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A Model for Determining Douglas-fir Bark Volume

Potential application for scanner scaling

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Timber Measurement Society Meeting

Outline

- Review of scanner scaling in B.C.
- Bark volume model
- Results

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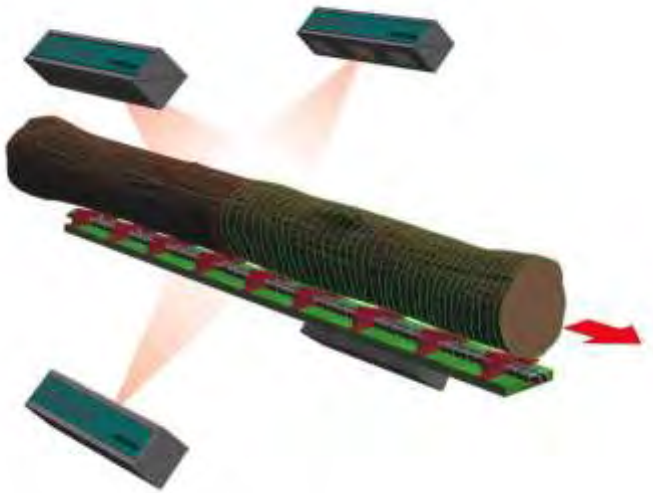
Scanner scaling technology

- Scanner heads emit a low power laser line on the log‘s surface
- Cameras in the scanning heads produce a three dimensional image of the log
- Scanner system produces accurate measurements of log diameter, length and volume



Images courtesy of Springer- Microtec

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B.C. scanner scaling update

- Measurement Canada certifies Springer-Microtec's Logeye 100 scanner in 2015
- The scanner is installed at Interfor's Acorn sawmill and the B.C. provincial government authorizes a scanner pilot project in 2016
- Pilot is successful and log scanning is now fully implemented

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Why develop a model for determining bark volume?

- Acorn sawmill scanner scans logs after they've been debarked
- There is interest in scanning logs over bark, because of the high cost of installing a de-barker and disposing of the bark at a sortyard
- Log volume could be determined from over bark measurements by :

  (over bark volume) – (bark volume) = under bark volume

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Project objective

- Develop a model for predicting Douglas-fir bark volume

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Study logs

- Logs came from 36 cut blocks on Vancouver Island
- Logs were scaled at one of five sort yards
- A log scaler measured bark thickness with a micrometer on 943 second growth Douglas-fir logs

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Data collected for each log

Timbermark	Cutblock	Length (M)	Top Size (rad) [a]	Butt Size (rad)	Grade	Butt or 2nd Cut	Top bark thickness (mm)	Butt Bark Thickness (mm)	BGZ	Volume m3
BGZ124	123H	12.5	17	20	J	B	9	16	CWHx m2	1.35
		41ft.	13 in.	16 in			0.35 in	0.62 in		

- BGZ (Biogeoclimatic zone) is an ecological classification system
- BGZ was included because of its likely influence on bark thickness
- Smalians formula was used to calculate log volume

[a] **rad is 2 cm class (1 inch= 2.54 cm)**

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Developing the bark volume model

- Regression analysis found a relationship between:
  - Butt diameter (DIB) to predict bark volume
  - Not a really strong relationship
- Developed a model
- Model calculates a bark volume based on the average ratio of top bark thickness/top diameter and butt bark thickness/ butt diameter (bark ratio)
- A different bark ratio is calculated for the six BGZ zone /subzones

Bark thickness ratios

- Ratio calculated for each log
- **Top diameter bark thickness ratio** = Top bark thickness / Top diameter (DIB)
- **Butt diameter bark thickness ratio** = Butt bark thickness / Butt diameter (DIB)
- **Average ratio =**(Top bark ratio+Butt bark ratio)/2

