EPA United States Environmental Protection Agency

Benefit Indicator Tools for Assessing Restoration Projects Based on who Benefits from Restored Ecosystem Services

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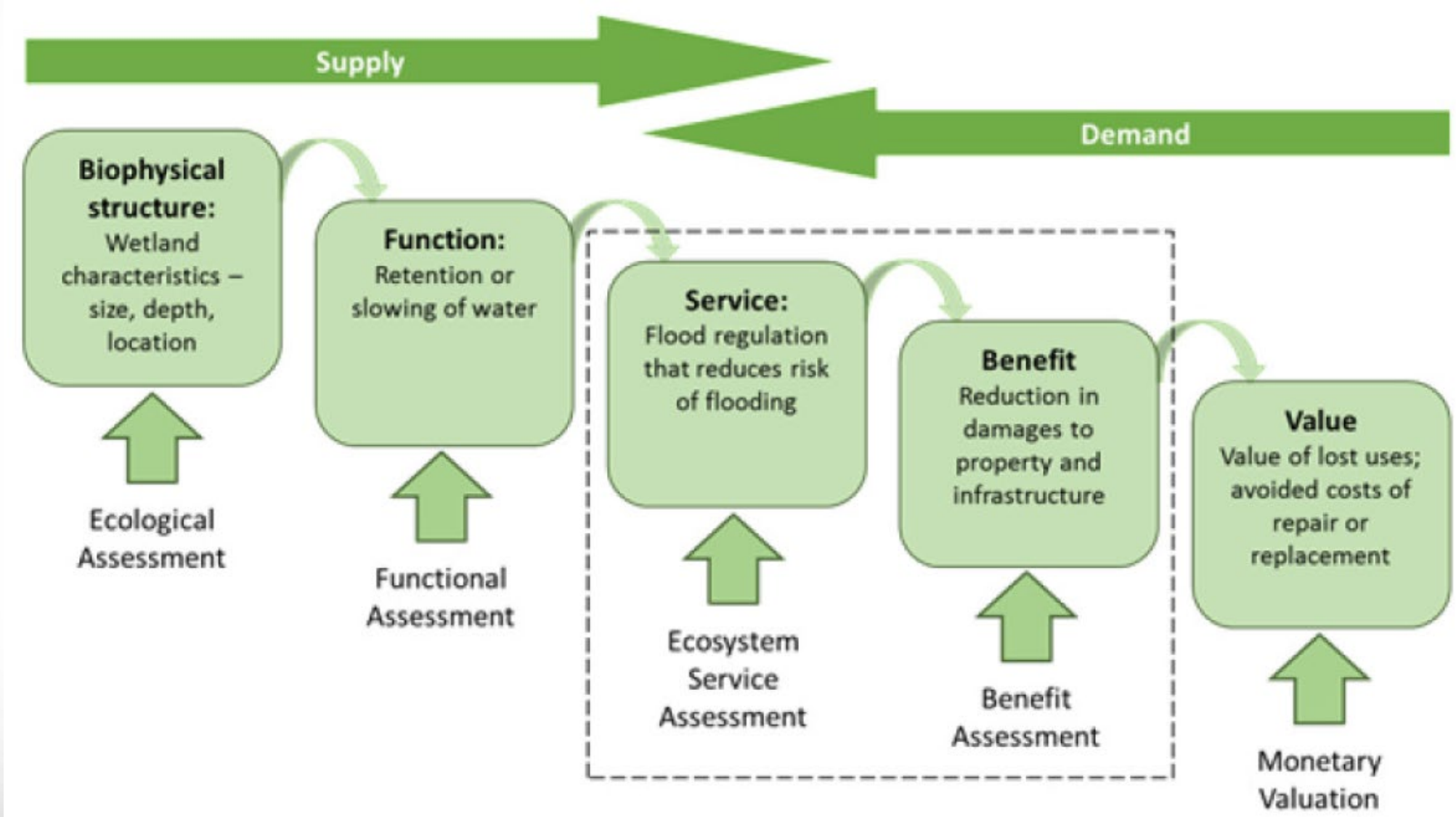
Challenges and Motivation

Environmental decisions require tradeoffs

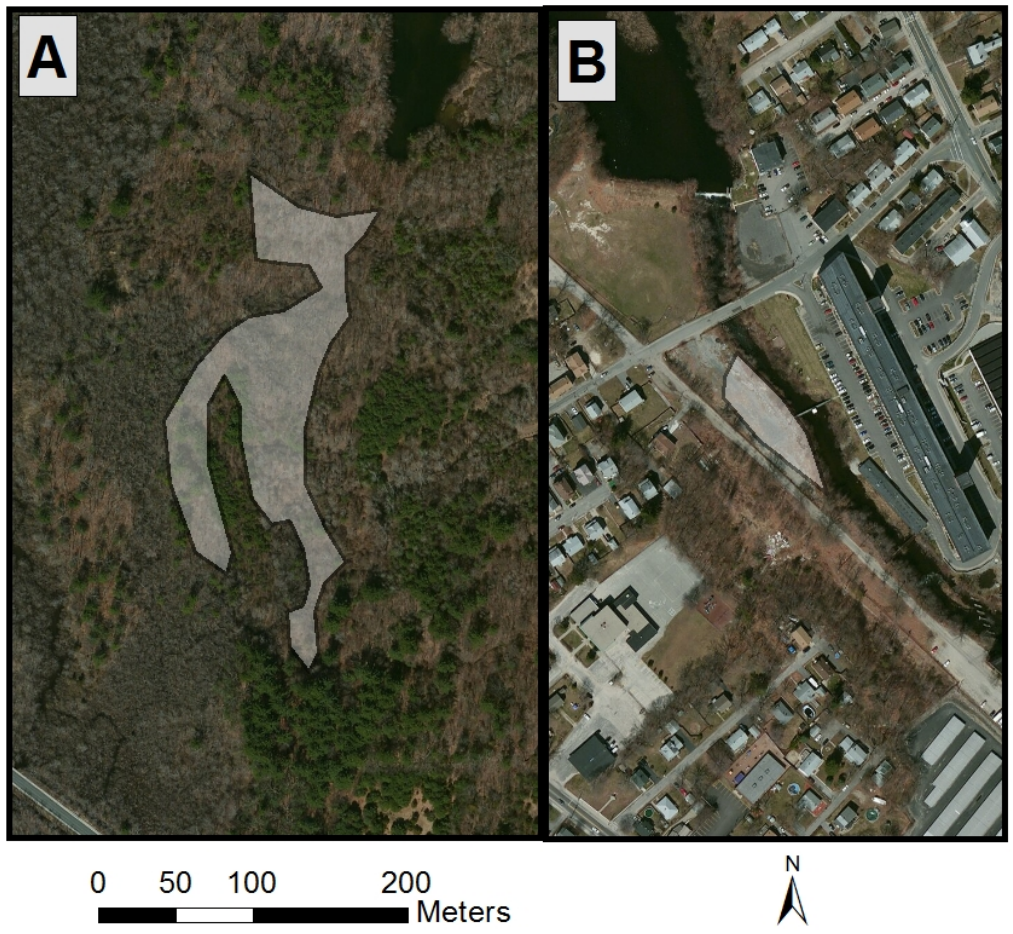
Which of these sites should we spend money on?

Both ecological and social criteria are important.

