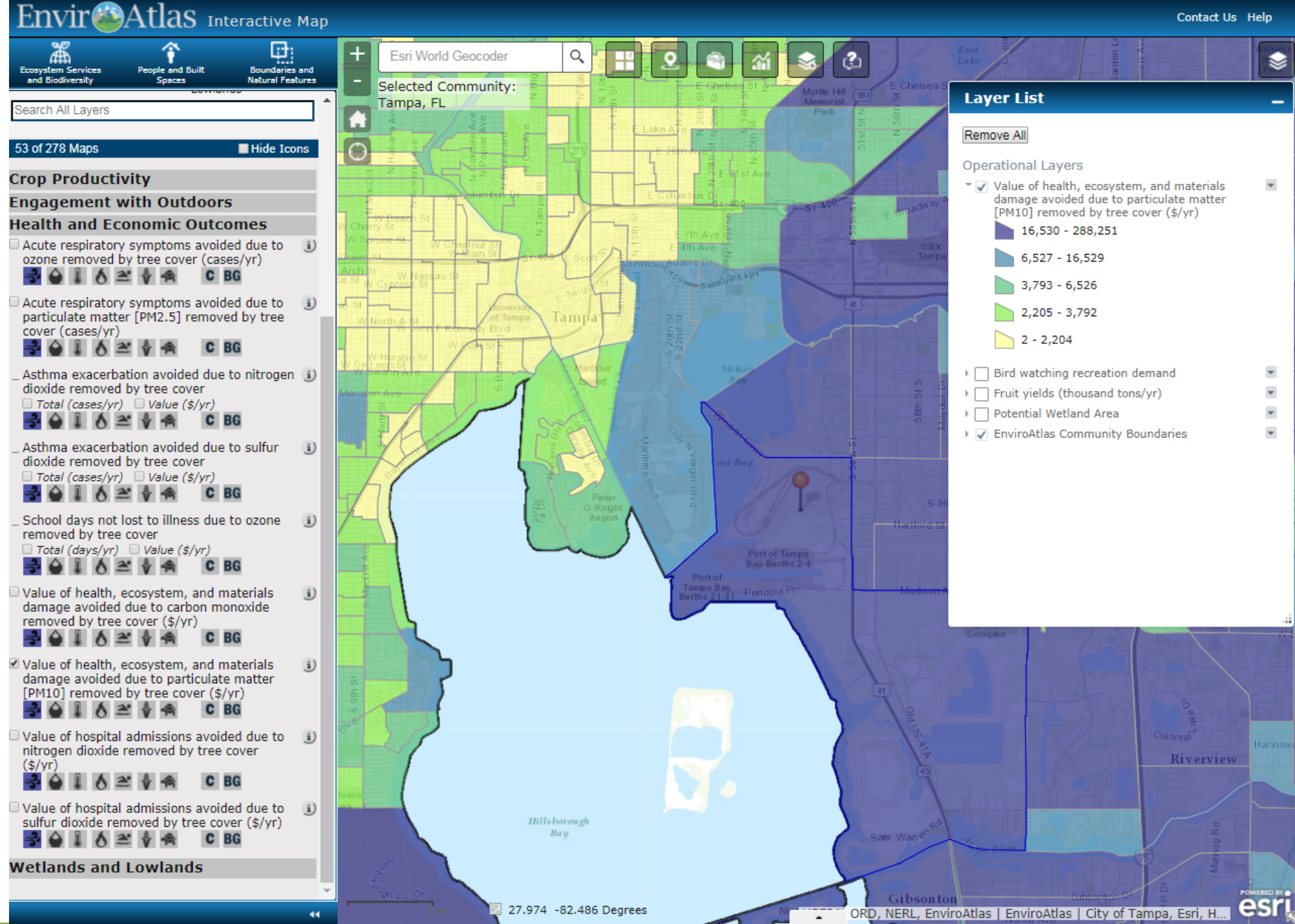


*Example 1: “Casual” Evaluation with EnviroAtlas for Raleigh Street Dump*

Site Consideration:  
Plan ecological reuse in an urban area.