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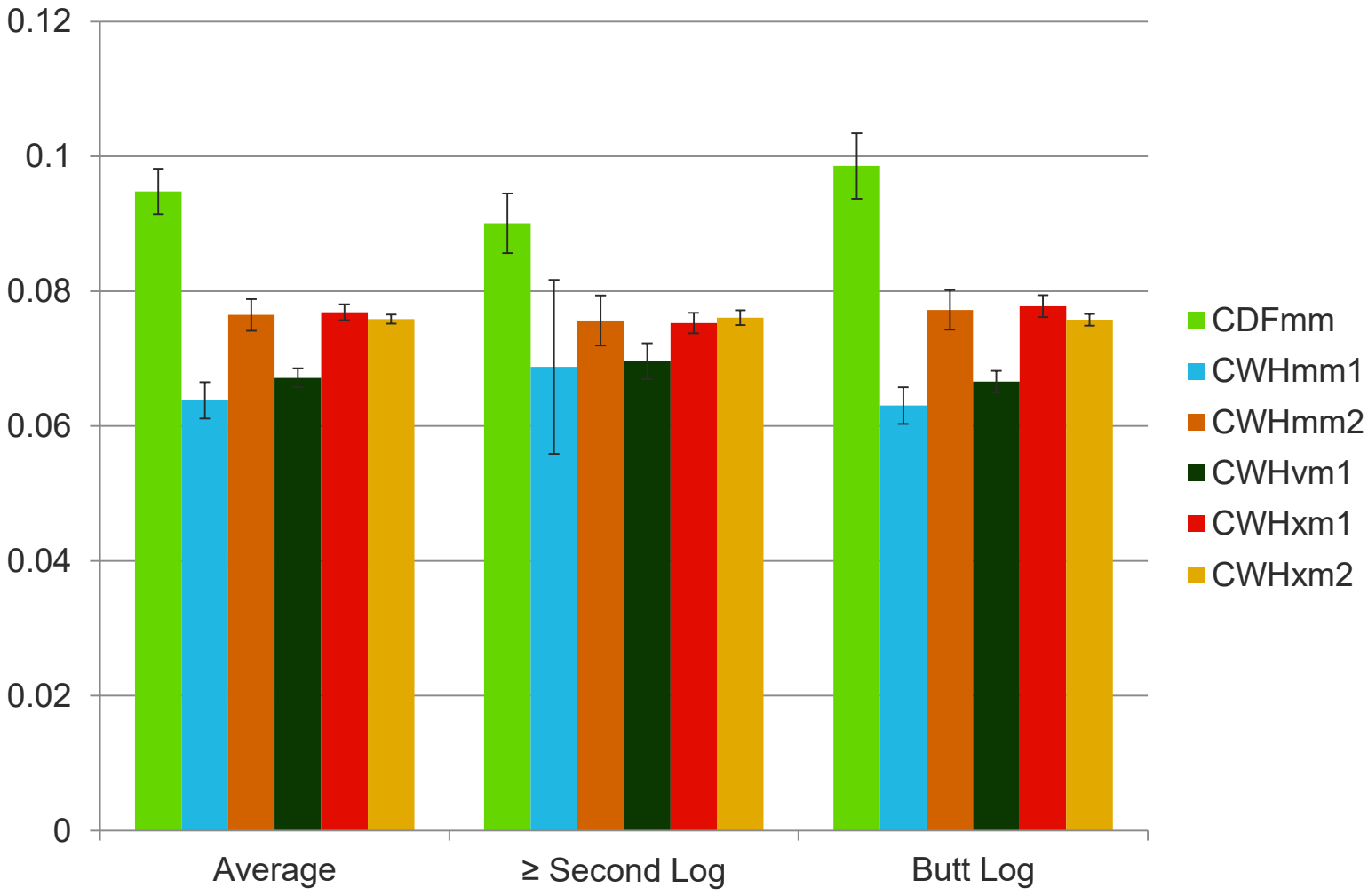
Log top end bark ratio



