Measuring Economic Benefits of Restoration for Spatial Targeting and Ecosystem Service Trades

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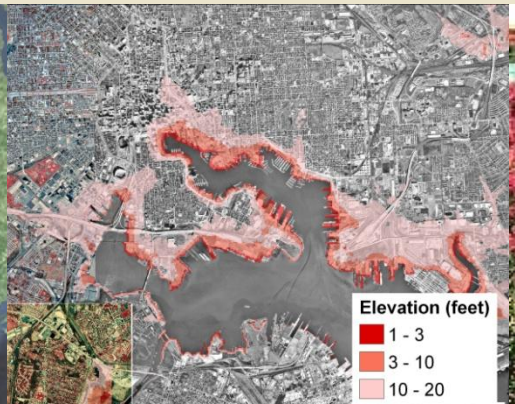
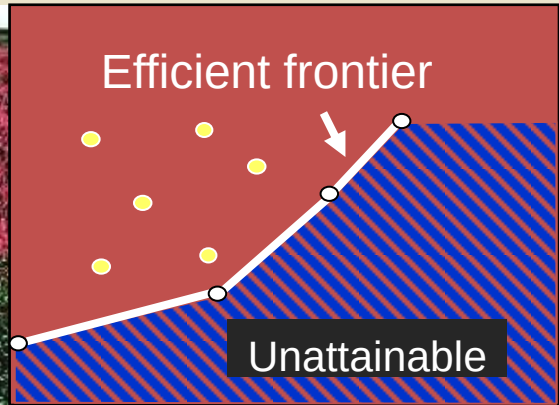
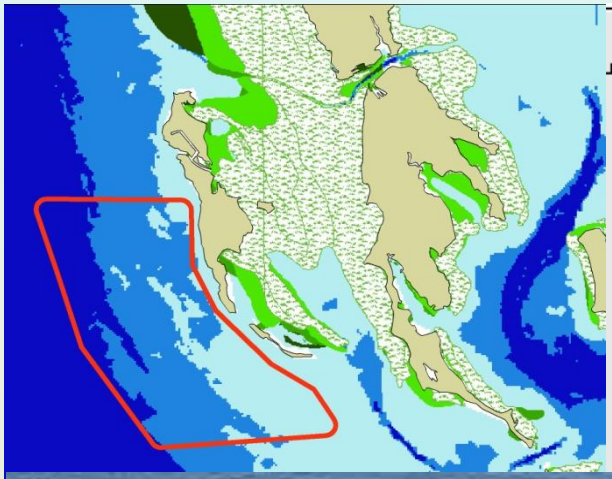
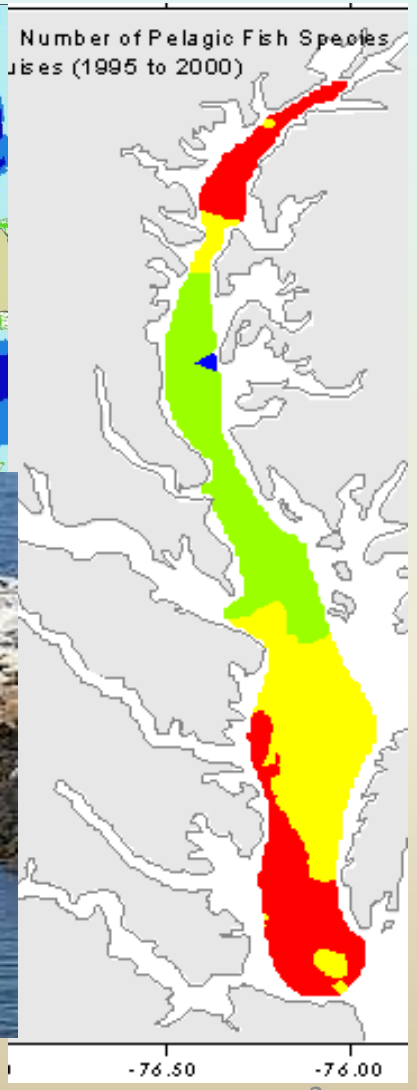




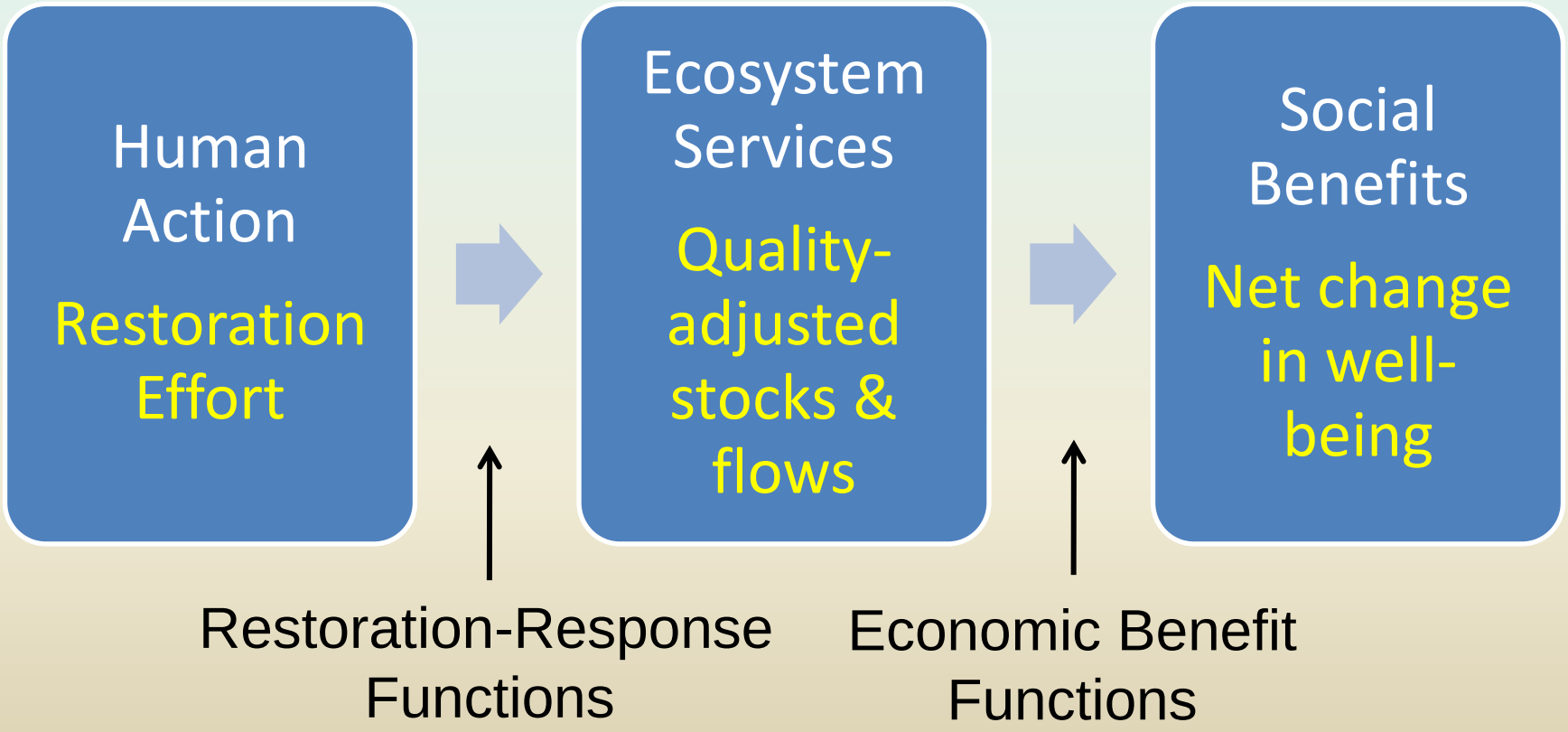
The Geography of Social Welfare from Ecosystem Services