Qualitative: Green space in urban areas positively impact human health.

Quantitative: In this part of Tampa, trees mitigate over \$16,000 per year of damage to health, ecosystems, and materials.



## Example 2: “Rigorous” Evaluation with SPA Map for St. Louis River Bay AOC

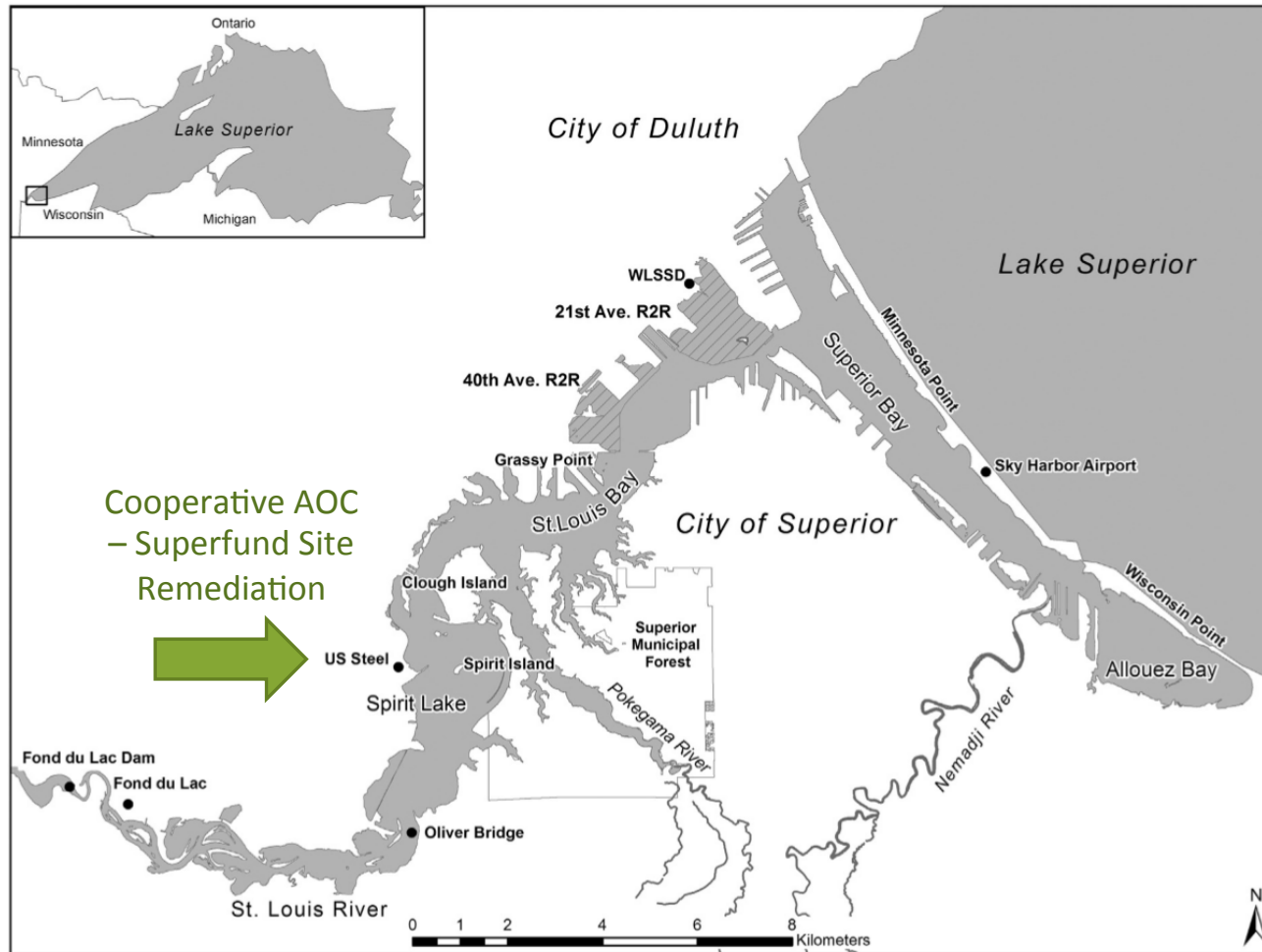


