Factors Affecting Weight-to-Volume Conversions in Idaho

Timber Measurements Society Meeting 2014

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Overview

- UI Moisture Loss Study
- UI Weight Scaling Study
- Future Work

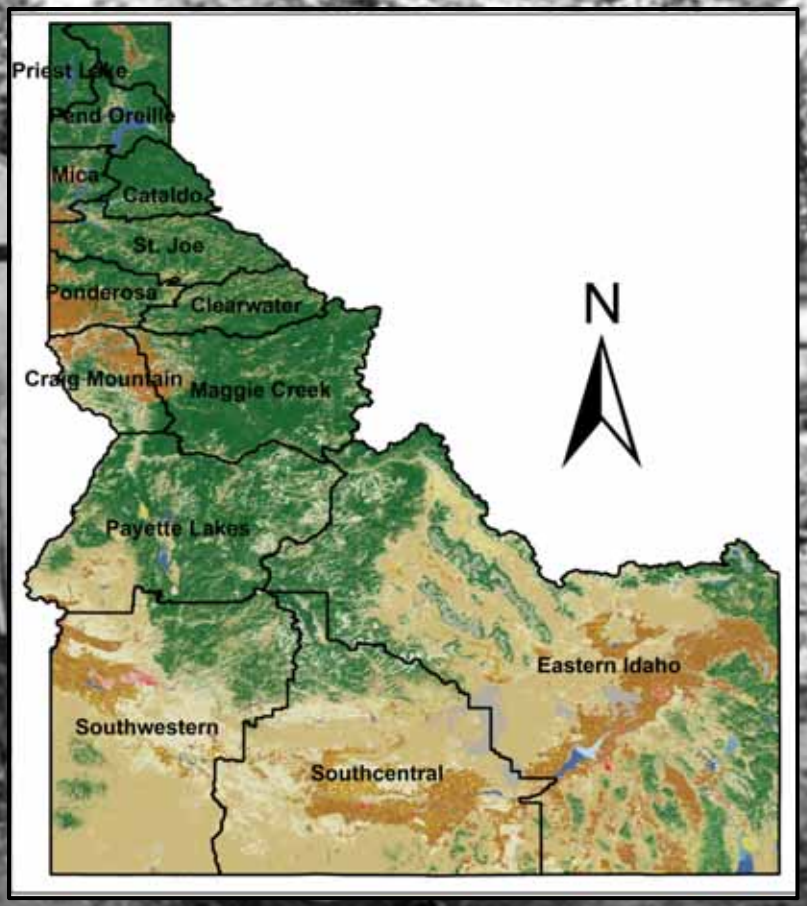


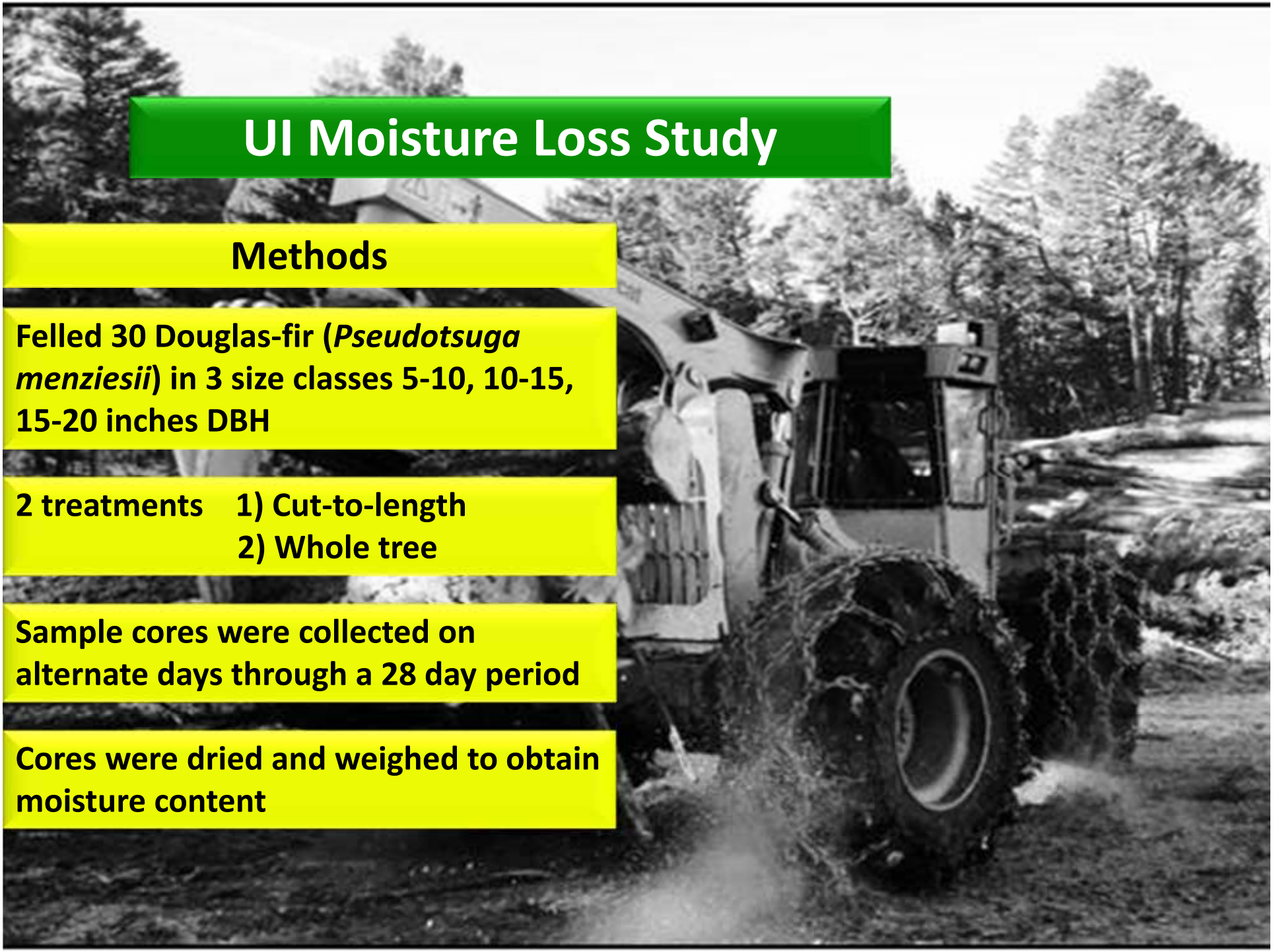
Weight Scaling

- Uses weight as the unit of measure when buying or selling logs
- Consists of sampling loads to establish weight-to-volume relationships
- Tangible to everyone
- Cheaper than traditional scaling
- Faster truck turn-times at mills

Current Practices

- One conversion for each supervisory district
- Updated Yearly
- Does not vary by season, species, product type, or defect %
- No conversions for cedar products, poles





UI Moisture Loss Study

Methods

Felled 30 Douglas-fir (*Pseudotsuga menziesii*) in 3 size classes 5-10, 10-15, 15-20 inches DBH