1. How do net benefits vary spatially?
   - Which ecosystem services are affected?
   - How much is each service user affected?
   - How many people gain or lose?
   - How do practice costs & effectiveness vary?
2. Are vulnerable populations treated equitably?
3. Are public and private interests balanced?





Linking Restoration Actions to Social Benefits



Spatial Economic Decision Support (SEDS) Tool

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

NATIONAL PARK SERVICE

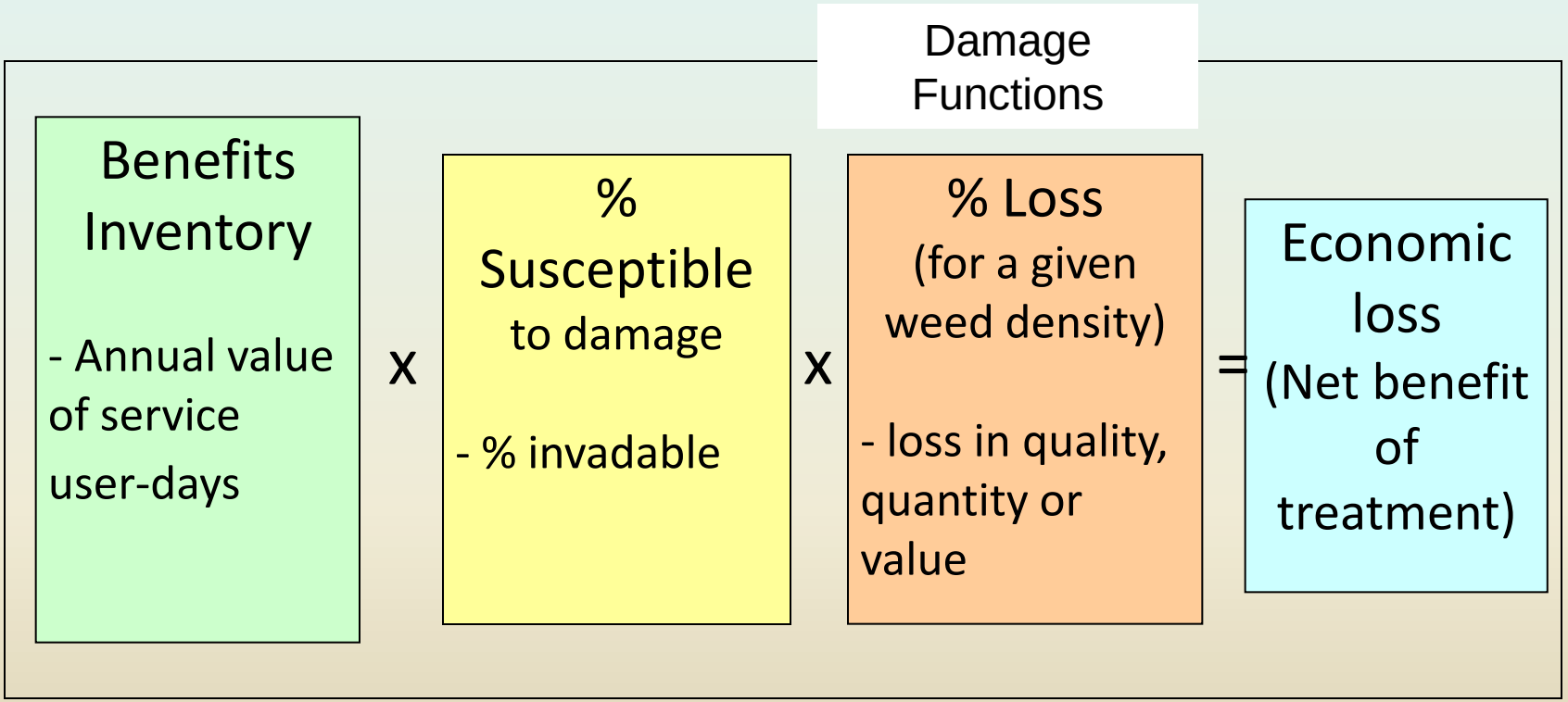
Major Goals of the SEDS Tool

1. Support selection of sites and treatment options to manage invasive species
2. Evaluate economic benefits of management options in terms of ecosystem service changes

Cooperative Agreement with National Park Service National Capital Region

Quantify Benefits of a Restoration Action

Benefits = Damage Costs Avoided



Benefits Inventory Step 1

Which “users” are affected and how sensitive are they to environmental change?

