

Practical Measurement of Ecosystem Services: Can We Standardize the Way We Count Nature's Benefits?

APPENDIX D

By Jim Boyd, Resources For the Future

May 25 & 26, 2006

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Practical Measurement of Ecosystem Services

An Expert Workshop
Resources for the Future
May 25 & 26, 2006

Sponsored by EPA's National Center
for Environmental Economics



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21st Century Environmentalism

- Not new laws
- Not new policies
- Not even new awareness

- Performance



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Thesis

- We aren't measuring performance
 - Problems
 - Science – economics and ecology
 - Institutions
 - Morale
- We can do something about it
 - Standardize what we count
 - Count ecosystem services



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Standardization

- Nature is a huge measurement problem
 - Too much to measure
 - No invisible, helping hand
- If too many things are counted...
 - Confusion, paralysis
- Standardization is the answer
 - What to count?
 - What to count first?

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Fear of Standardization

- We probably all have it
 - Hostile to creativity
 - Divisive
 - Inflexible
- But look to history
 - The sciences
 - Management

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Standards Require

- Consensus
 - Between ecology and economics
 - Agreement here is fundamental
 - Between science and the “consumer”
 - Are the standards valid and useful in public life?
- Conversation

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So Who Is Here Today?

- Ecologists
- Economists
- The Caretakers
 - Conservationists
 - Government trustees
 - Evaluators



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Ecosystem Services Measurement: Applications

- Conservancy priorities and communication
- Strategic Planning (also GPRA & PART)
- National Welfare Accounts
- Trade & Compensation Programs
- Regulatory Cost-Benefit Analysis



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A (Crazy?) Idea

- The same, standardized units can be applied across those applications
- Standardization
 - Huge benefit to the science
 - Huge benefit to decision-makers



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The Meeting Plan



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The Plan

Session I: What is needed?
What do “real world” trustees and evaluators want?

Session II: Why don't they have it already?
Why have ecology, economics, public policy not already delivered?



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The Plan (cont.)

Session III: An Example of Standardization
An economic definition of countable ecosystem services

Session IV: Ecological Perspectives on Measurement
What does ecology want to count?
What can it predict?



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The Plan (cont.)

Session V: 21st Century Measurement
Tools for counting and the state of the data

Session VI: A Powerful Metaphor – The National Welfare Accounts
What can we learn from market-based, national-scale counting?

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The Plan (cont.)

Session VII: Standardized Units Applied?
Two Ripe Opportunities: Ecological Farm Payments and Ecological Trades

Session VIII: Ecological Economics
Lessons from a decade of integrated analysis

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The Plan (cont.)

Session IX: Standardization and Cost-Benefit Analysis
Do standardized ecosystem units complement the economist's valuation toolkit?

Session X: Demand
Is there a regulatory constituency?

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The Plan (cont.)

Session XI: What Next?
Research priorities, partnerships, a reality check, and practical guidance to trustees



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Details

- Off the record
- Why are you're being taped?
- Language
- Rules of order
- Facilities
- Time constraints



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Introductions



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Session I: What Is Needed?

- Why ecosystem services?
- The state of performance measurement
- Communication of benefits to the public
- Different approaches
- Where do we need to do better?



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Al McGartland
Director, EPA's National Center for Environmental Economics

Dick Cole
Army Corps' Institute for Water Resources

Mike Shapiro
Deputy AA, Office of Water, EPA

Nancy Wentworth
Director, Environmental Analysis Division, EPA



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Taylor Ricketts
Director of Conservation Science, WWF

Mark Shaffer
Environment Director, Doris Duke Foundation



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Matt Birnbaum
Science Officer, National Fish &
Wildlife Foundation

