Fire History in the Strait of Georgia Lowlands

Sinead Murphy (SFU Master’s Candidate), Dr. Marlow Pellatt, and Dr. Karen Kohfeld

Geological Society of America (GSA) Annual Conference – October 20th 2014
Key Points

• **Fire suppression** = wildfire damage & hinders natural processes

• **Prescribed fire** to reduce fuel loads & restore vegetation

• Effective fire-based, ecological restoration requires **fire history**
  – Mean Fire Return Interval (MFRI)

• **Straight of Georgia lowlands** → 330 yr MFRI

• **MFRI influenced by:**
  – Temporal scale
  – Methodology
  – Local site factors
What is Fire History? Why is it Useful?

- Describes variability of fire disturbances over time
  - MFRI = average number of years between fires
- 1. Restoration direction & baselines
- 2. Role of humans & climate in shaping fire regimes
- 3. Public awareness to reduce resistance to active management

Short timescales | Long timescales
Why is this Study Area Interesting?

- **Ecopprovince**
  - Highly populated
  - Biodiverse
  - Ecosystem degradation
- **Fire history informs restoration**
  - Somenos Lake

![Map of British Columbia with Strait of Georgia Lowlands highlighted.](image)
History of Somenos Lake

Core 5 Core 4 Core 3 Core 2 Core 1

Mazama Unconformity
Dating the Core

- Age-depth model constructed with 12 $^{210}$Pb, two $^{14}$C, & the Mazama tephra
Charcoal Accumulation Rate (CHAR)

- Charcoal extraction (1 cm³ subsample of each 1 cm of core)
- \([\text{Charcoal}] = \# \text{ charcoal particles} \div \text{ volume}\)
- \(\text{CHAR} = [\text{Charcoal}] \times \text{Sediment Accumulation Rate (SAR)}\)
- CharAnalysis software models background and noise charcoal
Fire History

Increased fire frequency

Increased fire magnitude

No observable changes during MWP & LIA
Global Climate and Human Influence

- Increased global temperature
- European colonization

Graph showing changes in CHAR over time (cal yr BP) with arrows indicating increased global temperature and European colonization.
Mean Fire Return Interval

- MFRI = 330 yrs (174–512)
Comparing MFRI with other Studies

- Somenos Lake → 330 yr MFRI (Murphy, 2014)
- Quamichan Lake → 27 yr MFRI (McCoy, 2006)
Why does MFRI vary?

1. Temporal scale

<table>
<thead>
<tr>
<th>Lake</th>
<th>Length of Record (yrs)</th>
<th>Bottom Age (cal yr BP)</th>
<th>Top Age (cal yr BP)</th>
<th>MFRI (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somenos</td>
<td>4960</td>
<td>4904</td>
<td>-63.5</td>
<td>330</td>
</tr>
<tr>
<td>Quamichan</td>
<td>250</td>
<td>196.5</td>
<td>-53.5</td>
<td>27</td>
</tr>
<tr>
<td>Somenos (Truncated)</td>
<td>322</td>
<td>259</td>
<td>-63.5</td>
<td>81</td>
</tr>
</tbody>
</table>

End of Quamichan record
Why does MFRI vary?

2. Methodology
- Sampling resolution & sediment accumulation rate (SAR)
- KOH breaks down ~ 12% more charcoal than $(\text{NaPO}_3)_6$

<table>
<thead>
<tr>
<th>Lake</th>
<th>Sample Resolution (cm)</th>
<th>Average SAR over Record (cm/yr)</th>
<th>Length of Record (yrs)</th>
<th>Extraction Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somenos</td>
<td>1</td>
<td>0.1</td>
<td>322</td>
<td>5% $(\text{NaPO}_3)_6$</td>
</tr>
<tr>
<td>Quamichan</td>
<td>1</td>
<td>0.5</td>
<td>250</td>
<td>30% KOH</td>
</tr>
</tbody>
</table>
Why does MFRI vary?

3. **Local site factors**
   - Stochastic ignitions, topography & fuel loads
   - Connectivity to low elevation, south facing slopes

<table>
<thead>
<tr>
<th>Lake</th>
<th>MFRI (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooley</td>
<td>273</td>
</tr>
<tr>
<td>Rockslide</td>
<td>118</td>
</tr>
</tbody>
</table>

(Gavin et al., 2006)
Implications for Restoration

1. Need multi-lake & -proxy analysis to verify MFRI
   - Chadsey lake
   - Utilize other fire history studies

2. MFRI provides context for choosing restoration goals & getting fire management programs off the ground
   - For long-term success, need to be flexible
Questions