Role of storms and forestry practices in sedimentation in an Oregon Coast Range Lake

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Outline

• Background – lakes, climate, harvest
• Research questions
• Hypotheses
• Study site characteristics
• Approach
• Preliminary results
• Conclusions and future work
Start of WWII - 1939
Background

Timber harvest – Douglas Co., Oregon

Wheatcroft et al. 2013
Background

Timber harvest – Douglas Co., Oregon

1972: Oregon Forest Practices Act (OFPA)

Wheatcroft et al. 2013
Background

Wheatcroft et al. 2013

Source: Watershed Processes Group, OSU
Background

Wheatcroft et al. 2013

Source: Watershed Processes Group, OSU

Board Feet Harvested x 10^9

Cool-phase PDO

OFPA

Wheatcroft et al. 2013
1972: OFPA
From Poor to Best Management Practices (BMPs):
• Riparian buffers
• Better road construction
• Smaller parcels
• Lower-impact harvesting
• Slope & stability

Source: Alsea Watershed Study
<table>
<thead>
<tr>
<th>Research Questions for current work:</th>
</tr>
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<tbody>
<tr>
<td>What is the impact of historical (pre-OFPA) &amp; contemporary (post-OFPA) harvesting practices on lake sedimentation rate?</td>
</tr>
<tr>
<td>AND</td>
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<tr>
<td>Can we detect forestry practice changes in the lake sediment and if so, what is the effect?</td>
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</table>
Hypothesis

Sediment layer thickness decreases after OFPA

- less impact to land
- better buffers

Pre-OFPA

OFPA(1972)

Post-OFPA
Hypothesis

Sediment thickness post-OFPA:

Low precip:
  less sediment thickness
Extreme precip:
  BMPs break down
Study site

Loon Lake Catchment Study site

Source: PRISM

<table>
<thead>
<tr>
<th>Loon Lake Characteristics</th>
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<td>Catchment area</td>
<td>230 km²</td>
</tr>
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<td>Lake area</td>
<td>1.19 km²</td>
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<td><strong>Land ownership</strong></td>
<td>Private – 74%</td>
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<td>Tyee sandstone</td>
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<td>Precipitation range, annual</td>
<td>1700-2400 mm</td>
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</table>

Cohen et al. 2002

Loon Lake

Source: PRISM

Cohen et al. 2002

Harvest 1972-1995

Elevation

- Harvest 1972-1995
- 795 m
- 120 m
## Study site

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Approach
• Coring
• Chronology
  – $^{137}\text{Cs}$ peak 1963
  – Annual layers (varve counting)
• Layer thickness
• Precipitation/discharge
  - nearby gaging station
• Particle size analysis
• Magnetic Susceptibility
Preliminary results: 

*Sediment thickness*

<table>
<thead>
<tr>
<th>Lamination thickness (cm)</th>
<th>Pre-OFPA n=35</th>
<th>Post-OFPA n=40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.01</td>
<td>0.75</td>
</tr>
<tr>
<td>Median</td>
<td>0.84</td>
<td>0.50</td>
</tr>
<tr>
<td>S.D.</td>
<td>0.94</td>
<td>0.95</td>
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- Suggestive evidence of reduction in sedimentation rates
- Two sample t-test, p = 0.07
- Climate not taken into account
Preliminary results: Magnetic Susceptibility

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<thead>
<tr>
<th>M.S. SI (x10^{-5})</th>
<th>Pre-OFPA n=48</th>
<th>Post-OFPA n=72</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>72.7</td>
<td>70.0</td>
</tr>
<tr>
<td>S.D.</td>
<td>13.4</td>
<td>16.5</td>
</tr>
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Two-sample t-test
P = 0.34
Preliminary results:

**Grain size**

<table>
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<tr>
<th>Median grain size (μm)</th>
<th>Pre-OFPA n=30</th>
<th>Post-OFPA n=33</th>
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<tbody>
<tr>
<td>Mean</td>
<td>7.28</td>
<td>6.97</td>
</tr>
<tr>
<td>S.D.</td>
<td>2.04</td>
<td>1.29</td>
</tr>
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Two-sample t-test, p=0.25

Overall mean = 7.12 μm
Preliminary conclusions

• Sedimentary archive is useful for identifying and investigating events in the catchment.
  - Use to identify time and distinguish large events
  - Grain size distribution is different pre- and post-OFPA, but no significant difference in means of grain size median and magnetic susceptibility

• There is suggestive evidence that overall lamination thickness declines after Oregon Forest Practices Act (OFPA).
Future Work

1. Further vet climate data
2. Examine storm layers/extreme magnitude events
3. Quantify harvest pressure in the catchment
4. Investigate sediment source/transport processes
   - C, N, stable isotopes, and biomarkers
Other preliminary results:

*Sediment thickness*
Questions?

Contact Kris Richardson, richakri@onid.orst.edu

Sandstone boulders viewed upstream, downstream at Loon Lake outlet falls