Pathological considerations in growth and yield

• The “Big Four” in Alberta
  – Decay
  – Dwarf mistletoe
  – Armillaria
  – Rusts
• Risk assessment in intensively managed stands
• Concluding remarks
Stem decay
Stem decay

Effects of decay are typically incorporated in most models as long as net volume is considered.
# Stem decay

<table>
<thead>
<tr>
<th>Age</th>
<th>% Decay</th>
</tr>
</thead>
<tbody>
<tr>
<td>31-40</td>
<td>-</td>
</tr>
<tr>
<td>41-50</td>
<td>1.8</td>
</tr>
<tr>
<td>51-60</td>
<td>3.2</td>
</tr>
<tr>
<td>61-70</td>
<td>7.1</td>
</tr>
<tr>
<td>71-80</td>
<td>14.4</td>
</tr>
<tr>
<td>81-90</td>
<td>21.3</td>
</tr>
<tr>
<td>91-100</td>
<td>25.2</td>
</tr>
<tr>
<td>101-110</td>
<td>31.1</td>
</tr>
<tr>
<td>111-120</td>
<td>36.9</td>
</tr>
<tr>
<td>121-130</td>
<td>41.9</td>
</tr>
</tbody>
</table>
Stem decay

But net volume of what? Rot is often accompanied by stain – the impact on volume varies with end product
# Stem decay

<table>
<thead>
<tr>
<th>Product</th>
<th>Allowable % in product</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stain</td>
<td>Incipient decay</td>
<td>Advanced decay</td>
<td></td>
</tr>
<tr>
<td>Chemical pulp</td>
<td>no limit</td>
<td>?</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Particle board</td>
<td>no limit</td>
<td>20-40%</td>
<td>0-5%</td>
<td></td>
</tr>
<tr>
<td>Lumber (constr.)</td>
<td>25%</td>
<td>10-20%</td>
<td>0-10%</td>
<td></td>
</tr>
<tr>
<td>OSB</td>
<td>20-30%</td>
<td>10-20%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Mechanical pulp</td>
<td>10-15%</td>
<td>0-5%</td>
<td>0-1%</td>
<td></td>
</tr>
<tr>
<td>Lumber (furn.)</td>
<td>0-10%</td>
<td>0-10%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Chopsticks</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>

Breck, 1987
Dwarf mistletoes

• Impacts of growth and yield have been modelled since the 1970’s
  – Spread is slow and reasonably predictable
  – Reasonably easy to obtain incidence and severity data in the field
  – Severity / yield relationships exists
Dwarf mistletoes

Hawksworth et al. 1995
Dwarf mistletoes

• Calibration and validation of spread models won’t likely be fast
• If we are attempting to adjust current growth and yield models, do we know whether current models already capture the effects of disease?
Armillaria

Although its incidence appears to diminish with stand age, larger trees are killed.
Armillaria

p.c.t. does not appear to exacerbate in AB

Time (years)
Mortality (%)
Control 1.5 m 2.5 m
Initial mortality (%)
Final mortality (%)
Control 1.5 m 2.5 m
Armillaria

What is the effect of replacing fire with harvesting?
Rusts, esp. WGR

As harvesting replaces fire, what effect with the change in spatial scale have?
Rusts, esp. WGR

Incidence is hard to predict in time (wave years) and space

[Bar chart showing % of cankers over years]
Rusts, esp. WGR
How does incidence translate to impact - Survival
Rusts, esp. WGR

How does incidence translate to impact - Survival

![Graph showing the relationship between gall encirclement and probability of surviving for Stand 33 and Stand 632.](image-url)
Risk assessment

• In intensively managed poplar plantations where some clones may be planted over large areas what is the risk of major loss?
Final thoughts

• Each pathogen has its own very unique personality
• There is no substitute for pathologists working in conjunction with modellers