Social Values in River Corridors: Using PPGIS to Spatially Map Social Values Along Idaho’s Middle Fork of the Salmon River

NATHAN MOODY

nlm93@nau.edu
Department of Geography, Planning, and Recreation

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Outline

- Introduction
  - Summary of Results
  - Research Questions
  - Study Area
- Methods
  - Survey
- Data Analysis
  - Social Values for Ecosystem Services (SolVES)
- Results
  - Potential Management Applications
- Conclusion
Introduction:

- Valuation of Ecosystem Services
- Quantifying Perceived Social Values Through Survey Administration
- Spatially Connecting the Perceived Social Values of River Users to a River Corridor
Summary of Results

- Created successful GIS models for social values within a river corridor
- Identified correlation between social value intensity and management concern
- Found the need to incorporate a more diverse stakeholder population in river corridor social value mapping
Research Questions

- Can quantification and mapping of social values be applied to a wild and scenic river corridor to aid in management?

- Is the application SolVES a viable, streamlined tool to produce GIS products that are potentially useful in wilderness river management applications?
The Middle Fork of the Salmon River, Idaho (MFSR)

- Wild and Scenic River
- Heavy human use (11,284 users in 2015)
- River flows 104 miles through a designated wilderness area
Motivations for Research

River Management

- Possible connections between ecosystem conditions and perceived social value
- Decision making incorporating social value data

Human Impacted Campsites

- Campsites along the MFSR are monitored for human impact

Heavily Impacted Camp: Tumble Creek

2. Ground Vegetation Worn Away.

3. Ground Vegetation Lost.


5. Vegetation Dead. Soil Erosion.
"SolVES is designed to assess, map, and quantify the perceived social values of ecosystem services" (USGS. 2015)
Data Entered Into SolVES for MFSR Project

- Survey Points
- Environmental Layers
- Value Allocation

SolVES.gdb
Methods (Gathering Social Data)

- Survey designed to gather social data from MFSR user subgroups
- Three subgroups to which survey was administered:
  - Commercial Guides
  - Commercial Guests
  - Private Boaters
“VISITOR VALUES AND PREFERENCES RELATING TO THE WILD AND SCENIC MIDDLE FORK OF THE SALMON RIVER, IDAHO”

-Survey Used-

Section 1
User Demographics:
- Age
- Familiarity with Area
- Type of Use (Subgroup)

Section 2
Value Allocation:
- 100 Value points divided amongst 12 landscape values

Section 3
Spatially Locating Survey Points:
- Identifying locations along the MFSR which embody landscape values
### Value Typology

<table>
<thead>
<tr>
<th>Social Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetic</td>
</tr>
<tr>
<td>Biological Diversity</td>
</tr>
<tr>
<td>Cultural</td>
</tr>
<tr>
<td>Economic</td>
</tr>
<tr>
<td>Future</td>
</tr>
<tr>
<td>Historic</td>
</tr>
<tr>
<td>Intrinsic</td>
</tr>
<tr>
<td>Learning</td>
</tr>
<tr>
<td>Life Sustaining</td>
</tr>
<tr>
<td>Recreation</td>
</tr>
<tr>
<td>Spiritual</td>
</tr>
<tr>
<td>Therapeutic</td>
</tr>
</tbody>
</table>

### Value Point Allocation

- Participants were asked to attribute 100 ‘Value Points’ across the 12 landscape values.
  - More points = More Value
  - Less points = Less Value
  - No points = No Perceived Value
Methods (Spatial Location of Survey Points)

- Name or describe locations along the Middle Fork of the Salmon that embody the landscape values.
- Use common location names or nearness to such places based on commonly used guidebooks.
- Example: Redside Rapid (Aesthetic, Spiritual)
Survey Points
## Methods (Survey Administration)

<table>
<thead>
<tr>
<th>Physical Distribution</th>
<th>Email Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>(n = 31)</em></td>
<td><em>(n = 60)</em></td>
</tr>
<tr>
<td>• Physical copies of survey given to MFSR users at Cache Bar (the take out area of the river, common terminus of river trips)</td>
<td>• Identical survey was sent via email and results anonymously returned to a database created by Formsite.com with unique numerical identifiers for each response.</td>
</tr>
<tr>
<td>• Returned to researcher via mail back response</td>
<td></td>
</tr>
</tbody>
</table>
Survey Results