Ecosystem Services & Benefits

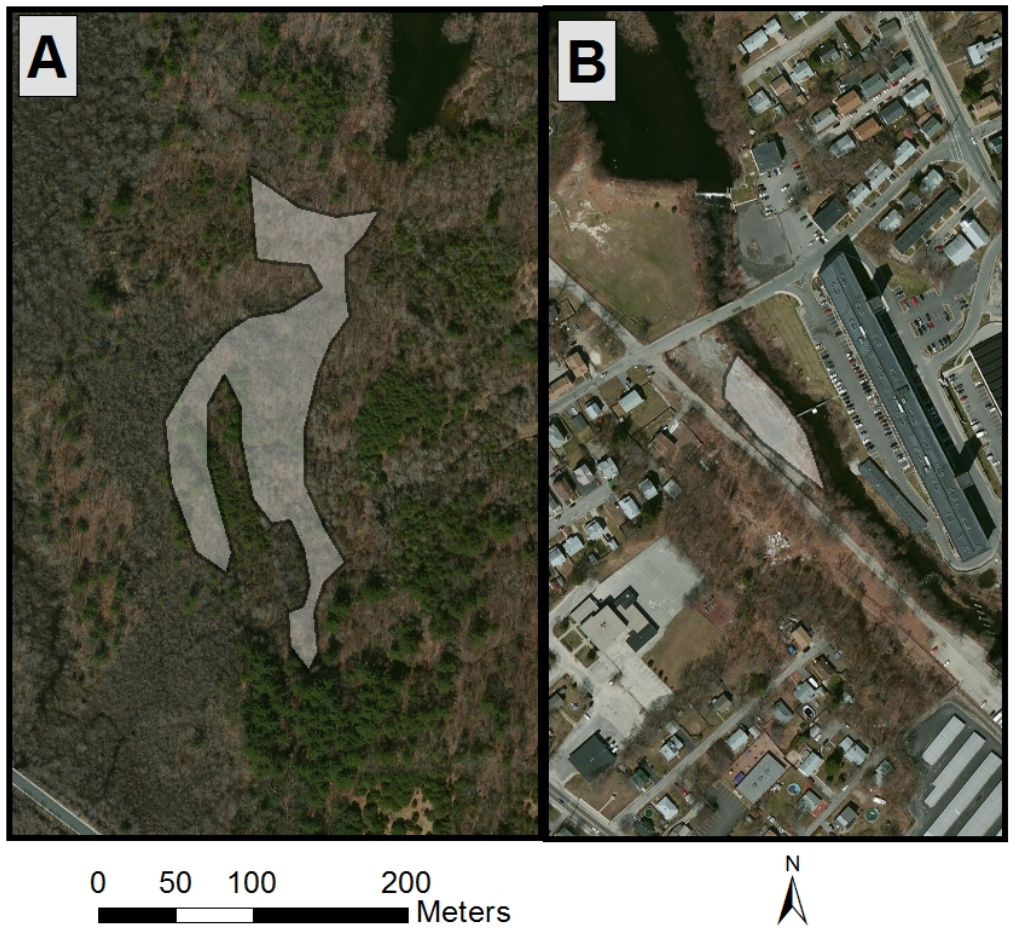


Example Site - Biophysical



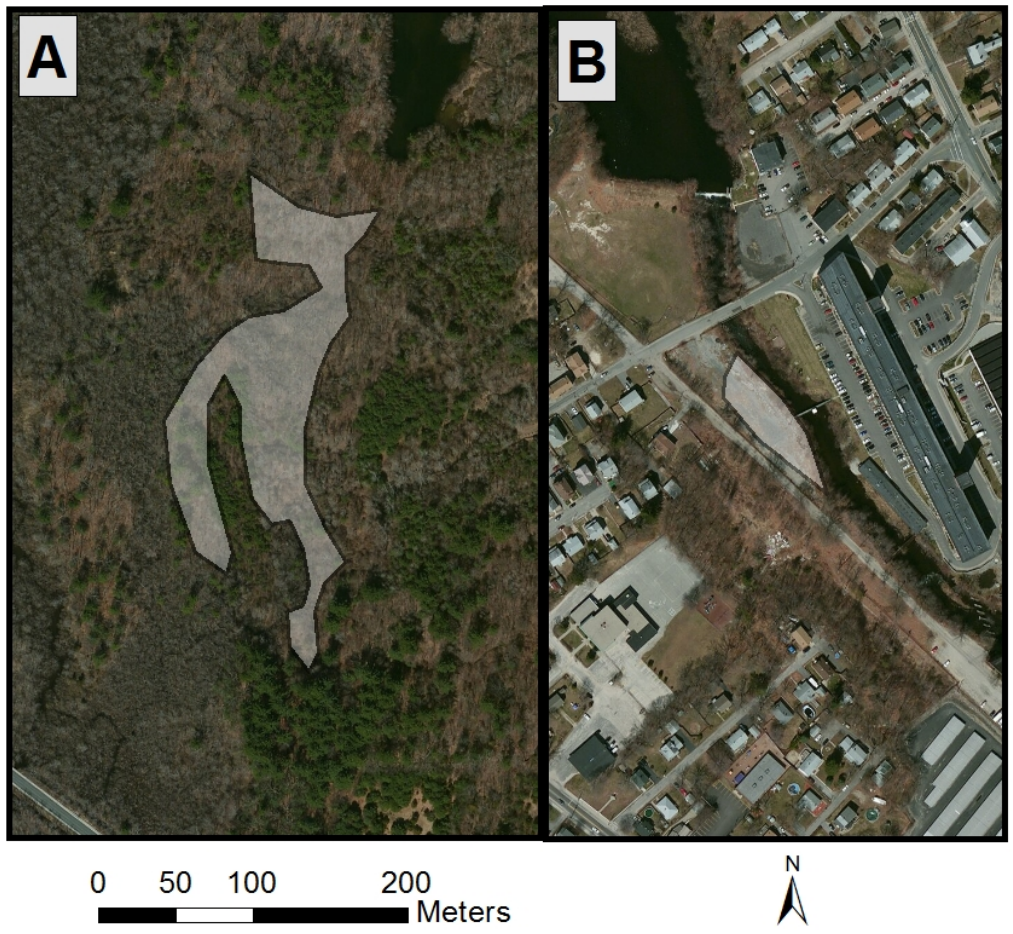
- **Structure:** Site A is larger

Example Site - Function



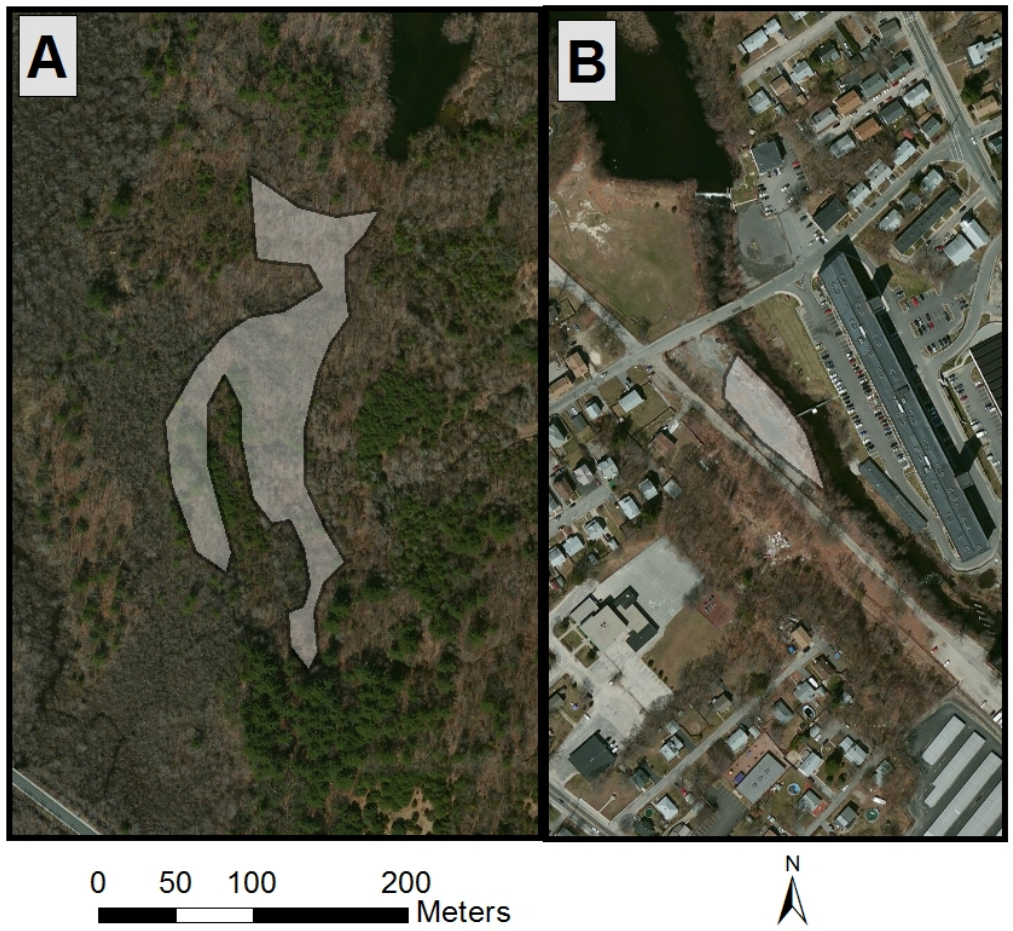
- **Structure:** Site A is larger
- **Function:** Site A retains more water than Site B

Example Site - Service



- **Structure:** Site A is larger
- **Function:** Site A retains more water than Site B
- **Service:** Site A reduces floodwaters (service production) more than Site B

Example Site - Value

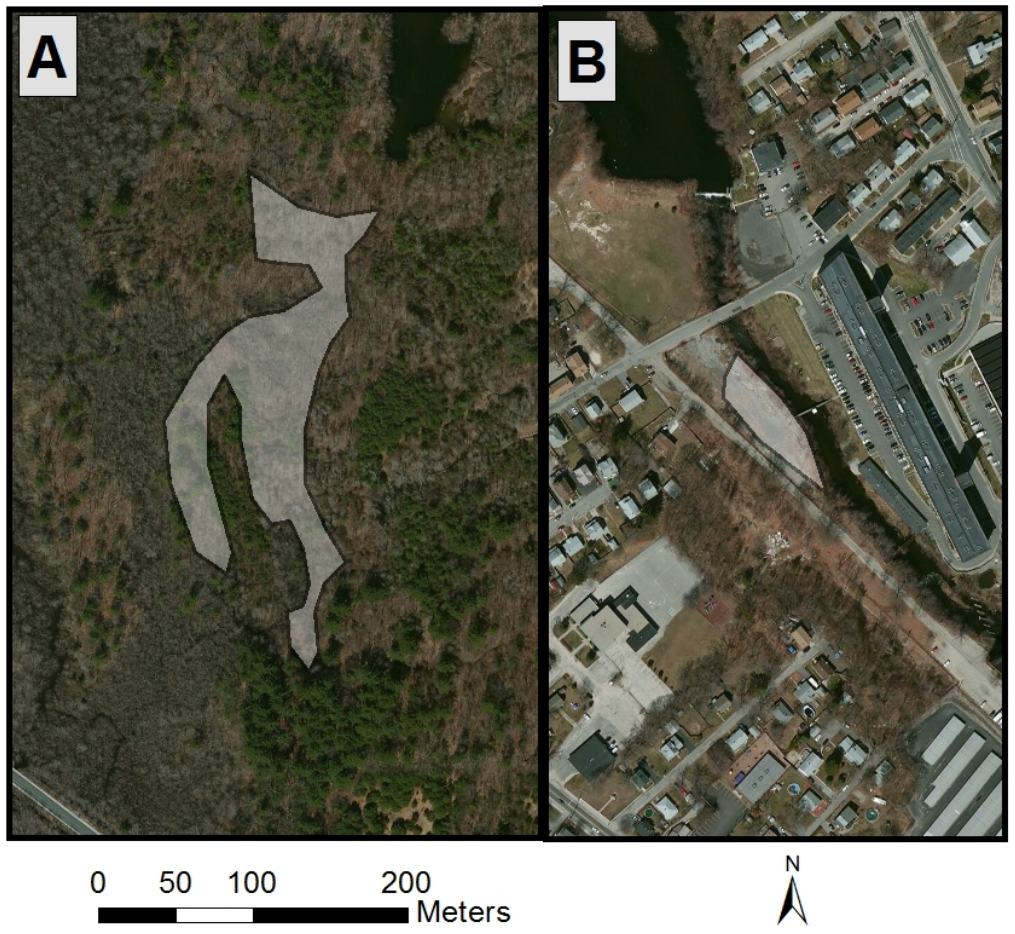


- **Structure:** Site A is larger
