Integrated Biomass Systems

Stuart Spencer & Dominik Roeser
Background

- British Columbia is experiencing fibre shortages
- Tenure system
- Market fluctuation & distortions
- Evolving secondary industry (pulp, pellets)
- Social license for open burning of biomass is getting increasingly difficult
- Shift in mindset
Business as usual
Business as usual
Business as usual
Business as usual

- Biomass has to be burned in burn piles during the winter season
How do we mobilize more biomass?
New paradigm

- Traditional forest industry, secondary users and government have been working together to find solutions to mobilize more biomass
  - Clarify liabilities
  - New approach to pricing biomass
  - New tenure types
  - Movement toward integrated biomass harvesting
New paradigm cont.
New paradigm cont.
Operational challenges
Solutions to challenge status quo

Best Management Practices for
Integrated Harvest Operations in British Columbia

Roadside Residue Handling

Best Piling Practises

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Solutions to challenge status quo

- Series of practical trials to test the feasibility of new integrated harvesting systems
  - Trial I: Modified piling techniques
  - Trial II: Comparison of processing techniques
  - Trial III: System analysis
Trial I: Modified piling techniques

We divided the piles into three categories:

1. Piles where the processor operator neatly stacked the tops and long butts.
   - Logging contractor said there was no difference in productivity between arranging the piles neatly and throwing the pieces in random directions.

2. Piles built for burning.
   - Edges of the piles were folded into the piles to facilitate burning.

3. Piles built for biomass extraction.
   - The processor piles were **re-built** with all tops aligned perpendicular to the road.
Trial I: Modified piling techniques

Results:

- When adding the piling cost to the grinding cost, the cheapest treatment was simply having the processor operators pile the residues neatly in the logging phase.

<table>
<thead>
<tr>
<th>Piling Treatment</th>
<th>Grinding cost ($/odt)</th>
<th>Piling Cost ($/odt)</th>
<th>Total Cost ($/odt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor only</td>
<td>$</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>Piling for biomass</td>
<td>$</td>
<td>$ 2.95</td>
<td>$ 14.83</td>
</tr>
<tr>
<td>Piling for burning</td>
<td>$</td>
<td>$ 3.57</td>
<td>$ 17.04</td>
</tr>
</tbody>
</table>
Trial I: Modified piling techniques

Other interesting secondary findings:

- **Contaminants**
  - By far, the fire piles had a **much** higher degree of contamination than the other two methods.

- **Fire risk**
  - Approximately 13% of the volume of the fire piles was left to be burned due to contamination. The other pile types had virtually no residue left after grinding (ie no burning costs).

- **Plantability**
  - Plantability was considered to be ‘very good’ post grinding for all methods with the exception of the residue piles left after grinding the fire piles.
Solutions

- Series of practical trials to test the feasibility of new integrated harvesting systems
  - Trial I: Modified piling techniques
  - Trial II: Comparison of processing techniques
  - Trial III: System analysis
Trial II: Comparison of processing techniques

- Does having the processing handle residues differently affect productivity?
Trial II: Comparison of processing techniques

- In both cases the difference in productivity was negligible

<table>
<thead>
<tr>
<th>Unprocessed Deck #</th>
<th>Handling Method</th>
<th>Productivity (m³/PMH)</th>
<th>Average piece size (m³/piece)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deck 1</td>
<td>Method 1 – Stacking neatly</td>
<td>34.6</td>
<td>0.33</td>
</tr>
<tr>
<td>Deck 1</td>
<td>Method 2 - Throwing</td>
<td>34.4</td>
<td>0.32</td>
</tr>
<tr>
<td>Deck 2</td>
<td>Method 1 – Stacking neatly</td>
<td>23.2</td>
<td>0.23</td>
</tr>
<tr>
<td>Deck 2</td>
<td>Method 2 - Throwing</td>
<td>25.6</td>
<td>0.24</td>
</tr>
</tbody>
</table>
Solutions

