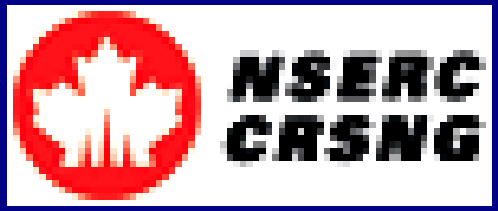
Relationship Between Stem Taper, Crown Depth and External Knot Characteristics in balsam fir (*Abies balsamea*) from the Maritime Lowlands

Doug Turner, M.Sc.
University of New Brunswick

Y.H. Chui, Ph.D.
University of New Brunswick

Tony Zhang, Ph.D.
Forintek Canada Corp.



Knots

- Knots are significant defect in lumber (Zhang *et al.* 1997), recognised in Visual Grading Criteria, and affecting Machine Stress Grading.
- Interest in knots has resulted in interest in log scanning technology e.g. Wagner *et al. (1989)*
- Decisions affecting utilization of lumber made during harvesting operations (Nordmark and Oja 2004).

Stem Quality Assessment

- Stem quality assessment via visual assessment by harvester/processor operator.
  - Some input from harvester operator in Sweden, though relationship between external and internal knot characteristics is poor (Uusitalo *et. al.* 2004)
- In forest conversion without consideration of log quality attributes contributes to suboptimal value recovery.

Cut-to-Length Harvesting

Continuous length and diameter measurement, stem shape prediction and optimisation.

