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Simple Sample Scaling

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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.

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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.

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Study location

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

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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.

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Scale site

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

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Creating a consistent load size

- Each truck was loaded to a target 7396 fbm (50 m^3) [1].

- **[1] Conversion of 6.76 m^3 = Mbf**

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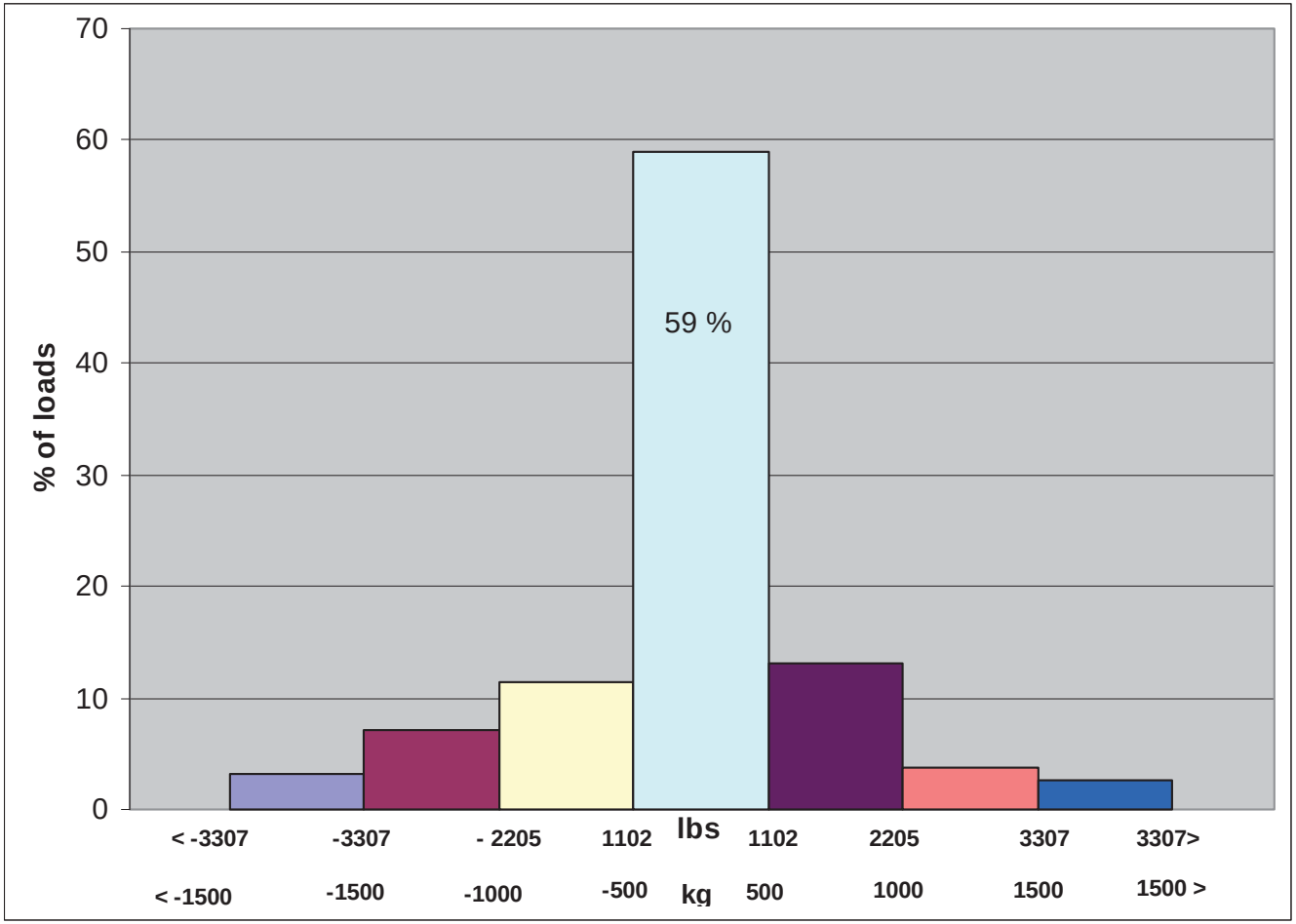
Use truck onboard weigh scales for consistent size loads