Bob Robinson
Managing Director, Natural Resources
and Environment, GAO

Jim Laity
OMB



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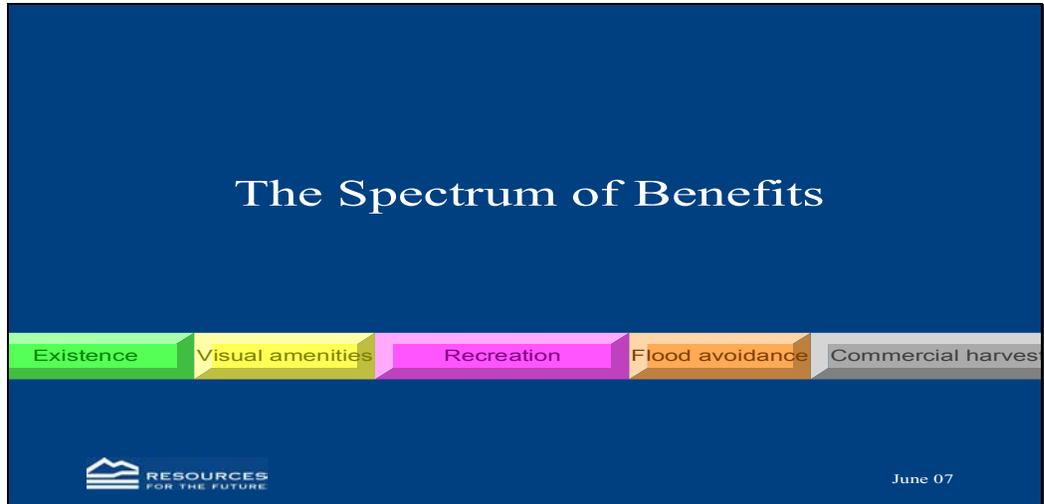
Regulatory Impact Analysis

- Does Cost-Benefit Analysis (for RIAs) pass a Cost-Benefit test?
- No
 - Monetization is expensive and difficult
 - Only a narrow slice of benefits is monetized
 - Reliance on old studies, inertia
 - Mitchell and Carson (1989)!

