THE MONONGAHELA NATIONAL FOREST PILOT GIS ECOSYSTEM SERVICES DECISION AID

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December 4, 2018

ACES Conference - Washington, DC

How does mapping ecosystem services help forest managers make better decisions?

We can more accurately identify costs, benefits, and interactions that result from planning and management actions.

Mapping Tradeoffs on the Monongahela National Forest

Objectives:

- Understand potential tradeoffs between ecosystem functions and economic values
- Inform and defend planning and management decision-making
- Provide continuity of knowledge over time
- Provide consistent measurement across forests

MAPPING ECOSYSTEM SERVICES ON THE MONONGAHELA NATIONAL FOREST

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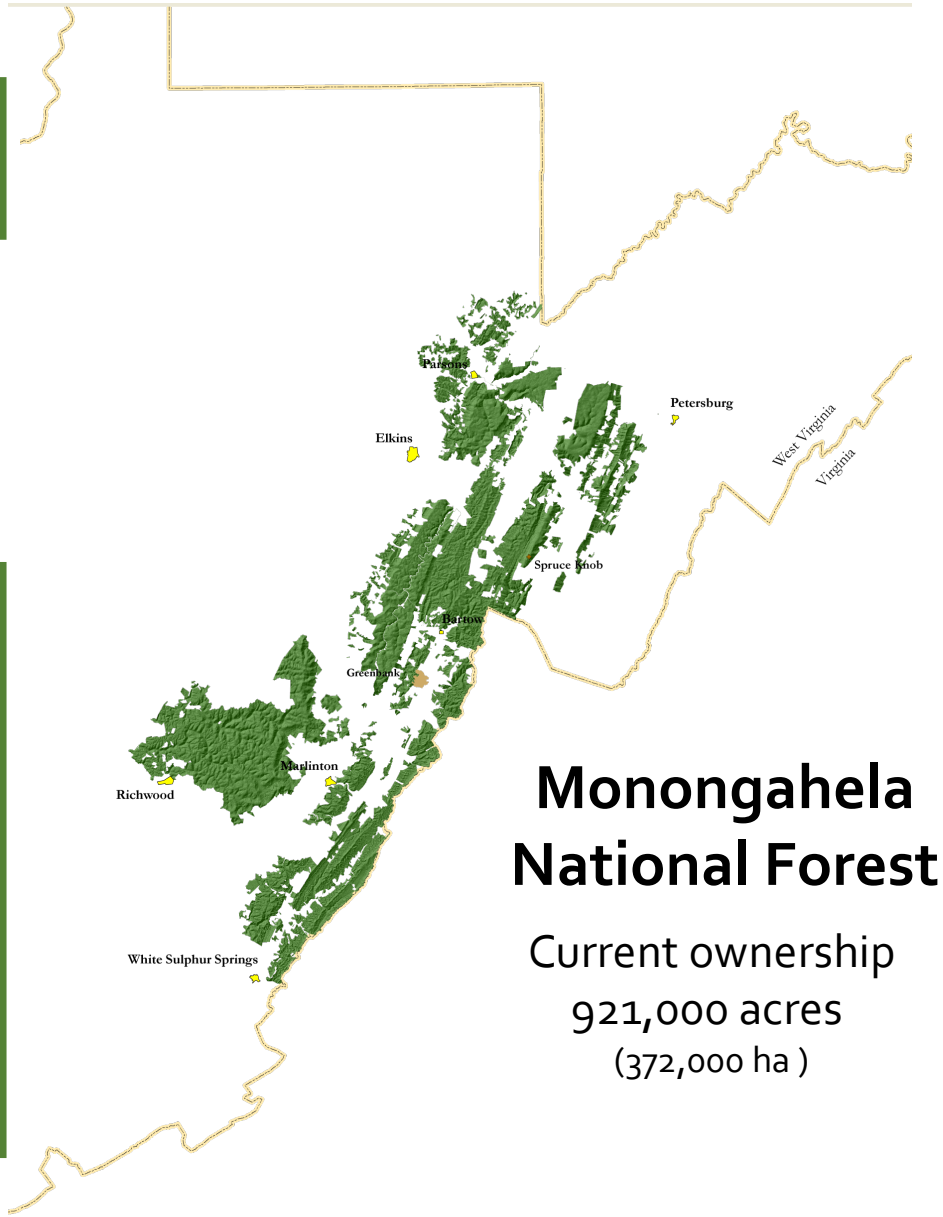


