USGS
science for a changing world

Mapping the social and cultural dimensions of ecosystem services

Darius Semmens, Ben Sherrouse, and Zach Ancona

Geosciences and Environmental Change Science Center

Denver, Colorado

SolVES
Social Values for Ecosystem Services

U.S. Department of the Interior
U.S. Geological Survey

Social Values for Ecosystem Services

- *Social values* = nonmarket values perceived by stakeholders for ecosystem services
- Close correspondence with cultural ecosystem services such as aesthetics and recreation
- Consideration of social values is lacking relative to ecological and economic values
- *SolVES* = GIS tool allowing users to assess, map, and quantify social values
  - Developed as an ArcGIS 10 Add-In toolbar for ArcMap
- Goal to augment ecosystem service assessments with social value information

USGS

Social Values and Cultural Ecosystem Services

- Aesthetic
- Biodiversity
- Cultural
- Economic
- Future
- Historic
- Intrinsic
- Learning
- Life Sustaining
- Recreation
- Spiritual
- Subsistence
- Therapeutic

Imagine that you could allocate 100 points toward what you value in the Arapaho-Roosevelt National Forest. For example, you might assign 100 points to one value and zero to all the others, or you might assign 50 to one, 25 to another,

Please read through the list bel

____ **Aesthetic value (A).** I valu
smells, etc.

____ **Biological diversity value**
variety of wildlife, plant li

____ **Cultural value (C).** I value
continue to pass down th

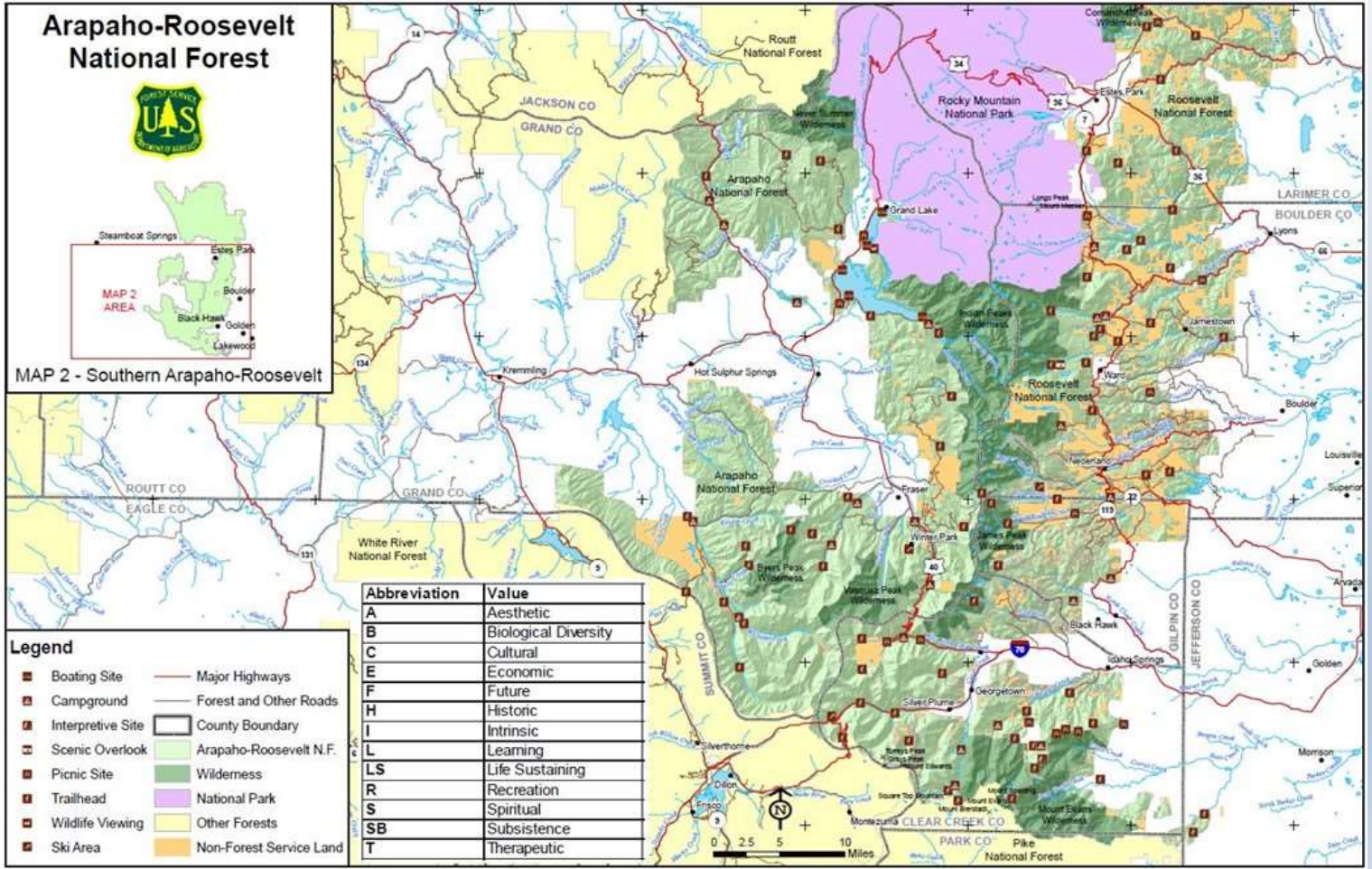
____ **Economic value (E).** I valu
opportunities, such as gui