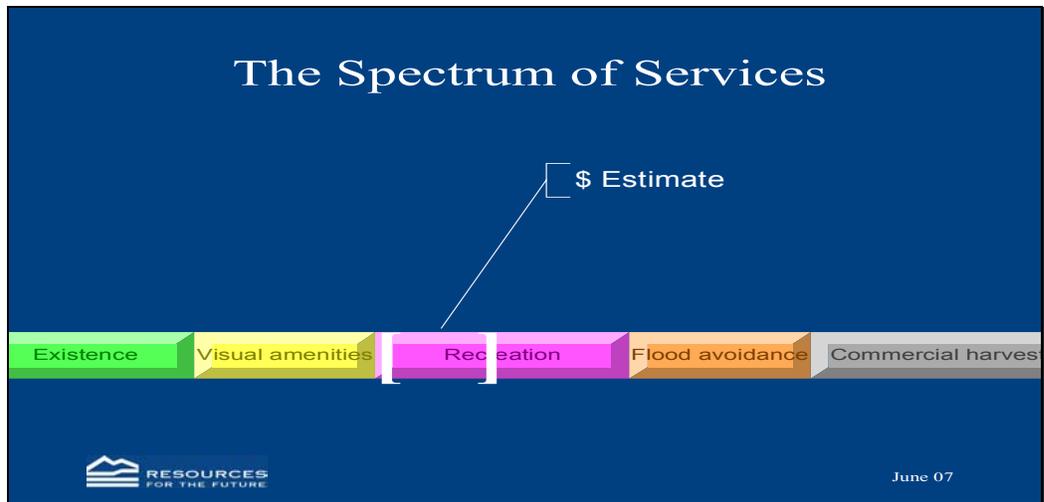


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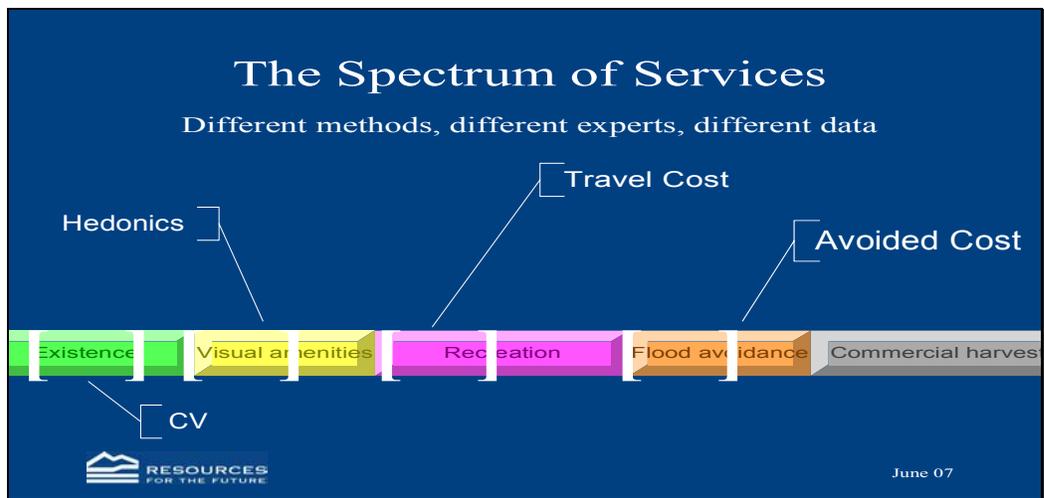
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OMB Guidance, Circular A-4

Monetize
Quantify
Discuss

“If monetization is impossible, explain why and present all available quantitative information.”



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The Missing Middle Ground

- Quantification – Counting
 - Tied to ecological and economic principles
- Not dollars
- But
 - Cheaper
 - Broader
 - More transparent



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Standardized Environmental Accounting Units: A Proposal



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The Problem

- Account for *public good* aspects of nature
- Public goods
 - Shared, government is trustee
 - Often intangible benefits
 - Beauty, species existence, health, etc.
- How to measure results?
 - National defense & public safety?



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An Old Problem, and Still a Problem

- Decades of struggle in economics, ecology, public policy



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Counting Initiatives

- Many indexes, indicators, & ways of counting
 - But inconsistent
 - Across agencies
 - Within agencies
 - NGOs, conservancies, international orgs
 - Across disciplines (e.g., economics and ecology)
 - Not enough debate over principles



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Thesis: Measurement Demands Standardization

- What *wouldn't* you measure
- What *rules* determine what is measured and what isn't?



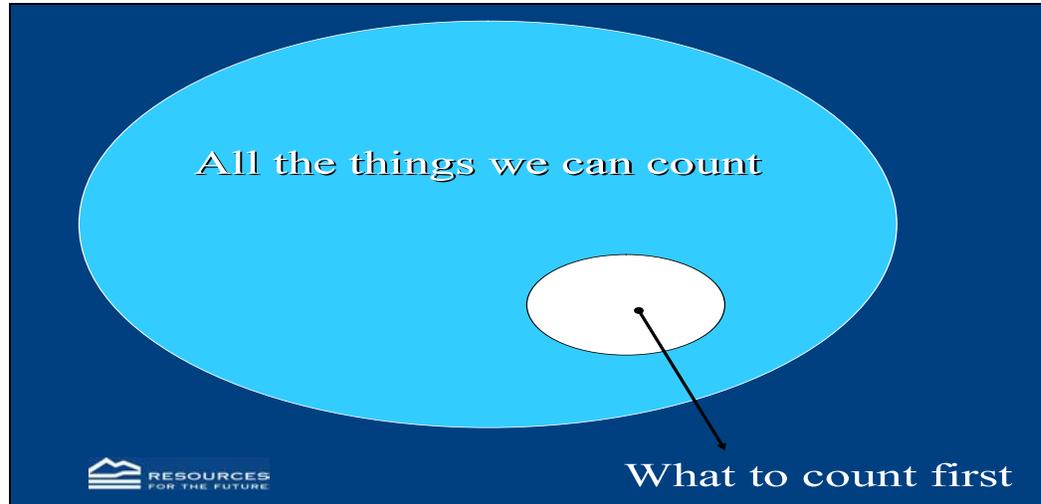
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GDP as Metaphor

- 100 years of debate over what to count
- Debate is guided by rules
- Debate is still not over



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Why Ecosystem Services as Units?