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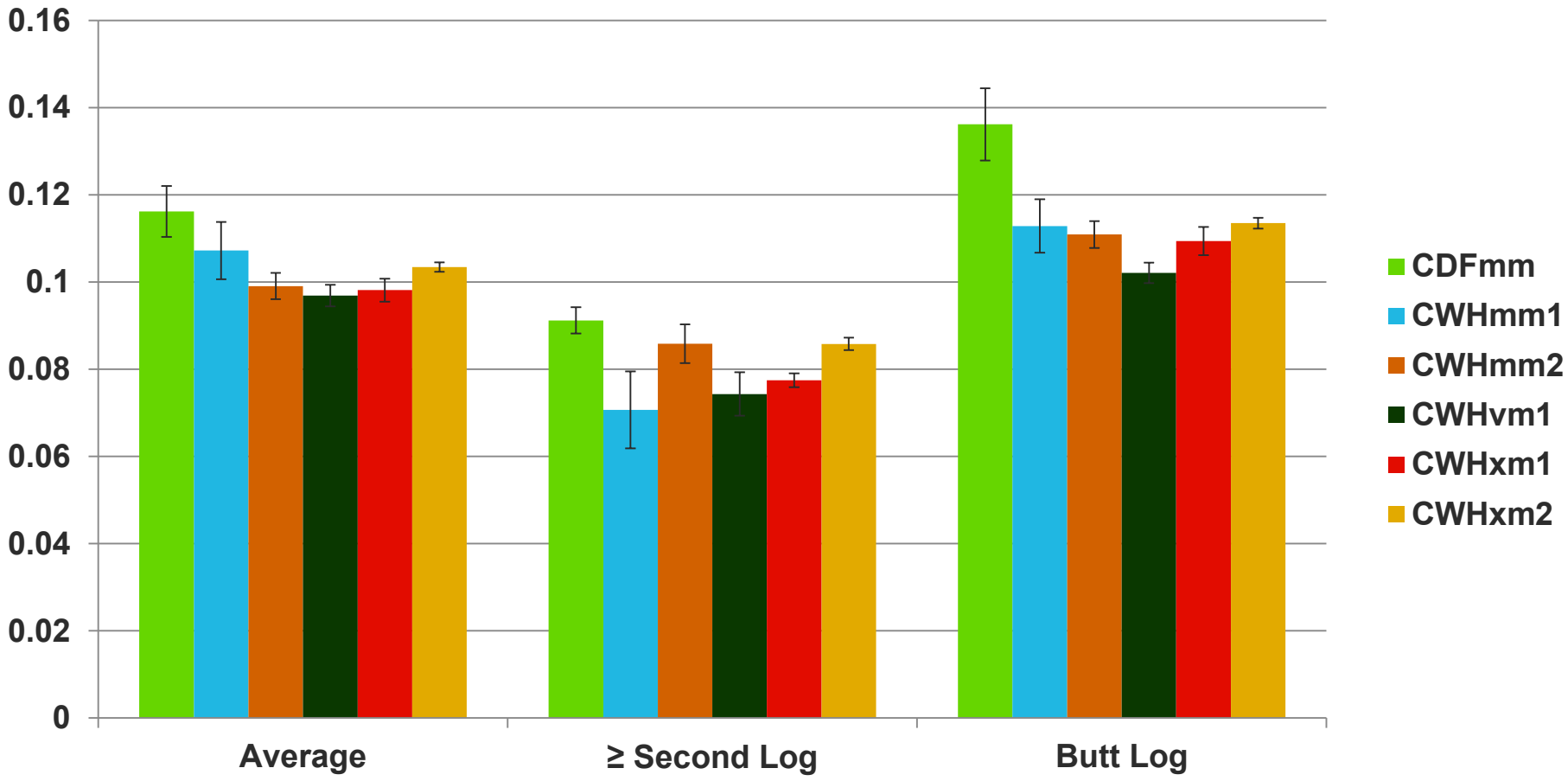
Log butt end bark ratio