____ **Future value (F).** I value A
know and experience the

____ **Historic value (H).** I value
natural and human histor

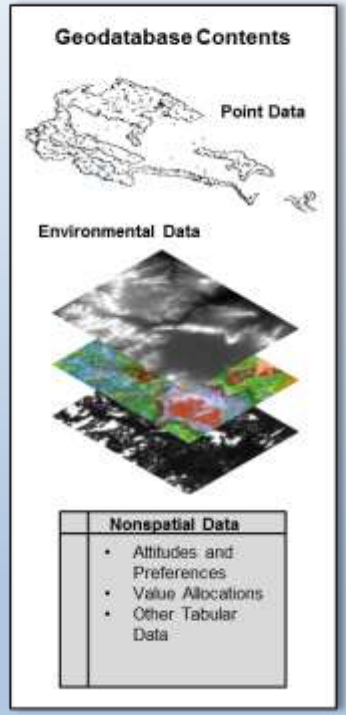
____ **Intrinsic value (I).** I value
matter what I or others th

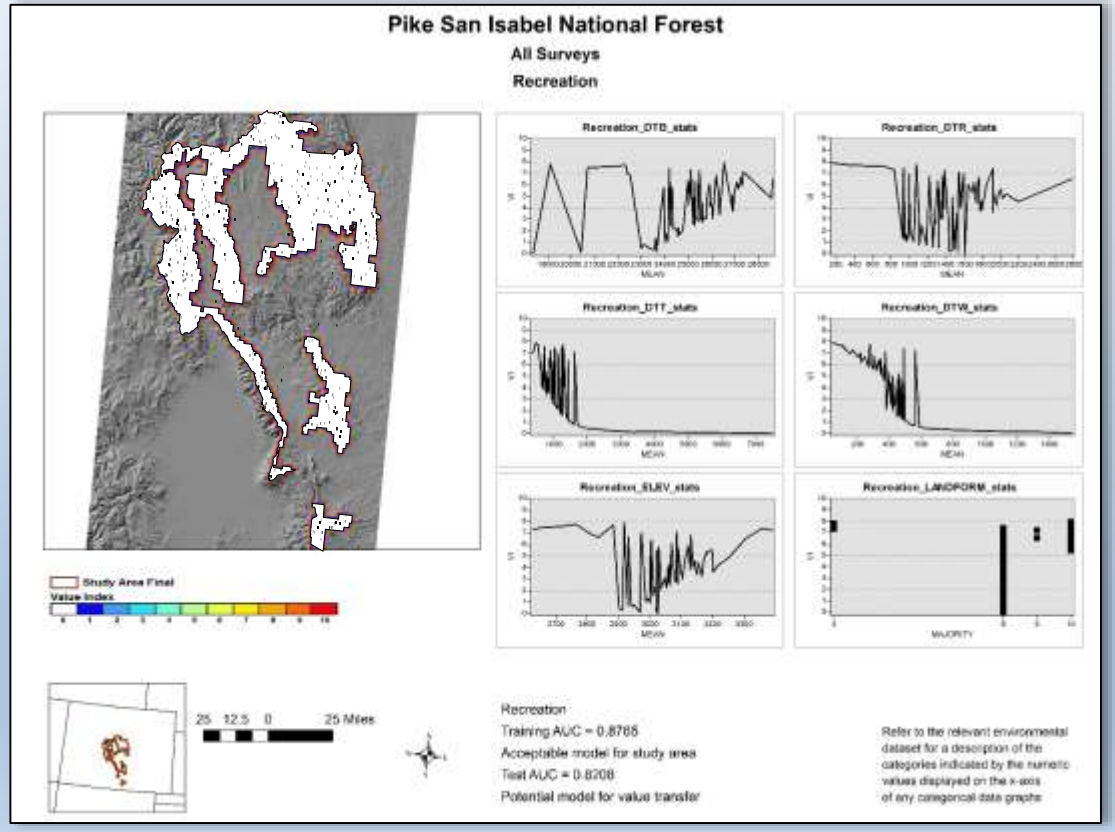
USGS



Abbreviation	Value
A	Aesthetic
B	Biological Diversity
C	Cultural
E	Economic
F	Future
H	Historic
I	Intrinsic
L	Learning
LS	Life Sustaining
R	Recreation
S	Spiritual
SB	Subsistence
T	Therapeutic

Social Values for Ecosystem Services (SolVES)