- Bridges ecological and economic thought
 - Both are needed
- A term in need of definition
 - A popular, but vague concept
 - MEA, governments, NGOs, conservancies, economics

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Definitions: Confusion

- Typical definition of ecosystem services
 - Ecology
 - Services = ecological functions or processes (like sequestration, nutrient cycling)
 - Economics
 - Services = benefits (like recreation)
- Note
 - These things aren't *things*
 - Not clear what to count

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Back to GDP



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The Benefit of Market Goods

- Need 2 things
- Quantities – the “units”
 - Cars, houses, hamburgers
- Weights
 - The prices we pay for these things



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Nature’s Benefits

- Need same two things
- Quantities
 - The units = ecosystem services
- Weights
 - The value of the services



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Nature's Benefits

- Need same two things
- Quantities
 - The units = ecosystem services
- ~~• Weights~~
 - ~~▪ The value of the services~~



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Focus on Defining the Q 's

- National welfare accounts
 - Economics heavily involved
- Environmental accounting
 - Economics not heavily involved



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Why Counting Problems?

- Lesson from GDP
 - Even when “easy,” it’s hard
- In our case, no markets
 - So no prices
 - But also no quantity units



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The Proposal



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One Way to Standardize

- Ecosystem service units
- Definition of services
 - Rooted in economic theory
 - But content is ecological
- Note: This definition rules things out



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What Are Ecosystem Services?

*The Need for Standardized
Environmental Accounting Units*

James Boyd and Spencer Banzhaf



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The Central Assumption

- Goal is welfare measurement
 - How does Nature improve human wellbeing?
- Are we all comfortable with this goal?
 - What are the alternatives?
- Note:
 - Many things can and should be counted for other reasons



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Important Clarification

- Everything in nature is valuable and connected
- Everything in the market economy is valuable and connected
- In neither case do we need to count everything



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The Definition of Ecosystem Services

- Five principles
 - End products
 - Benefit-dependent
 - Ecological
 - Concrete
 - Location- and time-specific



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Principle 1

- Ecosystem services are nature’s “final goods”
- Ecosystem processes and functions
 - Are not outcomes
 - Are not services
 - Cannot be valued in themselves

Example: carbon sequestration is not an ecosystem service



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Principle 1

- Final goods embody the value of inputs
- Examples
 - Cars embody value of
 - Steel, labor, the factory, leather, paint
 - Trout populations embody the value of
 - The trout’s food chain, habitat



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Principle 2

- Services are benefit-specific
- Are forests a service?
 - It depends
 - Benefit: beauty
 - Forests are a service
 - Benefit: bird species existence
 - Forests not a service
 - Species populations are the service



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Weird?

- Tomatoes, pickles, lettuce, mustard
 - Benefit: dinner at home
 - These are counted
 - Benefit: a Big Mac
 - These are not counted



Slide 26

Services are Benefit-Specific

| BENEFIT | Services | Not Services |
|------------------------------------|--|--|
| Flood damage mitigation | <div style="border: 1px solid white; border-radius: 10px; padding: 5px; display: inline-block;">Wetlands</div> | |
| Drinking water availability | ↘ | <div style="border: 1px solid white; border-radius: 10px; padding: 5px; display: inline-block;">Wetlands</div> |



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One More Example

- The trout population's food chain
 - Benefit: trout fishing
 - Species in food chain not services
 - Benefit: species existence benefits
 - Each species in food chain is a service



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That Clarification Again

- Everything in nature is valuable



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Principle 3

- Ecosystem services are ecological
 - Recreation
 - Not an ecosystem service
 - The number of fish caught
 - Not an ecosystem service



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Principle 3

- Recreation is a benefit
 - Combines nature, time, skill, capital
 - Isolate and count the nature part
- The number of fish caught
 - Depends on more than nature
 - Skill, the boat, the tackle
 - Count the fish population



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Principle 4

- Services are concrete things or qualities
- GDP
 - Cars, not driving satisfaction, not sex appeal
 - Computers, not the experience of computing



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Principle 4

- Even a century later
 - What is counted in GDP is driven by practicality
 - What can we count at reasonable cost?
- Count things and qualities
 - Populations, land cover, water quality, water availability, species populations, etc.