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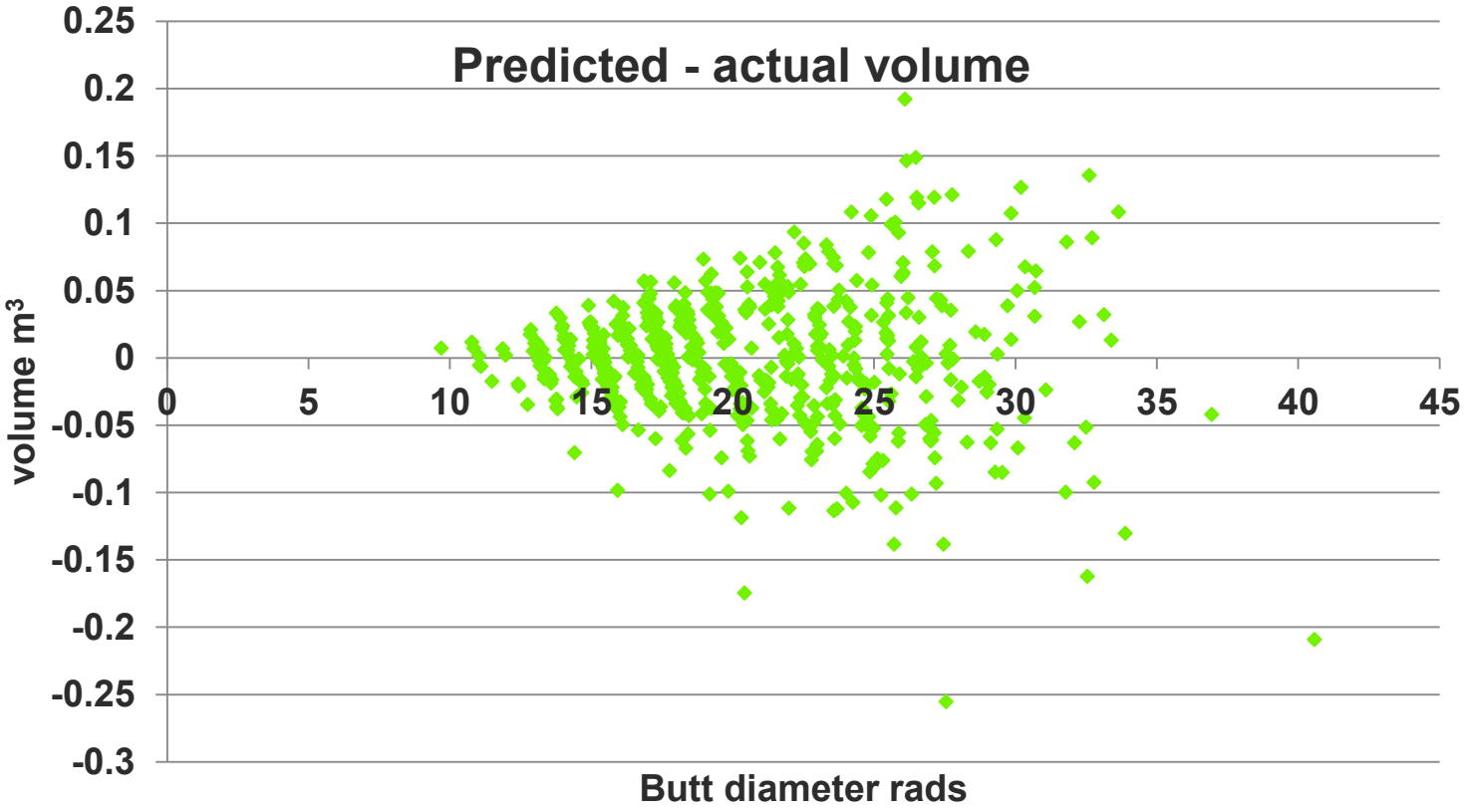
Accuracy of the CWHxm2 model



- Root men square error (RMS) [1] = 0.046 m^3
- On average model will predict volume within 0.046 m^3

[1] RMS is the is the difference between the model values and the actual

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Accuracy of all models

BGZ Model	Logs (no.)	RMSE
CDFmm	45	0.066
CWHmm1	15	0.050
CWHmm2	73	0.046
CWHvm1	75	0.070
CWHxm1	105	0.053
CCWHxm2	629	0.046

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Potential application using bark volume model in scanner scaling

- Scanner will measure log diameter outside bark (DOB) and length
- The bark thickness model will calculate an inside bark volume
- However, there is a problem if bark is missing at point where scanner measures diameter, as diameter will not be DOB. The scaler will have to “adjust” the scanner measured diameter
- Scaler “adjustment” to account for missing bark, is a method used in Sweden

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Future work

- Develop a model to predict bark thickness so diameter inside bark(DIB) can be determined
- Test the models on other logs
- Develop models for other species (i.e. hemlock, pine)

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Thank you

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