2 treatments 1) Cut-to-length
2) Whole tree

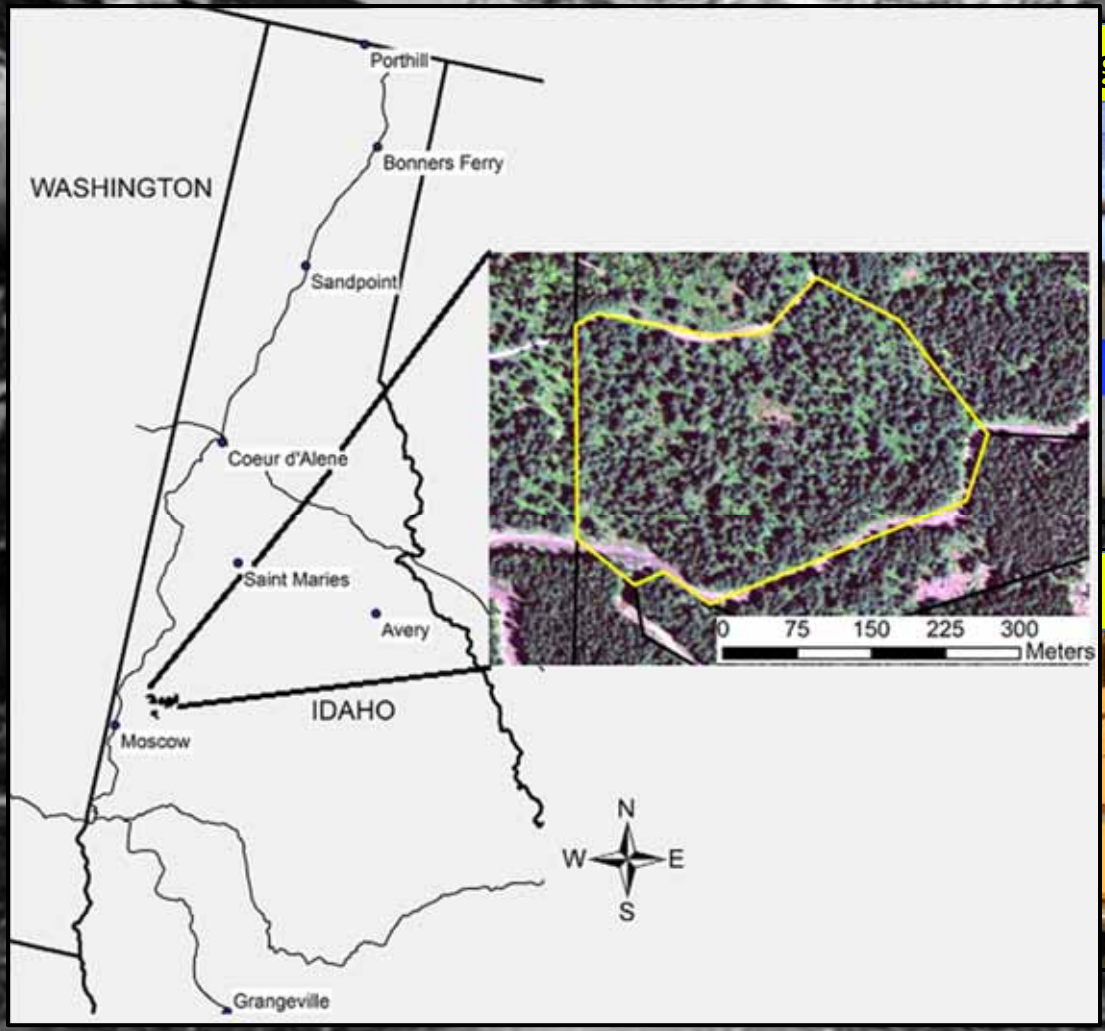
Sample cores were collected on alternate days through a 28 day period

Cores were dried and weighed to obtain moisture content

UI Moisture Loss Study

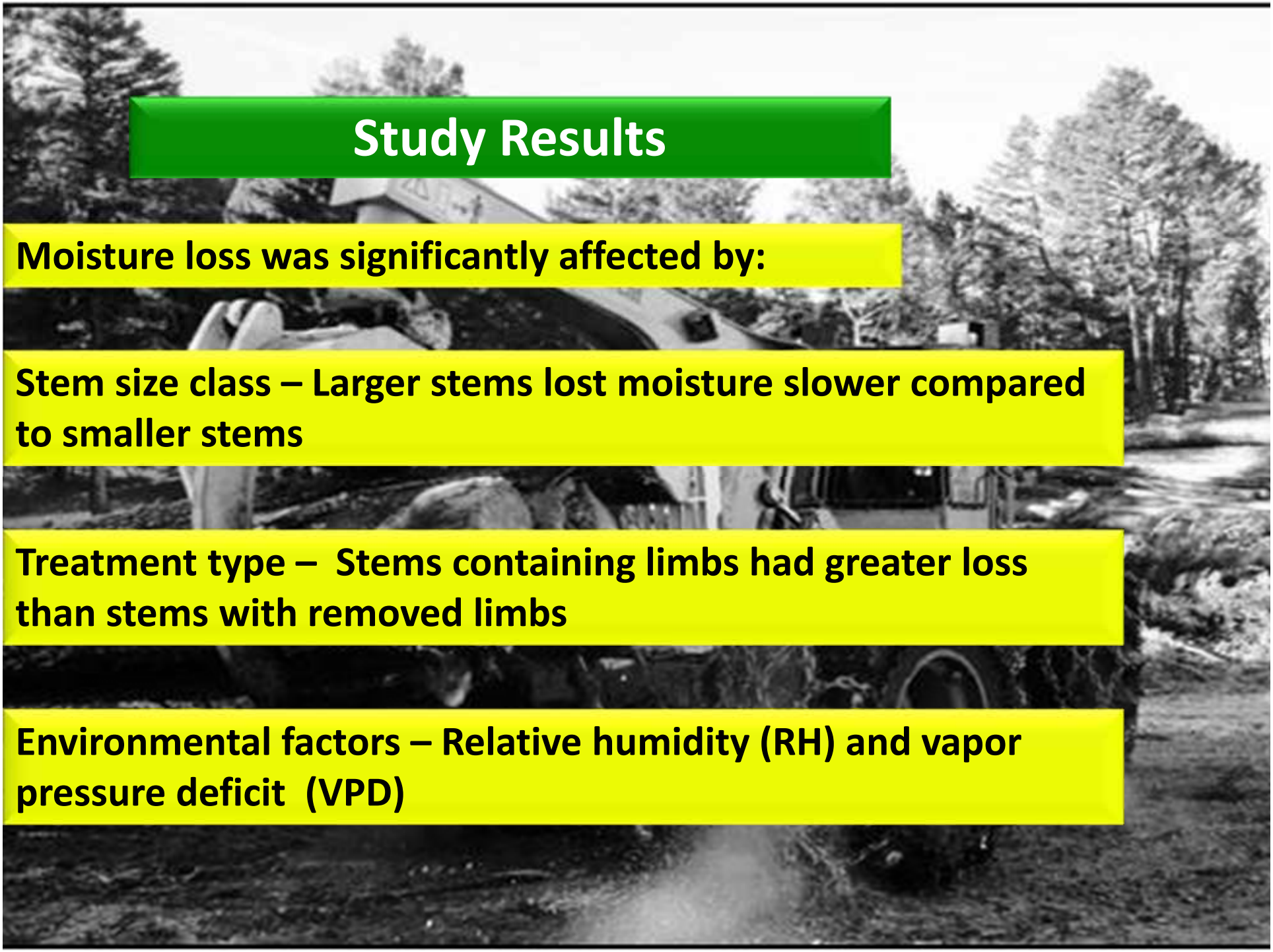
Methods cont.

Treatment 1



ght Sampling

Drying



Study Results

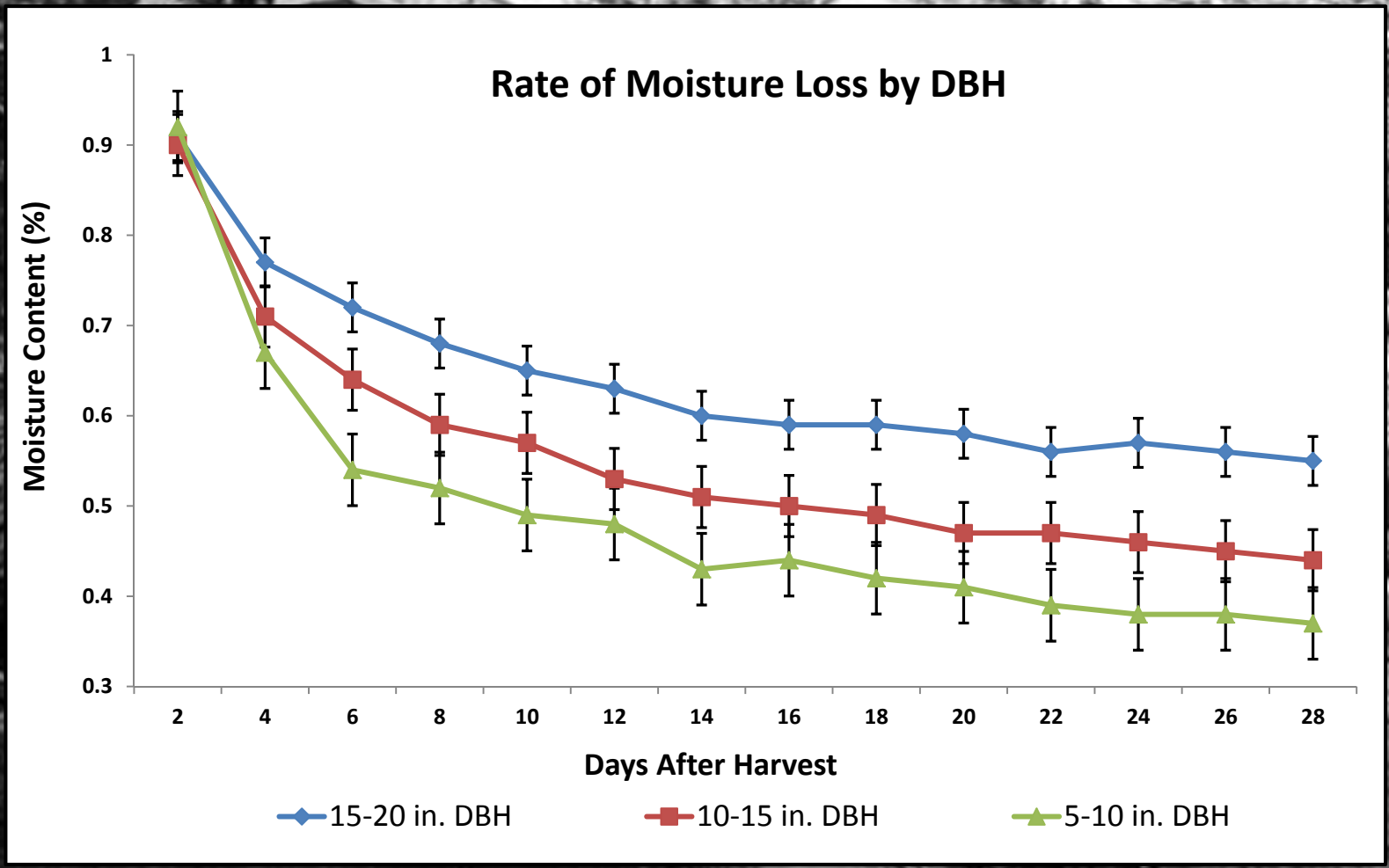
Moisture loss was significantly affected by:

Stem size class – Larger stems lost moisture slower compared to smaller stems

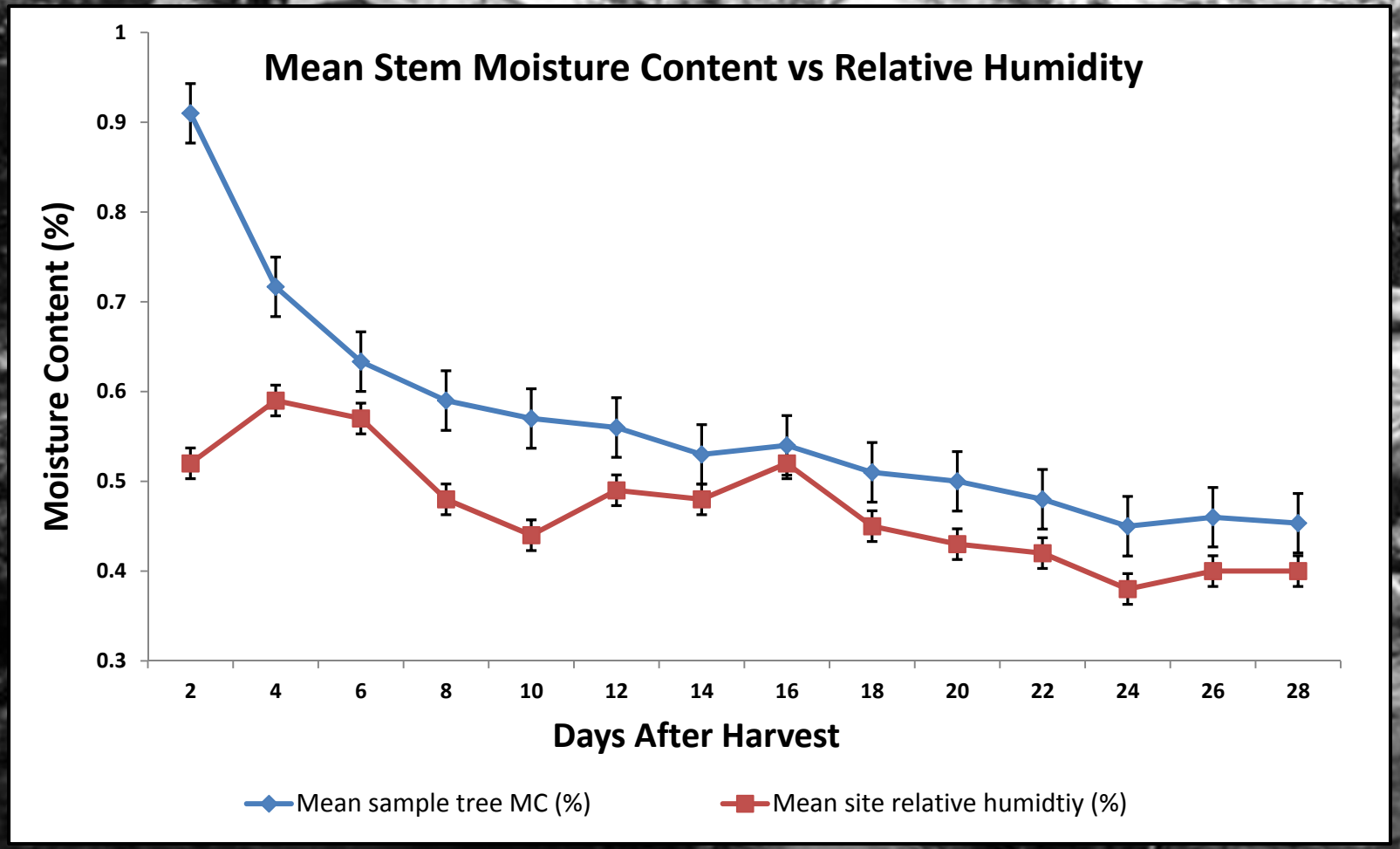
Treatment type – Stems containing limbs had greater loss than stems with removed limbs

Environmental factors – Relative humidity (RH) and vapor pressure deficit (VPD)

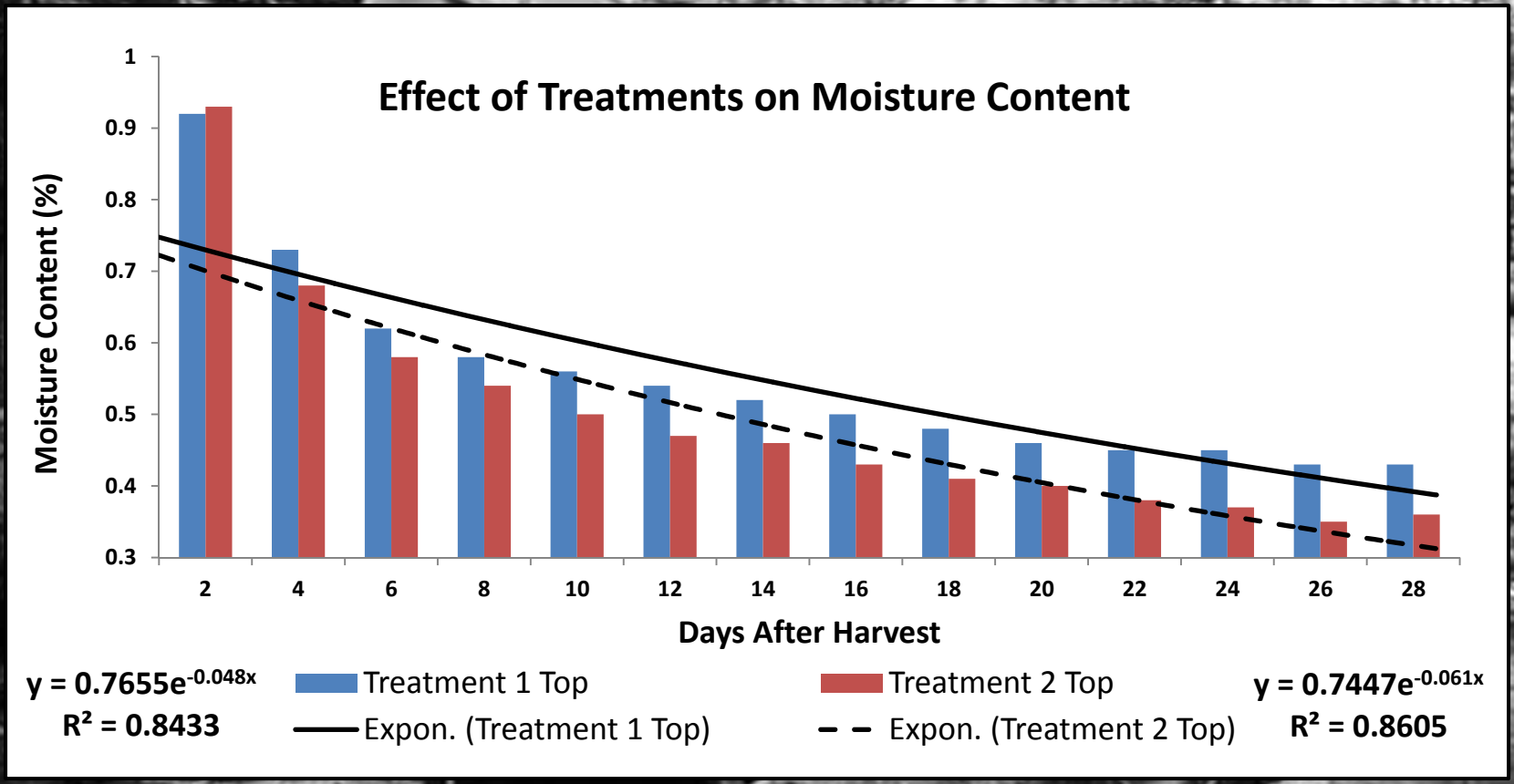
Study Results



Study Results



Study Results



Economic Impacts

2 Days

9% (1.2 tons)