- 213 Surveys administered during lottery season (June 2016 – September 2016)
- 0 Participation refusals
- 91 Completed surveys (42.75% response rate)
- Spatially relevant survey responses described below:

<table>
<thead>
<tr>
<th>User Subgroups</th>
<th>Viable Spatial Data in Relation to Value Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Users</td>
<td>7 responses (26.9% of Viable Survey Data)</td>
</tr>
<tr>
<td>Commercial Guests</td>
<td>4 responses (15.38% of Viable Survey Data)</td>
</tr>
<tr>
<td>Commercial Guide</td>
<td>15 responses (57.69% of Viable Survey Data)</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>26 (28.57% of Completed Total Surveys)</strong></td>
</tr>
</tbody>
</table>
Note on Survey Response

- Responses to survey (n = 91) resulted in two types of value allocation.
- 59 Respondents allocated 100 points across the 12 landscape values.
- Examples:
  - 30 – Aesthetic
  - 40 – Spiritual
  - 30 – Therapeutic
  - = 100 points total

- 32 Respondents allocated 100 points to each of the landscape values.
- Examples:
  - 95 – Aesthetic
  - 55 – Biological Diversity
  - 60 – Cultural
  - Etc....
  - = >100 points total

These points were normalized.
### Accounting for Difference
- Normalized Values represent percent of total allocated points.

<table>
<thead>
<tr>
<th>Before: Aesthetic</th>
<th>After: Aesthetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>8.995</td>
</tr>
</tbody>
</table>

### Testing for Difference
- Permutation test (10,000 iterations) was conducted to assess difference in response
  - $p = 0.0651$
  - Possible difference in response but not convincing
Below are the raster layers used as landscape metrics in the *SolVES* analysis.

<table>
<thead>
<tr>
<th>Environmental Variable Abbreviation</th>
<th>Name of Environmental Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTRAPIDS</td>
<td>Distance to Rapids</td>
</tr>
<tr>
<td>DTRIVER</td>
<td>Distance to River</td>
</tr>
<tr>
<td>DTRTRAIL</td>
<td>Distance to River Trail</td>
</tr>
<tr>
<td>MF_DEM1</td>
<td>Elevation</td>
</tr>
<tr>
<td>MFSR_HILLSHADE</td>
<td>Hill Shade</td>
</tr>
<tr>
<td>MFSR_SLOPE</td>
<td>Slope</td>
</tr>
</tbody>
</table>

**Description**

- *(DTRAPIDS)* The measured meter distance to rapids within the river corridor.
- *(DTRIVER)* The measured meter distance to the Middle Fork of the Salmon River.
- *(DTRTRAIL)* The measured meter distance to the river trail that follows ~78 miles of the Middle Fork.
- *(MF_DEM1)* Elevation of the River Corridor measured in meters.
- *(MFSR_HILLSHADE)* A model layer depicting hill shade based on azimuth and altitude of the sun.
- *(MFSR_SLOPE)* The measure of degrees of slope along the Middle Fork.
# Environmental Layer Contribution Example

<table>
<thead>
<tr>
<th>Variable</th>
<th>Percent contribution</th>
<th>Permutation importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>dtriver</td>
<td>80.5</td>
<td>89.7</td>
</tr>
<tr>
<td>dtrapids</td>
<td>10.7</td>
<td>0.4</td>
</tr>
<tr>
<td>dtrtrail</td>
<td>5.2</td>
<td>3.7</td>
</tr>
<tr>
<td>mf_dem1</td>
<td>3.3</td>
<td>5.4</td>
</tr>
<tr>
<td>mfsr_slope</td>
<td>0.3</td>
<td>0.8</td>
</tr>
</tbody>
</table>
Data Entered Into SolVES for MFSR Project
## Social Value Models (Goodness of Fit)

