Douglas-fir plantation productivity: effects of organic matter retention, competing vegetation, and soil compaction

Investigators:

Tim Harrington and Connie Harrington, USDA Forest Service
Tom Terry, Weyerhaeuser Company
Rob Harrison, University of Washington
Stephen Schoenholtz, Virginia Tech
and those scientists in training...
Some of the participating organizations...
Study context: extending the LTSP network

Does manipulating organic matter, soil porosity, and the complexity of the plant community affect a forest site’s productive capacity?

Powers et al. 2004
Approach: compare productivity across a wide range of organic matter, vegetation, and soil treatments
## Site characteristics

<table>
<thead>
<tr>
<th></th>
<th>Fall River</th>
<th>Matlock</th>
<th>Molalla</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>soils</strong></td>
<td>silt loam</td>
<td>very gravelly loamy sand</td>
<td>cobbly loam</td>
</tr>
<tr>
<td><strong>rainfall</strong></td>
<td>90”</td>
<td>100”</td>
<td>70”</td>
</tr>
<tr>
<td><strong>site index</strong></td>
<td>138’</td>
<td>110’</td>
<td>120’</td>
</tr>
<tr>
<td><strong>planted</strong></td>
<td>2000</td>
<td>2004</td>
<td>2004</td>
</tr>
</tbody>
</table>

Grove soil series near Matlock
Precipitation and temperature differences

Fall River: coldest
Matlock: wettest
Molalla: warmest & driest
Dominant effect: competing vegetation

Competing vegetation effects

Organic matter retention effects
How does Douglas-fir development compare among sites?
Interacting effects of organic matter retention and competing vegetation

Individual-tree study
Soil water: primary driver of productivity

Direct relationship of diameter growth to soil water content at Fall River

Competing vegetation effects

Organic matter retention effects
Organic matter retention effects on competing vegetation: Reduced herb abundance

Individual-tree study: vegetation present
Nitrogen losses: small and short term

Soil water nitrate-N (60cm depth) by herbicide treatment and site

Competing vegetation effects

Organic matter retention effects
Soil compaction effects: small to non-detectable

Third-year size of Douglas-fir: differences not statistically significant
Soil microbial community responses: fate of carbon

Microbial respiration by woody-debris retention at Molalla

Organic matter retention effects

Microbial respiration by herbicide treatment at Molalla

Competing vegetation effects
The Next Steps

• linking similar data sets
  ◦ collaborative relationship
  ◦ 5th-yr data in 2008

• characterizing the drivers
  ◦ how do they work?

• formulating decision-analysis systems
  ◦ how will this work be supported?

• predicting management consequences
  ◦ model validation