Fig. 1. Map of the St. Louis River Estuary. Hatched areas are remediation to restoration (R2R) projects discussed in the paper.

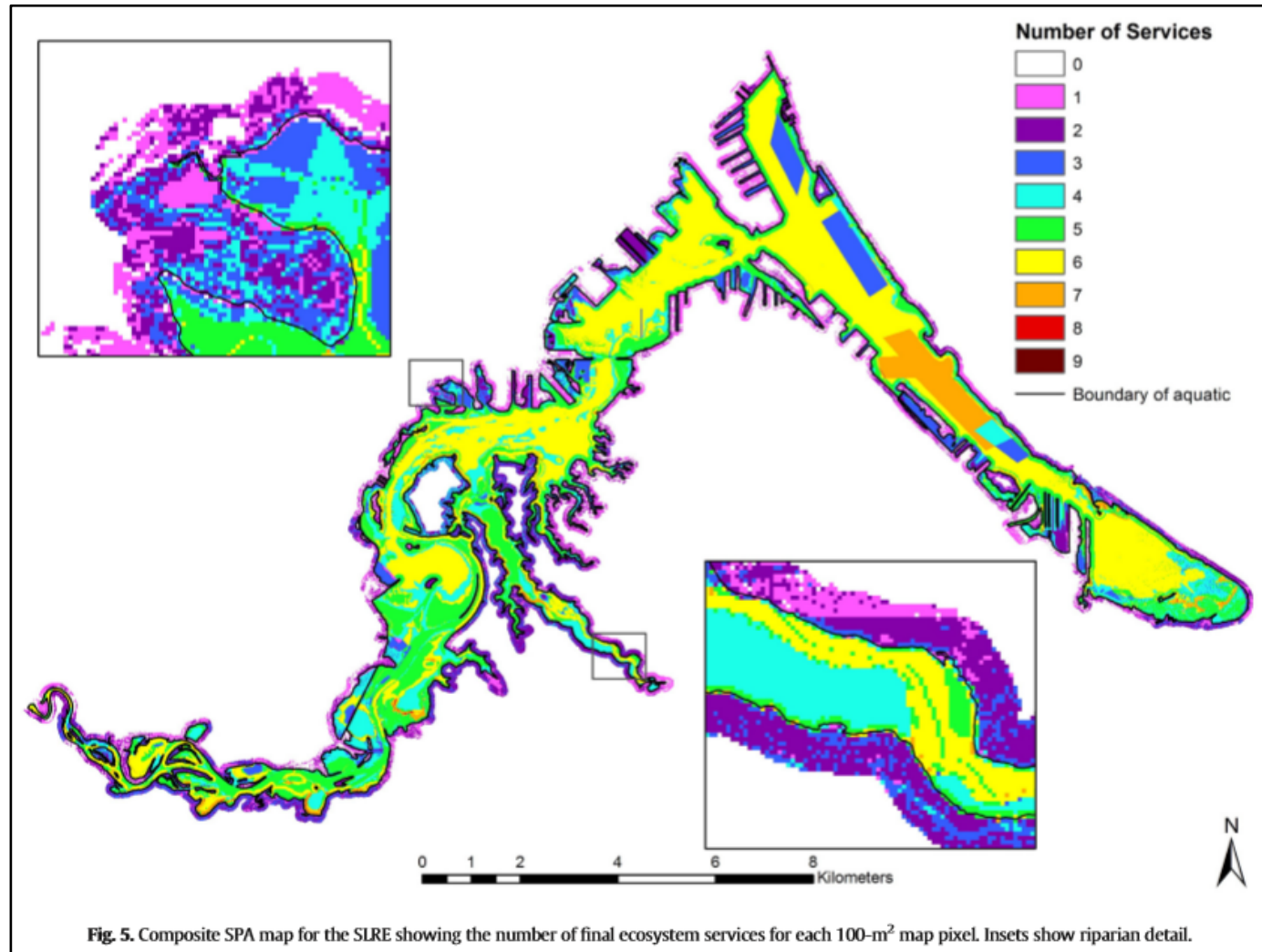
Great Lakes “Area of Concern” designation reflects significant environmental degradation resulting in use-impairments.

