GIS and freshwater ecosystem services valuation under climate change and conservation

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Outline

- Introduction
- Study area and methods
- Results
- Discussion and conclusion
Introduction

- Direct and indirect benefits of freshwater ecosystem services (ES)

- Uncertainty from climate and anthropogenic changes

- Agricultural intensification and declining institutional interests in conservation
Study area and methods

- Portneuf river catchment as an agricultural semi-arid basin
- High in CRP enrollment
- River listed as impaired under the federal Clean Water Act
CRP enrollments

Climate change

Water ES modeling
- Water yield
- Water purification
- Sediment retention

InVEST
integrated valuation of ecosystem services and tradeoffs

Scenario building

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Climate data</th>
<th>Enrollment acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRP Benchmark</td>
<td>1986-2015</td>
<td>92,217</td>
</tr>
<tr>
<td>CRP Loss</td>
<td>2036-2065</td>
<td>38,261</td>
</tr>
<tr>
<td>CRP Decline</td>
<td>2036-2065</td>
<td>65,239</td>
</tr>
<tr>
<td>CRP Baseline</td>
<td>2036-2065</td>
<td>same as benchmark</td>
</tr>
<tr>
<td>CRP Reboost</td>
<td>2036-2065</td>
<td>118,700</td>
</tr>
<tr>
<td>CRP Reboost+</td>
<td>2036-2065</td>
<td>122,895</td>
</tr>
</tbody>
</table>

ES response

Catchment level
Instream indicator
Spatial variation

Implications for mitigating degradation
Scenario generator
- Five land use scenarios
- 100 possible climate and land scenarios

API
- 20 CMIP5 climate models
- Three types of freshwater ES

InVEST
integrates valuation of ecosystem services and tradeoffs

Spatially explicit valuation of ES
Results

- Spatial variation
  - Mountainous areas as “water towers”
  - Less water scarcity along the matrix diagonal.
  - Marsh Creek region sensitive to stressors.
Results

- Spatial variation
  - High export associated with intensive agricultural practice.

- Change of rainfall erosivity due to climate change.

- Difference between the exploitation or conservation land use policy.
Discussion and conclusion

- Implications for land use management and conservation planning
  - Solve the water scarcity problem
  - Improve water-use efficiency
  - Marsh Creek region with priority
  - Riparian conservation as a high benefit-cost ratio practice

![Water yield comparison chart]

- CRP Reboost (128.8% of baseline)
- CRP Reboost+ (133.3% of baseline)
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Thank you!

Questions?

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