- **Function:** Site A retains more water than Site B
- **Service:** Site A reduces floodwaters (service production) more than Site B
- **Value:** What is Site A restored worth?

  Benefits Transfer – uses an value estimated somewhere else to assign a $/area of wetland

  Replacement Cost - estimates the cost to replace the same service production (e.g. with gray infrastructure)

Example Site - Value



- **Structure:** Site A is larger
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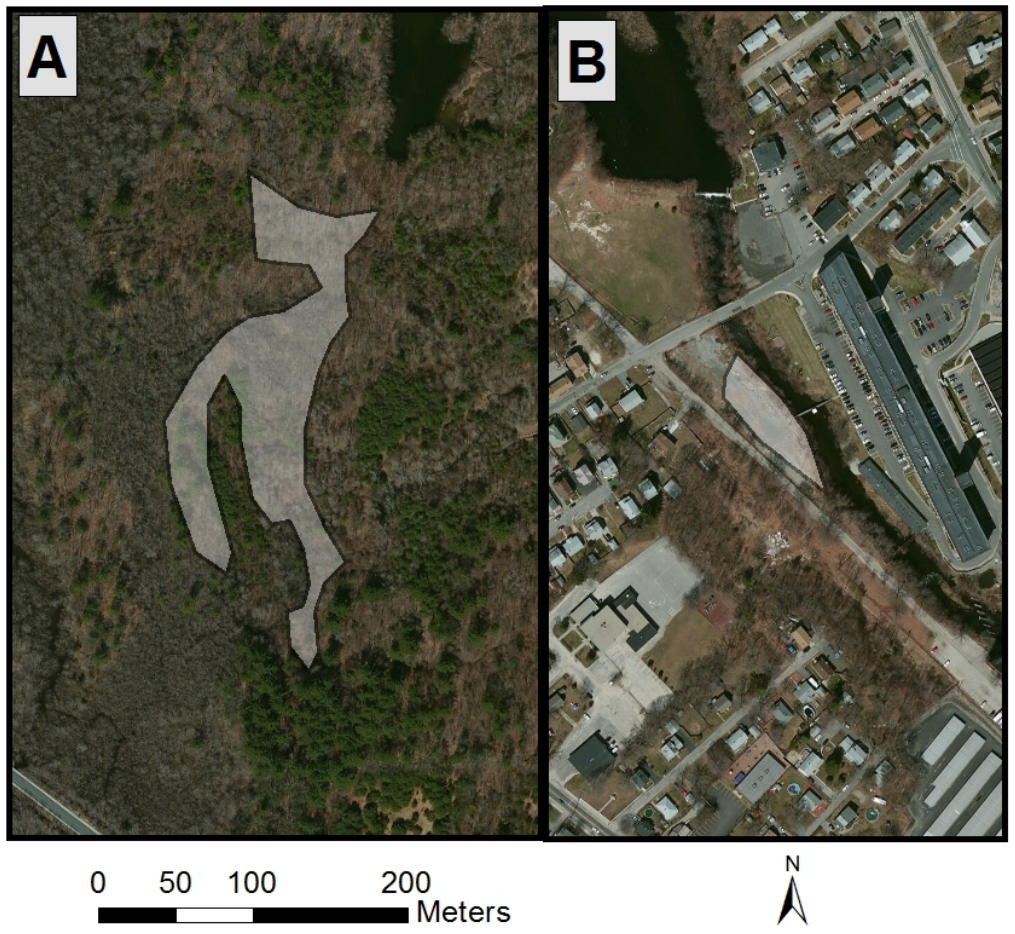
- **Service:** Site A reduces floodwaters (service production) more than Site B
- **Value:** What is Site A restored worth?

