



Creating forest sector solutions

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## Simple Sample Scaling

Peter Dyson  
Researcher  
Forest Operations  
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Tacoma

# Background

- There are currently only two scaling methods permitted in British Columbia.
  1. Scale every log with a scale stick.
  2. Weight scaling.
- Forest companies are interested in new scaling techniques that may reduce scaling costs while maintaining accuracy.
- FPInnovations collaborated with Western Forest Products on a study which tested simple sample scaling.

# What is simple sample scaling

- A scaling method recognized by the U.S. Forest Service.
- The total volume from a harvest area is calculated from the average truck load volume.



# Simple sampling methodology

- All truck loads are counted.
- Loads are randomly selected as sample loads and stick scaled.
- Volume from sample loads is used to calculate total volume.

# Key to an accurate scale

- Building loads with the same consistent volume.



# Study location

- Study was done on northern Vancouver Island between January and March 2010.



# Harvest site and harvest method

- 70 year second growth stand.
- The stand contained by volume:  
Hemlock/balsam 85%, Douglas-fir 13%,  
Spruce 2%.
- The timber was mechanically processed  
and sorted into 7 sorts at roadside.



# Scale site

- A software program running on a laptop identified sample loads.
- Sample loads stick scaled.
- Loads banded, unloaded and put in booms.



# Creating a consistent load size

- Each truck was loaded to a target 7396 fbm (50 m<sup>3</sup>)<sup>1</sup>.



- <sup>1</sup> Conversion of 6.76 m<sup>3</sup> = Mbf

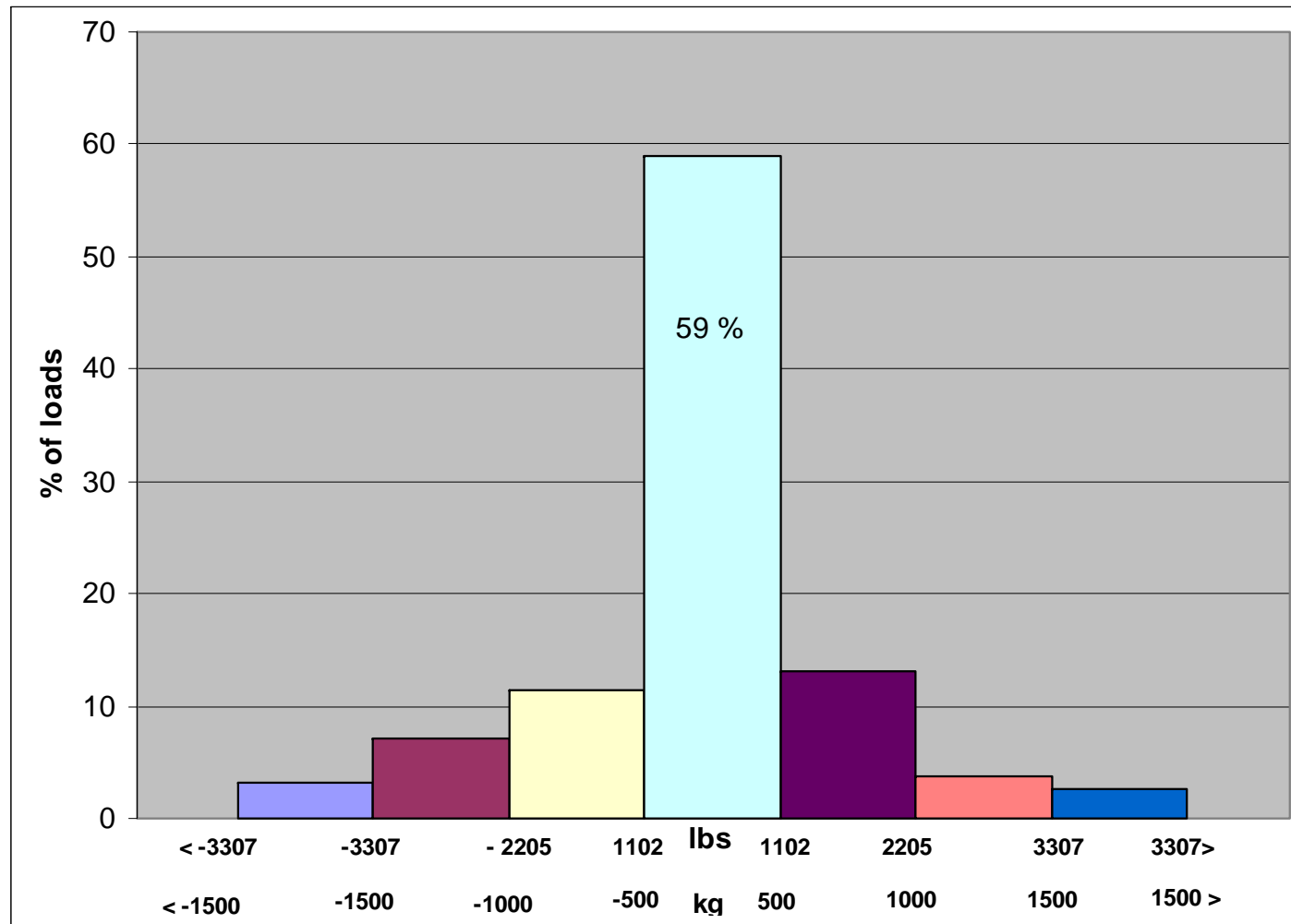
# Use truck onboard weigh scales for consistent size loads