1.2 tons = $87.56

3 Days

19% (2.5 tons)

2.5 tons = $182.60

4 Days

23% (3.1 tons)

3.1tons = $226.27

Idaho Trucks Avg. 27.3 net tons

Idaho DFL $400/mbf

State W-V Avg. 5.48 tons/mbf

Extreme Case Scenario

Conclusions

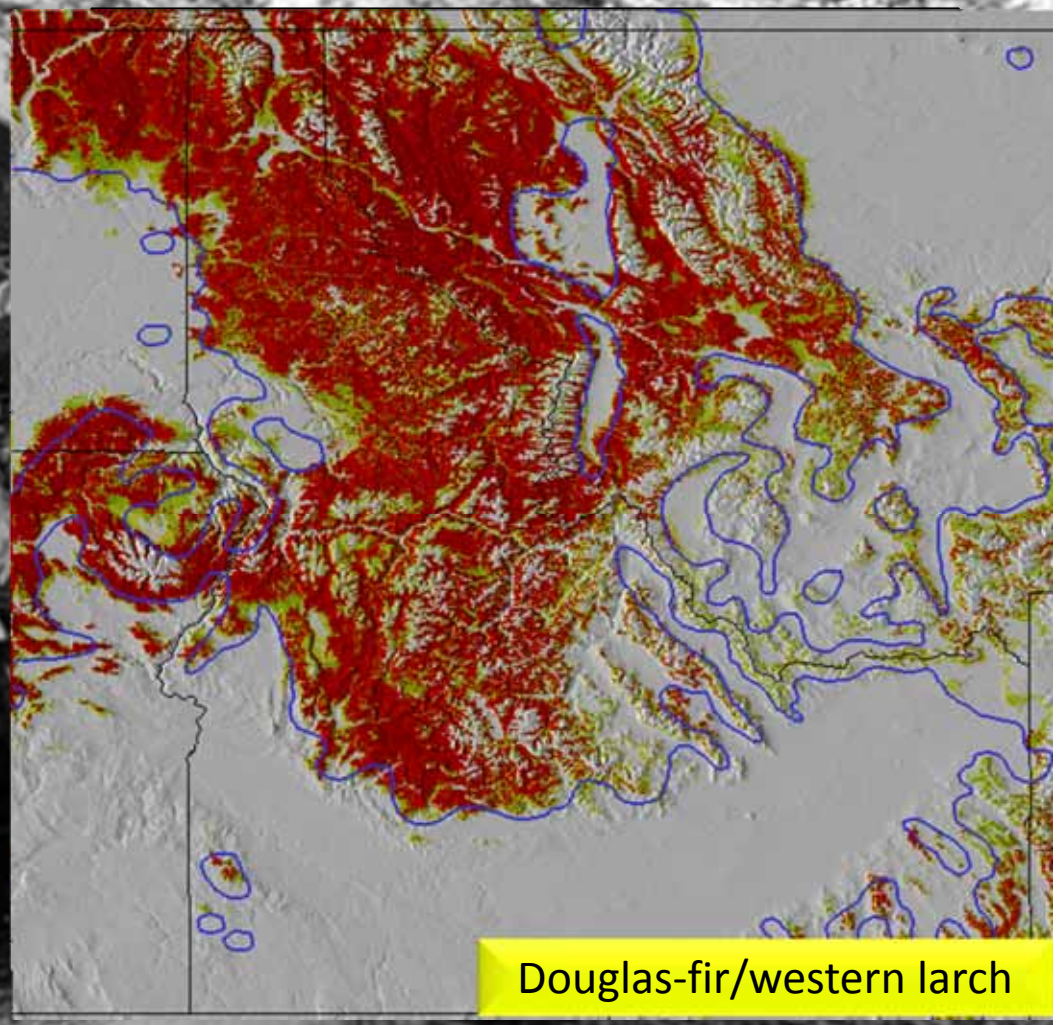
Large logs (15-20 in.) lost an average of 34% moisture content, equivalent to 4.5 tons of weight from a 27 ton truckload of sawlogs

Trees processed directly after harvesting (cut-to-length) lose moisture slower then trees processed later (whole tree)

UI Weight Scaling Study

Methods

- 7900 scaled loads from across Idaho
- Investigating climate data (ppt & temp)
- Also looking at species and season
- Working to make conversions more accurate and understandable



Douglas-fir/western larch

UI Weight Scaling Study

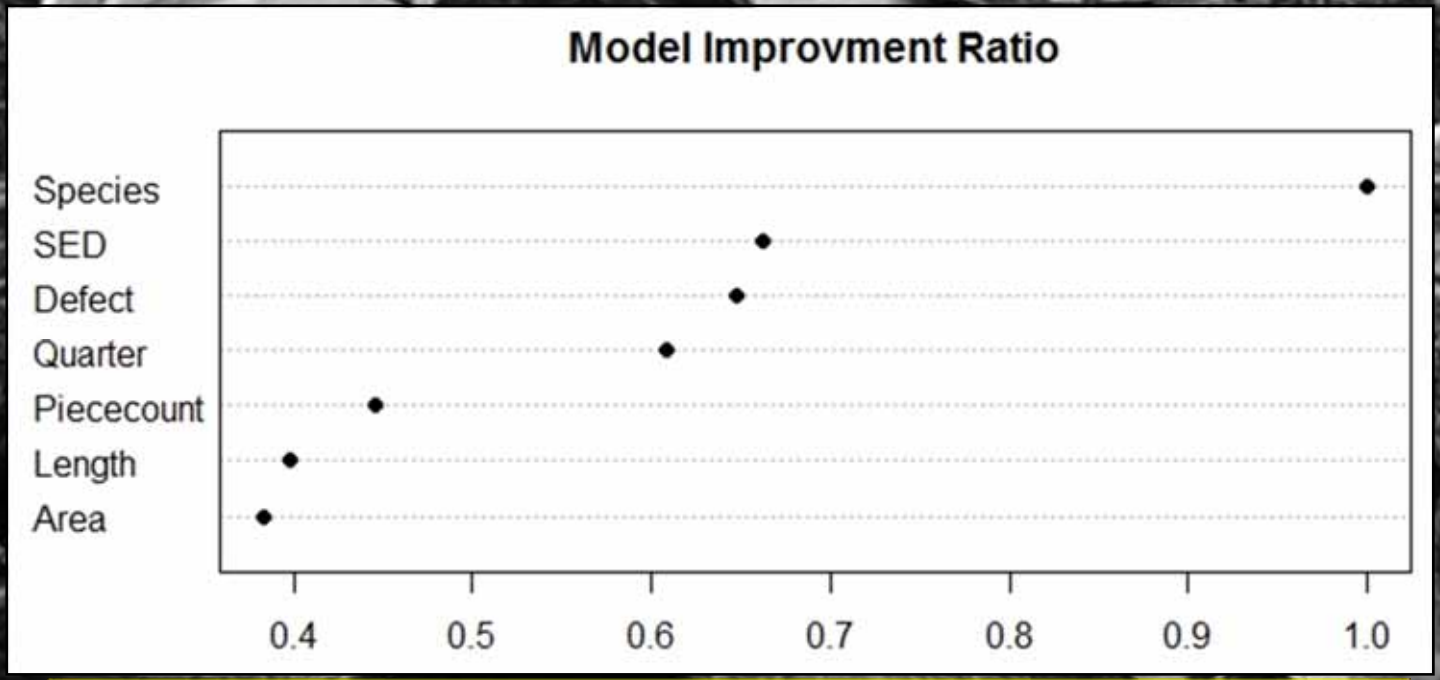
Methods cont.