Monetary measures are not always the solution:

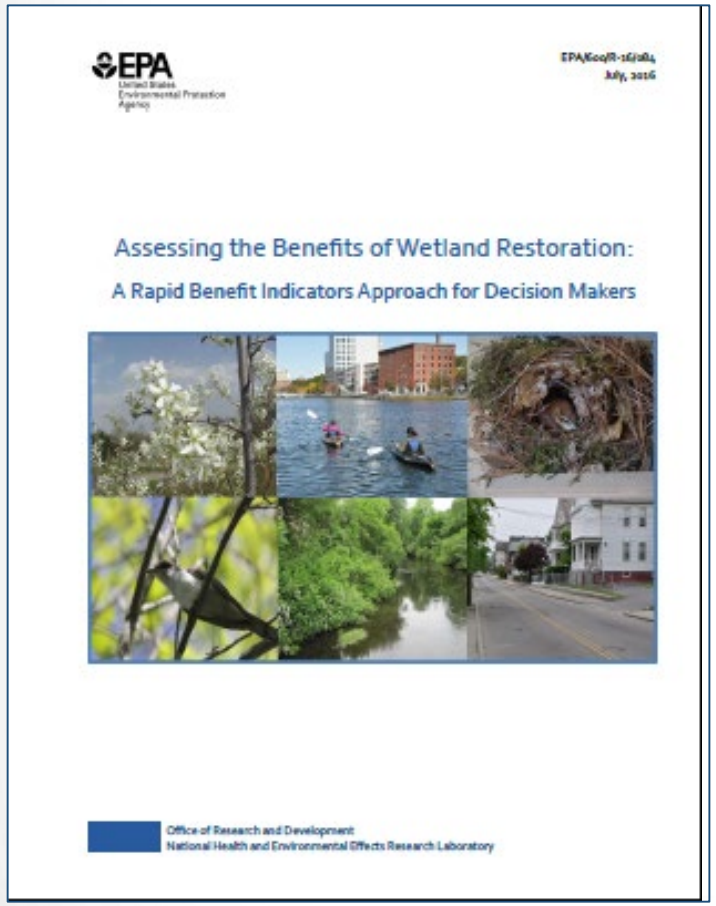
- Does it fit the decision?
  - Decision maker may lack resources
  - Decision may be able to be made without
- Does it tell the right story?
  - "Total value" is elusive
  - Distribution of benefits/ environmental justice

Example Site - Benefit



- **Structure:** Site A is larger
- **Function:** Site A retains more water than Site B
- **Service:** Site A reduces floodwaters (service production) more than Site B
- **Benefit:** How much would each site reduce flood damages (service delivery)?

A rapid assessment approach using benefit indicators



- A framework for compiling and using benefit indicators
- Rapid and User Friendly, but can be applied with different levels of detail depending on the context
- Focus is on benefits to people
- Designed to be used along with a biophysical/functional assessment
- Initial application to freshwater wetlands in a watershed ranging from urban to rural
  - May be applied, with modifications, to other ecosystems

Benefit indicators answer these questions:

1. Can people benefit from an ecosystem service?
2. How many people benefit?
3. How much are people likely to benefit?
4. What are the social equity implications?
5. How reliably will services be provided over time?

EPA

- The Guidebook includes examples of 5 Ecosystem Services:
  - Flood water regulation
  - Scenic landscapes
  - Learning opportunities
  - Recreational opportunities
  - Birds

Checklist and Spatial Analysis Tools are set up to assess benefits for these same 5 ecosystem services.

Services and Benefits Addressed in this Guide

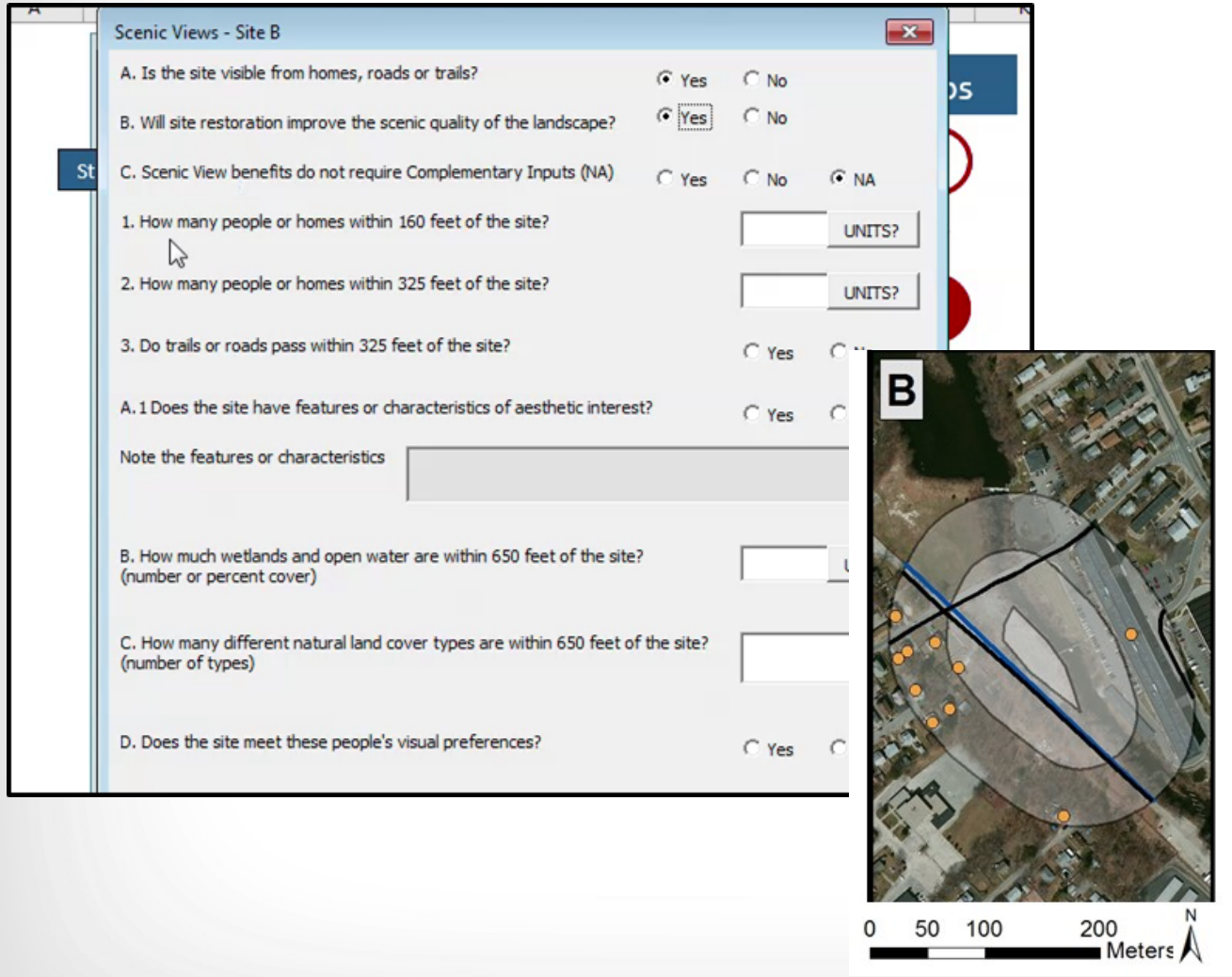
This guide addresses the following important services and benefits provided by wetlands in urbanized areas. We selected these because:

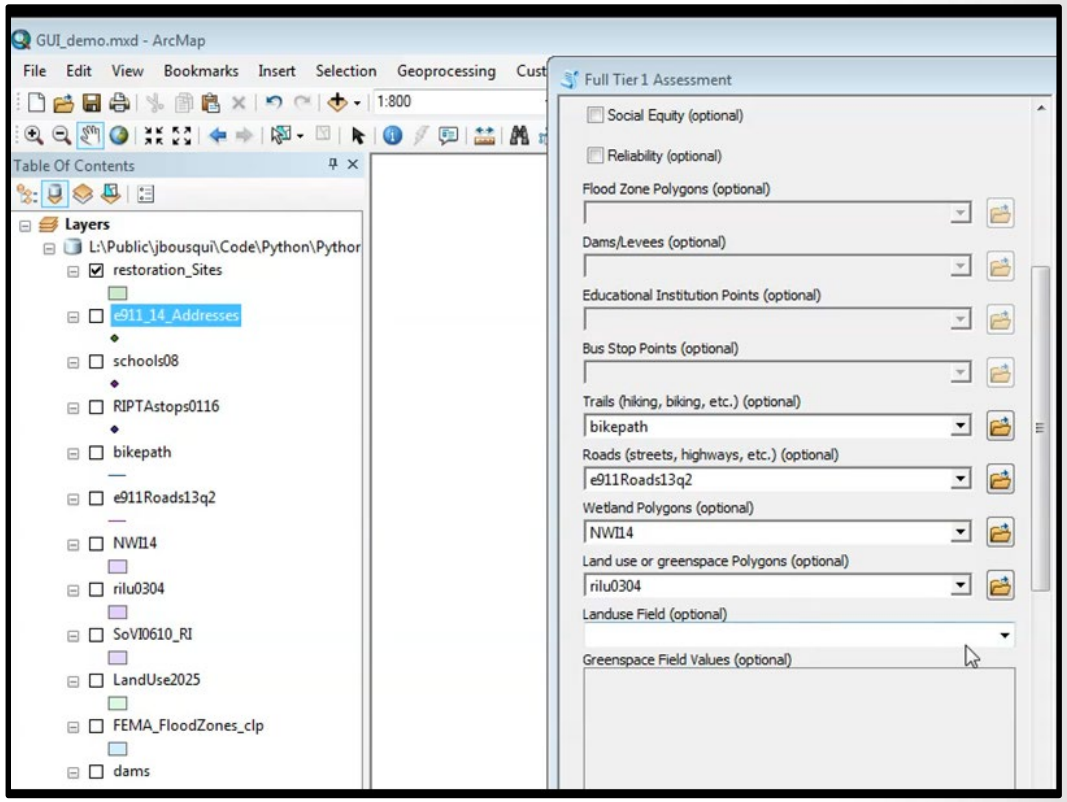
- They may be provided by relatively small, urban sites
- They are relevant to our example watershed
- They were mentioned in our interviews with managers

Wetlands can provide other services, and multiple types of benefits may result from each service. We are not providing indicators for a comprehensive set of freshwater wetlands' benefits, but are focusing on this subset of possible benefits. The approach we illustrate can be applied in a similar way to other services and benefits.

Ecosystem Service		How people benefit
	**Flood water regulation**	**Reduced Flood Risk:** The risks from floods to people and structures are reduced.
	**Scenic landscapes**	**Scenic Views:** People can enjoy scenic views.
	**Learning opportunities**	**Environmental Education:** People can benefit from studying nature or from enhanced connection to nature.
	**Recreational opportunities**	**Recreation:** People can enjoy recreation
	**Birds**	**Bird Watching:** People can watch or hear birds.

Checklist & Spatial Analysis Tools





1. Can people benefit from an ecosystem service?

Yes, if:

There is demand

Photo: https://www.allstate.com/tools-and-resources/home-insurance/do-i-really-need-flood-insurance.aspx

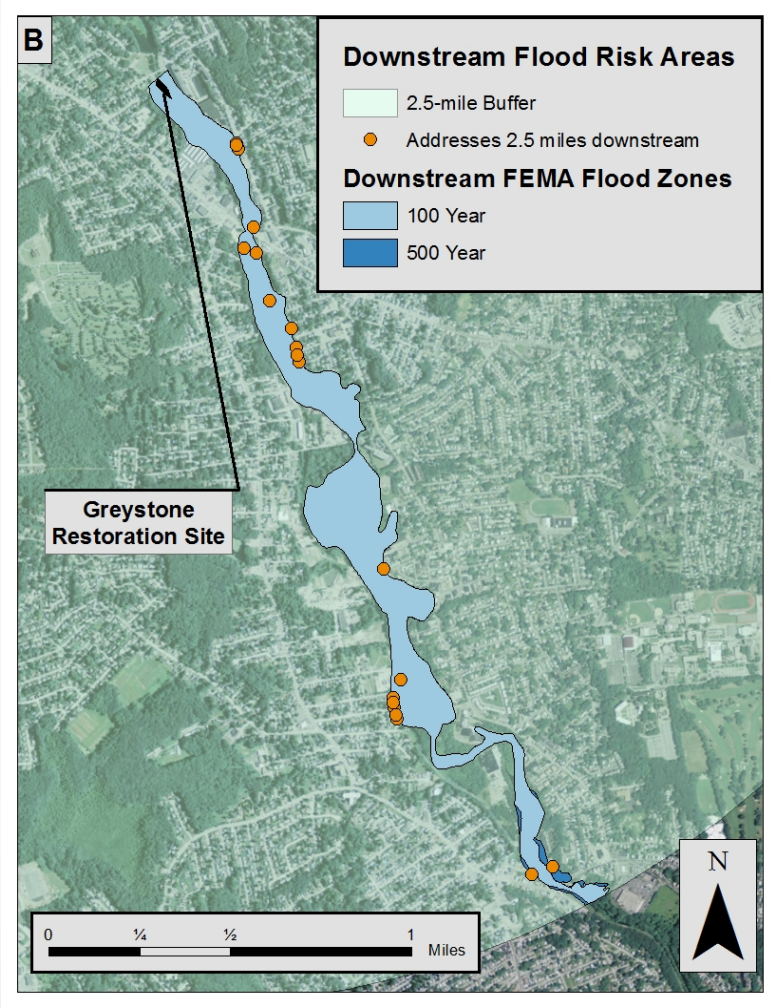
If required, complementary inputs are available