Remediation to Restoration Process “R2R”

- State of Minnesota AOC-related R2R projects.
- Cooperative AOC-Superfund contaminated sediment remediation project at the former Duluth Works of the U.S. Steel Corporation.

Please cite this article as: Angradi, T.R., et al., Mapping ecosystem service indicators in a Great Lakes estuarine Area of Concern, J. Great Lakes Res. (2016), <http://dx.doi.org/10.1016/j.jglr.2016.03.012>

## Example 2: “Rigorous” Evaluation with SPA Map for St. Louis River Bay AOC



The project team used spatial mapping software to create Service Providing Area (SPA) maps of the AOC.

- Mapped 23 ecosystem services indicators. Examples:
  - Bald eagle nesting habitat characteristics
  - Wild rice bed locations
  - Safe boating area characteristics
  - Shoreline characteristics of habitat for riparian and semi-aquatic wildlife

Please cite this article as: Angradi, T.R., et al., Mapping ecosystem service indicators in a Great Lakes estuarine Area of Concern, J. Great Lakes Res. (2016), <http://dx.doi.org/10.1016/j.jglr.2016.03.012>

Example 2: “Rigorous” Evaluation with SPA Map for St. Louis River Bay AOC

Ecosystem Service	Existing SPA (km2)	Alternative 8 SPA (km2)	Alternative 12 SPA (km2)
Bald eagles	0.08	0.02	0.03
Wild rice	0.09	0.08	0.21
Power boating areas	0.04	0.13	0.08
Riparian and semi-aquatic wildlife	0.04	0.04	0.05

Table 7 adapted: Mapped changes in SPA (km2) for ecosystem services responding to biophysical changes resulting from two remedial action alternatives.

Angradi et al. 2016

The project team was interested in comparing two of the proposed remediation alternatives:

- “Alternative 8”
  - Wetland would be excavated to create open water habitat
  - Confined disposal facility would be created in part of the former wetland, within site of Spirit Island, to store the sediment.
- “Alternative 12”
  - Wetland would be excavated to create open water habitat
  - The contaminated sediment would be disposed at an upland site outside the AOC.

