Riparian Wetland Response to Livestock Exclusion in the Lower Columbia River Basin (LCRB)
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Background

- Lower Columbia River Basin
  - Riparian Restoration
  - Endangered Salmon
  - Land Use and Restoration
- Livestock Grazing
  - Intensive Riparian Use
  - Exclusion = Passive Restoration
- Invasive Plants
  - Reed Canarygrass (RCG) *Phalaris arundinacea* L.

Factors Involved In Determining Livestock Grazing Impacts on Riparian Wetlands In the LCRB

Local Environment
- Climate
- Hydrology
- Soils
- Topography
- Vegetation

Livestock Grazing
- Stocking Density
- Time of Grazing
- Duration of Grazing
- Livestock Type (Vegetation Preference)

Degree of Disturbance
- Soil Compaction
- Decreased Infiltration
- Biomass Removal
- Plant Damage (Trampling)
- Erosion
- Nutrient Input-Removal

Riparian Wetland

Plant Species Composition
- Species Richness:
  - Native vs. Non-Native & Invasive
- % Cover

Water Quality
- Sediment, Nutrients

Hydrology-Soils
- Bulk Density
- Infiltration
- Nutrient Cycling

Topography
- Erosion

Riparian Wetland Ecological Health, Habitat Quality

Citations: See References
RCG - Livestock Forage

- RCG has been planted for livestock forage production

- Livestock successfully feed on RCG throughout the growing season and prefer young RCG stands and re-growth (Decker et al. 1969).
Objectives

Evaluate Grazing vs Excluded Riparian Wetlands

- Examine riparian plant communities and soil characteristics along a succession gradient of livestock exclusion.
- Determine plant species richness and dominance
Hypotheses

- Grazed riparian wetlands will have higher native and non-native species richness than excluded wetlands.
  - RCG will be the dominant non-native species within the excluded wetlands.
Site Locations
Lower Columbia River Basin
Oregon, USA

- Current Grazing (CG)
  State Land, Historic and Current Grazing

- Short-term Exclusion (STE)
  Hogan Ranch, 3 Years Exclusion

- Long-term Exclusion (LTE)
  Metro Multnomah Wetland, 13 Years Exclusion
Study Sites: Grazed Site

- Currently and Historically Grazed
- Heavy Grazing Utilization > 1200 AMU
  May - October
Current Grazing Site
Oregon Park and Recreation State Lands

September 2009
Study Sites: Short-term Exclusion (STE)

- Historically Grazed
- 3 Years of Livestock Exclusion
Short-term Exclusion Site, 3 Years
Hogan Ranch Boundary Wetland

August 2009
Study Sites: Long-term Exclusion (LTE)

- Historically Grazed
- 13 Years of Livestock Exclusion
Methods

Sample Site Selection

- 6 (60-45 meter) transects placed randomly with in each site

Parameters Measured

- Soil Survey
- LiDAR Elevation Data
- Vegetation Survey
Soil Survey

- **Soil Surface Bulk Density (g/cm³)**
  - Using a soil corer of known volume, calculated as soil dry weight (g) divided by total core volume (cm³)

- **Soil Texture Analysis**
  - Dry Sieving and Hydrometer to determine % Gravel, Sand, Silt and Clay

- **Soil % Organic Matter**
  - Loss-on-ignition

(Kalra and Maynard 1991)
Vegetation Survey

- **Line Intercept Method** (Brower et al. 1997, Jerkins et al. 2008)
  - Plant Cover for Each Species
  - Every 10cm (1dm)

- **Native, Non-Native Veg. Data:**
  - Species richness (Ludwig and Renolds 1988, Chaneton and Facelli 1991)
  - Relative cover
  - Diversity: Shannon’s Index (H’) (Pielou 1975)
Preliminary Results: Soil Survey

- **Bulk Density** \((g/cm^3)\)
  - Similar Between all Sites

- **Soil Texture Analysis**
  - Clay Loam for all sites

- **% Organic Matter (OM)**
  - Grazed site had a higher OM content than the exclusion sites
Preliminary Results

Vegetation Survey: Species Richness

Site Vegetation Species Richness
Summarized from Transect Data

<table>
<thead>
<tr>
<th>Study Sites</th>
<th>Total Species Richness</th>
<th>Non-Native</th>
<th>Native</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Grazing (CG)</td>
<td>44</td>
<td>25</td>
<td>17</td>
</tr>
<tr>
<td>3 Years Exclusion (STE)</td>
<td>24</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>13 Years Exclusion (LTE)</td>
<td>20</td>
<td>9</td>
<td>11</td>
</tr>
</tbody>
</table>

* Indicates significant difference (p-value<0.05) between sites, Kruskal-Wallis and Wilcoxon Rank Sum Test
Preliminary Results
Vegetation Survey: Relative Cover

### Current Grazing Site
**Top 5 Species by Average % Cover**

<table>
<thead>
<tr>
<th>Plant Species</th>
<th>Average % Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reed canarygrass</td>
<td>53</td>
</tr>
<tr>
<td>Water purslane</td>
<td>15</td>
</tr>
<tr>
<td>Mixed fescues</td>
<td>11</td>
</tr>
<tr>
<td>Water pepper</td>
<td>6.4</td>
</tr>
<tr>
<td>Moneywort</td>
<td>2.4</td>
</tr>
</tbody>
</table>

### Short-term Exclusion Site
**Top 5 Species by Average % Cover**

<table>
<thead>
<tr>
<th>Plant Species</th>
<th>Average % Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reed canarygrass</td>
<td>43</td>
</tr>
<tr>
<td>Wapato</td>
<td>31</td>
</tr>
<tr>
<td>Creeping spike rush</td>
<td>14</td>
</tr>
<tr>
<td>Moneywort</td>
<td>2.9</td>
</tr>
<tr>
<td>Yellow pond lily</td>
<td>2.6</td>
</tr>
</tbody>
</table>

### Long-term Exclusion Site
**Top 5 Species by Average % Cover**

<table>
<thead>
<tr>
<th>Plant Species</th>
<th>Average % Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reed canarygrass</td>
<td>95</td>
</tr>
<tr>
<td>Bulrush</td>
<td>2.9</td>
</tr>
<tr>
<td>Pacific willow</td>
<td>0.5</td>
</tr>
<tr>
<td>Water purslane</td>
<td>0.5</td>
</tr>
<tr>
<td>Barnyard grass</td>
<td>0.4</td>
</tr>
</tbody>
</table>
Preliminary Results
Vegetation Survey: Relative Cover

Boxplot of % Reed Canarygrass Cover

% Reed Canarygrass
0  20  40  60  80  100
Research Sites
CG  STE  LTE

Expected Results
Preliminary Results
Vegetation Survey: Diversity

Boxplot of Shannon Diversity Index by Site

Shannon Diversity Index

CG
STE
LTE

Research Sites
Conclusions

- More native and non-native species were found in the grazed site than the excluded sites.
- Reed canarygrass was the dominant species for all of the wetland sites.
- The grazed and short-term exclusion wetlands had similar Diversity and RCG cover.
Why is this important?

Hogan Ranch and Adjacent State Lands

No Grazing

Grazing
Future Restoration Projects

It is possible that the impacts of cattle grazing in the riparian wetlands of the LCRB may decrease the abundance of RCG and increase riparian vegetation diversity and habitat quality (Zedler 2000, Tesauro 2001).
Thank you! Questions?

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