Casual Visitors
Aesthetics of visitor experience
Boating Opportunities
Walking, Hiking, Biking Opportunities
Safety of Outdoor Recreation
Avid Recreationists
Birdwatching
Native plant/wildflower viewing
Insect watching (e.g., butterflies)
Amphibian / reptile watching
Nature photography
Historic / cultural experiences
Students & Researchers
Educational and research opportunities

Through Travelers & Neighbors
Safety & convenience of travel
Aesthetics from roads & viewpoints
Property values
Buffer incompatible uses
Reduce maintenance costs
Businesses
Agricultural production
Other Non-Proximal
Climate Regulation
Native ecosystem preservation
Charismatic species preservation
Maintain significant natural areas
Maintain historic structures and character

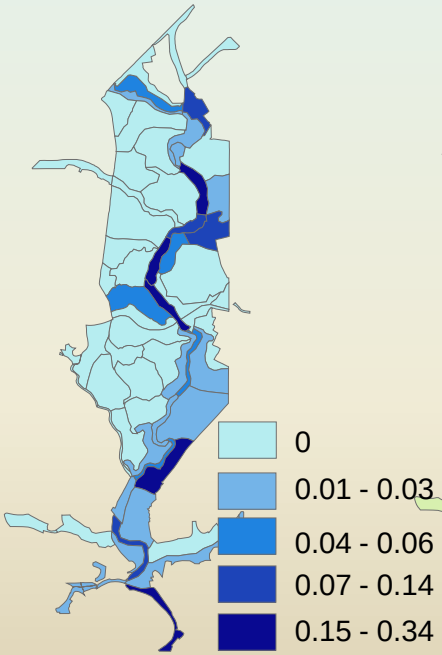
Benefits Inventory Step 2

Quantify quality and substitutability of service flows

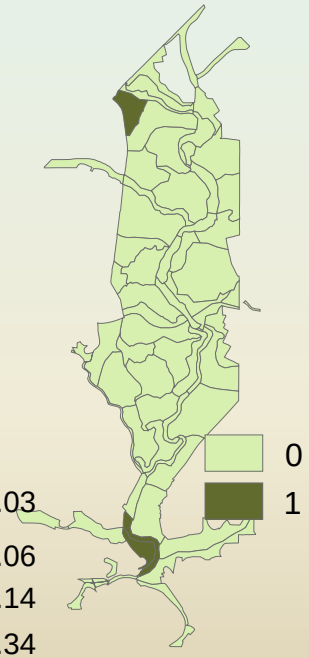
1. Quality / Attractiveness	• Do site features enhance the user experience?
2. Landscape Enhancements	• Does adjacency or connectivity affect potential benefits?
3. Substitutability & Rarity	• Are local substitutes available? • Is site irreplaceable?

Mapping Service Quality
Wildlife Viewing

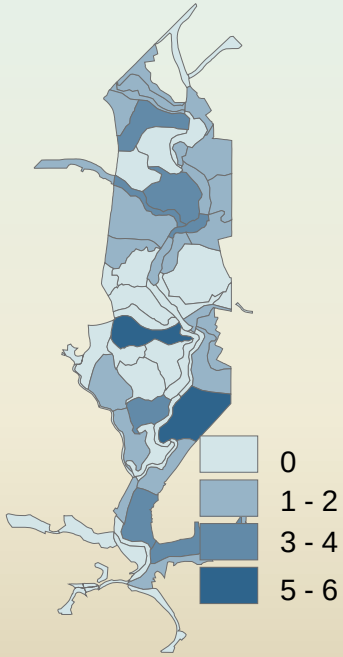
Attractiveness
-Vegetation Diversity
-Miles of Stream Adjacent to Trail



Connectivity
-Connected to Green Infrastructure Corridor



Rarity
- # Rare Plants;
- Only park occurrence



Gower Distance Metric

Wildlife Viewing Quality Metric

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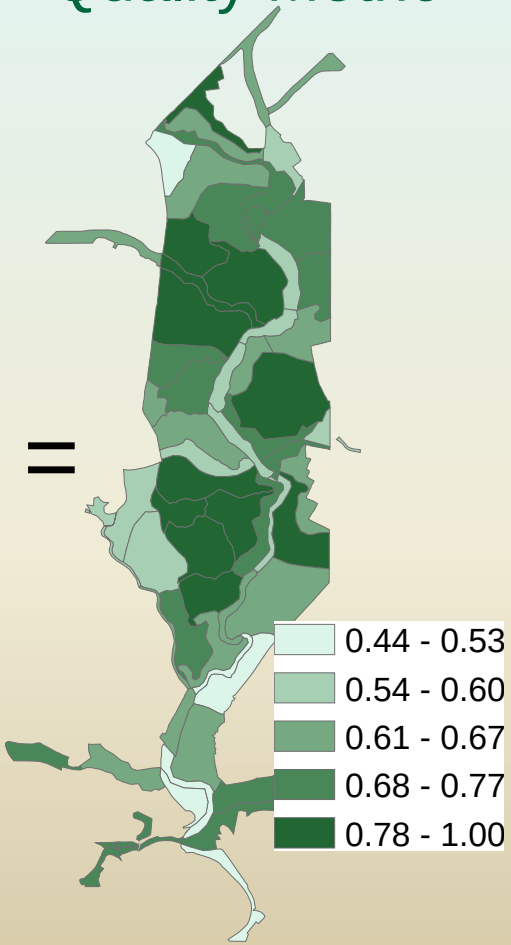
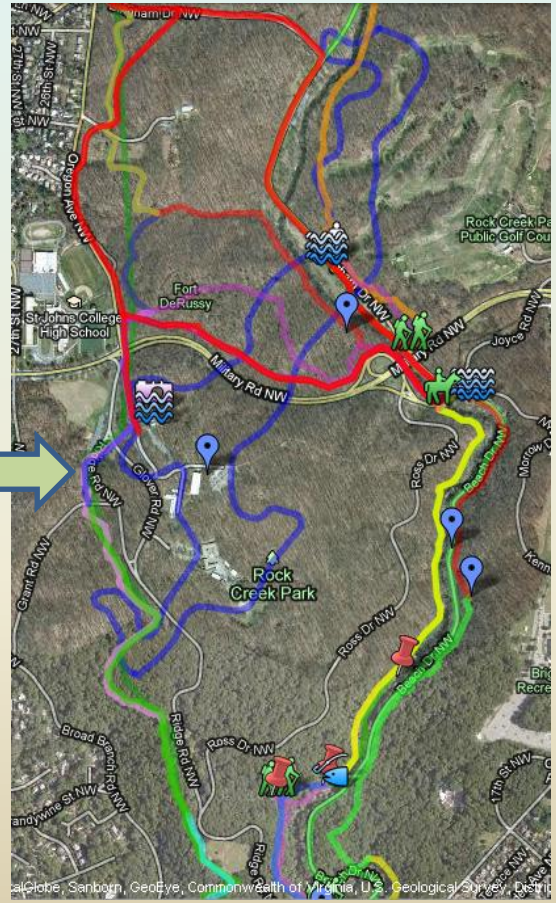