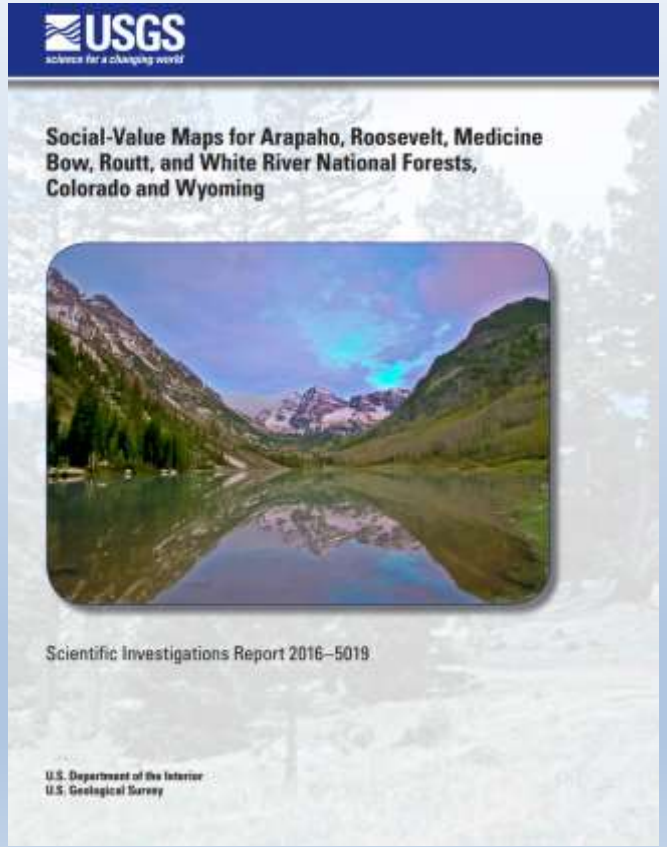




USGS

What can you do with SolVES?

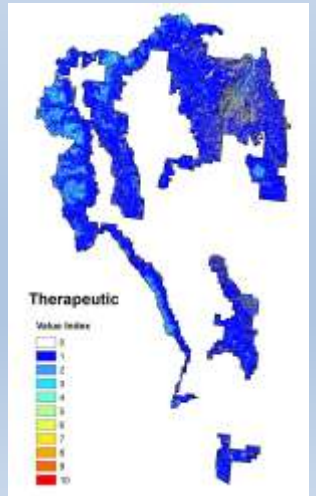
- Model & map cultural ES value over small or large areas, on land or water
- Combine information on cultural services with other types of ES information to inform management
- Consider impacts of alternative land-use, management, or visitation scenarios

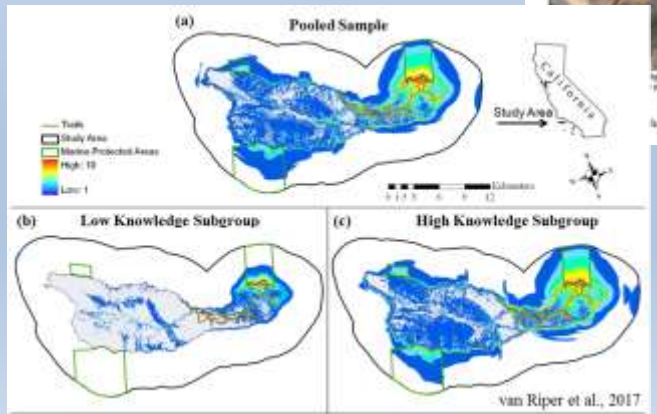


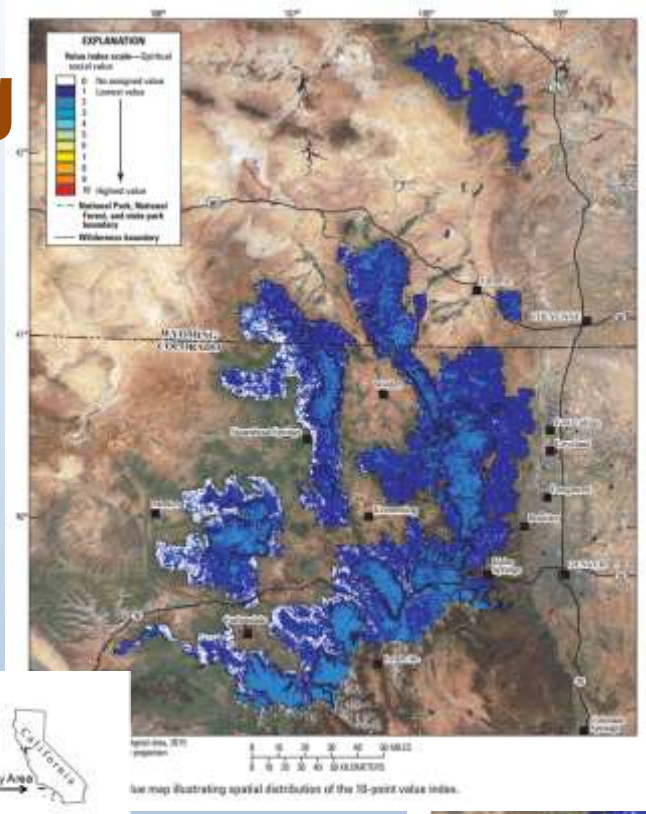
USGS

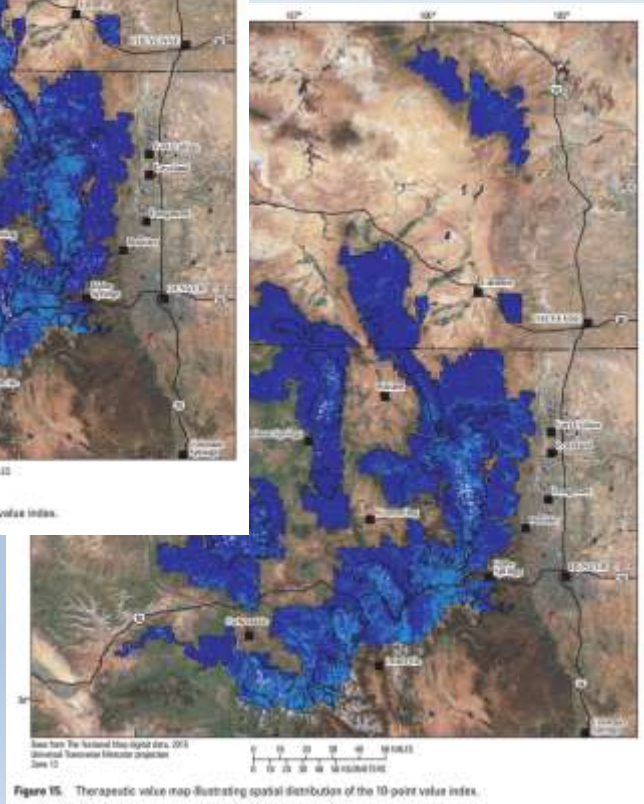
Cultural ES mapping

- Six National Forests
  - Report with full results and methods for three of them
- Five coastal applications
- Rural & urban examples in the works