# Discussion of ecosystem services with Regional EPA site teams

---

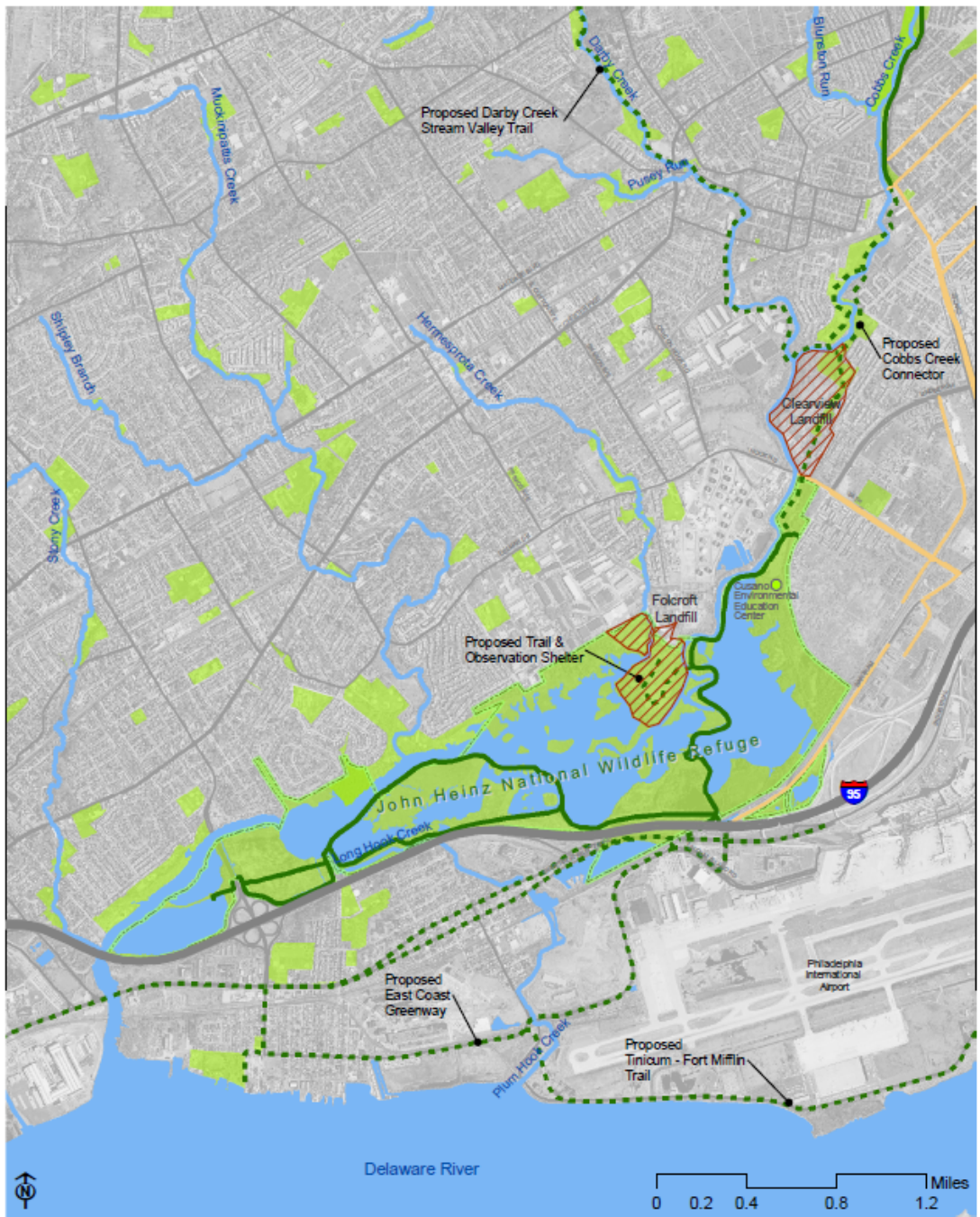
Josh Barber, Remediation Project Manager, Region 3

Bruce Pluta, Biological Technical Assistance Group, Region 3

Kim Prestbo, Remedial Project Manager, Region 10

Kira Lynch, Superfund Technology Liaison, Region 10





# Lower Darby Creek Area, Philadelphia, PA

Urban location, local scale

Josh Barber, RPM, and Bruce Pluta, BTAG

## *Lower Darby Creek Area*

### *Question 1*

Can you describe some of the ecosystem services currently present at the Clearview Landfill site? And ecosystem services that are expected to result as part of the remediation efforts?

What about the Folcroft Landfill?



Photo: Bruce Pluta



Photo: Bruce Pluta



Photo: Bruce Pluta

*Lower Darby Creek Area*  
*Question 2*

How did community involvement inform the identification of ecosystem services?



Photo: Bruce Pluta



Photo: Bruce Pluta



Photo: Bruce Pluta

*Lower Darby Creek Area*  
*Question 3*

How is consideration of ecosystem services influencing remedial design?