Benefits Inventory Step 3

Map Spatial Demand Based on Accessibility & Popularity

Service	# Visitors (2009)
Trail Use	247,500
Wildlife Viewing	146,250
Historical/ Cultural	67,500
Road Use	10,500,000



Wildlife Viewers

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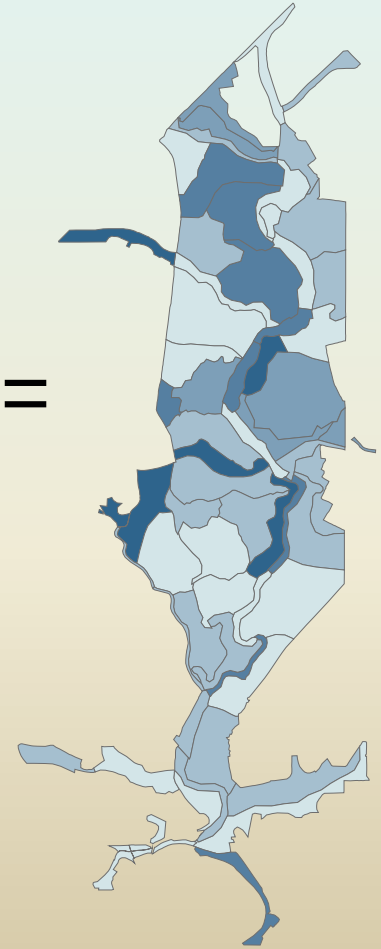
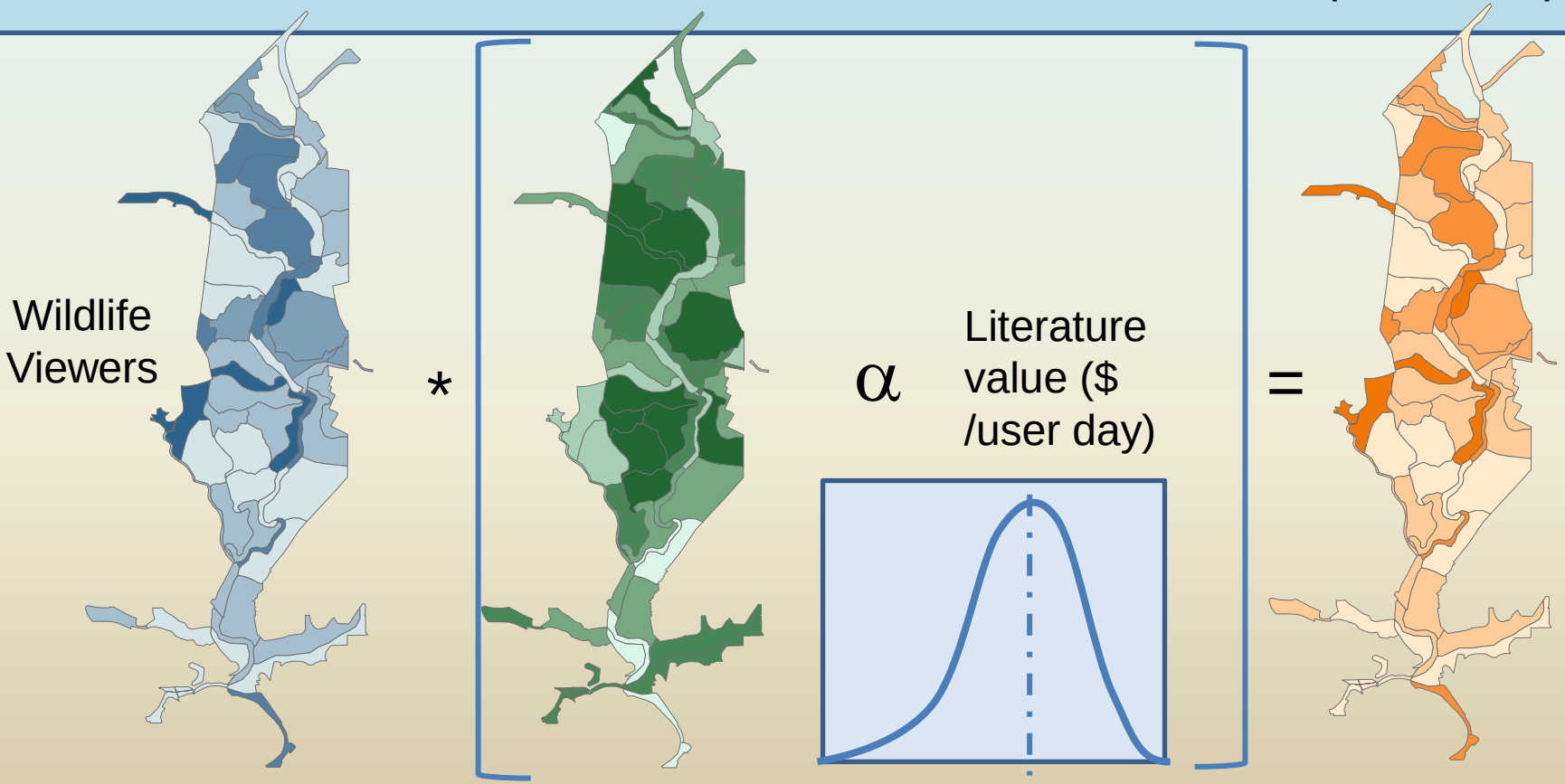