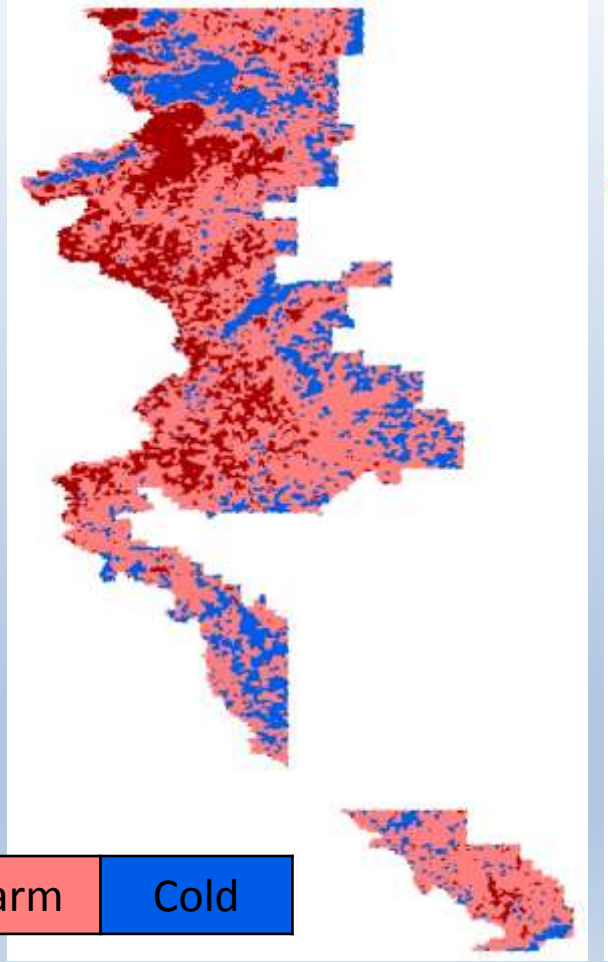




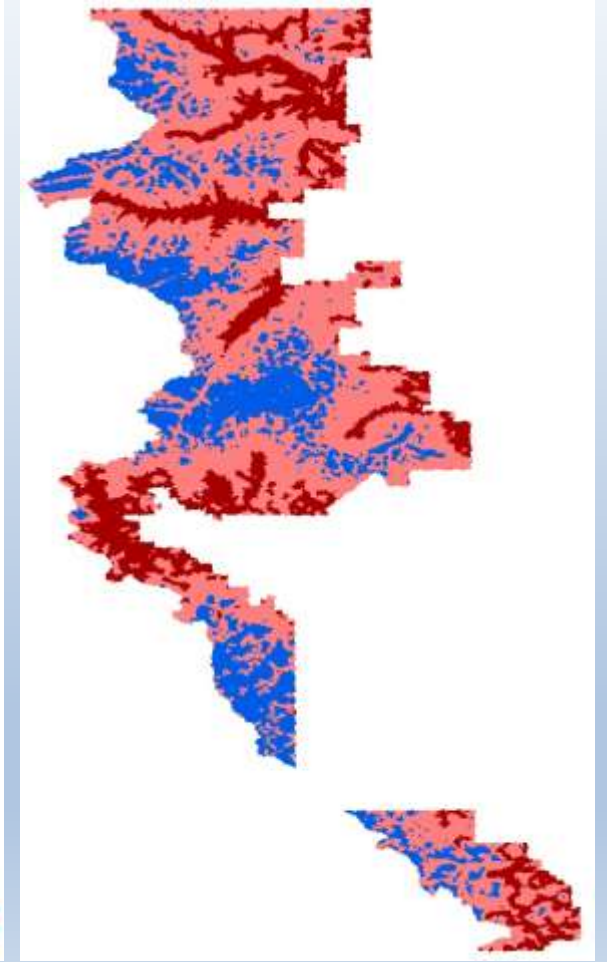
Combining cultural and biophysical ES

- Normalize and sum modeled ES provision
- Getis-Ord Gi* tool for hotspot identification at α = 0.10 significance level
- Coldspots identified in the same way
- Result is a statistically significant hot-warm-cold map for each group of services