Photo: Bruce Pluta



Photo: Bruce Pluta



Photo: Bruce Pluta

## Lower Darby Creek Area

### Question 4

How could documenting and quantifying ecosystem services be a useful tool for site work?



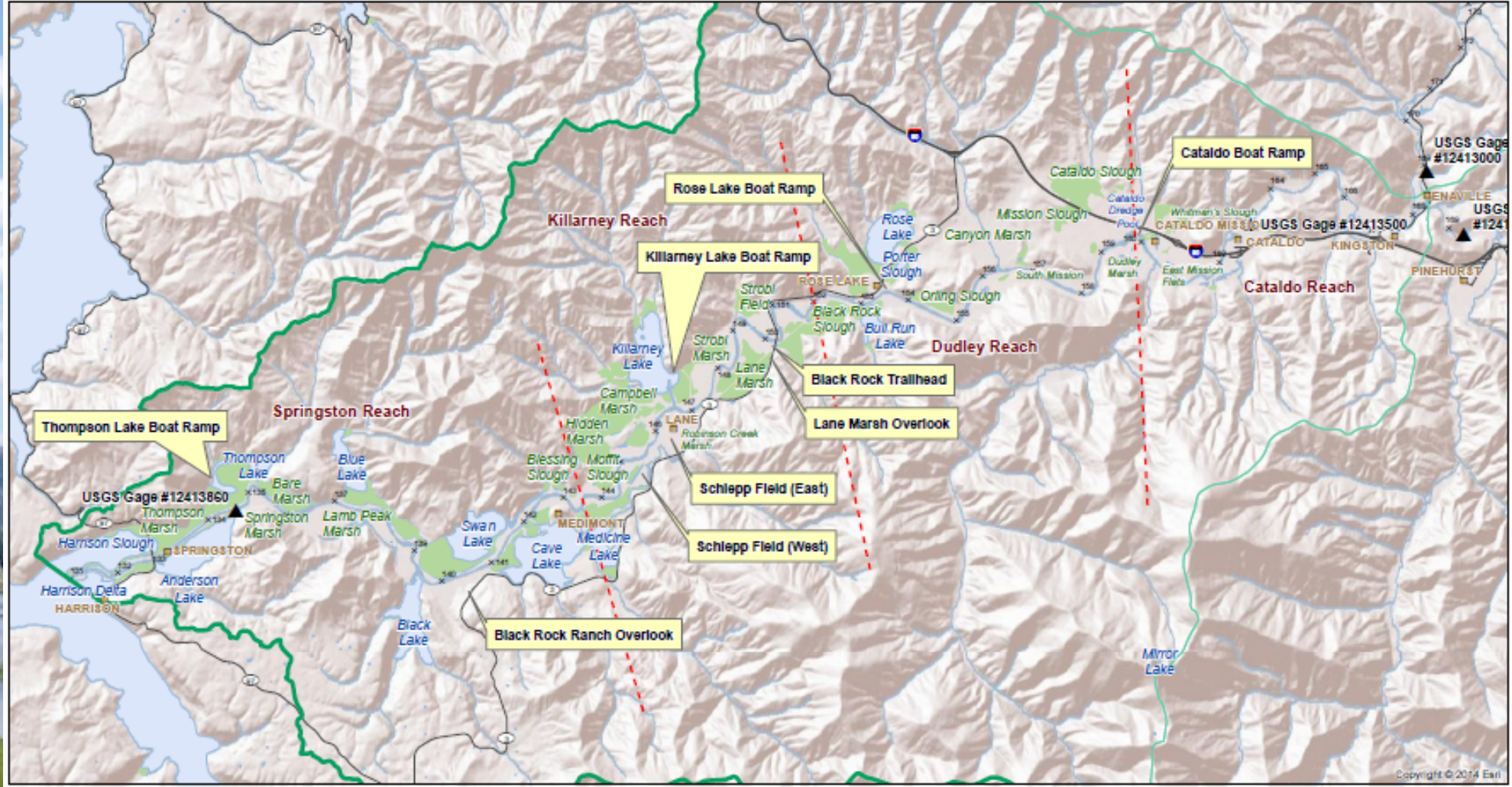
Photo: Bruce Pluta



Photo: Bruce Pluta



Photo: Bruce Pluta



# Bunker Hill Mine Complex, Coeur d'Alene, ID

Rural location, watershed scale

## *Bunker Hill Mine Complex*

### *Question 1*

What are some of the ecosystem services in the Coeur d'Alene River Lower Basin, currently and potentially after remediation?



*Bunker Hill Mine Complex*  
*Question 2*

How did community involvement inform the identification of ecosystem services?





## *Bunker Hill Mine Complex*

### *Question 3*

How is consideration of ecosystem services influencing remedial design?



## *Bunker Hill Mine Complex*

### *Question 4*

How could documenting and quantifying ecosystem services be a useful tool for site work?



# Conclusion

- Ecosystem services approach can help site teams optimize remedy design and communicate the positive cleanup outcomes.
- Free evaluation tools provide several options for quantification of ecosystem services.
  - Different tools for different needs or “niches”
- Learn more about the concepts and find more tool options in the Engineering Forum issue paper, <https://www.epa.gov/remedytech/ecosystem-services-contaminated-site-cleanups>

 United States Environmental Protection Agency

EPA 542-R-17-004  
August 2017

*Engineering Forum Issue Paper*



*Agriculture-to-wetland project at the Lower Basin of Coeur d'Alene River Superfund site in northern Idaho. Photo Credit: Jewel Lipps*

### Ecosystem Services at Contaminated Site Cleanups

**Contents**

1. Purpose
2. Ecosystem Services
3. Considerations During Cleanup
4. Community Involvement
5. Ecosystem Services Evaluation Tools
6. Best Management Practices for Ecosystem Services
7. Summary
8. Acknowledgements
9. Notice and Disclaimer
10. Selected Resources
11. Cited References