<table>
<thead>
<tr>
<th>Value Model</th>
<th>Training AUC</th>
<th>Test AUC</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetic_value_A</td>
<td>0.9902</td>
<td>0.99</td>
<td>Potential model for value transfer</td>
</tr>
<tr>
<td>Biological_diversity_value_B</td>
<td>0.986</td>
<td>0.9954</td>
<td>Potential model for value transfer</td>
</tr>
<tr>
<td>Cultural_value_C</td>
<td>0.9887</td>
<td>0.9946</td>
<td>Potential model for value transfer</td>
</tr>
<tr>
<td>Economic_value_E</td>
<td>0.9912</td>
<td>0.9907</td>
<td>Potential model for value transfer</td>
</tr>
<tr>
<td>Future_value_F</td>
<td>0.9891</td>
<td>0.9472</td>
<td>Potential model for value transfer</td>
</tr>
<tr>
<td>Historic_value_H</td>
<td>0.9915</td>
<td>0.9917</td>
<td>Potential model for value transfer</td>
</tr>
<tr>
<td>Intrinsic_value_I</td>
<td>0.9886</td>
<td>0.983</td>
<td>Potential model for value transfer</td>
</tr>
<tr>
<td>Learning_value_L</td>
<td>0.9882</td>
<td>0.9893</td>
<td>Potential model for value transfer</td>
</tr>
<tr>
<td>Life_Sustaining_value_LS</td>
<td>0.9886</td>
<td>0.9595</td>
<td>Potential model for value transfer</td>
</tr>
<tr>
<td>Recreation_value_R</td>
<td>0.9893</td>
<td>0.9828</td>
<td>Potential model for value transfer</td>
</tr>
<tr>
<td>Spiritual_value_S</td>
<td>0.9887</td>
<td>0.9872</td>
<td>Potential model for value transfer</td>
</tr>
<tr>
<td>Therapeutic_value_T</td>
<td>0.9895</td>
<td>0.9757</td>
<td>Potential model for value transfer</td>
</tr>
</tbody>
</table>
Middle Fork of the Salmon River Social Values
All Surveys
Aesthetic_value_A

Aesthetic_value_A
Training AUC = 0.9902
Acceptable model for study area
Test AUC = 0.99
Potential model for value transfer

Refer to the relevant environmental dataset for a description of the categories indicated by the numeric values displayed on the x-axis of any categorical data graphs.
**SolvES Results (Detail)**

Legend:
- 2015 Chinook Salmon Redds
- Campsites

Frisse/Cole Class:
1 - Site is Natural
2 - Slight Damage
3 - Veg. Loss, Damaged
4 - Well Worn, Bare Soil
5 - Soil Erosion, Extensive Human Damage

Aggregate Social Value Index:
- 7.89668
- 6.9096
- 5.92251
- 4.93543
- 3.94834
- 2.96126
- 1.97417
- 0.987085
- 3.46399e-011

Map showing locations:
- Marble Creek Left (Class 4)
- Marble Creek Right (Class 4)
- Little Soldier (Class 4)
- Lost Oak (Class 3)
Are there correlations between campsite impacts and social values?

- YES and NO
- Strongest: Intrinsic
- Weakest: Therapeutic

<table>
<thead>
<tr>
<th>Value Type</th>
<th>Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetic</td>
<td>0.00140838</td>
</tr>
<tr>
<td>Biological Diversity</td>
<td>0.055591472</td>
</tr>
<tr>
<td>Cultural</td>
<td>0.065693902</td>
</tr>
<tr>
<td>Economic</td>
<td>-0.091063699</td>
</tr>
<tr>
<td>Future</td>
<td>0.147506669</td>
</tr>
<tr>
<td>Historic</td>
<td>0.036556628</td>
</tr>
<tr>
<td>Intrinsic</td>
<td>0.211027503</td>
</tr>
<tr>
<td>Learning</td>
<td>-0.121011253</td>
</tr>
<tr>
<td>Life-Sustaining</td>
<td>-0.097580081</td>
</tr>
<tr>
<td>Recreation</td>
<td>0.019177324</td>
</tr>
<tr>
<td>Spiritual</td>
<td>-0.030817772</td>
</tr>
<tr>
<td>Therapeutic</td>
<td>-0.190051063</td>
</tr>
</tbody>
</table>
Conclusion

- Refine survey methods to account for response value allocation differences

- Explore differing user subgroups (ex. Shoshone/Bannock Tribes) for analysis of value along river corridor

- Work with land and river managers to prioritize landscape metrics for management concerns to correlate with SolVES social value intensity output for other wild river corridors
Questions?
References


• All Middle Fork photo credits: Skip Volpert, Idaho River Journeys