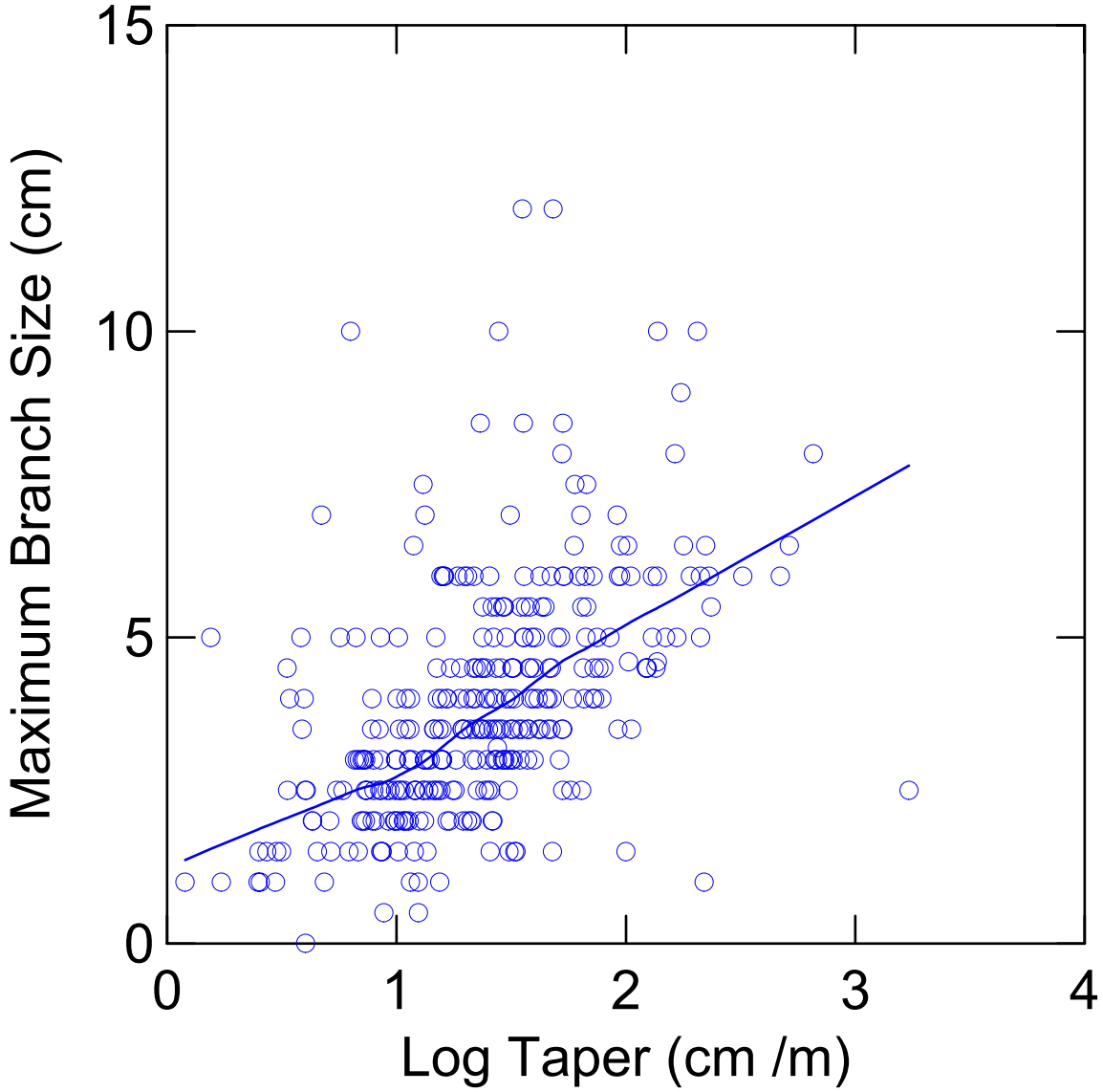
Research Objective

- To investigate whether there is a a means of assessing wood quality (knot characteristics) during tree processing? *Without adding to the working difficulties of the harvester operator?*
- Therefore using the stem measurement capabilities of the harvester/danglehead processor.

Acadia Road 9 Research Project

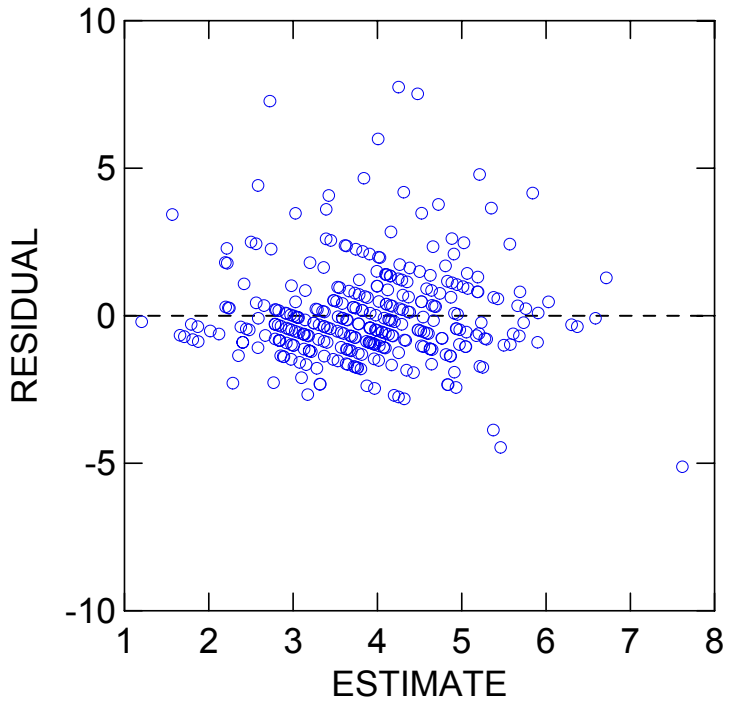
- 103 balsam fir (*Abies balsamea* {L.} Mill) were harvested as part of a larger research project.
- 332 logs processed by harvester and assessed by researchers for length, top diameter, butt diameter, mid diameter and maximum knot size.
- 329 logs usable for statistical analysis.