Monongahela National Forest

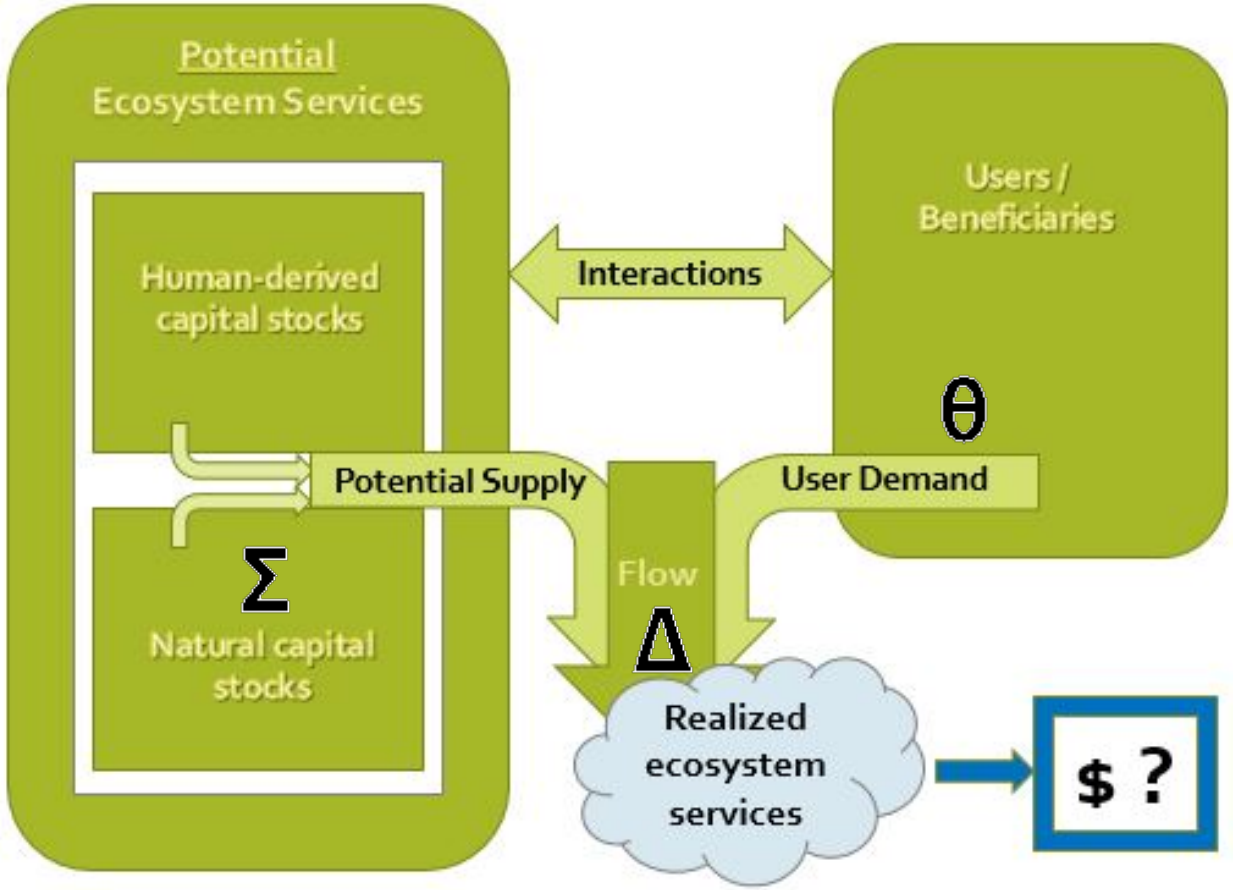
Current ownership
921,000 acres
(372,000 ha)

Mapping Process in Two Steps

- Locate, calculate, or estimate data for a space
  - Biophysical capital and functioning
  - Economic value of services from the capital

- Map the data to the site
  - Data at highest possible resolution

Data Classifications and Layers



Adapted from "Stocks and flows of natural and human-derived capital in ecosystem services" by Jones et al. (2006)