Variables collected:

- Load Delivery Date
- Sale Number/Load Ticket #
- IDL Harvest Area
- Species (WRC, DFL, GFHAF, LPPP)
- Net Truckload weight (tons)
- Seasonal Quarter
- Scribner Gross/Net Volume (bd. ft.)
- Defect %
- Avg. Length (ft.)
- Avg. SED (in.)
- Piece Count (no.)
- LAT/LONG Harvest Unit
- Harvest Unit Elevation (ft.)
- Precipitation and Temperature 30 days prior to delivery

Study Results

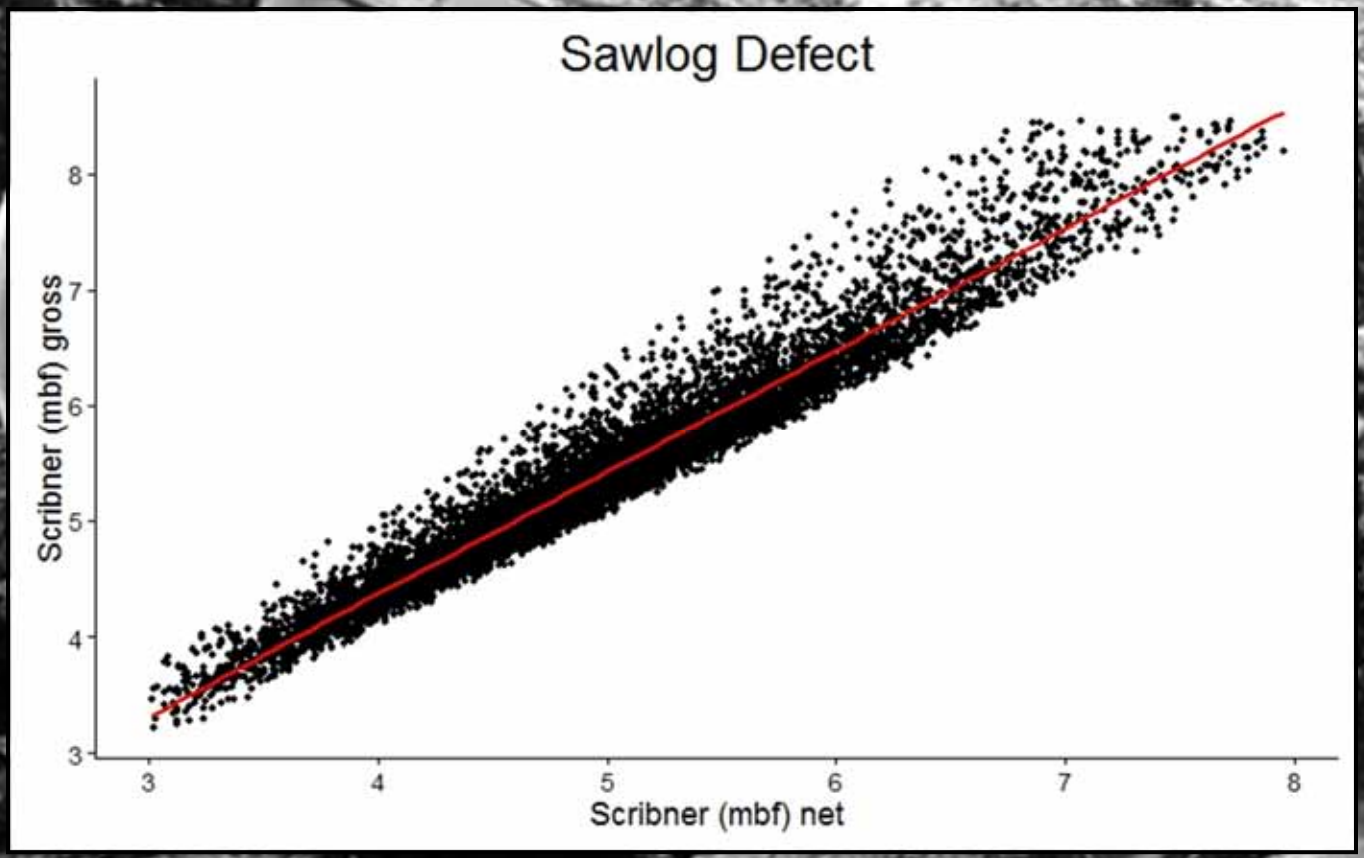
W:V relationships were best explained by:



Quarter was used as a surrogate for precipitation and temperature

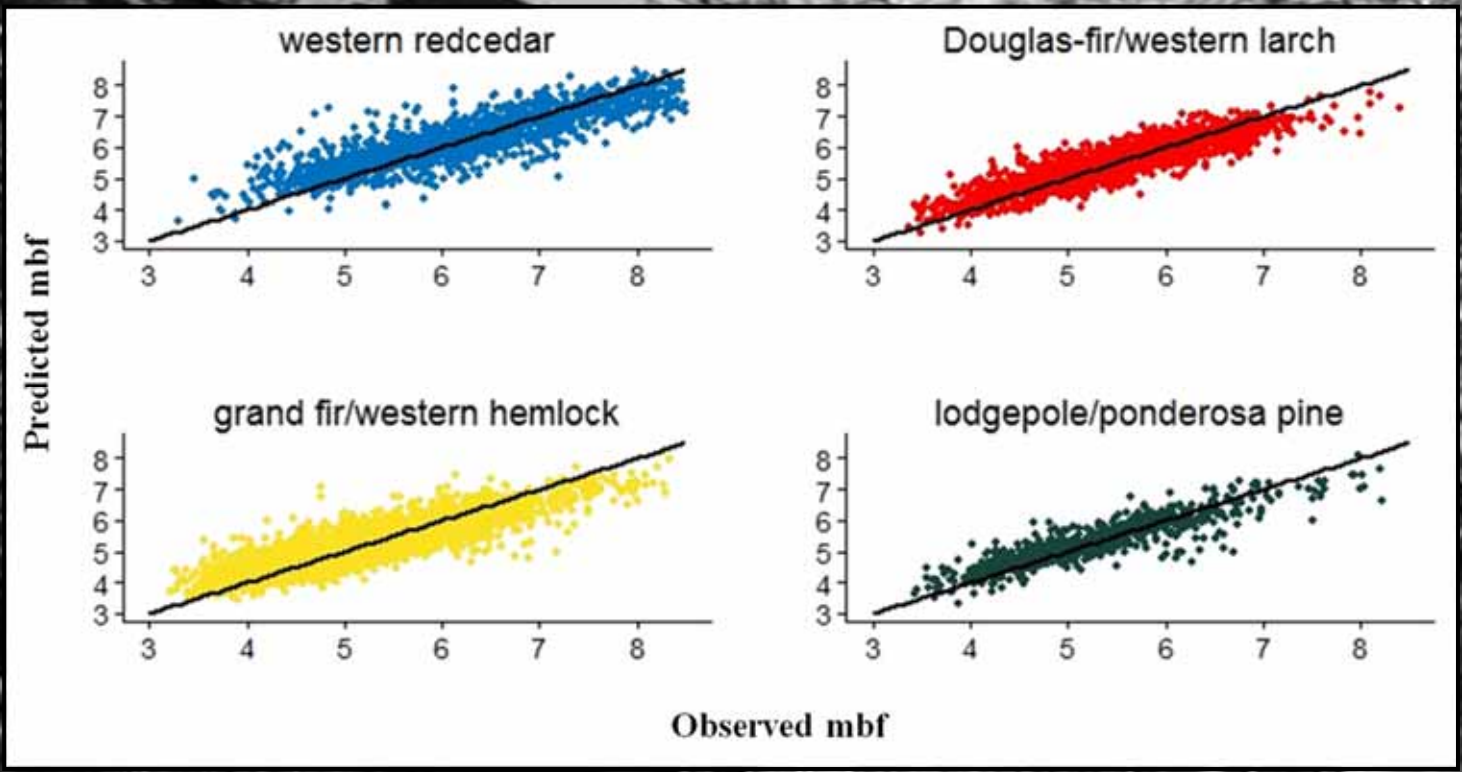
Harvest Area was not found to be a significant predictor