Biophysical ES hotspots



Cultural ES hotspots

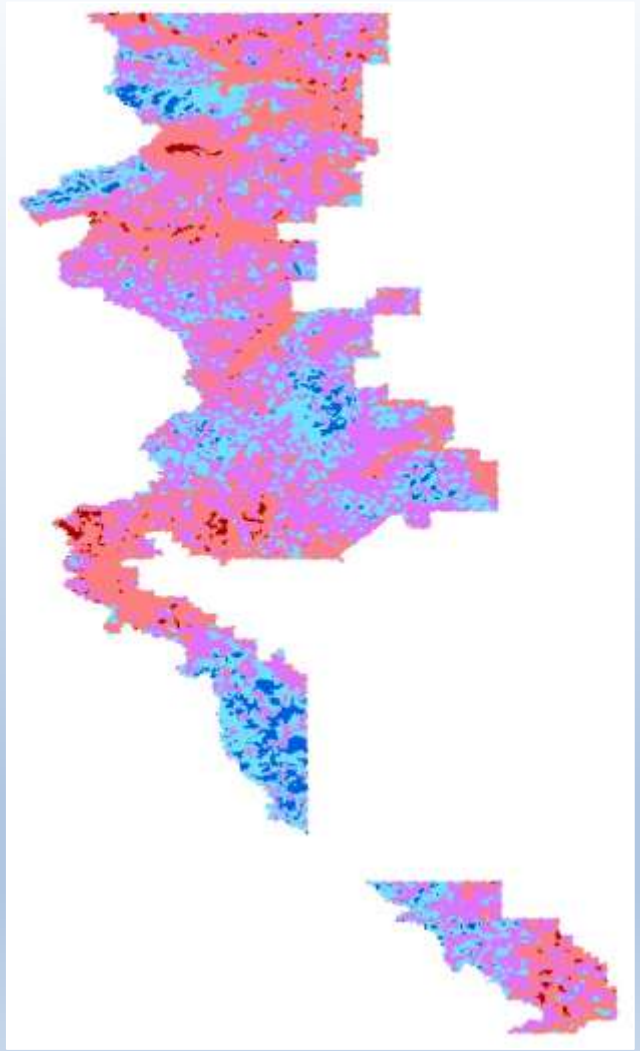


USGS

Hot | Warm | Cold

Combining cultural and biophysical hotspots

- Combine the two hotspot maps, preserving their original classifications
- 9 possible combinations of hot-warm-cold from each group of services
- Color coding can be interpreted in terms of the potential management implications



USGS

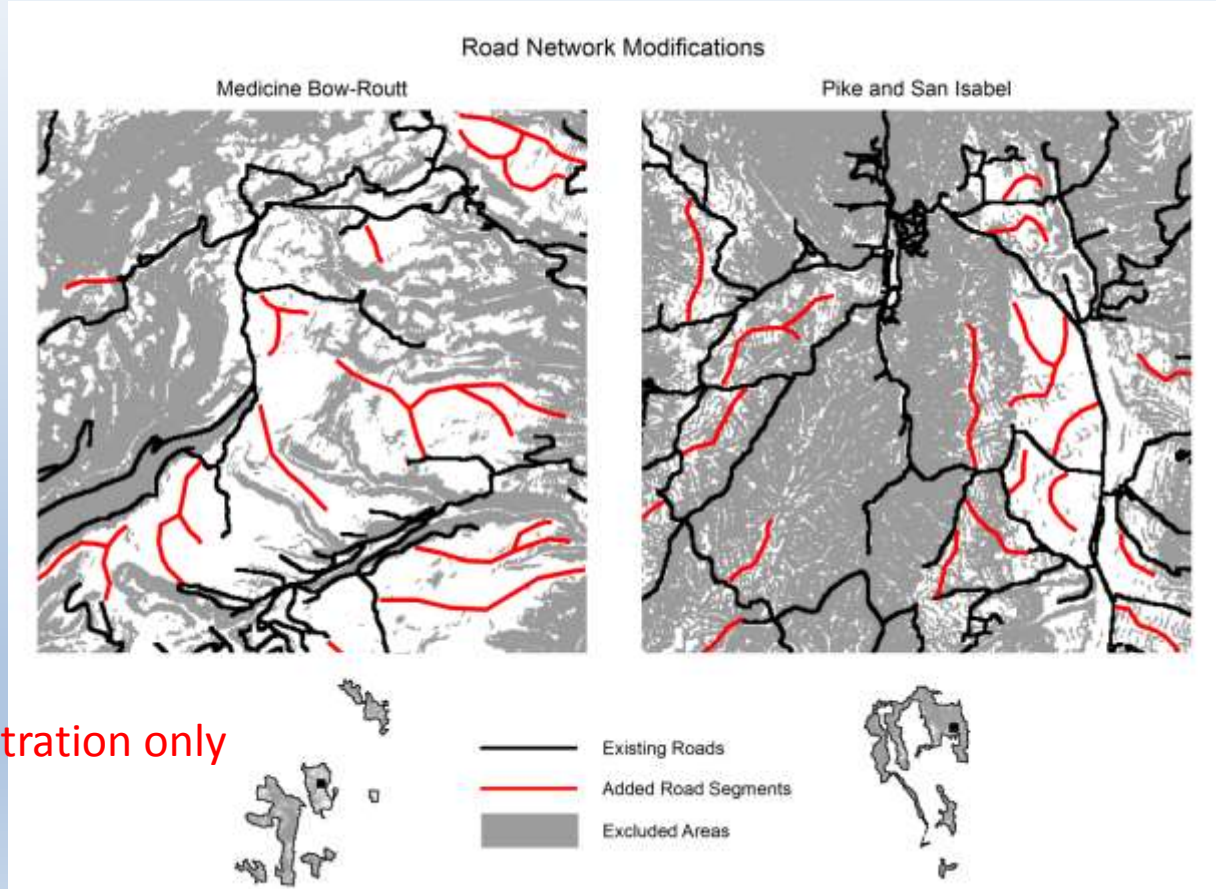
Management implications

		Biophysically modeled ecosystem services (mapped using ARIES)		
		Hot	Warm	Cold
Social values (mapped using SolVES)	Hot	High management support (if social values & services are compatible) OR potential conflict between management & traditional uses (if social values & services are not complementary)		High support for traditional uses; cases where biophysical modeling alone is inadequate to map value
	Warm			Areas suitable for development or resource extraction, assuming other important natural or cultural resources are absent (e.g., high biodiversity, threatened & endangered species, indigenous cultural significance)
	Cold	Public outreach needed to build support for management (e.g., for watershed protection programs)		

