Evaluation of the Benewah Creek Restoration Project

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Benewah Creek Restoration Evaluation

- Benewah Creek Long-term Goals

- Summer 2007 Monitoring Project
  - Stream Temperature Patterns
  - Macroinvertebrate Communities
  - Trout Populations
    - Snorkeling
    - Electroshocking

- Conclusions
Benewah Creek

- Splash Dam, Logging, and Grazing
- Physical stream degradation
- Non-native brook trout (*S. fontinalis*)
- Coeur D’Alene Tribe Fisheries Program
- 3.2 miles of stream restoration

Overall Goal: Holistic revival
westslope cutthroat trout (*O. clarki lewisi*)
Other Monitoring Methods

- Habitat quality and physical changes measurements
- Temperature patterns
- *O. clarki lewisi* population assessments
Summer 2007 Project Goals

- University of Idaho - NSF REU

- Evaluate biological response of restoration efforts
  - Stream temperature patterns
  - Macroinvertebrate communities
  - Fish density and trout populations

- Provide baseline data for index sites
- Present methods for monitoring
Specific Study Sites

- Completed restoration sections for 2005 and 2006
- Started restoration section for 2007

- Monitoring Sites 2007
  - Restored 2005
  - Restored 2006
  - Un-restored 2007
  - Highly Disturbed Reference - Meadow
  - Minimally Disturbed Reference - Pristine
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Stream Temperature

- **Temporal temperature patterns**
  - Five Hobo Temperature Sensors
  - Air temperature
  - Every hour from 18 June to 20 July 2007

- **Spatial temperature patterns**
  - Temperature probe
  - 19 June 2007
Temporal Steam Temperature Pattern

Date and Time

R2005
R2006
Meadow
Site 17
Pristine
Temporal Air Temperature Pattern
Temperature (°C) from 19 June 2007

<table>
<thead>
<tr>
<th>Temp</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>orange</td>
</tr>
<tr>
<td>1.0</td>
<td>yellow</td>
</tr>
<tr>
<td>2.0</td>
<td>green</td>
</tr>
<tr>
<td>3.0</td>
<td>cyan</td>
</tr>
<tr>
<td>4.0</td>
<td>blue</td>
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<td>7.0</td>
<td>pink</td>
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<td>yellow</td>
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<td>15.0</td>
<td>pink</td>
</tr>
<tr>
<td>16.0</td>
<td>red</td>
</tr>
</tbody>
</table>

Spatial Temperature Pattern
Stream Temperature Results

- Same stream = same temperature patterns
- Diurnal Cycle: 5 – 10°C variation
- Substantial variation moving downstream
  - More than just air temperature
  - Differences in riparian cover
  - Water depth, flow levels, and groundwater interaction
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Macroinvertebrates

- 20 samples from 5 different stream reaches
  - Two pools and two riffles
- 3-minute kicks with a d-net
- Samples sorted and identified to family
Abundance of Macroinvertebrates

Stream Section (Downstream to Upstream)
Richness of Macroinvertebrates

Stream Section (downstream to upstream):
- R2005
- R2006
- UR2007
- Meadow
- Pristine

The graph shows the richness of macroinvertebrates across different stream sections from 2005 to 2007, with the Pristine section having the highest richness.
Macroinvertebrates Diversity and Evenness

Shannon Diversity

Evenness

R2005 R2006 UR2007 Meadow Pristine

Section (downstream to upstream)
Macroinvertebrates Results

- Pristine section has the greatest abundance, richness, and diversity values
- Restored and degraded sections have lower and similar values
- Upstream restoration impacts downstream communities
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Fish: Snorkeling

- R-2005, R-2006, Meadow, and Pristine reaches
- Overlaps with macroinvertebrate sampling
- Estimates population size and interaction
- Counting and identification of all fish seen
## Snorkeling Density and Population

