Measuring and quantifying the ecosystem service values of conservation investments on western rangelands

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RANGELAND’S CAPITAL:
THE BENEFITS OF ECOSYSTEM SERVICES

NATURAL CAPITAL
Healthy rangelands contain native grasses and shrubs.

ECOSYSTEM FUNCTION
Plant roots can trap, slow, and filter rainwater and runoff, improving the water quality of nearby streams and rivers.

ECOSYSTEM GOODS + SERVICES
Cleaner water benefits people living downstream that may use it as a source for drinking water, irrigation, or industrial uses.
RANGELAND’S CAPITAL: THE BENEFITS OF ECOSYSTEM SERVICES

- Ecosystem services provide market and non-market benefits
- Non-market benefits are hard to value, and often left out of reporting... they are effectively valued at $0
- Rangelands provide these services, but conservation success is reported in acres treated or number of practices applied
**PROJECT SUMMARY**

- **Vision:** Build a framework federal agencies can use that adds ecosystem service values into rangeland decision-making processes.

- **Goals:**
  - Report conservation outcomes in ways the general public values at scale.
  - Provide broad sense of non-market economic benefits from conservation investments.
  - Identify existing science gaps and research priorities.
PROJECT CONSTRAINTS

- Limited data on practice applications
- Some data suppressed for confidentiality
- Results should be timely
- Produce consistent and repeatable analysis
PROJECT CONSTRAINTS

- Should use data agencies already collect, but there is limited data on practice applications
- Some data suppressed for confidentiality
- Results should be timely
- Produce consistent and repeatable analysis

Use secondary analysis:
- available Agency-collected data
- Scientific literature reviews
STUDY AREA

• Land Resource Region D
• 351 million acres
• 11 states
• 23 MLRAs
• Non-federal rangeland and BLM
**ACTION**
What actions are being done to the system?

**BASELINE**
Where are we starting?

**AFFECTED AREA**
What is being affected by the action?

**EFFECT SIZE**
How big is that effect?

**BENEFITS**
How do conservation practices benefit communities, the environment, and producers?
NRCS Contracts certified from 2011-2020
BLM Land Treatment Digital Library from 2016-2020
Practices: Brush Management, Prescribed Grazing, Herbaceous Weed Treatment
Land Use: Rangeland
Rangeland types

Rangeland health attributes

Unit values of ecosystem services
<table>
<thead>
<tr>
<th>Landcover</th>
<th>Study Area</th>
<th>Non-Federal Land</th>
<th>BLM Land</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>millions of acres</td>
<td>(percent of acres)</td>
<td></td>
</tr>
<tr>
<td>Forest</td>
<td>4.5</td>
<td>3.2</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>(2%)</td>
<td>(4%)</td>
<td>(1%)</td>
</tr>
<tr>
<td>Grassland</td>
<td>27.9</td>
<td>13.7</td>
<td>14.1</td>
</tr>
<tr>
<td></td>
<td>(15%)</td>
<td>(15%)</td>
<td>(14%)</td>
</tr>
<tr>
<td>Shrubland</td>
<td>160.5</td>
<td>72.7</td>
<td>87.9</td>
</tr>
<tr>
<td></td>
<td>(83%)</td>
<td>(81%)</td>
<td>(85%)</td>
</tr>
<tr>
<td>Total</td>
<td>192.9</td>
<td>89.6</td>
<td>103.4</td>
</tr>
<tr>
<td></td>
<td>(100%)</td>
<td>(100%)</td>
<td>(100%)</td>
</tr>
</tbody>
</table>
National Resources Inventory

Assessment, Inventory, and Monitoring data

Graphs showing index scores for Non-Federal Rangeland and BLM-Managed Rangeland, with categories for Soil and Site Stability, Hydrologic Function, and Biotic Integrity.
• We know:
  • Acres treated
  • MLRA
• Review published literature on the effects of conservation practices
• Link effects to rangeland health index categories
Effects of Practices on Health Indices

Solid green = values used in report
Dashed = mean
Dotted = median
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VALUING ECOSYSTEM SERVICES

• Benefit transfer methods (BTM): applies values estimated for one site to a different site
• Provides rapid analysis when primary site data doesn’t exist
• More literature reviews!
<table>
<thead>
<tr>
<th>ECOSYSTEM SERVICES VALUED IN THIS STUDY</th>
<th>FOREST</th>
<th>GRASSLAND</th>
<th>SHRUBLAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetics</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Air quality</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Biological control</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Carbon sequestration</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Fire risk reduction</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Forage production</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Habitat</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recreation</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Social</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil fertility</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil retention</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste treatment</td>
<td>●</td>
<td></td>
<td></td>
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<tr>
<td>Water supply</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
</tbody>
</table>

![Graphs showing the valuation of ecosystem services in Forest, Grassland, and Shrubland]
• Expect ability of rangelands to provide ES to decline with health

• Discount ecosystem service values by range health index (Aplet et al., 2000; Esposito et al., 2011; Phillips & McGee, 2014)

• Assumes $ values are for "healthy" locations

• Assumed linear response of health and valuation effects from practices
Acres of land cover type \( x \)

Index of rangeland health \( x \)

Percent change in health index \( x \)

\$/acre/year ecosystem service values =

\$/year changes to ecosystem service values

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<tbody>
<tr>
<td>• $13.1 million/year in Financial Assistance</td>
<td>• 105 treatments/year</td>
</tr>
<tr>
<td>• 795 contracts/year</td>
<td>• 83 thousand acres treated per year (~0.07%)</td>
</tr>
<tr>
<td>• 1.7 million acres treated per year (~1.8%)</td>
<td>• Increase in ESV of $6M - $9M/year</td>
</tr>
<tr>
<td>• <em>Increase in ESV of $8M - $21M/year</em></td>
<td>• $30 - $55/acre treated over 5 years</td>
</tr>
<tr>
<td>• $25 - $75/acre treated over 5 years</td>
<td></td>
</tr>
</tbody>
</table>
TAKE-AWAYS

• Federal agencies are called to incorporate the values of ecosystem services more and more

• Including ecosystem services value into conservation planning efforts communicates the cost-effectiveness of rangeland conservation and the off-site benefits to the public.

• Estimated scale of benefits of rangeland conservation: at least as much as NRCS spends in Financial Assistance—tens of millions annually

• There are many gaps in the literature that can be filled to improve secondary analysis of benefits at-scale
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Interactive summary & PDF report:
www.eartheconomics.org/conservation-and-communities