USGS

Evaluating alternative future scenarios

- Road/trail networks, pipeline routes, wilderness designation, increased visitation, public land acquisition
- Here we consider a 10% road network expansion
  - How it effects different value types
  - Tradeoffs between value types and/or user groups



Hypothetical example for demonstration only

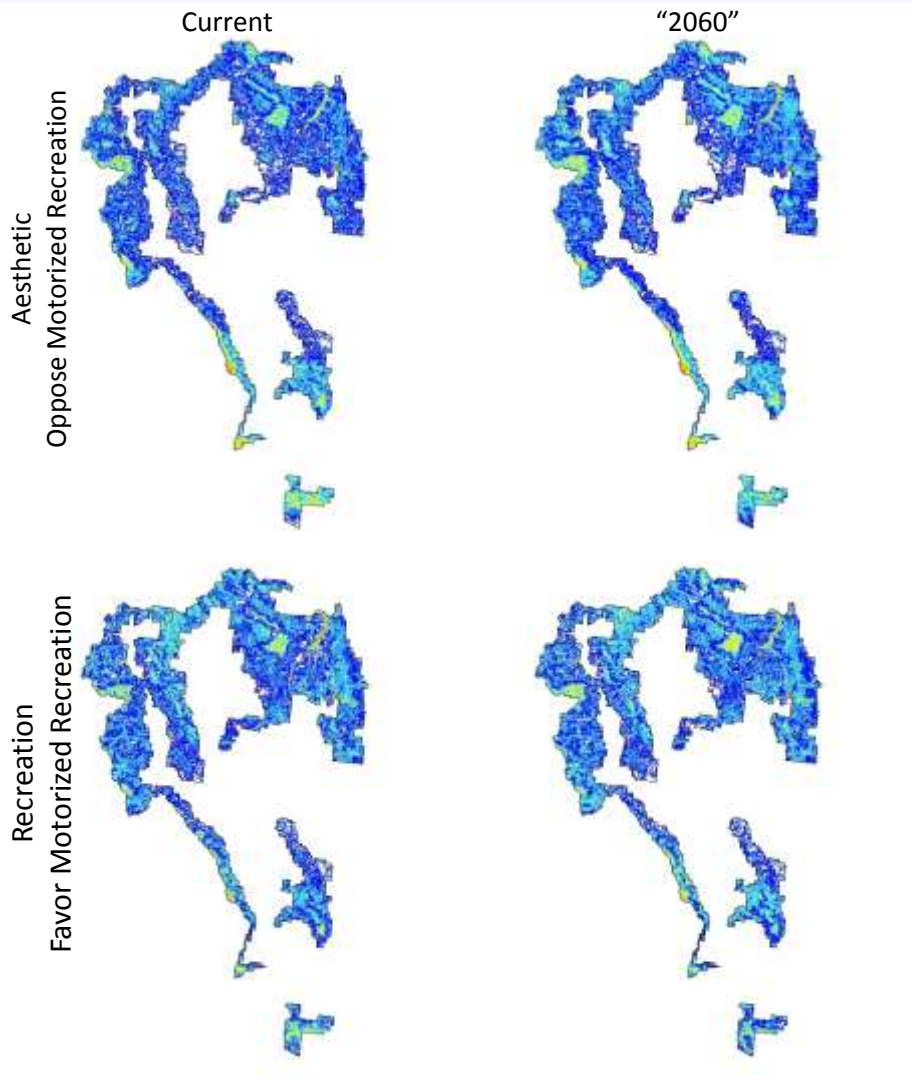
USGS

Scenario Impacts on Social Values

- If we add roads, who wins and who loses?
  - Are there differences in how value types are impacted?
  - Does it matter where we put roads?
  - Can we use information on tradeoffs to optimize benefits between different user groups or value types?