Photo: outboardmotoroilblog.com

There is sufficient quantity and quality of the service


Photo: http://pubs.usgs.gov/circ/circ1209/major_findings.htm

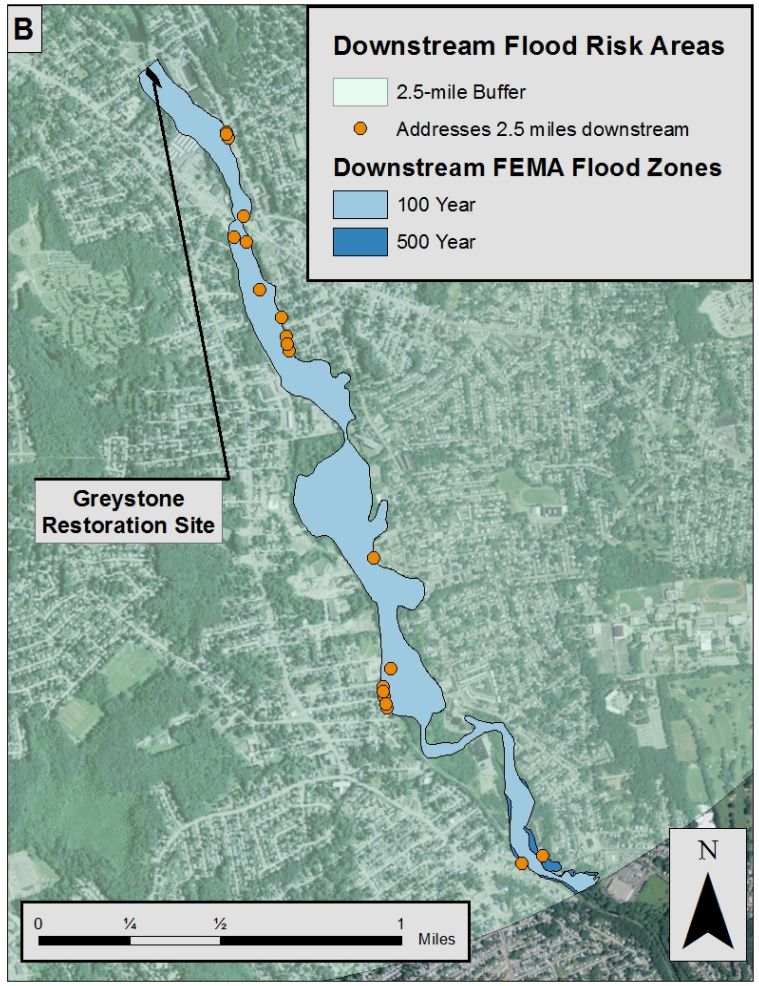
2. How many people benefit?



- **Structure:** Site A is larger
- **Function:** Site A retains more water than Site B
- **Service:** Site A reduces floodwaters (service production) more than Site B
- **Benefit:** Site B benefits more people

(1) Map flood zones downstream from the sites within the distance benefits are expected to travel (e.g. 2.5 miles)

2. How many people benefit?



- **Structure:** Site A is larger
- **Function:** Site A retains more water than Site B
- **Service:** Site A reduces floodwaters (service production) more than Site B
- **Benefit:** Site B benefits more people

(1) Map flood zones downstream from the sites within the distance benefits are expected to travel (e.g. 2.5 miles)

(2) Map who benefits by identifying houses, people, and/or infrastructure within the downstream flood zones

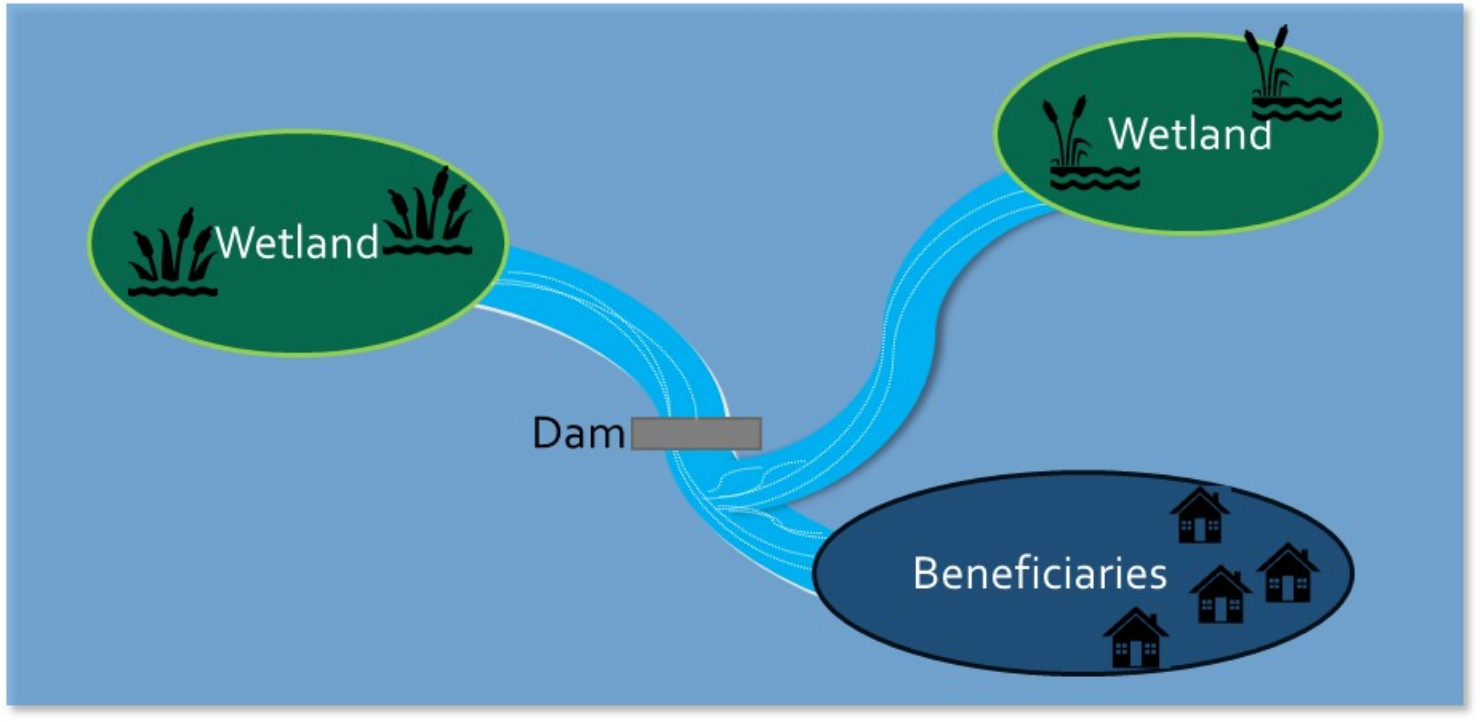
More people who benefit → Greater value

3. By how much do people benefit?

3.1 Substitutes:

How many natural and technological substitutes are there?