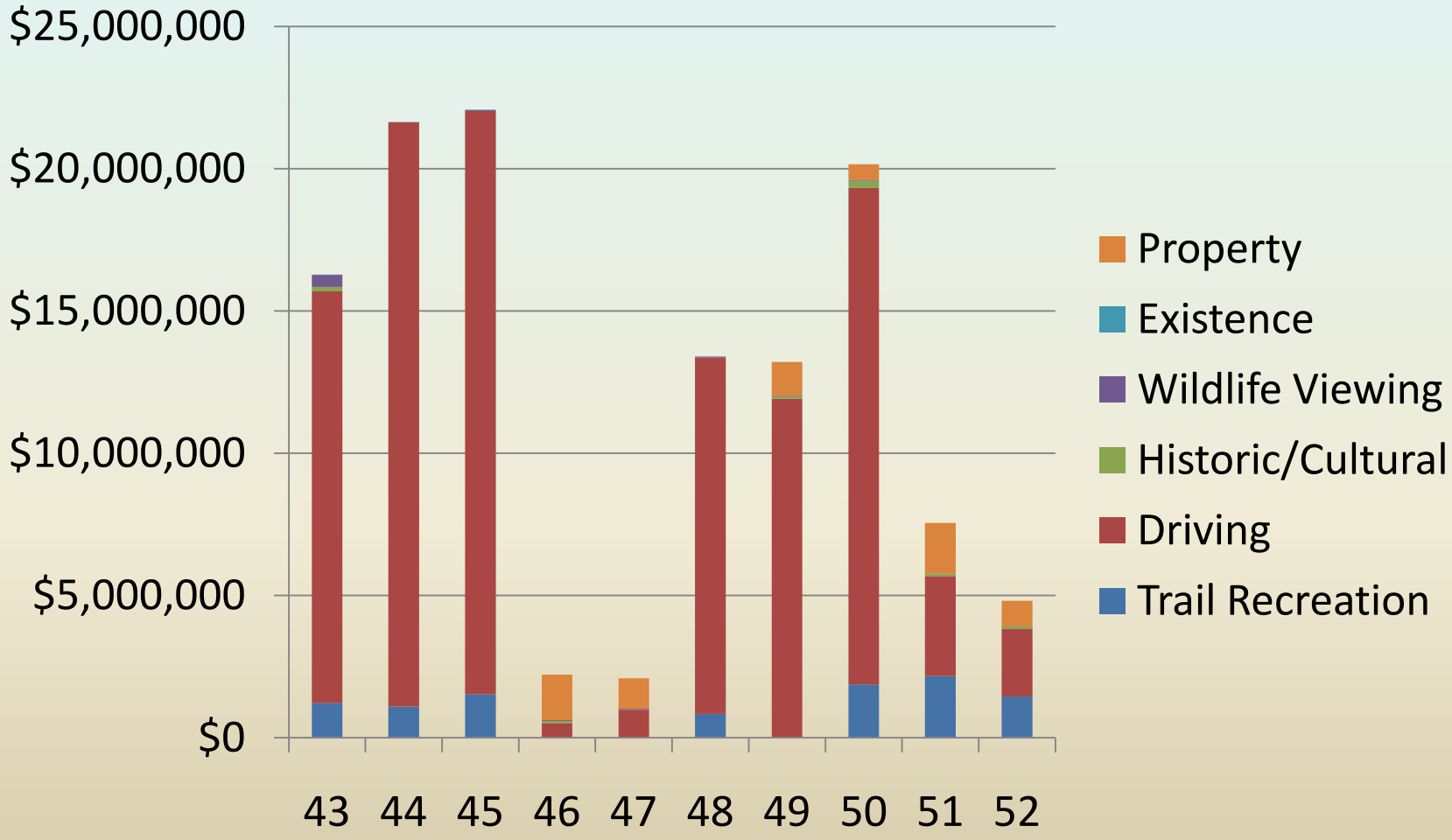
Benefits Inventory Step 4

Value Ecosystem Services by Location using Spatial Benefit Transfer

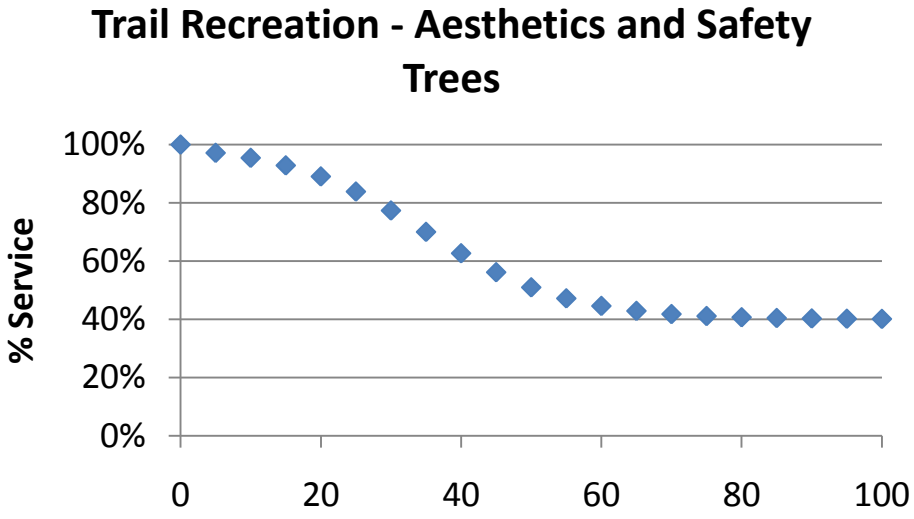
Spatial Demand (user days) * (Relative Quality Metric α Mean consumer surplus per visit) = $ Value (no weeds)