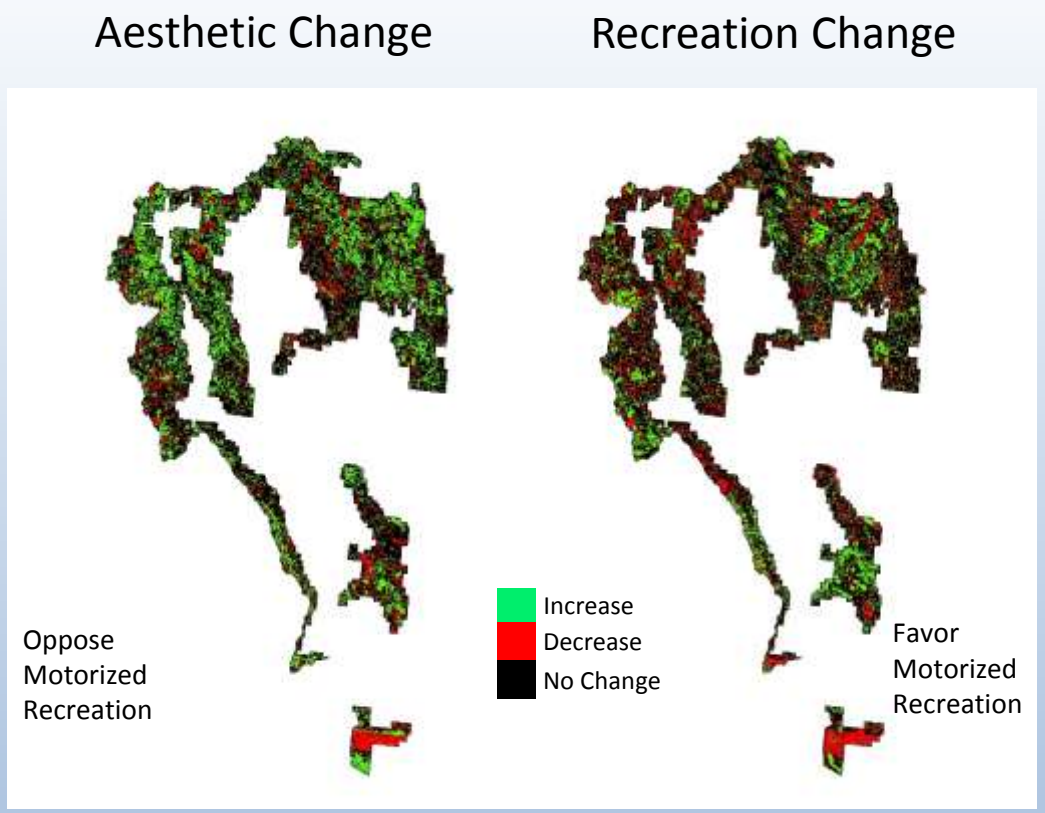
- Considered social-value impacts of road-network expansion
  - Aesthetic values of those opposing motorized recreation
  - Recreation value of those favoring motorized recreation

USGS



Scenario Tradeoffs

- Change between baseline and scenario results
  - Different value types
  - Different user groups
- Maps show both how and where changes are different
- Tradeoff matrix indicates the extent of agreement and disagreement between the results compared



Tradeoff Matrix

		Recreation		
		Decrease	No Change	Increase
Aesthetic	Decrease	4%	6%	3%
	No Change	10%	40%	10%
	Increase	4%	15%	8%

USGS

Assumptions & Limitations

- Maps only reflect values of the survey respondents
  - User groups or communities of interest may have to be targeted specifically
- Values are related to & can be predicted by environmental variables
  - Care required when selecting them
- Social value survey is required
  - Cost and method of delivery
  - Social science expertise to design
- Survey limitations
  - Respondent fatigue and response rate
  - Self-selection bias

USGS

solves.cr.usgs.gov

Social Values for Ecosyste... ×

solve.cr.usgs.gov

Apps | https://ipds.usgs.go... | DOI Access Portal -... | Log in to Concur | C... | Google Scholar | Putting humans in t... | Google Maps | GECSC Intranet | Welcome to the US... | Other bookmarks

USGS science for a changing world

USGS Home
Contact USGS
Search USGS

Social Values for Ecosystem Services (SolVES)

HOME

SolVES
Social Values for Ecosystem Services

Downloads

- SolVES 3.0 Tool
- Sample Data
- Quick-Start Tutorial
- User Manual
- Publications
- Sample Survey

Contacts

- Contact Information

SolVES 3.0 Now Available! (ArcGIS 10-compatible)

A GIS Application for Assessing, Mapping, and Quantifying the Social Values of Ecosystem Services

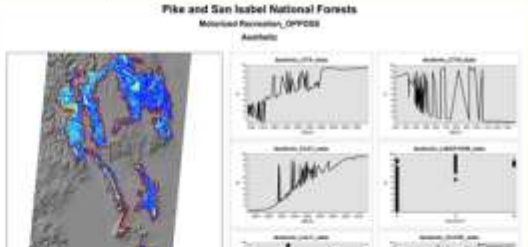
Ecosystem services are the benefits provided by nature, which contribute to human well-being. These benefits can range from tangible products such as food and fresh water to cultural services such as recreation and aesthetics. As the use of these benefits continues to increase, additional pressures are placed on the natural ecosystems providing them. This makes it all the more important when assessing possible tradeoffs among ecosystem services to consider the human attitudes and preferences that express underlying social values associated with their benefits. While some of these values can be accounted for through economic markets, other values can be more difficult to quantify, and attaching dollar amounts to them may not be very useful in all cases. Regardless of the processes or units used for quantifying such values, the ability to map them and relate them to the ecosystem services to which they are attributed is necessary for effective assessments.