- Loader operators and truck drivers given chart showing target weight required for a 7396 fbm (50 m<sup>3</sup>) load.

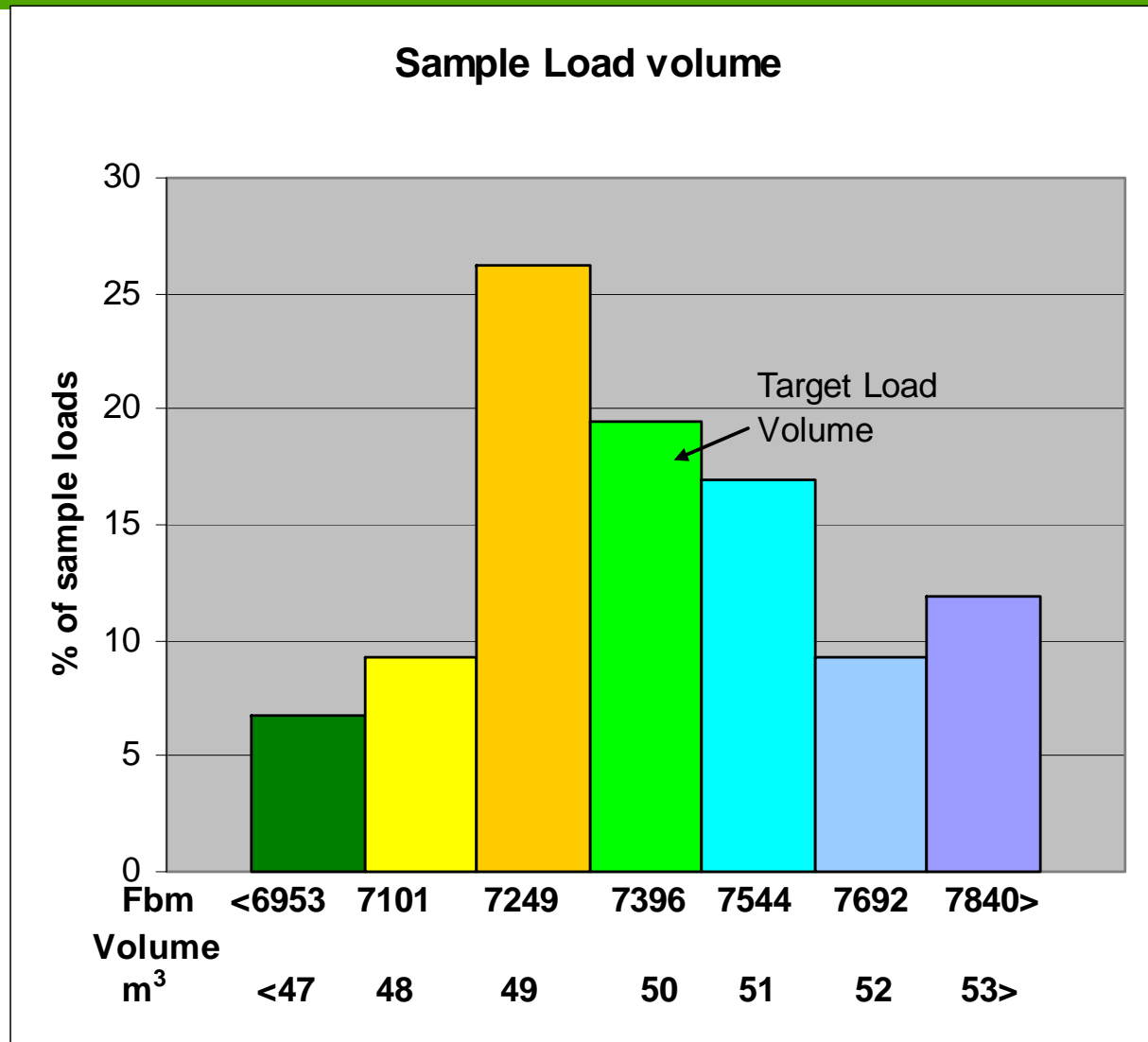
Species	Weight ton (Kg)
Douglas-fir	66.7 (60 500)
Hemlock/balsam	71.1 (64 500)
Spruce	66.9 (60 700)

