

Ecosystem Services: The Need for Standardized Environmental Accounting Units

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Resources for the Future

Forest Service presentation March 21, 2006

Ecosystem Services

- A powerful concept
 - Unites ecological and ecological thinking
- The right concept
 - Focus on nature's value
- A popular concept
 - MEA, governments, NGOs, conservancies
 - Manage services, trade services

We're Not Ready Yet

- “Ecosystem services” is too vague
 - Failures of definition
 - Failures of measurement
- How can we manage services (or trade them!) when we can't agree on what they are?

Build A Foundation

- This talk will advocate
 - A particular definition of ecosystem services
 - rooted in economic theory
 - & one that provides a bridge between ecology & economics
 - The definition yields practical, intuitive measures
 - We can do this now

What Are Ecosystem Services?

*The Need for Standardized
Environmental Accounting Units*

James Boyd and Spencer Banzhaf

Outline of this Talk

- Why is accounting for services so difficult?
 - Competing definitions, confusion
- What can we do about it?
 - Count services in a particular way
- Relevance to the Forest Service

The Counting Problem

- Ecosystem services are
 - Public goods and/or not sold in markets
 - *No* convenient units
- Nature is complex
 - *Too many* things to count

Counting Problems: The Result

- Too many ways of counting
 - Too many, conflicting definitions of services
 - Too many indicator/index proposals
- No consistency, no standardization

Can we standardize the definition & measurement of ecosystem services?

Confusion: Examples

- The definition of services
 - Ecology
 - Services = ecological functions (like sequestration)
 - Economics
 - Services = benefits (like recreation)
- Both are ... imprecise

The “Normal Person” Challenge

- Can't reach them via technical, expert-oriented black boxes
- But still need to be scientifically sound

Can services be counted in intuitive, concrete – yet rigorous – ways?

Goals for the Method

- Standardized units
 - Ecologically and economically sound
 - Clear point of contact between ecological and economic analysis
- Practical
 - Replicable nationally (even globally)
 - No stovepipes!

A unifying architecture for measurement

Nature's Benefits

- You need two things
 - (1) Quantities
 - (2) Weights
- Quantities
 - How much do we have?
- Weights
 - How important or valuable are the components?

Focus on Counting the Q 's

- Economists get hung up on the weights (*prices*)
- The first step has been neglected
 - What should we count in the first place?

Step 1: What Are Ecosystem Services?

- Components of nature that directly yield human well-being
 - Services are *things*, not functions or processes
 - Services are nature's "end-products"
- Services are specific to particular benefits
 - But *services are not benefits*

- purification of air and water
- mitigation of droughts and floods
- generation and preservation of soils and renewal of their fertility
- detoxification and decomposition of wastes
- pollination of crops and natural vegetation
- dispersal of seeds
- cycling and movement of nutrients
- control of the vast majority of potential agricultural pests
- maintenance of biodiversity
- protection of coastal shores from erosion by waves
- protection from the sun's harmful ultraviolet rays
- partial stabilization of climate
- moderation of weather extremes and their impacts
- provision of aesthetic beauty and intellectual stimulation

Gretchen Daily, Nature's Services, Island Press, 1997

An Illustrative Inventory

- Services are things or qualities
- Measured at finest practical spatial resolution
- Generally, services are countable and mapable via GIS

We can do this

Harvests	Managed commercial	Pollinator populations, soil quality, shade and shelter, water availability
	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

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

The Finer Points

- Many ecosystem characteristics are valuable but are not services
 - Carbon sequestration, nutrient cycling are valuable *functions*
- Services are benefit-specific
 - Drinking water
 - Chemical water quality is a service
 - Angling
 - Chemical water quality is *not* a service

Output of Step 1: Spatially-Explicit Quantity Measures

Good News #1: Data is already being collected by

- Conservancies, Governments, NGOs

Good News #2: You don't have to count everything

- Focus on intuitive, concrete “end products”

Good news # 3: The units are a precise point of contact between ecology and economics

- A blueprint for interaction between the disciplines

The Thought Experiment

- Are you clear on why you're measuring what you're measuring?
 - What stays in, what's left out?
- Why are there so many different versions?
 - Standardization possible only if principles guide definition

Step 2: Benefits, Weights, Prices

- Economic assessment requires weighting of service quantities
 - According to their social value
 - Market prices can't be used as weights
- Weights are
 - Site-specific
 - Controversial

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?