Study Results



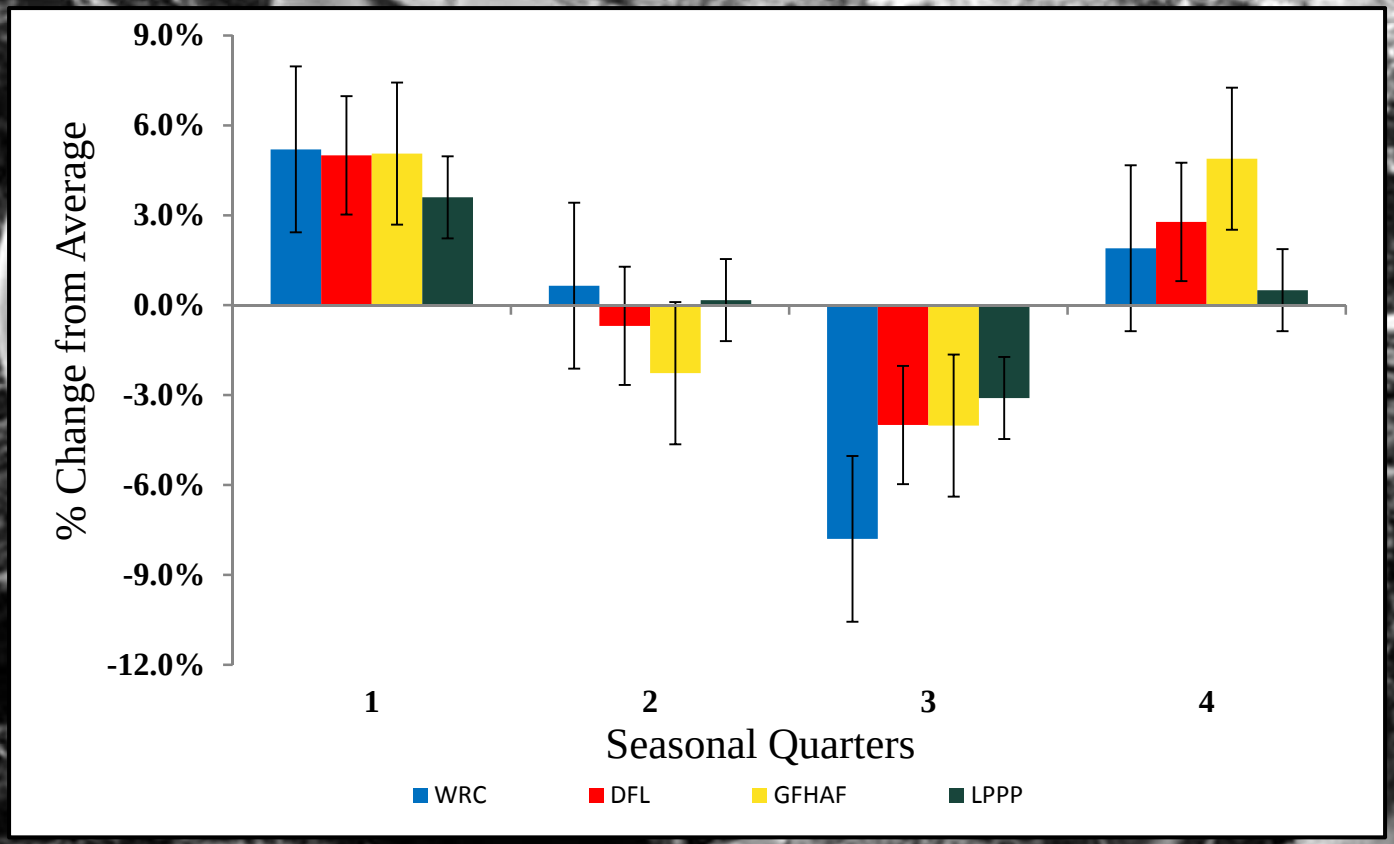
Defect was not significantly different across species, area, season

Study Results



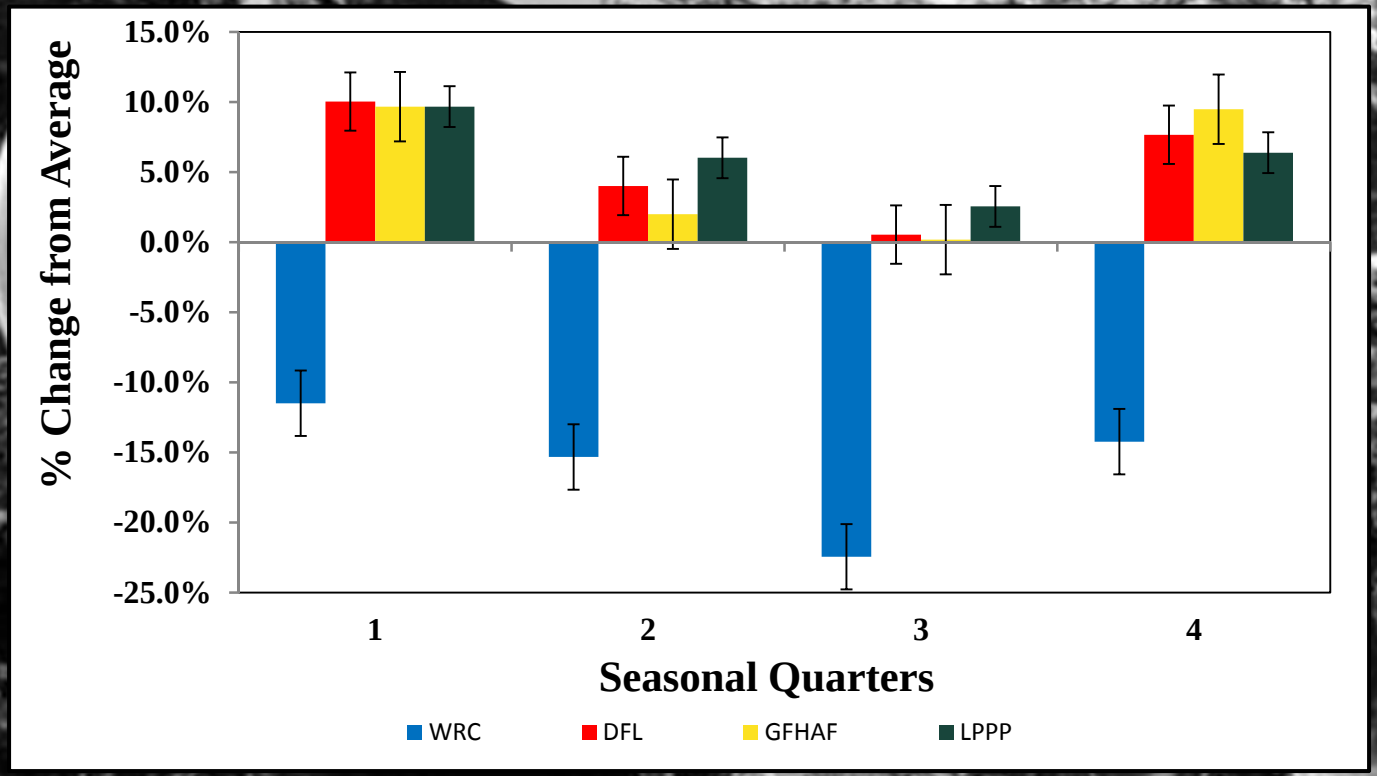
Variation between observed and predicted values of net truckload volumes