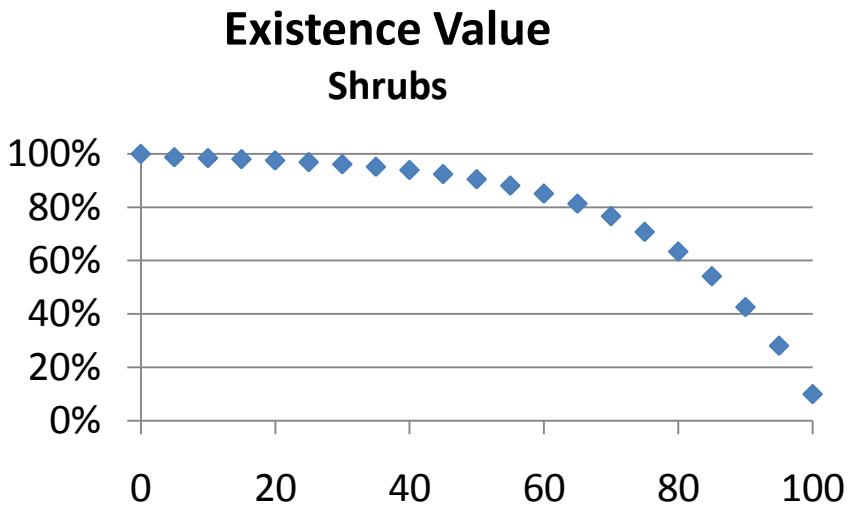


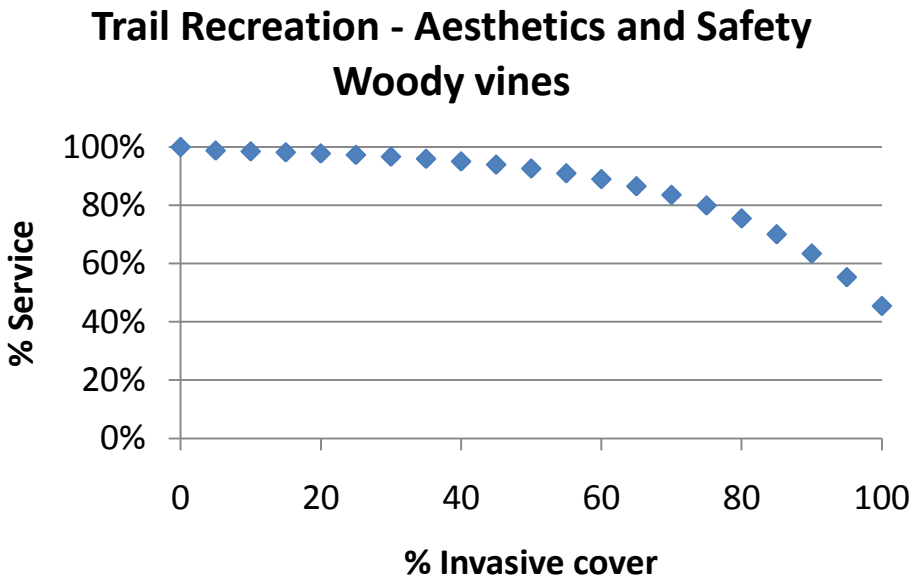
Inventory Results: Location-specific benefit measures that capture ecological quality, desirability and rarity