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Principle 5

- Count Services at fine resolution
 - Count services in particular places
 - At particular times
- Why?
 - The value of services is dependent on place and time



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Principle 5

- The value of ecological assets must be “built up” from finer units
- A million acre-feet of water in the U.S.
 - Meaningless
 - *Where* is that water and *when*



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An Illustrative Inventory

- Articulate benefit categories
 - Define benefit-specific services
 - Count and map them



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| | | |
|---------------------------------|---------------------------------|--|
| Waste assimilation | Avoided disposal cost | Surface and groundwater, open land |
| Drinking water provision | Avoided treatment cost | Aquifer, surface water quality |
| | Avoided pumping, transport cost | Aquifer availability |
| Recreation | Birding | Relevant species population |
| | Hiking | Natural land cover, vistas, surface waters |
| | Angling | Surface water, target population, natural land cover |
| | Swimming | Surface waters, beaches |



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| | | |
|--------------------------------------|-------------------------------|--|
| Harvests | | |
| | Subsistence | Target fish, crop populations |
| | Unmanaged marine | Target marine populations |
| | Pharmaceutical | Biodiversity |
| Amenities & "Fulfillment" | Aesthetic | Natural land cover in viewsheds |
| | Bequest, spiritual, emotional | Wilderness, biodiversity, varied natural land cover |
| | Existence benefits | Relevant species populations |
| Damage Avoidance | Health | Air quality, drinking water quality, land uses or predator populations hostile to disease transmission |
| | Property | Wetlands, forests, natural land cover |

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The Right-Hand Column

- All have meaning to “real people”
- All are amenable to concrete choices
- Much of the data is already available
- All can be spatially counted

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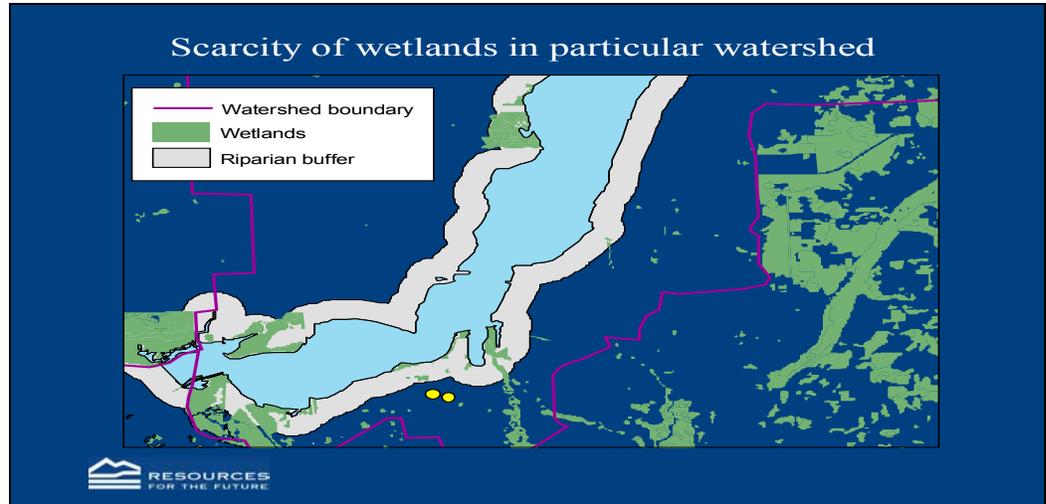
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What Do You Mean By “Spatial Counting”



Location-specific open space, wetlands, forests, surface waters, aquifers, species populations

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Conclusion

- We can standardize ecosystem services
 - A clear point of contact between ecology & economics
 - Consistent with measurement of market goods and services
- But clearly, not the only way to standardize
 - Discuss...

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The Role of Ecology

- Ecology describes the factory that makes all these services
 - Production functions
 - Prediction
- The future matters to welfare accounting
 - If current consumption affects the future, that needs to be counted



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The Role of Ecology

- What are implications of forest loss today?
 - Future forest services
 - Regeneration of forests
 - Other services dependent upon forests
 - Bird populations
- Energy consumption and GHG production?
 - Impact of GHG on future ecosystem services



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Only Ecology Can Do This

- Ecological production functions necessary for *prediction*
- Prediction is fundamental to welfare measures
 - If robbing the future, subtract what is robbed from current benefits
 - Akin to “Net GDP”



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Can Ecology Predict Effectively?