Study Results

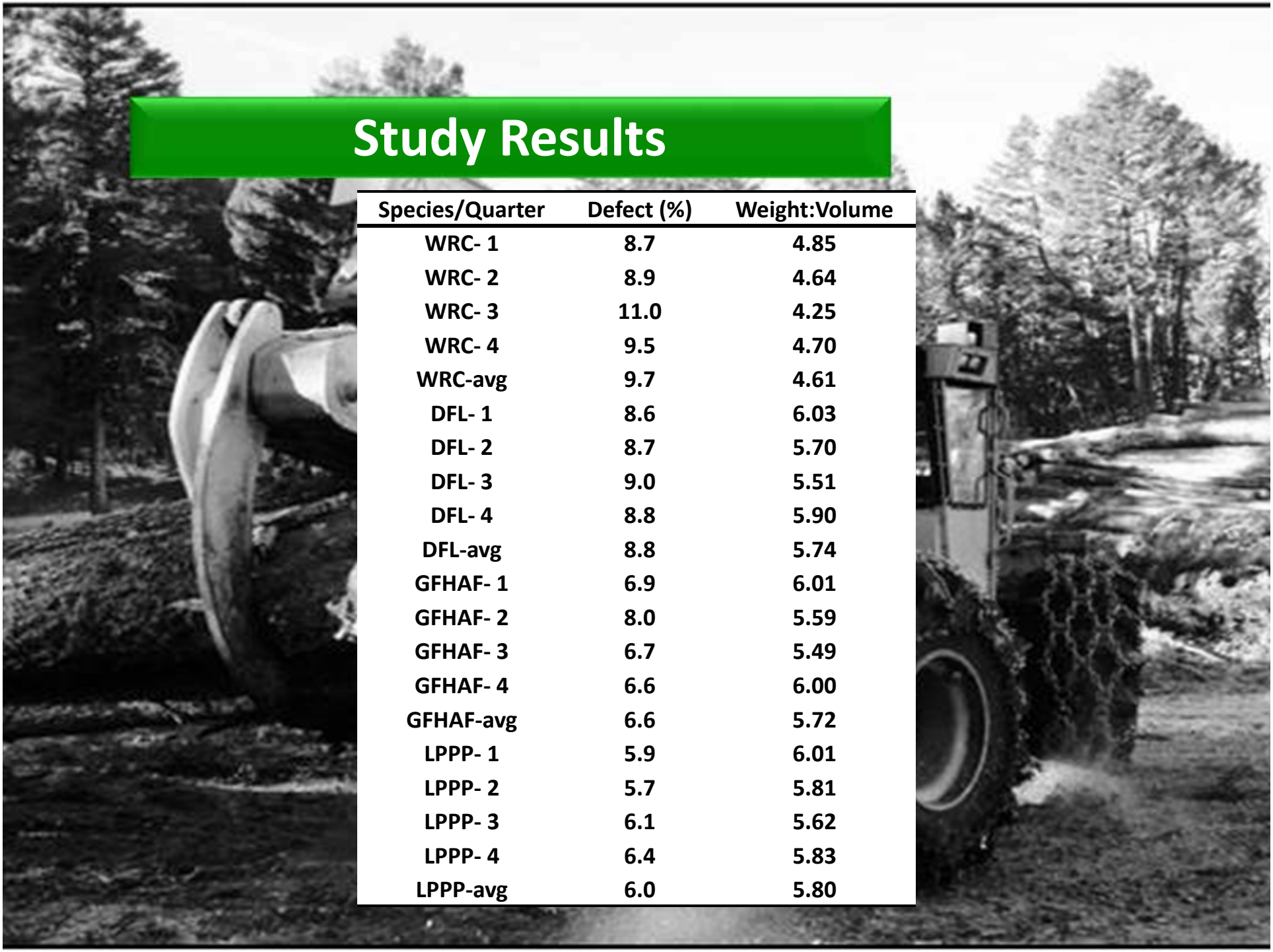


% change in W:V relationship of each species sort compared to their yearly average W:V

Study Results

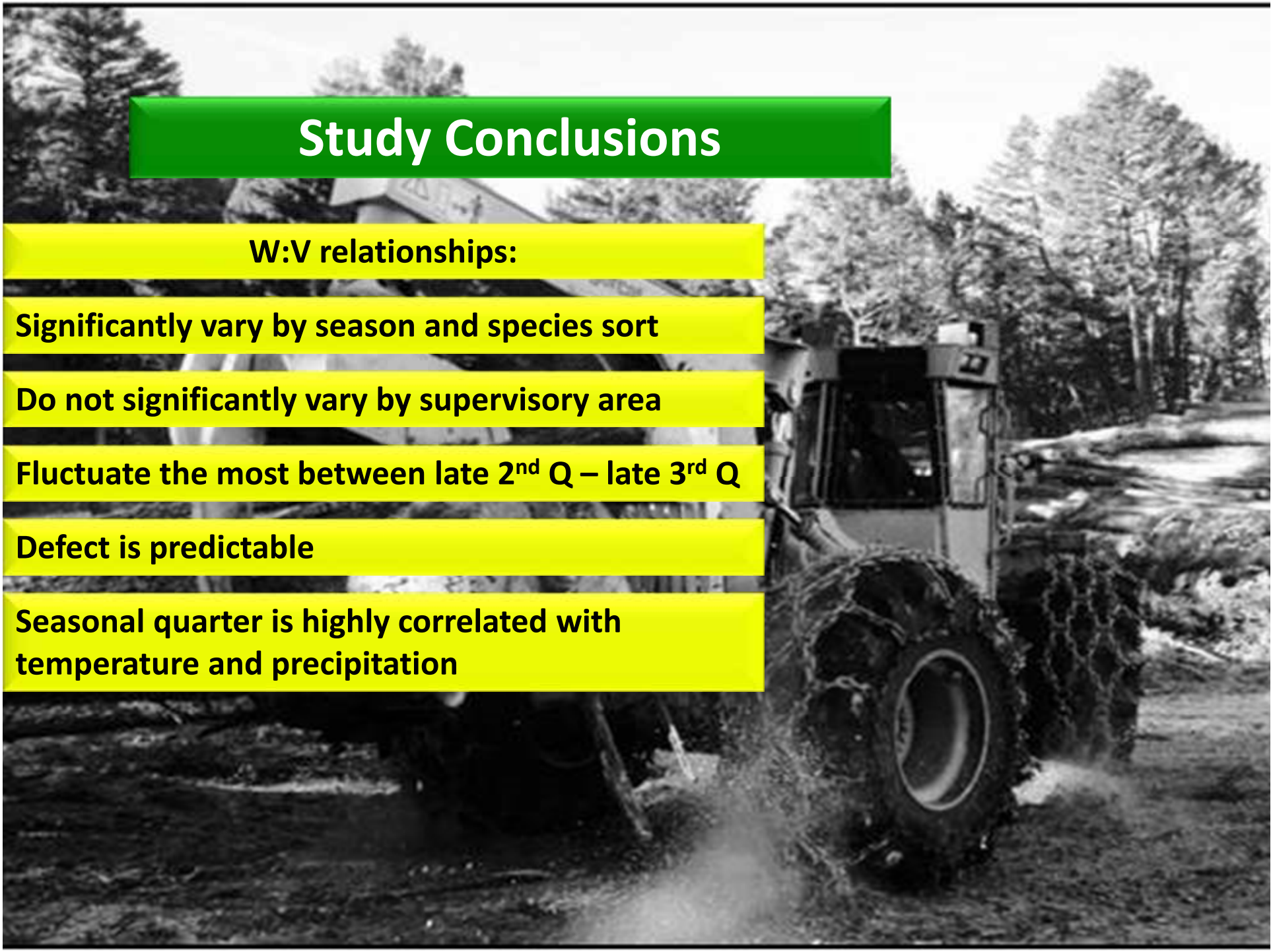


% change in W:V relationship of each species sort compared to the current IDL yearly state average of 5.48 tons/mbf