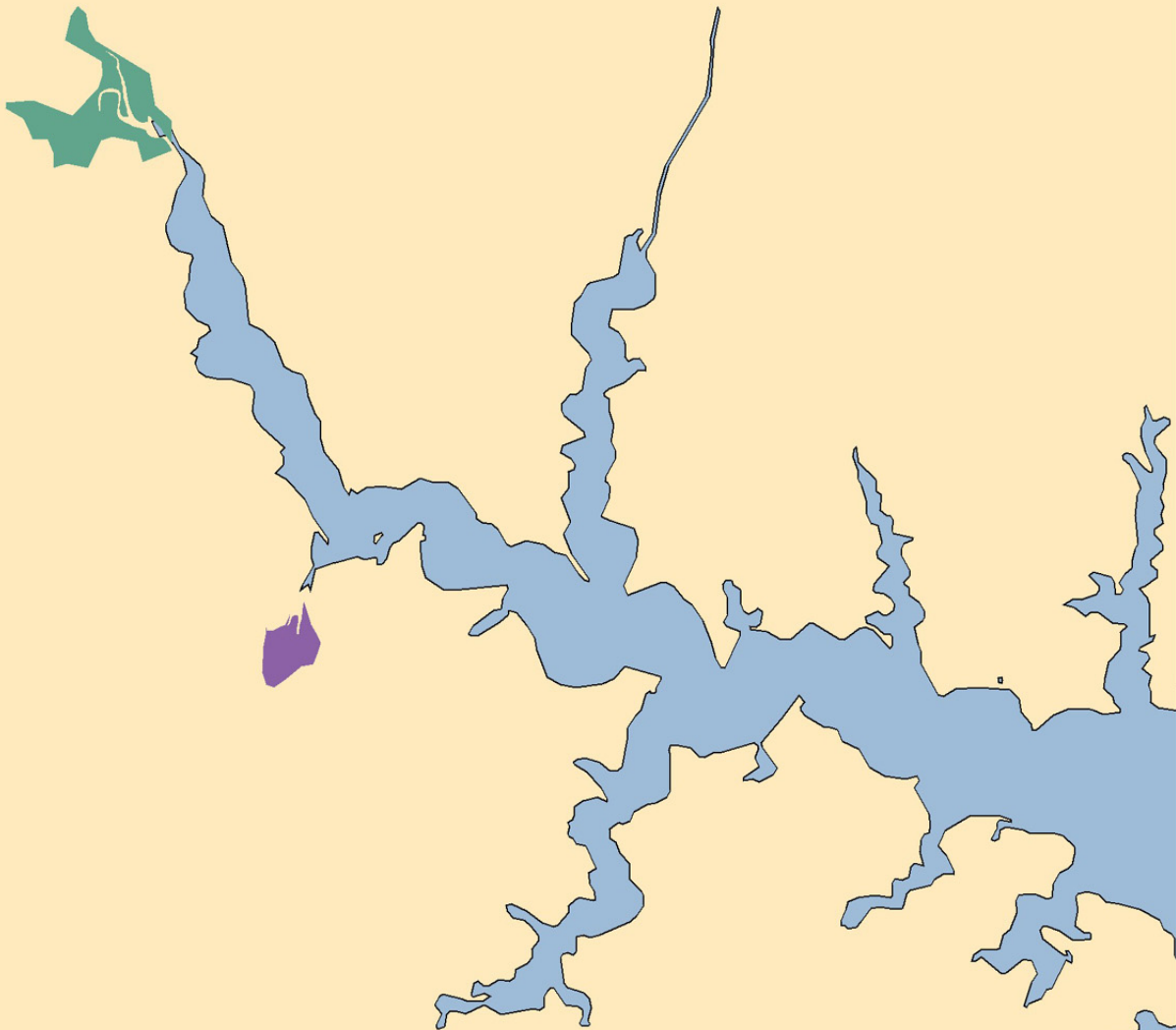
Solution: Benefit Indicators

- 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