Graph 1 – Log Taper versus Maximum Branch Size



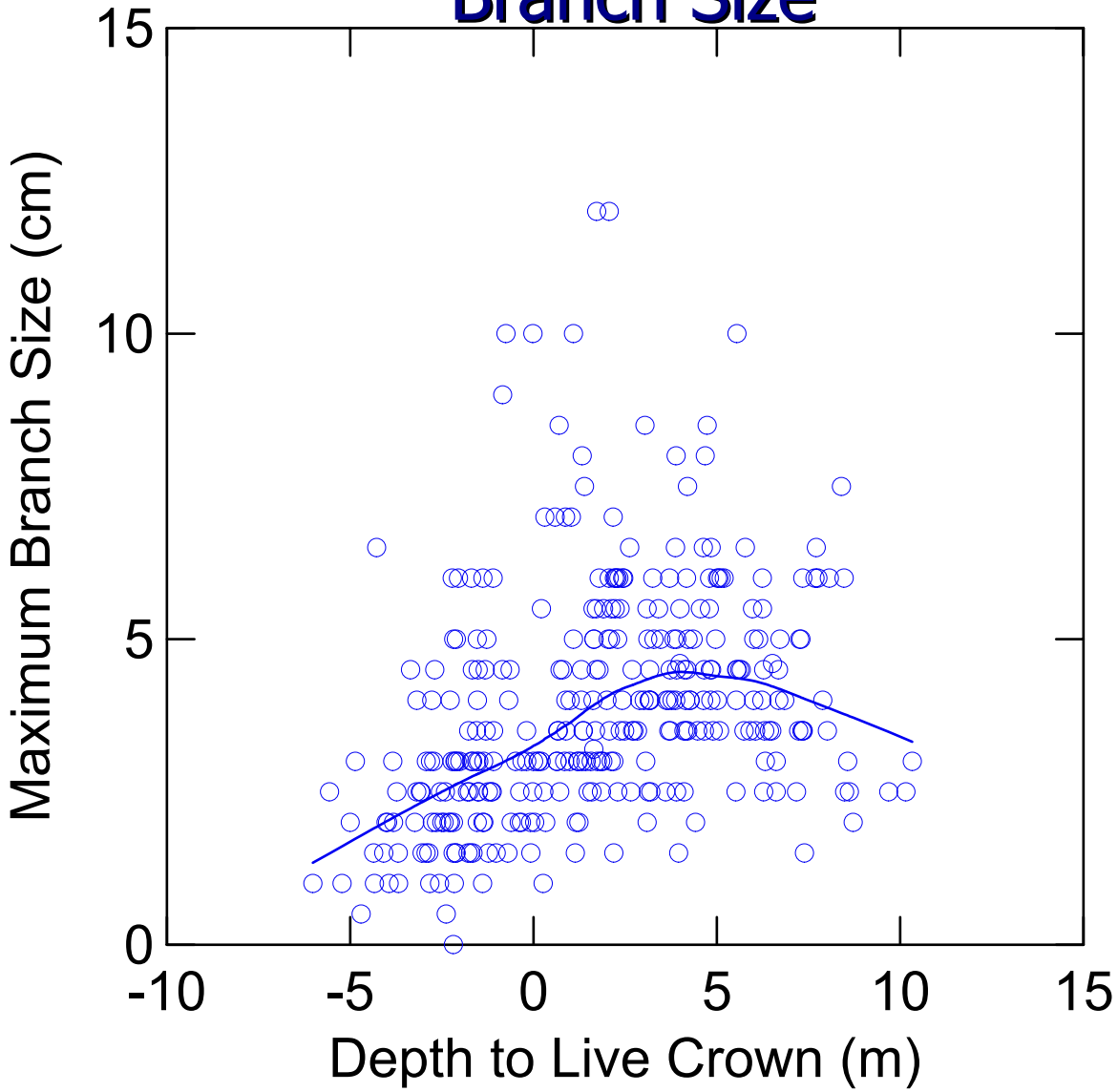
Taper & Branch Size Regression Results

Graph 2: Plot of Residuals



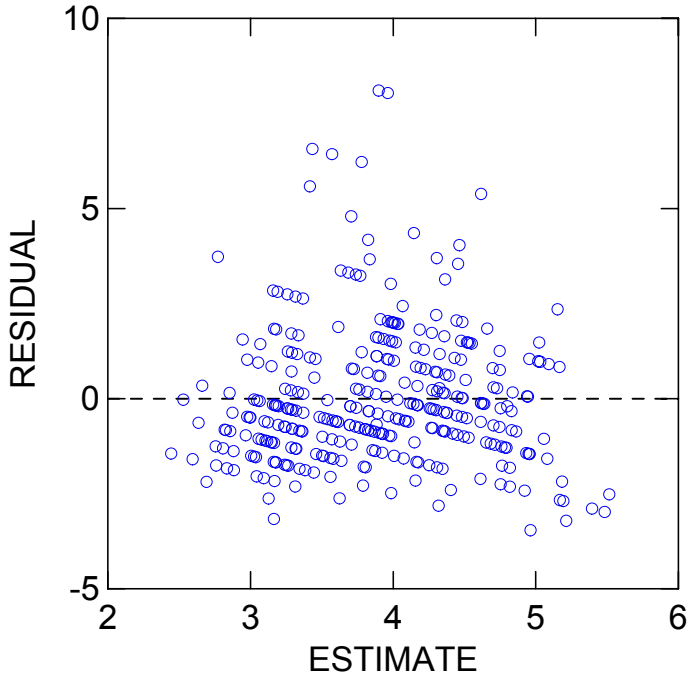
- Analysis suggested that taper is highly significant ($\alpha = 0.05$, $p<0.05$).
- Adjusted $R^2 = 0.257$, n = 329
- Standard Error = 1.646