# Difference between target weight and actual weight of all loads.

- 83% Of the loads were within  $\pm 2205$  lbs (1000 kg) of the target weight.



# Building loads with a consistent volume



- 63% of the loads were within + - 7249 and 7544 fbm

# Total Volume

Sort (stratum)	Hemlock /Balsam Quad	Hemlock /Balsam Gang	Hemlock /Balsam Chip n' Saw	Fir Sawlog	Fir Quad	Fir Chip n' Saw	Spruce	Total
All loads	498	452	253	42	140	14	27	1 426
Estimated total volume (Mbf)	3 711	3 324	1 817	305	1 002	97	227	10 482
Estimated total volume (m <sup>3</sup> )	25 086	22 471	12 281	2 059	6 772	654	1 532	70 855

- <sup>a</sup> From 2 samples

# Sample Sort Volume

Sort (stratum)	Hemlock /Balsam Quad	Hemlock /Balsam Gang	Hemlock /Balsam Chip n' Saw	Fir Sawlog	Fir Quad	Fir Chip n' Saw	Spruce	Total
Sample loads	22	38	16	9	24	2	7	118
Average Volume (fbm)	7456	7337	7204	7189	7219	7293	8411	7362
Sampling rate (%)	4	8	4	21	17	14	26	8
Standard deviation	249.4	273.9	123.1	364.1	210.7	546.6	389.7	379.5
Coeffecient of variation (%)	3.34	3.73	1.71	5.06	2.92	7.49	4.63	5.15
Precision (%)	1.44	1.16	0.87	3.42	1.11	61.79 <sup>a</sup>	3.65	<b>0.64</b>

- <sup>a</sup> From 2 samples

# Volume to weight ratio

Volume to weight Ratio (m <sup>3</sup> /tonne)	Hemlock/Balsam	Douglas-fir	Spruce
<b>Initial</b> <sup>a</sup>	1.092	1.196	1.190
<b>Attained</b>			
Mean	1.088	1.164	1.329
Maximum	1.163	1.244	1.422
Minimum	1.007	1.035	1.291
Standard deviation	0.031	0.049	0.045

- <sup>a</sup> Calculated from previous scale data.

# Stable weight to volume ratio

- Three factors which contributed to a steady weight to volume ratio:
  1. Wood density in logs of the same species was relatively homogenous.
  2. Sorting was accurate.
  3. Logs did not loose moisture due to weather conditions. Harvested over a three months in the winter.

# Conclusion

- Western Forest Products achieved accurate scale results through simple sampling.
  1. Target truck load weights were set so each load would contain 7396 fbm (50 m<sup>3</sup>)
  2. Loader operators and truck drivers built loads to the target weight using the onboard weigh scales.
  3. Logs were accurately sorted and scaled soon after harvesting.
- The total estimated volume was within 0.64% of the actual volume at the 95% confidence interval. This met the British Columbia Ministry of Forests Lands and Natural Resource Operations scaling regulation.

# Thank you