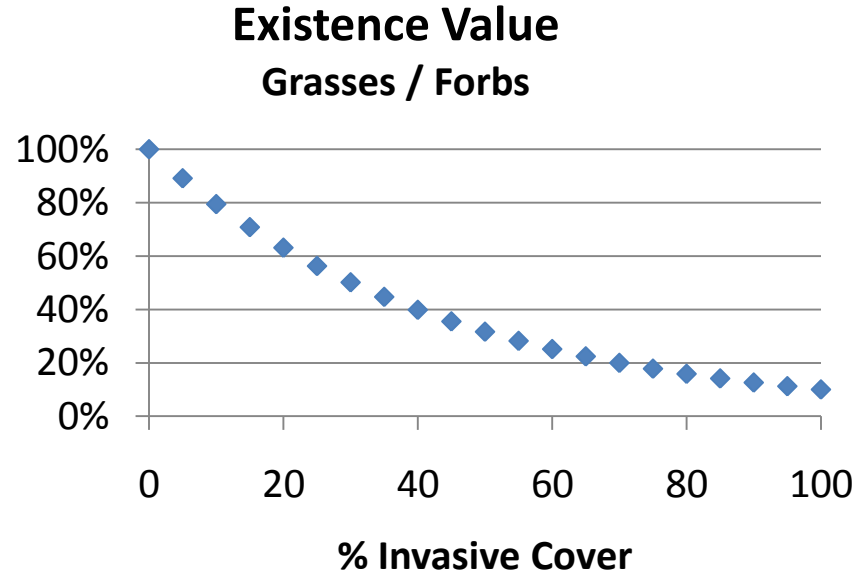


Damage Functions

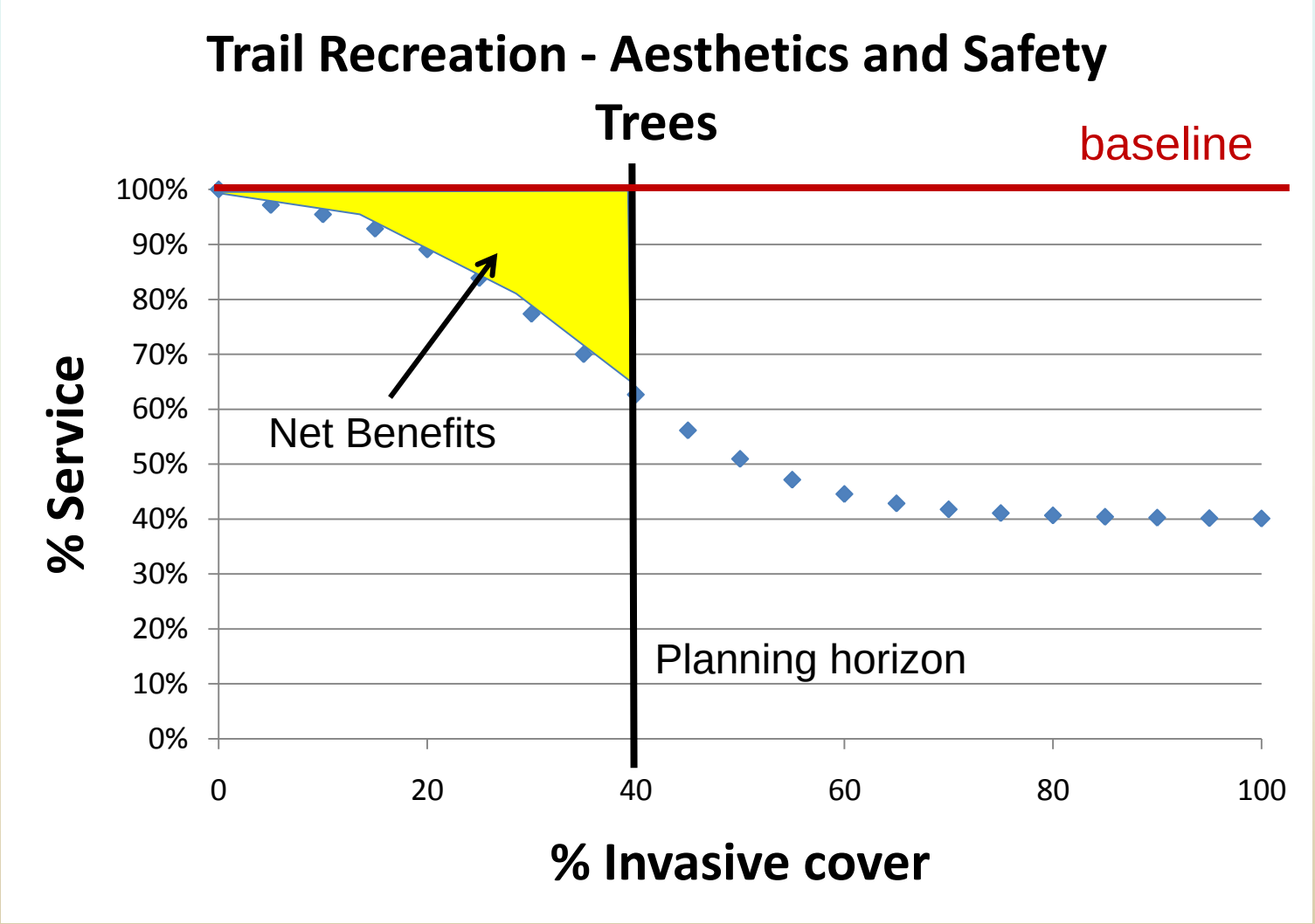






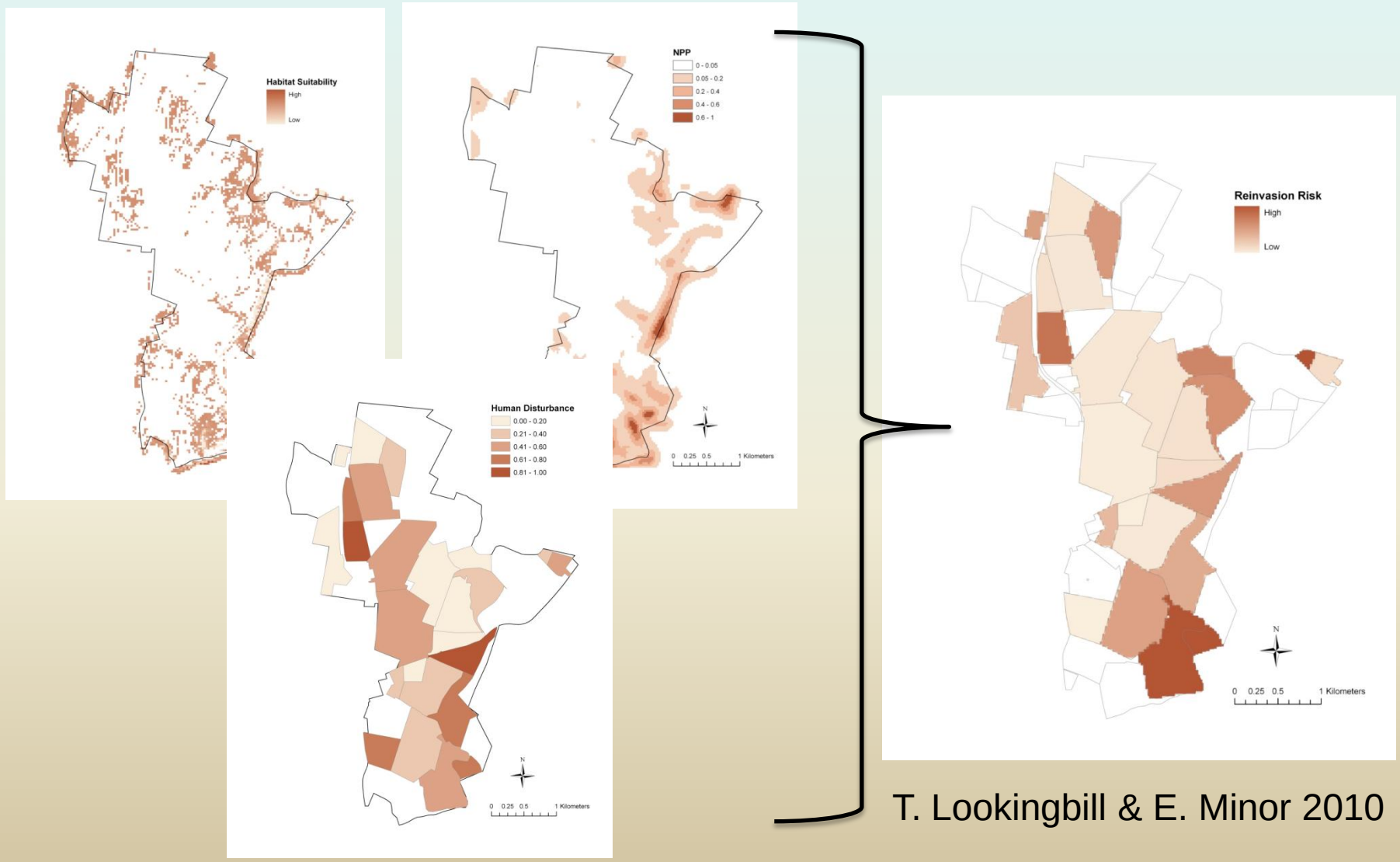


Net Benefits of Restoration Step1



Net Benefits Step 2 – Risk Adjustments

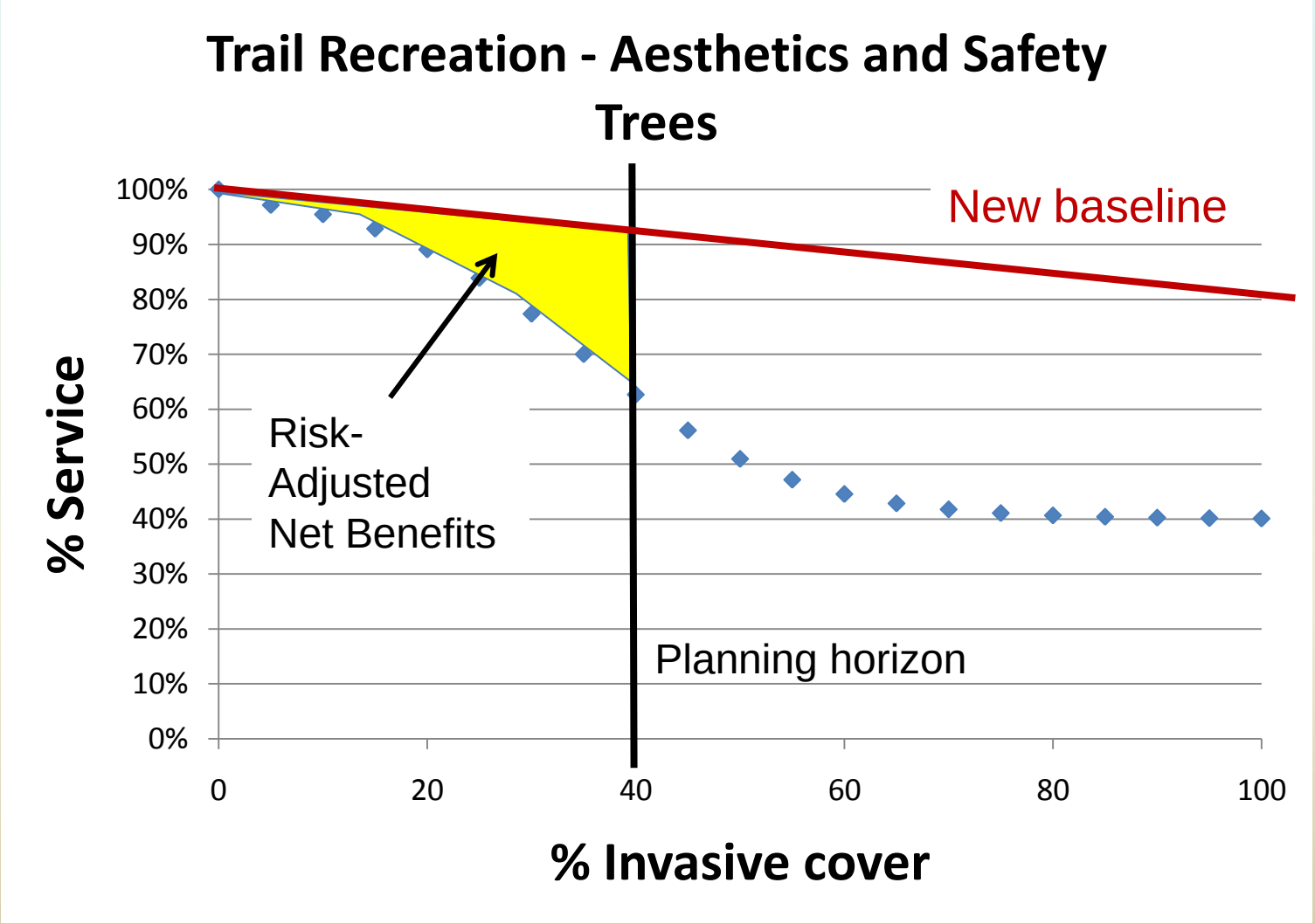
Treatment Risk = Probability that Species Will Reappear