Fewer substitutes or lower quality substitutes ⟶ Greater value



3. By how much do people benefit?

3.2 Quality:

Higher quality service → Greater value

3. By how much do people benefit?

3.3 Quality of complements:

Higher quality complements → Greater value

3. By how much do people benefit?

3.4 Strength of Preferences:

Includes factors such as avidity, willingness/ability to adapt

not so avid angler

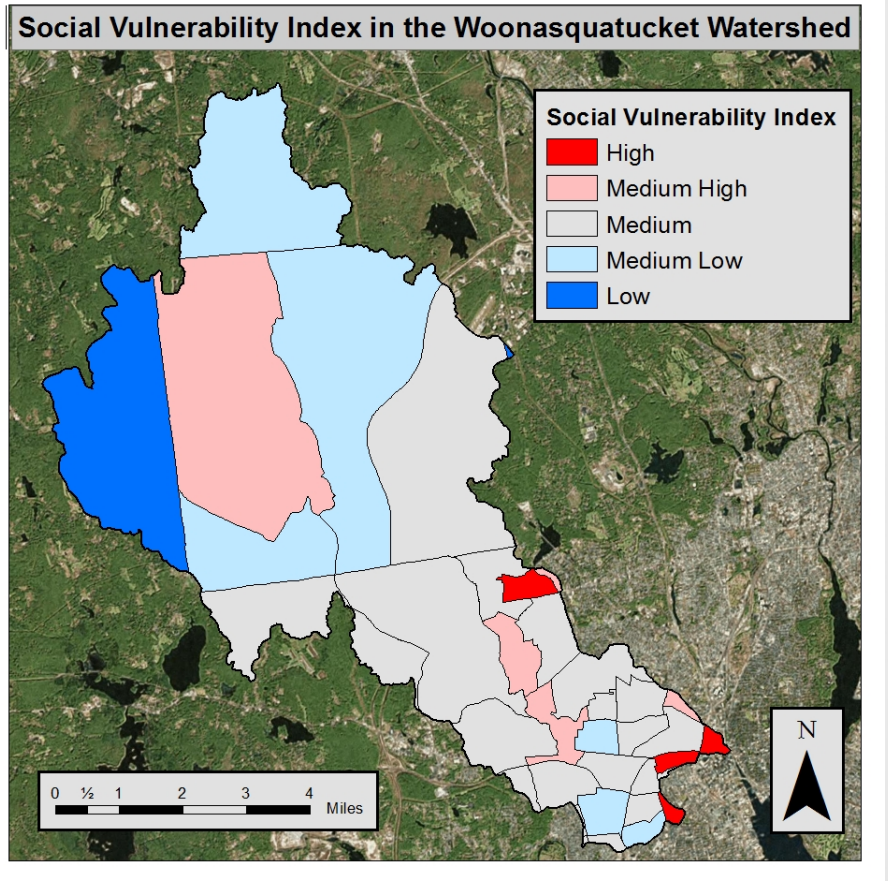
avid angler

4. What are the social equity implications?

Social Equity:

Are groups that are particularly socially vulnerable affected?

More vulnerable → Greater value

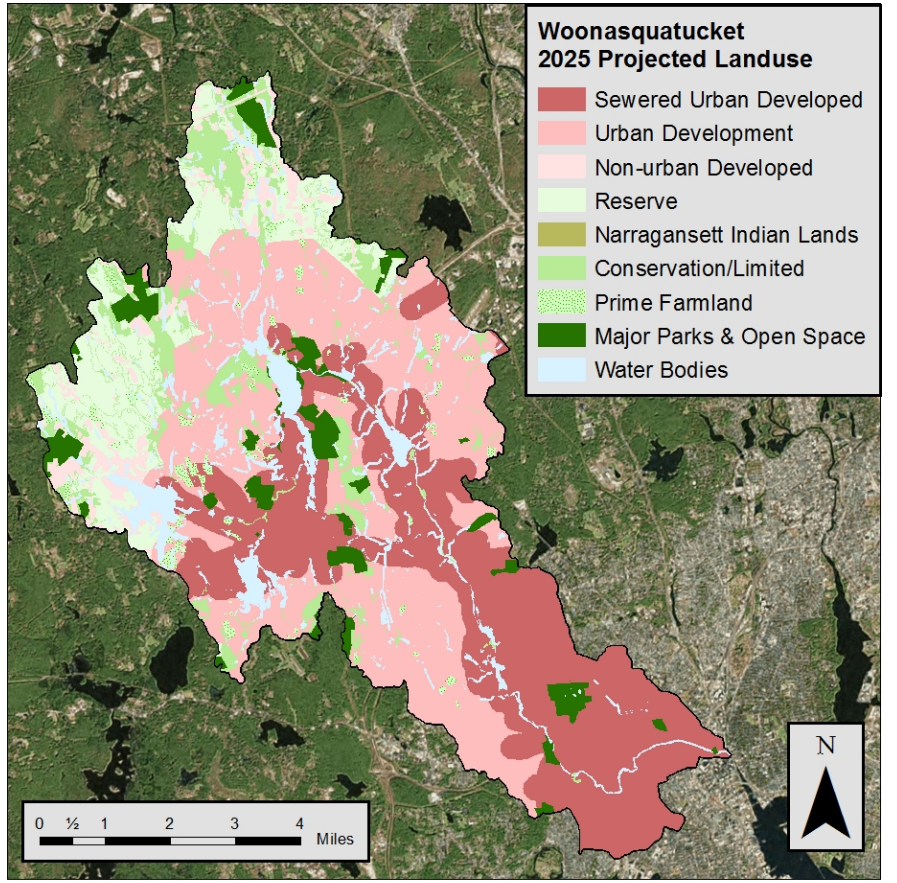


5. How reliably will services be provided over time?

Reliability:

How sure are we that benefits will continue?

More reliable → Greater value



Tool Outputs - Summarize Indicators

❖ PDF

Step 4	Summarize the Indicators		Site	
Benefit	Indicators		B	A
Flood Risk	3.2 How Many Benefit?	2.5 mi downstream of site and in flood zone		
	3.3.A Service Quality	Area of restoration site (acres)		
		Features that increase retention volume?		
	3.3.B Scarcity	Dams and levees 2.5 mi downstream?		
		Wetlands within 5 mi (number or % area)		
	3.3.C Complements	NA	NA	NA
	3.3.D Preferences	Are people worried about flood risk?		
Scenic Views	3.2 How Many Benefit?	Number within 160 ft of site	1	0
		Number within 325 ft of site	9	0
		Weighted number who benefit	3.4	0
		Are there roads or trails within 325 ft of site?	Yes	No
	3.3.A Service Quality	Aesthetic features or characteristics?	Yes	Yes
	3.3.B Scarcity	Wetlands or water within 650 ft (number or %)	7.7	35
	3.3.C Complements	Natural land use types within 650 ft (types)	4	2
	3.3.D Preferences	Will people find it aesthetically pleasing?	Yes	Yes
Environmental Education	3.2 How Many Benefit?	Education institutions within 0.25		
	3.3.A Service Quality	Features/habitat/wildlife of educat		
	3.3.B Scarcity	Wetlands within 0.5 mi of the site		
	3.3.C Complements	Educational facilities or infrastruct		
	3.3.D Preferences	Will people prefer charcteristics of		
Recreation	3.2 How Many Benefit?	Number within 1/3 mi of the site		
		Are there bike paths within 1/3 mi		
		Are there bus stops within 1/3 mi		
		Number within 0.3 to 0.5 mi of site		
		Number within 0.5 to 6 mi of site		
	3.3.A Service Quality	Total area of green space around		
	3.3.B Scarcity	green space within 2/3 mi of site		
		green space within 1 mi of site		
		green space within 12 mi of site		
	3.3.C Complements	Infrastructure supporting recreatio		
	3.3.D Preferences	Are there additional features on th		
g		Number within 0.2 mi of site		