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

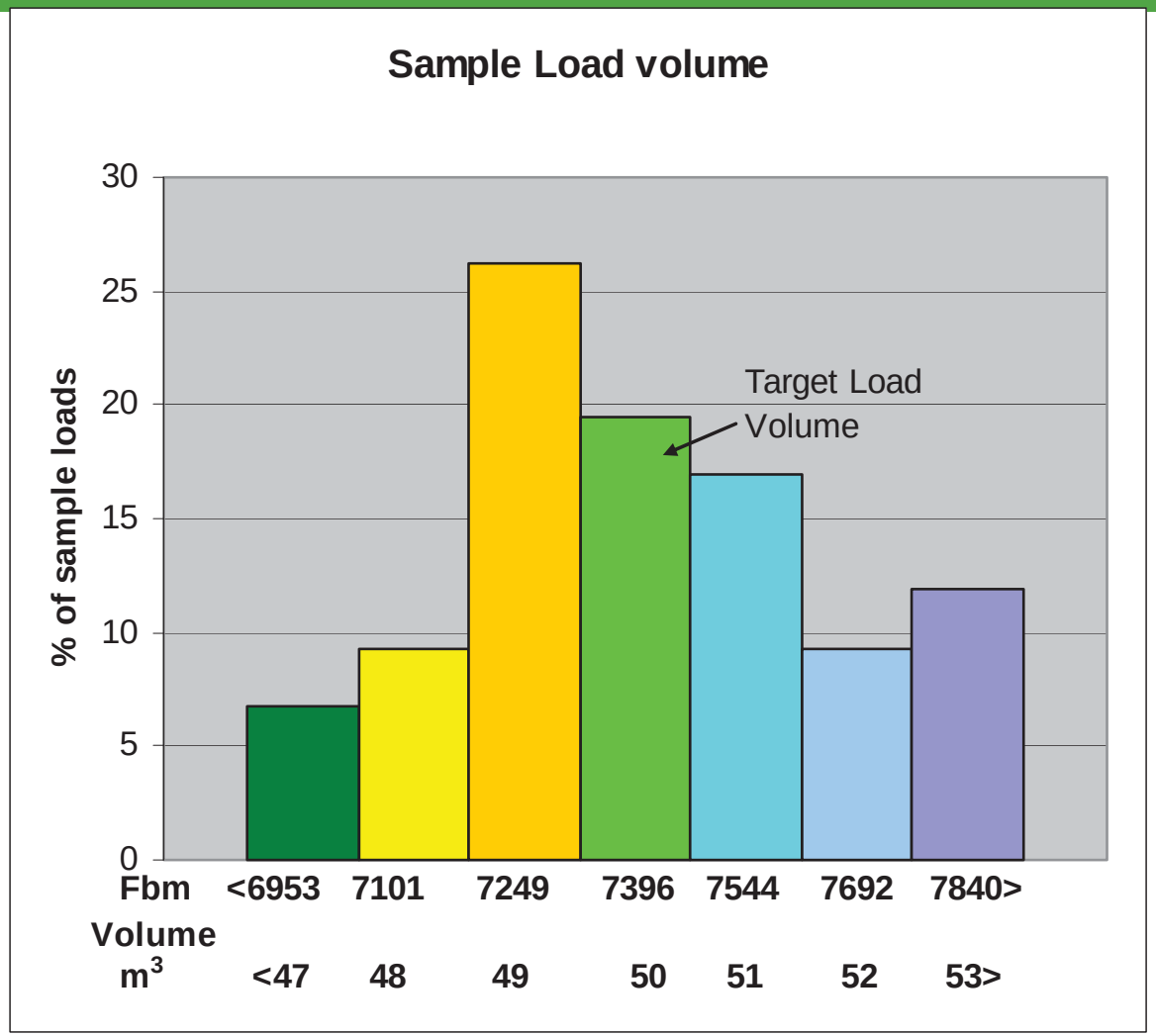
Species	Weight ton (Kg)
Douglas-fir	66.7 (60 500)
Hemlock/balsam	71.1 (64 500)
Spruce	66.9 (60 700)

Difference between target weight and actual weight of all loads.

- 83% 0f the loads were within ± 2205 lbs (1000 kg) of the target weight.



Building loads with a consistent volume



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

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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 ($m^{3)}$	25 086	22 471	12 281	2 059	6 772	654	1 532	70 855

- [a] From 2 samples

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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 [a]	3.65	**0.64**

- [a] From 2 samples

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Volume to weight ratio

Volume to weight Ratio (m^3/tonne)	Hemlock/ Balsam	Douglas-fir	Spruce
Initial [a]	1.092	1.196	1.190
Attained			
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

- [a] 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 m3)
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

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