T. Lookingbill & E. Minor 2010

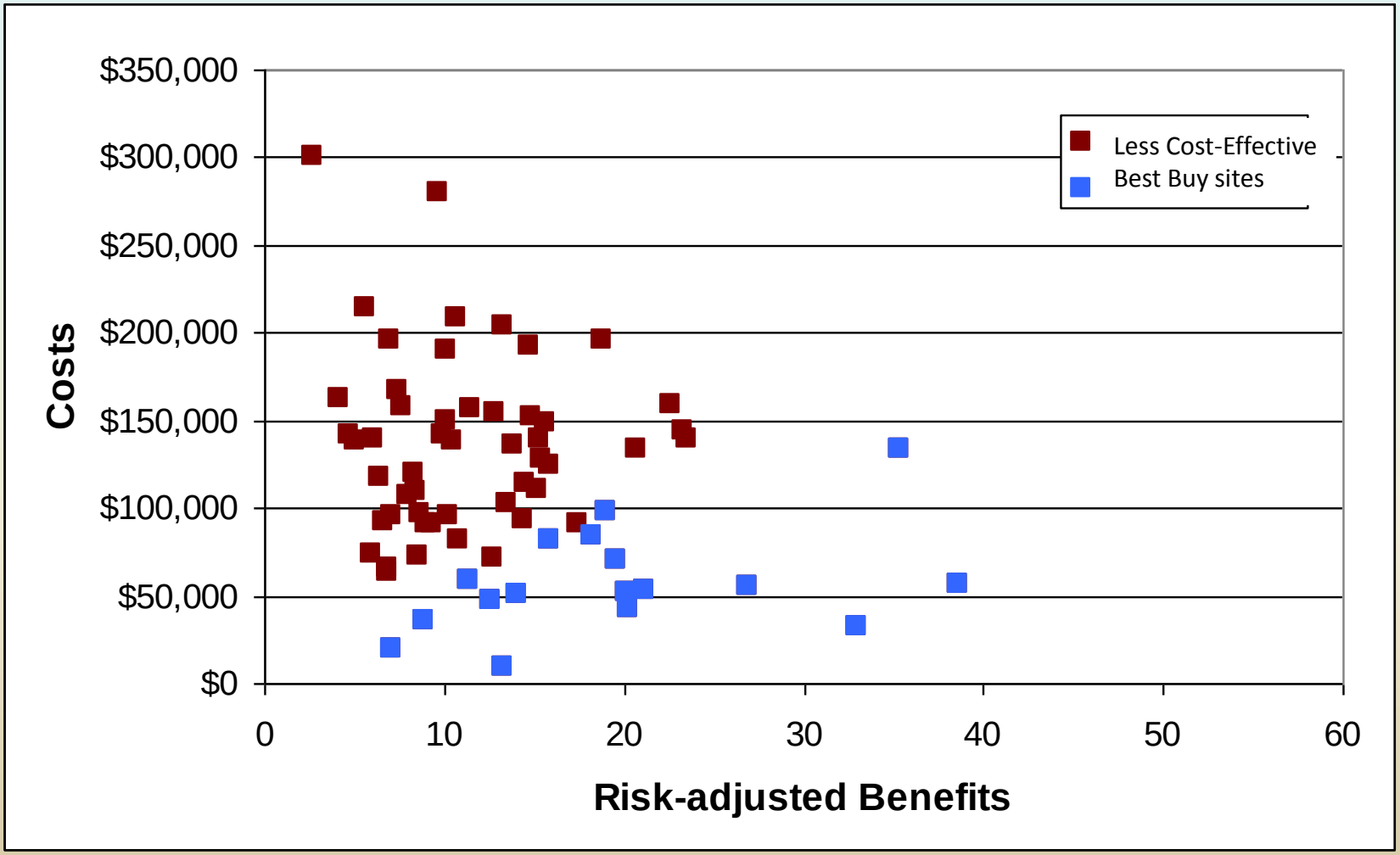
Risk-Adjusted Benefits

Treatment Risk Is a Deflator on Benefits



Costs vs. Risk-Adjusted Benefits

Allow Selection of Cost-Effective Restoration



Novel Elements of Spatial Economic Decision Support Tool

1. ***Spatial benefit transfer*** used to value ecosystem services in ways that are sensitive to ecological qualities
2. ***Damage functions*** translate loss of ecological qualities into changes in well-being
3. ***Treatment costs*** are estimated from extensive databases and reflect site characteristics
4. ***Risk-adjusted benefits*** reflect spatial variability of practice effectiveness
5. Can be applied to targeting restoration and evaluating equivalency of trades/offset in terms of ecosystem service changes