Data Layers

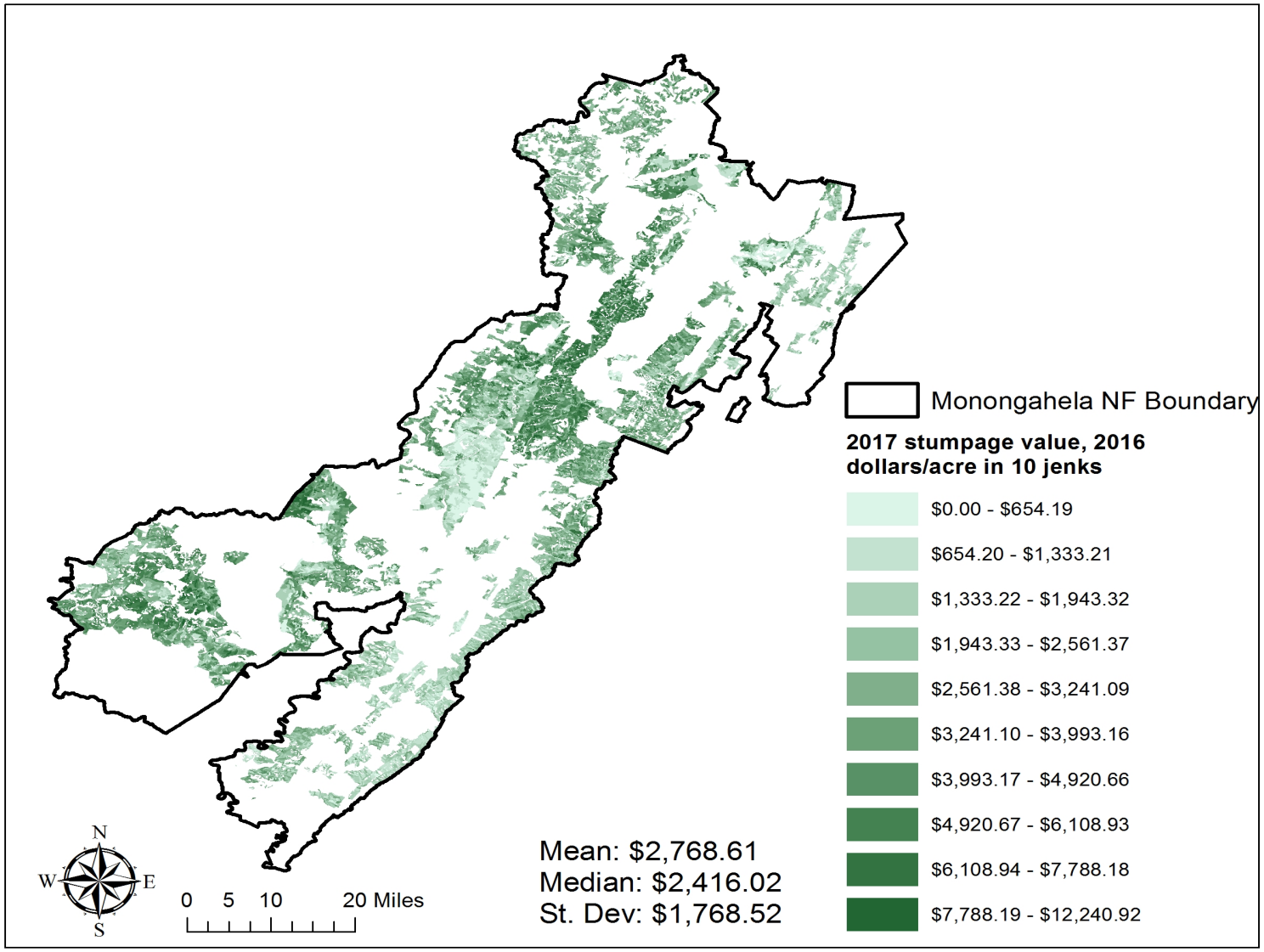
- **Σ** – total potential stock of a resource that provides ecosystem services
- **Δ** – historical, realized or potential flow of ecosystem service values across space
- **Θ** – intermediate metric, such as user demand or an interaction between users and environmental resource stocks
- **Ψ** – geospatial tradeoffs or synergies among alternatives without necessarily quantifying an ecosystem service stock or flow
- **$** - monetary quantification of a potential ES stock or flow or realized ES flow

Ecosystem Services				
1	**Carbon**			
		Total Stand Carbon		Δ, $
2	**Invasives**		Basal Area Lost	Θ
3	**Recreation**			
		Aesthetics		Ψ
		NVUM, by District	Visitation	Θ
		Hunting	Kills	Θ
		Site Data	Use Index	Θ
4	**Timber**			
		Red Spruce Cover		Ψ
		Stumpage Value		Σ, Δ, $
5	**Non-Timber**			
		Ginseng Harvest		Δ, $
		Trees with Medicinal Value	Volume	Σ
		Trees with Palatable Parts	Volume	Σ
6	**Water**			
		Water Yield		Σ
7	**Wildlife**			
		Endangered Species		Ψ

Example: Mapping Standing Timber Value (ΣΔ$)

- Simple application of the Two-Step Process
- Stands simulated using single-tree simulator FVS (Forest Vegetation Simulator) with both stand exam data from MNF and imputed data.
- FVS' Eastern Variant growth model was applied to each stand in the Monongahela, and a "clearcut" scenario
- Tree species each assigned average price per MBF for lumber delivered to mill, based on MNF transactions evidence indexed to regional prices
  - Prices were the most problematic to define and assign
- Creation of the layer was straightforward after the simulation