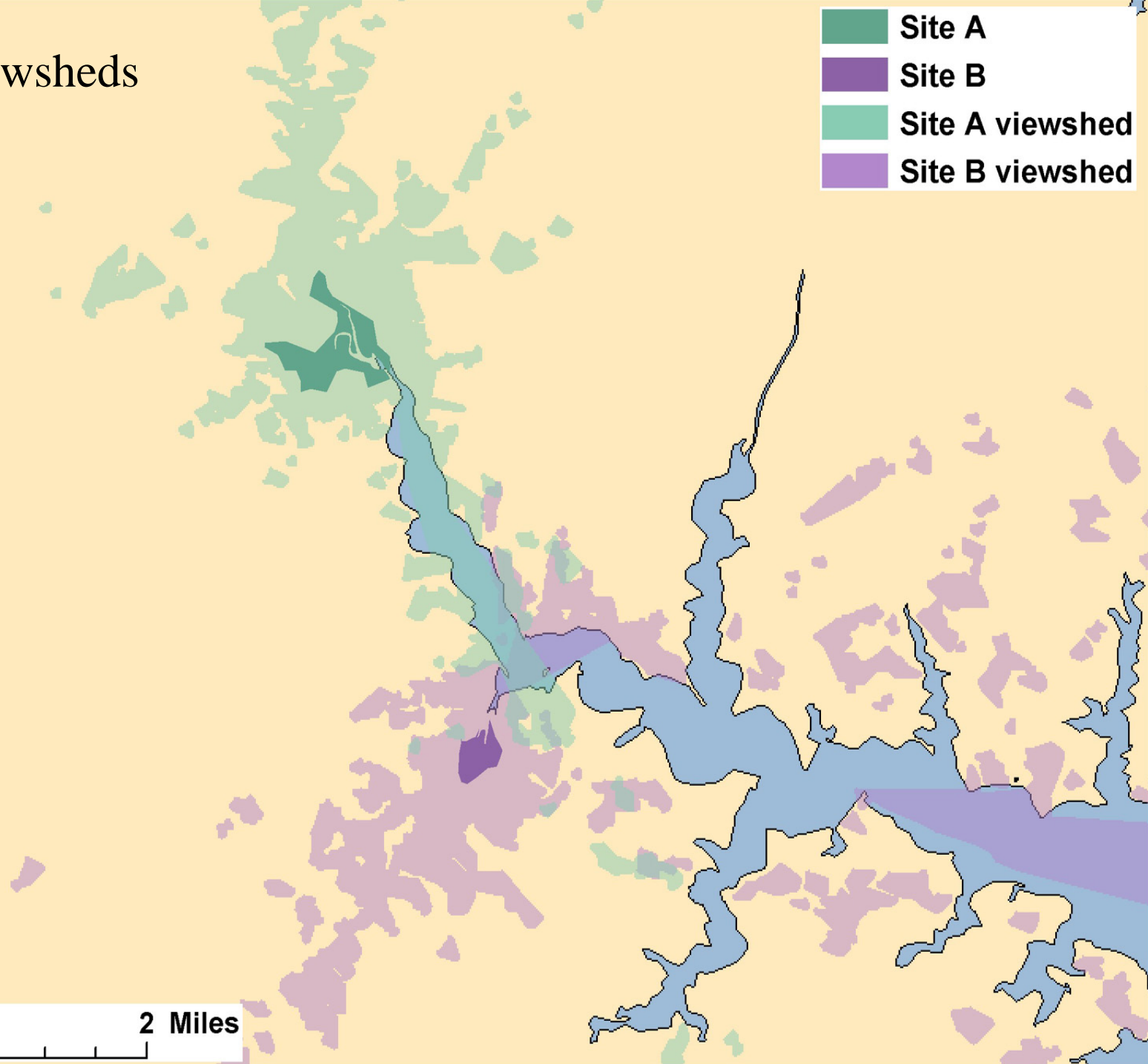
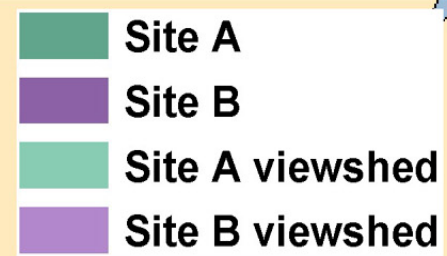
Indicators and Weighting