<table>
<thead>
<tr>
<th>Section</th>
<th>R2005</th>
<th>R2006</th>
<th>Meadow</th>
<th>Pristine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>555.3 m²</td>
<td>743.6 m²</td>
<td>177.1 m²</td>
<td>226.1 m²</td>
</tr>
<tr>
<td>Cutthroat Trout</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>27</td>
</tr>
<tr>
<td>Brook Trout</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
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<tr>
<td>Non-salmonid</td>
<td>332</td>
<td>0.71</td>
<td>550.0</td>
<td>0.74</td>
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<tr>
<td>Total</td>
<td>332</td>
<td>0.71</td>
<td>550.0</td>
<td>0.74</td>
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<tr>
<td>% Density of Salmonids ***</td>
<td>0</td>
<td>0</td>
<td>7.3</td>
<td>75</td>
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<tr>
<td>% Density of Cutthroat</td>
<td>0</td>
<td>0</td>
<td>3.6</td>
<td>75</td>
</tr>
<tr>
<td>% Density of Non Trout</td>
<td>100</td>
<td>100</td>
<td>92.7</td>
<td>25</td>
</tr>
</tbody>
</table>
Fish: Electroshocking

- Three pass electroshocking
- All surfaced fish collected and counted
- WCT and BT were weighed and measured
- Brook trout were exterminated
## Electroshocking Density and Population

<table>
<thead>
<tr>
<th></th>
<th>R-2005</th>
<th>R-2006</th>
<th>Meadow</th>
<th>Pristine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Area</strong></td>
<td>555.3 m²</td>
<td>743.6 m²</td>
<td>177.1 m²</td>
<td>226.1 m²</td>
</tr>
<tr>
<td><strong>Fish</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Count</td>
<td>Density</td>
<td>Count</td>
<td>Density</td>
</tr>
<tr>
<td>Sculpin</td>
<td>13</td>
<td>0.023</td>
<td>1</td>
<td>0.001</td>
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<tr>
<td>Longscale Sucker</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0.004</td>
</tr>
<tr>
<td>Red Sided Shiner</td>
<td>55</td>
<td>0.099</td>
<td>9</td>
<td>0.012</td>
</tr>
<tr>
<td>Longnose Dace</td>
<td>1</td>
<td>0.002</td>
<td>1</td>
<td>0.001</td>
</tr>
<tr>
<td>Brook Trout</td>
<td>1</td>
<td>0.002</td>
<td>3</td>
<td>0.004</td>
</tr>
<tr>
<td>Cutthroat Trout</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>70</td>
<td>0.126</td>
<td>17</td>
<td>0.022</td>
</tr>
<tr>
<td>% Density of Salmonids ***</td>
<td>1.6</td>
<td>18.2</td>
<td>14.9</td>
<td>59.4</td>
</tr>
<tr>
<td>% Density of Cutthroat</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>16.7</td>
</tr>
<tr>
<td>% Density of Non Trout</td>
<td>98.4</td>
<td>81.8</td>
<td>85.1</td>
<td>23.9</td>
</tr>
</tbody>
</table>
Fish Results

- Pristine significantly showed highest percent density of salmonids
  - Cutthroats only seen in the pristine section
  - Increased trout density in the pristine

- Snorkeling and electroshocking give similar trends
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Conclusions

- Restoration affects stream temperature
- Pristine trended to higher abundance, richness, and diversity of macroinvertebrate communities
- Restoration limiting trout habitat
  - Pristine contains physical and biological factors to provide cutthroat trout habitat
Discussion

- Trends in stream condition post-restoration not as strong as expected
- Pristine sections still best for WCT recovery
- Restored sections experience lasting restoration disturbances
- Restoration that has a shorter recovery time a better option than no intervention
Recommendations

- Analyze habitat qualities
- Measure flow, stream depth, and groundwater interaction
- Larger sample sizes
- Seasonal changes in macroinvertebrate and fish communities
- Fish growth and spawning locations
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Dr. Chris Peery  
Coeur d’Alene Tribe  
Fisheries Program  
Kal Johnson  
REU Students  

University of Idaho  
National Science Foundation  
RRNW for this opportunity