Ecosystem Service Value of Timber

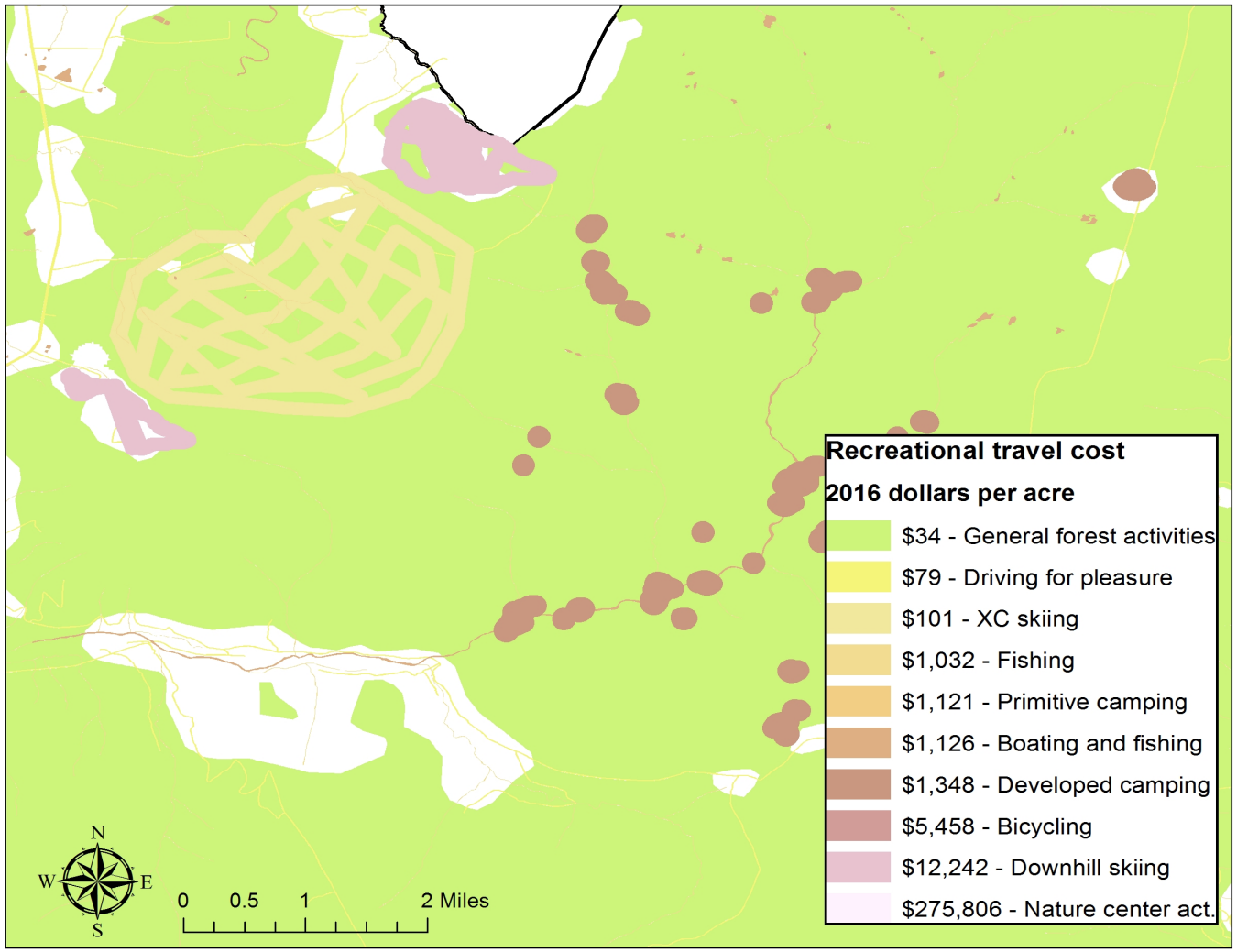


Example: Mapping Recreation Value

- Calculate number of visits (θ) from expected value of the number of site visits for NVUM sample points by district
- Calculate estimated average travel cost for each recreational activity group (θ, $) by multiplying average travel cost estimate numbers for each of the local and nonlocal day or overnight strata
- Calculate per acre value for expected travel cost by activity group by dividing expected total travel cost by summed acreage of all geographic features corresponding to the particular activity group
- Apply appropriate estimated spatial buffers around sites to per acre value of expected travel cost area of value, for example, 5-ft buffer around streams and bike trails, to get summed expenditures layer by activity (Δ, $)

Ecosystem Service Value of Recreation

Summed travel cost values and NVUM site visit estimation accrued to corresponding landforms



Lessons Learned

- Available national data sets on ecosystem conditions and outputs may not provide quantitative data that can be integrated into a spatially-explicit economic value
- Limited spatial resolution of data and outputs from ecological models limits usefulness for applications that require sub-forest spatial analysis
- Dearth of integration between ecological and economic modeling software to enable analysts to rapidly import and map externally hosted data

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