ENVIROMENTAL IMPACTS AND SOIL

Dirt FOR SALE
(530) 662-6200
SHADES OF GRAY:
FUEL TREATMENTS AND SOILS
TOPICS FOR DISCUSSION

Mechanical thinning
• soil compaction
• is whole-tree harvesting ok?
• masticated fuels: a looming soils problem?

Fire
• The forest floor: fuel or soil organic matter?
• Pile burning is hot. But does it matter?

Cumulative effects
• what do we know?
We know how to compact a soil

- Harvest when soil is moist or wet
- Use heavy equipment
- Drive equipment on bare soil
- A few repeated passes

Knowledge gained has led to thinning contracts that include best management practices for soils
SOIL COMPACTION

Are soils universally damaged by compaction?

**Proposed R5 risk rating**

<table>
<thead>
<tr>
<th>Coarse Fragment Content by Volume*</th>
<th>Soil Texture</th>
<th>Hazard Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fragmental (&gt; 70%)</td>
<td>Any Texture</td>
<td>Low</td>
</tr>
<tr>
<td>Skeletal (35 - 70%)</td>
<td>(s, ls, sl**)</td>
<td>Low</td>
</tr>
<tr>
<td>Skeletal (35 - 70%)</td>
<td>Loamy (sl**, l, si, sil)</td>
<td>Moderate</td>
</tr>
<tr>
<td>Skeletal (35 - 70%)</td>
<td>Clayey (sc, sicl, scl, cl, sic, c)</td>
<td>High</td>
</tr>
<tr>
<td>&lt; 35%</td>
<td>(s, ls, sl**)</td>
<td>Low</td>
</tr>
<tr>
<td>&lt; 35%</td>
<td>Loamy (sl**, l)</td>
<td>Moderate</td>
</tr>
<tr>
<td>&lt; 35%</td>
<td>Silty (si, sil)</td>
<td>High</td>
</tr>
<tr>
<td>&lt; 35%</td>
<td>Clayey (sc, sicl, scl, cl, sic, c)</td>
<td>High</td>
</tr>
</tbody>
</table>
Is whole-tree harvesting ok?

- No, retain residues on site for soil quality purposes
- Yes, remove residues to lower fuel loading or for biomass use
Balance sheet approach

1. Select a forest type and condition:

2. Measure or estimate the N content of tree crowns: 87 kg/ha

3. Select a thinning regime, estimate N removal 49 kg/ha or 2% of ecosystem N

4. Estimate N replenishment from N deposition and N fixation:
Is whole-tree harvesting ok?

**Thinning residues**

- are not a major nutrient source (Janowiak and Webster 2010).
- exceptions to rule: aspen stands, serpentine soils, extremely infertile soil
- Avoid whole-tree harvesting on sites with high risk of physical disturbance
- Balance sheets!
Masticated fuels: a looming soils problem?

- Limited scientific knowledge
- Concerns for excessive soil heating and tree mortality if burned
- Unknown effects on soil nutrients, microclimate, C sequestration
- Soil compaction
Masticated fuels: a looming soils problem?

• Mulch layers are often surprisingly thin (Kane et al. 2009)

• Soil heating is a concern when burning heavy fuel loads only (Busse et al. 2010)

• Soil C, N, and microbial communities are unaffected (Busse et al. 2010)

• Changes in soil temperature and moisture are modest
Prescribed fire and soil

- Ephemeral changes in soil chemistry and biology

- Benign effects, except for severe burning

- Repeated treatment may be detrimental to forest floor nitrogen capital (Verburg 2009)
Pile burning is hot. But does it matter?

![Image of a pile burning]

![Graph showing temperature changes over time at different depths (0cm, 5cm, 10cm, 30cm)]
• What is the extent of ground coverage? Measure it!

• Nearby sensitive areas?

• Needs for re-treatment?
We need to recognize and account for:

- Past and present activity
- Predicted future activity (treatment effectiveness)
- Soil resilience on a site basis
- Unknowns - climate change, landuse, population demands

*Johnson et al. 1998*
Summary

• Soils are a piece of the puzzle

• Single-entry fuel treatments often yield shades-of-gray responses

• Exceptions to the rule exist

• Awareness and understanding of cumulative treatment effects is crucial