Study Results

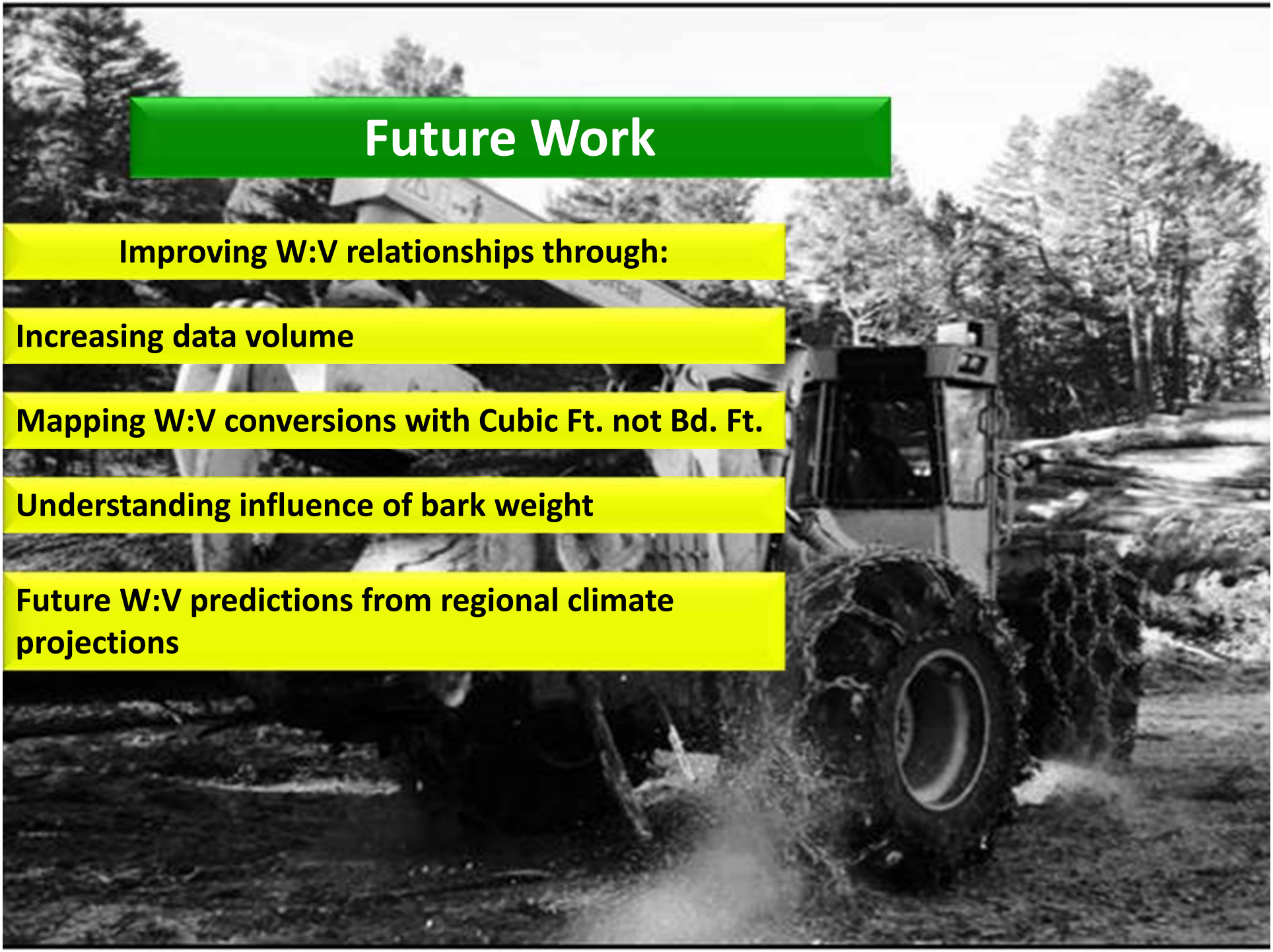
Species/Quarter	Defect (%)	Weight:Volume
WRC- 1	8.7	4.85
WRC- 2	8.9	4.64
WRC- 3	11.0	4.25
WRC- 4	9.5	4.70
WRC-avg	9.7	4.61
DFL- 1	8.6	6.03
DFL- 2	8.7	5.70
DFL- 3	9.0	5.51
DFL- 4	8.8	5.90
DFL-avg	8.8	5.74
GFHAF- 1	6.9	6.01
GFHAF- 2	8.0	5.59
GFHAF- 3	6.7	5.49
GFHAF- 4	6.6	6.00
GFHAF-avg	6.6	5.72
LPPP- 1	5.9	6.01
LPPP- 2	5.7	5.81
LPPP- 3	6.1	5.62
LPPP- 4	6.4	5.83
LPPP-avg	6.0	5.80



Study Conclusions

W:V relationships:

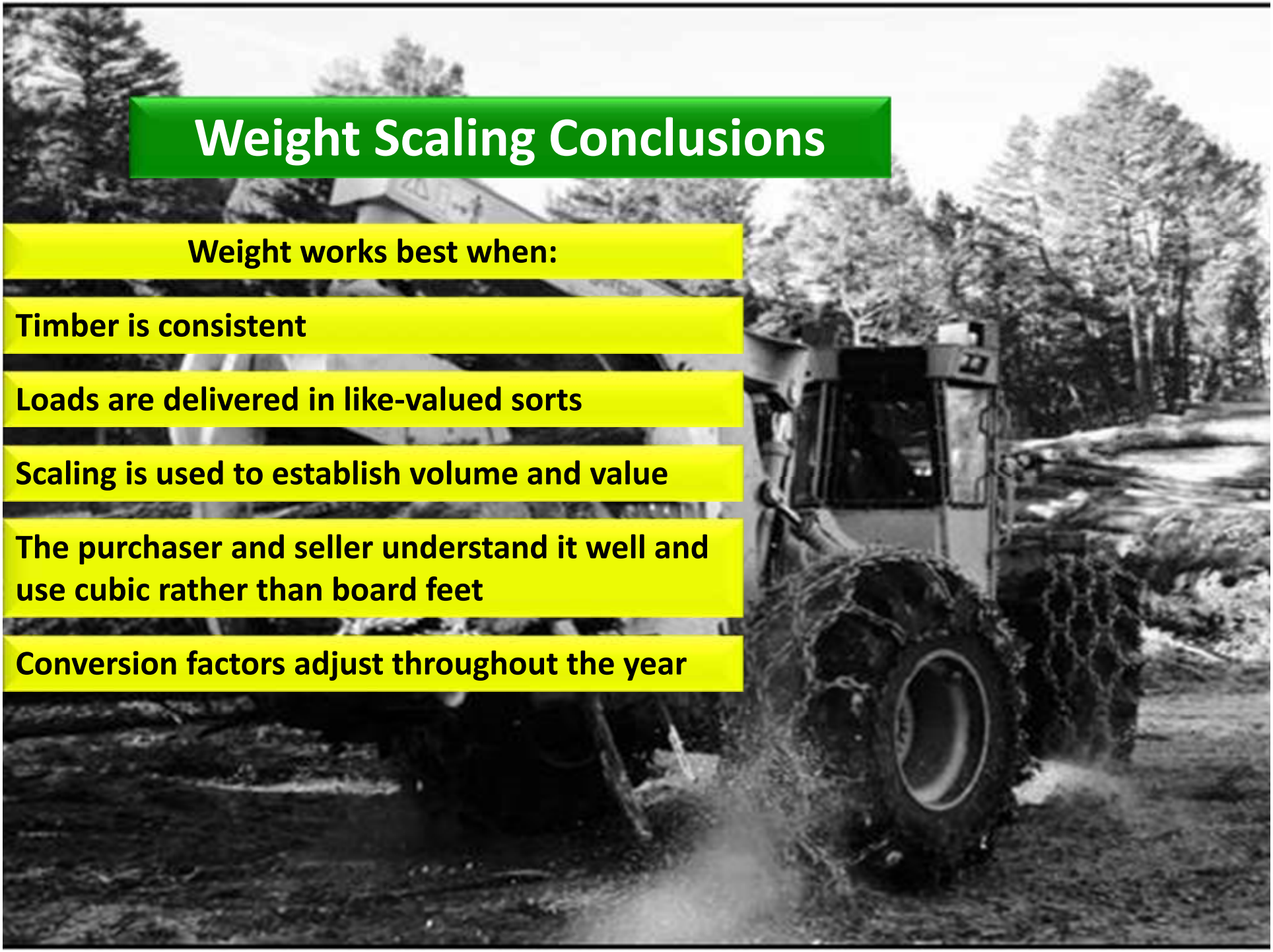
- Significantly vary by season and species sort
- Do not significantly vary by supervisory area
- Fluctuate the most between late 2nd Q – late 3rd Q
- Defect is predictable
- Seasonal quarter is highly correlated with temperature and precipitation



Future Work

Improving W:V relationships through:

- **Increasing data volume**
- **Mapping W:V conversions with Cubic Ft. not Bd. Ft.**
- **Understanding influence of bark weight**
- **Future W:V predictions from regional climate projections**



Weight Scaling Conclusions

Weight works best when:

- Timber is consistent
- Loads are delivered in like-valued sorts
- Scaling is used to establish volume and value
- The purchaser and seller understand it well and use cubic rather than board feet
- Conversion factors adjust throughout the year

Citations and Acknowledgements

•Bauer, E., Hogan, R. 2006. *Log Scaling in Idaho, Scaling and Marketing Private Timber*. University of Idaho Cooperative Extension

•Bowyer, J. L., Shmulsky, R., and Haygreen, J. G. 2007. *Forest Products and Wood Science: An Introduction*. Blackwell Pub. Ames, Iowa. 558p.

•Breiman, L., 2001. Random Forests. *Machine Learning*, 45: 5-32.

•Daniels, Robert A. 2005. *Marketing Your Timber: The Basics Of Weight Scaling*. Starkville: Mississippi State University. Cooperative Extension Service.

Questions?

Associated Logging Contractors Inc. Idaho

University of Idaho

Idaho Department of Lands

Forest Operations University of Idaho