- More Informal
 - Use to inform public process
 - Use as input to mediated modeling
 - Use as input to citizen juries, voting procedures
- More formal
 - Use in conjunction with benefit transfer
 - \$-based studies lack landscape data
 - Inhibits BT

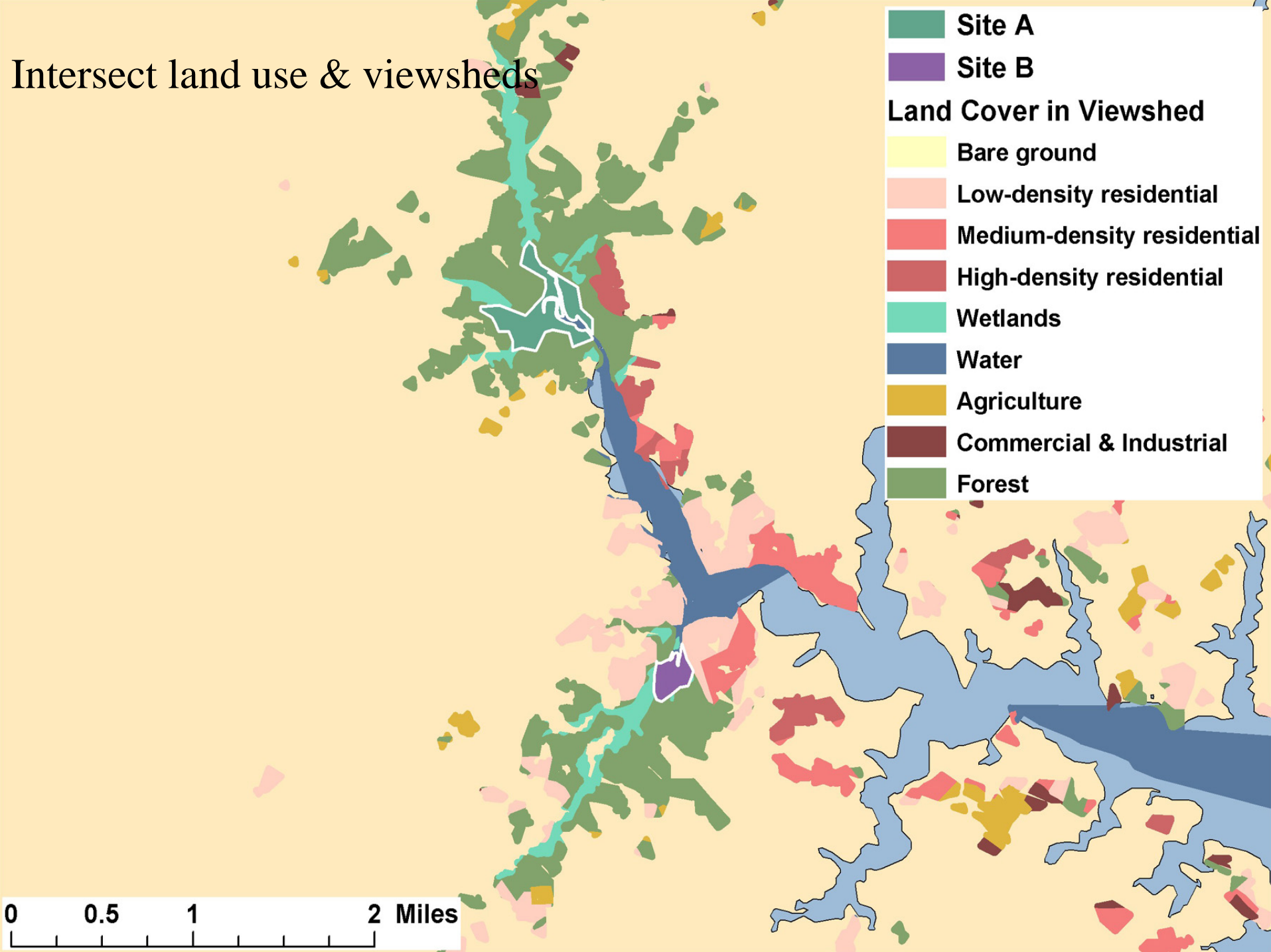
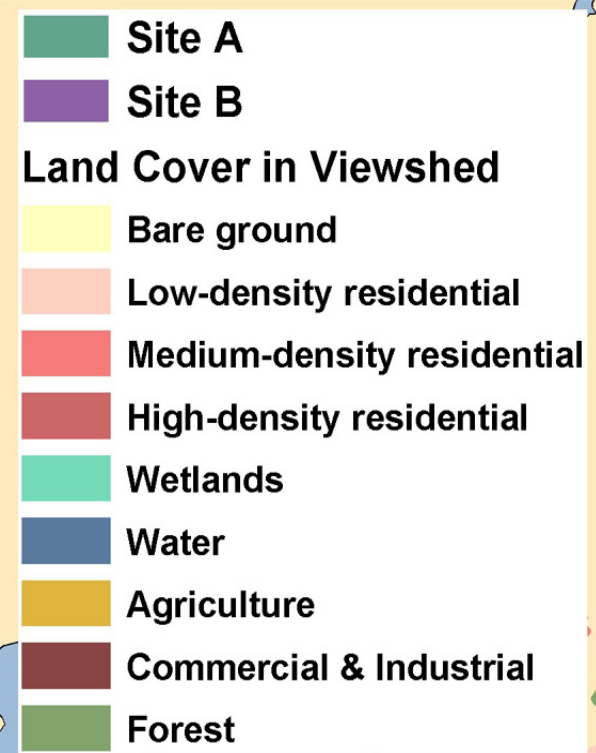
Benefit: Visual Amenity
Service: Natural Land Cover



Calculate Viewsheds



Intersect land use & viewsheds



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
 - Public lands in viewshed

Conclusion

- Standardization of ecosystem services is a neglected 1st step
 - Start measuring the Q 's!
 - Measurement of weights p are conditional on this step
- We can begin to measure “performance” without weights

Implications for the Forest Service

- Analysis of resource management options
 - Count the “lift and loss” in services
- Communicate the benefits of resource management
 - Communities will care about what happens to these *quantities*
- Communicate with Congress & OMB
 - Budgets, PART analyses

A Pilot Study

- With the Pacific Northwest & Pacific Southwest Research Stations
- Northern Sierra fire management
- Option-specific analysis of services
 - GIS
 - Forest ecology – biophysical scenarios
 - Mapping services and benefits
- An illustration of the approach

Thank you

Comments? Questions?

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www.rff.org/whatareecosystemservices