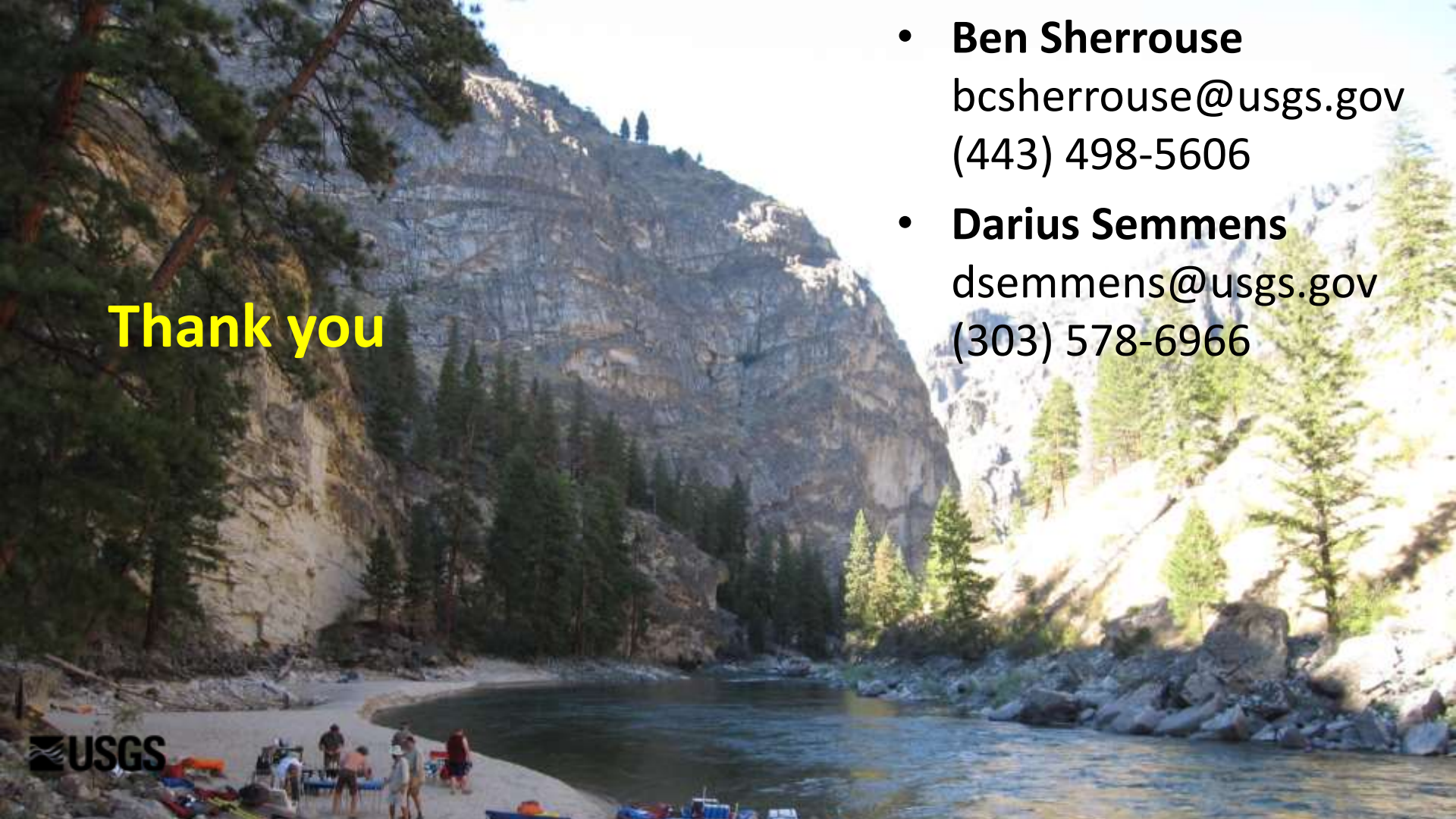
In response to the need for incorporating quantified and spatially explicit measures of social values into ecosystem service assessments, the geographic information system (GIS) application, Social Values for Ecosystem Services (SolVES), was developed. SolVES is designed to assess, map, and quantify the perceived social values of ecosystem services. Social values, the perceived, nonmarket values the public ascribes to ecosystem services, particularly cultural services, such as aesthetics and recreation can be evaluated for various stakeholder groups. These groups are distinguishable by their attitudes and preferences regarding public uses, such as motorized recreation and logging. SolVES derives a quantitative, 10-point, social-values metric, the "value index", from a combination of spatial and nonspatial responses to public value and preference surveys and calculates metrics characterizing the underlying environment, such as average distance to water and dominant landcover.

Version 3.0 (SolVES 3.0) continues to extend the functionality of SolVES. Like previous versions of SolVES, SolVES 3.0 is integrated with the Maxent maximum entropy modeling software to generate more complete social-value maps and to produce robust models describing the relationship between social value intensity and explanatory environmental variables. Maxent also more readily permits the transfer of social-value models to physically and socially similar areas where primary survey data are not available. Due to its flexible design, SolVES 3.0 users are able to define their own social values and public uses, model any number and type of environmental variables, optionally weight mapped survey data, and modify the spatial resolution of analysis. SolVES 3.0 provides an improved public-domain tool for decision makers and researchers to evaluate the social value of ecosystems and to facilitate discussions among diverse stakeholders regarding the tradeoffs among different ecosystem services in a variety of physical and social contexts, ranging from forest and rangeland to coastal and marine.

Getting Started with SolVES 3.0

- ✓ SolVES 3.0 requires ArcGIS 10, 10.1 or 10.2 software.
- ✓ Download the SolVES 3.0 tool.
- ✓ Download the Sample Data for use with the Quick-Start Tutorial. These sample data are provided for demonstration purposes only.
- ✓ The Quick-Start Tutorial includes instructions for installing SolVES 3.0 and exercises providing immediate, hands-on experience using SolVES 3.0 with the provided Sample Data.
- ✓ More detailed information about how SolVES 3.0 works, data requirements, advanced options, and troubleshooting is included in the User Manual.





Thank you

- **Ben Sherrouse**
  bcsherrouse@usgs.gov
  (443) 498-5606
- **Darius Semmens**
  dsemmens@usgs.gov
  (303) 578-6966

USGS