- Can economics predict?
- We're asking a lot
 - Not micro-prediction
 - Landscape-level prediction



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Benefits, Weights, Prices

- Economic assessment requires weighting of services
 - According to their social value
 - Market prices can't be used as weights
- Weights are
 - Location- and time-specific



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Standard Quantity Units

- Service units as control variables
 - Facilitate benefit transfer
 - Meta-analysis of valuation studies
- Specific valuation studies
 - Report service units to which value is attached
 - A template for the literature



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Weights

- Is there a comparable way to approach weights?
 - Yes, standardized weighting indicators



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Benefits are Site-Specific

- The value of services depends on the “social landscape”
- Example: recreational benefits
 - Are recreators nearby?
 - Are there complementary goods like access?
- Example: flood damage avoidance
 - Are there buildings and people in need of protection?
 - Are there man-made substitutes?

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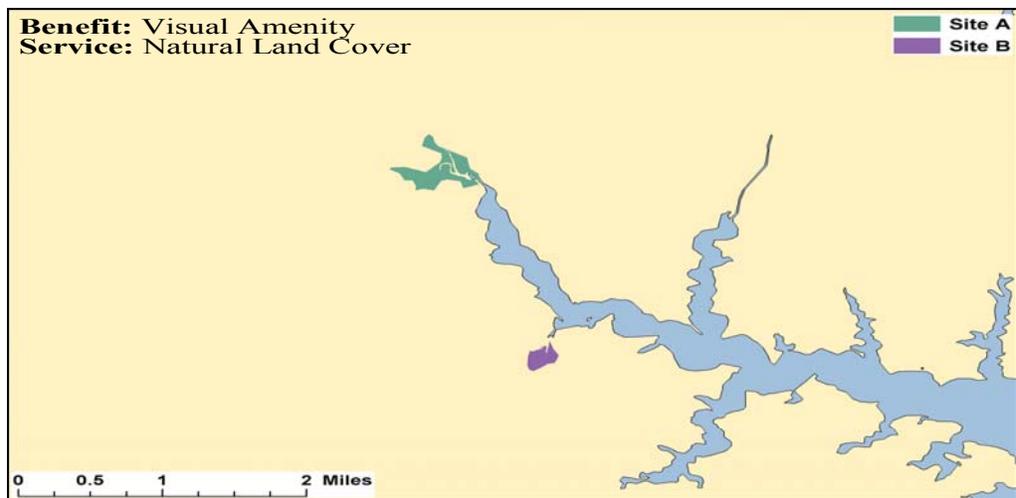
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Solution: WTP Indicators

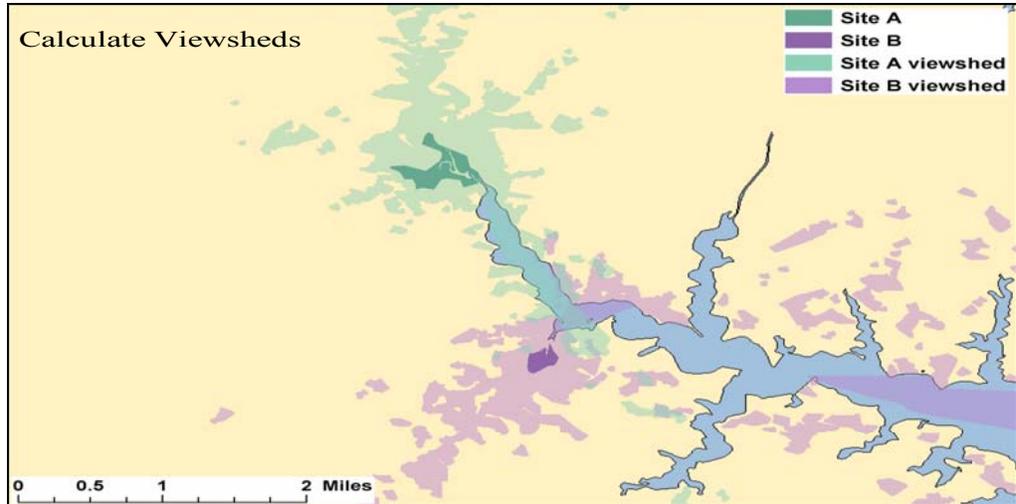
- Service- and location-specific data
- Things that affect benefits
 - Consumers of the service
 - Scarcity and substitutes
 - Complementary goods and services
- Countable, map-able items
 - Again, already collected by conservancies and governments