Appendix A. Ecosystem Services Evaluation Tools

*The Technical Support Project (TSP) Engineering Forum issue papers provide information on remediation technologies or technical issues of interest. The information is not guidance or policy.*

"Ecosystem goods and services are the many life-sustaining benefits we receive from nature — clean air and water, fertile soil for crop production, pollination, and flood control."  
- U.S. Environmental Protection Agency, 2017  
[www.epa.gov/eco-research/ecosystems-services](http://www.epa.gov/eco-research/ecosystems-services)

#### 1. Purpose

The U.S. Environmental Protection Agency (EPA) developed this issue paper to provide cleanup site teams with information about ecosystem services. These concepts and tools are useful in communicating the positive results of cleanup in addition to achieving the goals of cleanup. Information about ecosystem services may be considered in characterization of future land use options or design of a cleanup that is consistent with anticipated ecological reuse, depending on the regulatory authority of the cleanup program. This document does not provide guidance on how ecosystem services may or may not be factored into specific cleanup programs.

1

# Acknowledgements

---

EPA Region 3: Josh Barber, Bruce Pluta

EPA Region 10: Kira Lynch, Ed Moreen, Kim Prestbo

EPA Office of Research Development: Mike Kravitz, Matthew Harwell, Joel Hoffman, Anne Neale

EPA Office of Superfund Remediation and Technology Innovation: Michele Mahoney, Carlos Pachon

Engineering Forum and Ecological Risk Assessment Forum

This project was supported in part by an appointment to the Internship/Research Participation Program at the Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, administered by the Oak Ridge Institute for Science and Education through an interagency agreement between the U.S. Department of Energy and EPA.

# Contact

---

Jewel Lipps

Biology Graduate Student at Georgetown University

[el785@georgetown.edu](mailto:el785@georgetown.edu)