- Series of practical trials to test the feasibility of new integrated harvesting systems
  - Trial I: Modified piling techniques
  - Trial II: Comparison of processing techniques
  - Trial III: System analysis
Trial III: System analysis

Objectives:

- Determine productivity of handling residuals in the processing phase (piling versus flinging)
- Determine productivity of piling (burn piles), hoe-chucking, loading and transporting residuals to a central sortyard
Trial III: System analysis

Processing
- Confirmation that processing into decks does not negatively affect productivity
- Should be more commonly applied

Piling
- Average cost for building of the piles was $2.92 per oven dry tonne or $1.27 per cubic metre

Hoechucking
- Hoechucking was considerably cheaper for piled tops

Transport
- Maximize payload

<table>
<thead>
<tr>
<th>Pile</th>
<th>Productivity (m$^3$/SMH)</th>
<th>Costs ($/ODT)</th>
<th>Costs ($/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oriented</td>
<td>129.8</td>
<td>1.15</td>
<td>2.65</td>
</tr>
<tr>
<td>Burn</td>
<td>19.2</td>
<td>6.90</td>
<td>15.87</td>
</tr>
</tbody>
</table>
## Trial III: System analysis

<table>
<thead>
<tr>
<th>Bin/trailer type</th>
<th>Average load size (odt)</th>
<th>Average transport cost ($/odt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small bin (34.4 m³)</td>
<td>4.08</td>
<td>$</td>
</tr>
<tr>
<td>Big bin</td>
<td>5.91</td>
<td>$</td>
</tr>
<tr>
<td>Roll-off and trailer</td>
<td>12.54</td>
<td>$</td>
</tr>
<tr>
<td>Roll-off only</td>
<td>5.55</td>
<td>$</td>
</tr>
</tbody>
</table>
Trial III: System analysis

Recommendations

- Lowest cost option combined utilization of oriented piles and larger transport configurations

<table>
<thead>
<tr>
<th>Pile Type</th>
<th>Bin/trailer type</th>
<th>Piling cost</th>
<th>Hoechuck cost</th>
<th>Loading cost</th>
<th>Transport cost</th>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$/m³</td>
<td>$/odt</td>
<td>$/m³</td>
<td>$/odt</td>
<td>$/m³</td>
</tr>
<tr>
<td>Oriented pile</td>
<td>Small bin (34.4 m³)</td>
<td>-</td>
<td>-</td>
<td>1.15</td>
<td>2.65</td>
<td>4.95</td>
</tr>
<tr>
<td></td>
<td>Big bin (45.9 m³)</td>
<td>-</td>
<td>-</td>
<td>1.15</td>
<td>2.65</td>
<td>4.19</td>
</tr>
<tr>
<td></td>
<td>Roll off and trailer</td>
<td>-</td>
<td>-</td>
<td>1.15</td>
<td>2.65</td>
<td>5.16</td>
</tr>
<tr>
<td></td>
<td>Roll off only</td>
<td>-</td>
<td>-</td>
<td>1.15</td>
<td>2.65</td>
<td>8.03</td>
</tr>
<tr>
<td>Burn pile</td>
<td>Small bin (34.4 m³)</td>
<td>1.27</td>
<td>2.92</td>
<td>6.90</td>
<td>15.87</td>
<td>4.95</td>
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</tr>
</tbody>
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Conclusions

- As researchers we need to make more effort to understand the drivers of the industry
- We need to be able to clearly answer the following questions
  - Is industry ready for what we are proposing?
  - How can we implement new systems with the least amount of impact on the existing methods?
  - How do we convince contractors of the benefits?
  - How do we make sure that benefits along the supply chain are shared fairly among all stakeholders?
  - How do we replicate initial positive results from studies to other areas?
  - Are all stakeholders clear about the process and desired outcomes
- How does this tie into harvesting systems of the future?