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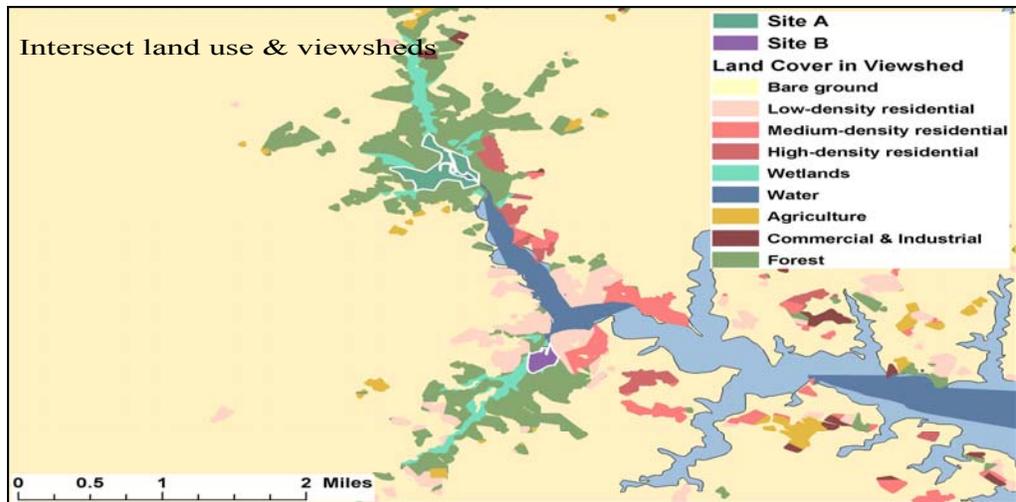
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Sample WTP Indicators

- For visual amenity benefit
 - Land area in viewshed with land uses complementary to visual enjoyment
 - Housing density-weighted land areas
 - Acres of natural land area in viewsheds of households
 - Percent natural land area in viewsheds of households

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Standardize these Weights?

- Use to develop stated preference scenarios
 - Contingent valuation and conjoint analysis
- Stated preference could be used to calibrate the indicators
 - Map indicators into stated values
 - Improve justification for benefit transfer
 - If done at necessary scale

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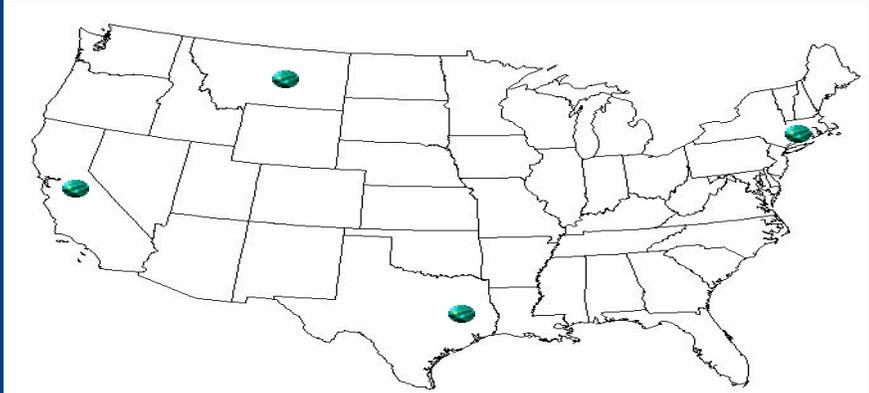
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The Argument

- The q 's are standardized & measurable
- Estimate the weights via experimentation
 - With willingness to pay indicators I
 - For q , $WTP(I_1, I_2, I_3, \dots)$
- Again standardization is important
 - Standardize the indicators (I_1, I_2, I_3, \dots)
 - Facilitates experimentation, meta-analysis, transferability

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