Graph 3 – Depth in Live Crown versus Maximum Branch Size



Depth in Live Crown & Branch Size Regression Results

Graph 4: Plot of Residuals

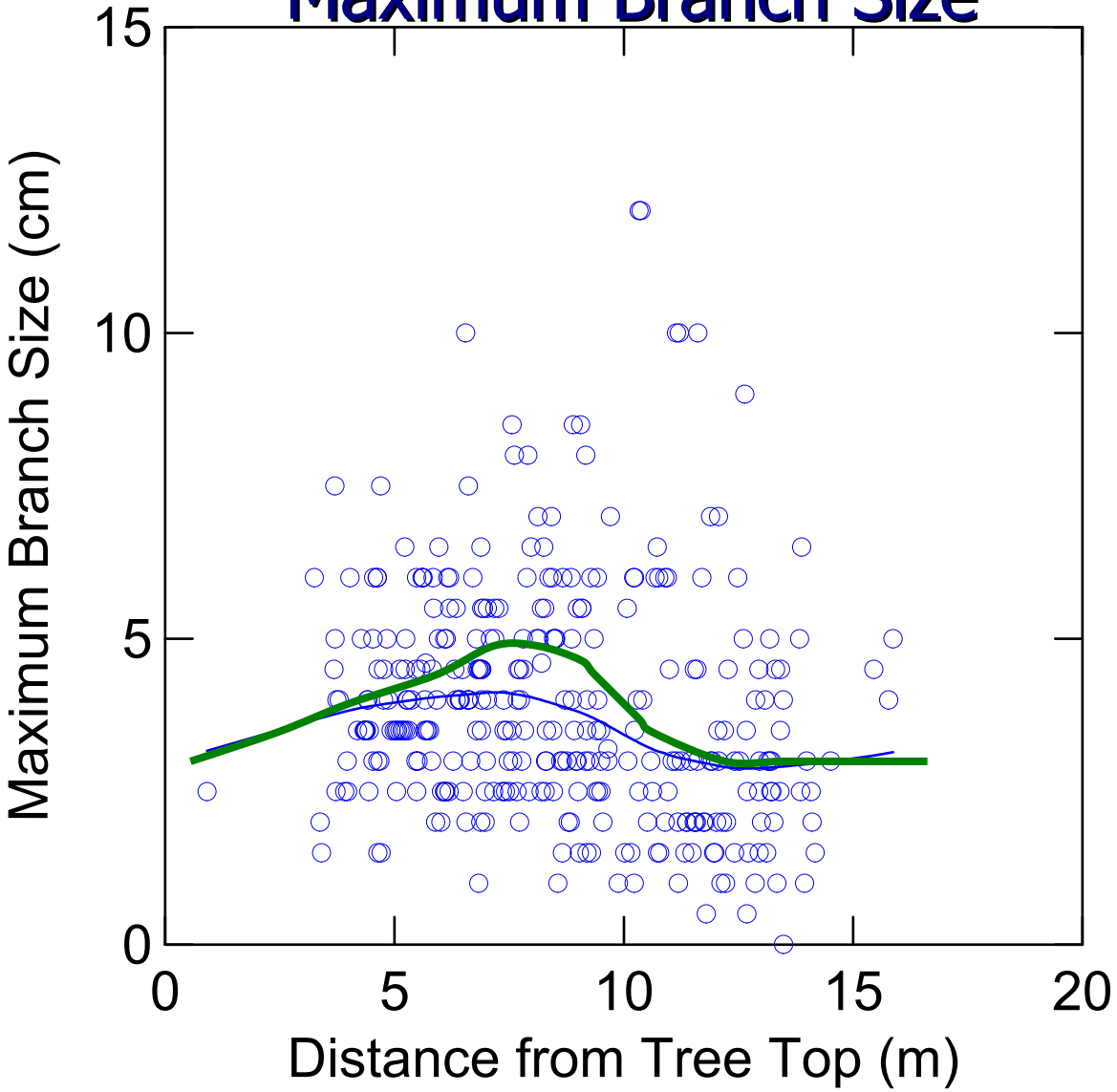


- Analysis suggested that depth in live crown is highly significant ($\alpha = 0.05$, $p<0.05$).
- Adjusted $R^2 = 0.117$, n = 329
- Standard Error = 1.794

Regression Combining Taper and Depth in Live Crown

- Analysis suggested that taper is highly significant, depth of live crown not statistically significant ($\alpha = 0.05$, $p<0.05$).
- Adjusted $R^2 = 0.264$, n = 329
- Standard Error = 1.640

Graph 5: Distance Below Tree Leader versus Maximum Branch Size



Conclusions

1. In this research there is a statistically significant relationship between taper and external knot size.
2. In this research there is a statistically significant relationship between depth in live crown and external knot size.
3. Neither relationship would be reliable for prediction of external knot size.

Conclusions

4. Reliability of taper to predict knot characteristics likely to decline with increasing tree age, dependent on silvicultural practices.
5. Tree taper might be more reliably used to assess different log and wood quality attributes.

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Questions or Comments

Douglas R. Turner

a6a2y@unb.ca