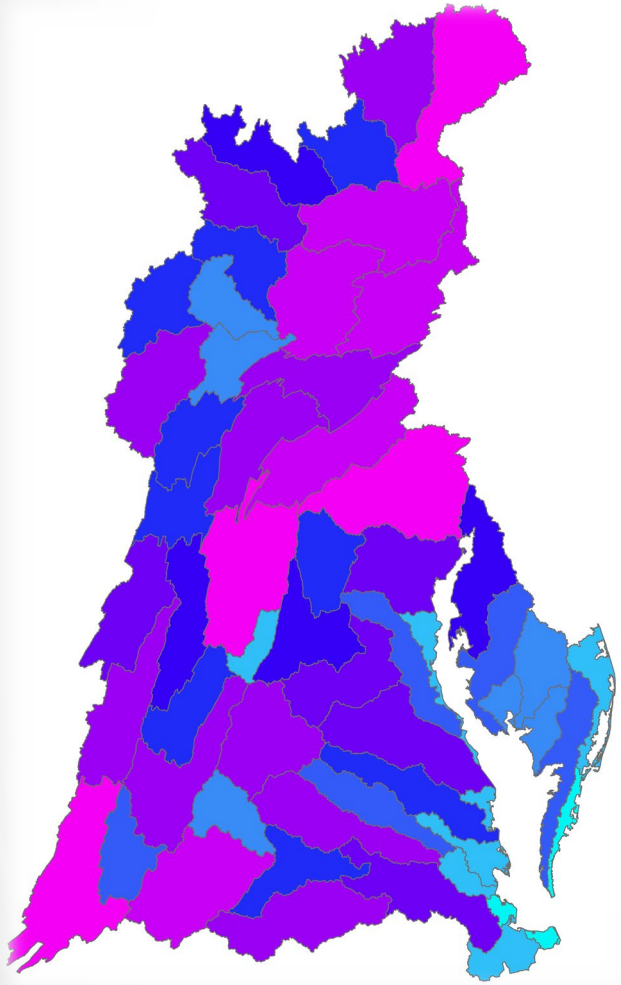
❖ Checklist

Step 4	Summarize the Indicators		Site	
Benefit	Indicators for Woonasquatucket Example		Site B	Site A
Scenic Views	3.2 How Many Benefit?	Number within 160 ft of site	1	0
		Number within160- 325 ft of site	9	0
		Weighted number who benefit	3. 4	0
		Are there roads or trails within 325 ft of site?	Yes	No
	3.3.A Service Quality	Aesthetic features or characteristics?	Yes	
	3.3.B Scarcity	Wetlands or water within 650 ft (number or %)	7.7	
	3.3.C Complements	Natural land use types within 650 ft (types)	4	
	3.3.D Preferences	Will people find it aesthetically pleasing?	Yes	
me it	3.2 How Many Benefit?	ENTER QUESTION		

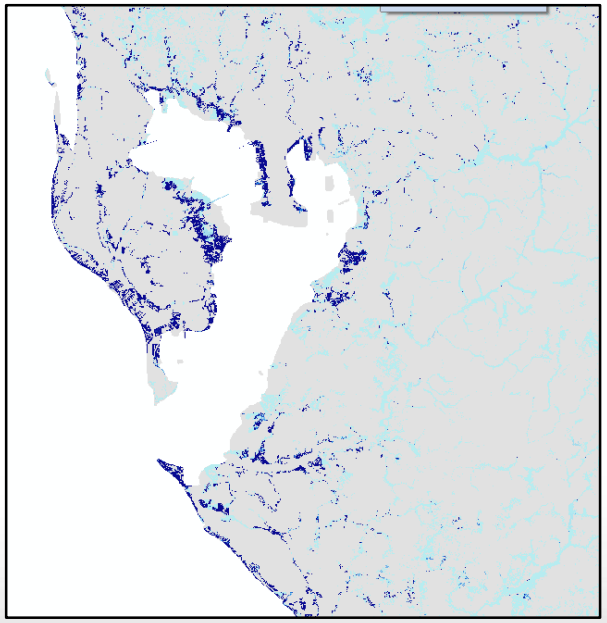
❖ Spatial Tool

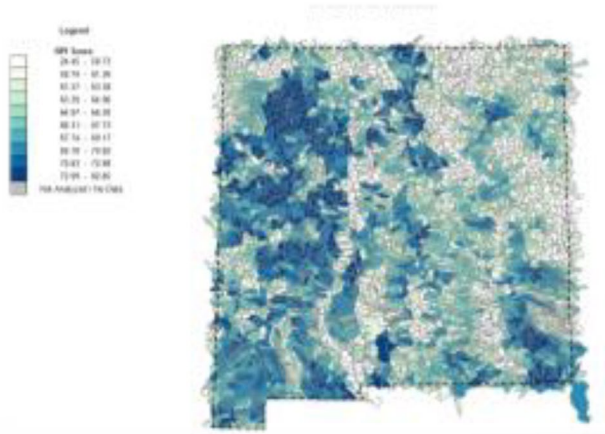
Step 4	Summarize the Indicators		Site	
Benefit	Indicators		Site 1 B	Site 2 A
Flood Risk	3.2 How Many Benefit?	2.5 mi downstream of site and in flood zone		
	3.3.A Service Quality	Area of restoration site (acres)		
		Features that increase retention volume?		
	3.3.B Scarcity	Dams and levees 2.5 mi downstream?		
		Wetlands within 2.5 mi (percent area)		
	3.3.C Complements	NA	NA	NA
	3.3.D Preferences	Are people worried about flood risk?		
Scenic Views	3.2 How Many Benefit?	Number within 160 ft of site	1	0
		Number within 160-325 ft of site	9	0
		Weighted number who benefit	3.4	0
		Are there roads or trails within 325 ft of site?	Yes	No
	3.3.A Service Quality	Aesthetic features or characteristics?		
	3.3.B Scarcity	Wetlands or water within 650 ft (percent area)	30.8	35.0
	3.3.C Complements	Natural land use types within 650 ft (types)	4	2
	3.3.D Preferences	Will people find it aesthetically pleasing?		
		ucation institutions within 0.25 mi of site		
		atures/habitat/wildlife of education interest?		
		etlands within 0.5 mi of the site (percent area)		
		ucational facilities or infrastructure on site?		
		ill people prefer characteristics of the site?		
		mber within 1/3 mi of the site		
		e there bike paths within 1/3 mi of site?		
		e there bus stops within 1/3 mi of site?		
		mber within 0 to 0.5 mi of site		
		mber within 0.5 to 6 mi of site		
		tal area of green space around site		
		een space within 2/3 mi of site		
		een space within 1 mi of site		
		een space within 12 mi of site		

Streamlining Geoprocessing



- Automated data download (e.g. NHDPlus data)
- Use of EPA EnviroAtlas datasets (e.g. Raster flooding)
- Use of webservices in place of downloaded data (e.g. NWI)
- Harmonization with other tools (e.g. H2O, RPS, etc.)





Tool Transferability

- Benefits of proposed restoration in Mobile Bay, AL
- Co-benefits of green infrastructure in San Juan, PR
- Use of EnviroAtlas Communities data in Tampa, FL
- National assessment of flood benefits
- Comparison to ecosystem service based prioritization in Great Lakes

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Questions?

https://www.epa.gov/water-research/rapid-benefit-indicators-rbi-approach