Stem damage in New Zealand planted forests

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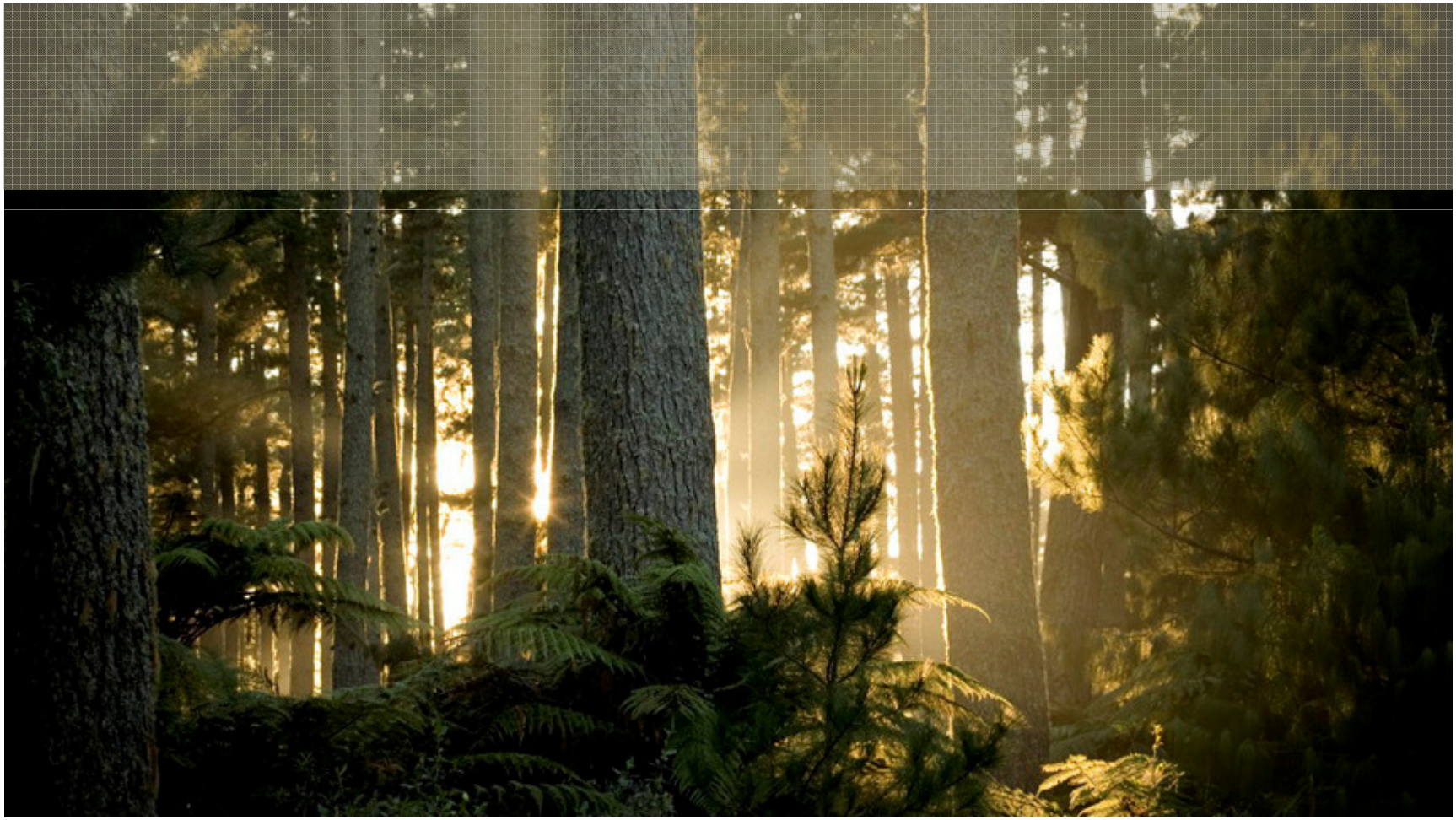
J.C. Grace and C. Meredieu



Background

- Growth Models
  - Assume straight stems
  - Regular branching pattern
- But trees are not “perfect”, especially in windy environments
  - For example: trees can lose their top in a storm
  - Results in:
    - Poor stem form
    - Large branches
- Descriptive codes are recorded in New Zealand Permanent Sample Plots

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Descriptive codes – related to branching

- BW: Basket Whorl
- DL: Double leader
- FK: forked, two leaders above 1.4 m
- ML: multileader
- DT: dead top
- TO: top out
- LR: leader replacement
- RC: ramicorn
- MF: undefined malformation

Descriptive codes – related to stem form

- SW: gentle sweep
- BS: extreme butt sweep
- CK: crooked
- LN: growing with excessive lean
- SO: socketing
- TP: toppled, roots damaged but tree alive

Descriptive codes – forked trees

- Trees forked below 1.4 m counted as separate trees
- For this study, such trees assigned descriptive code LF (low fork)

This study: Analysis of stem descriptive codes

- Radiata Pine trials
  - Genetics and stocking
  - Eight radiata pine trials containing a range of improved seedlots including ones developed for wood density
- Douglas-fir trial
  - Stocking and Pruning
  - One trial with a range of silvicultural treatments

Radiata pine trials

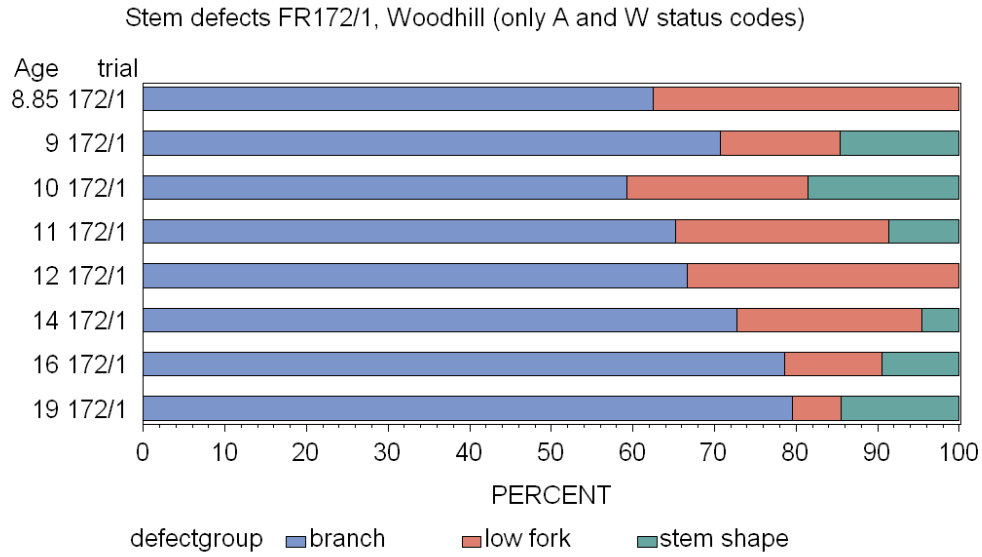
5 trials planted in 1992, 3 planted in 1994

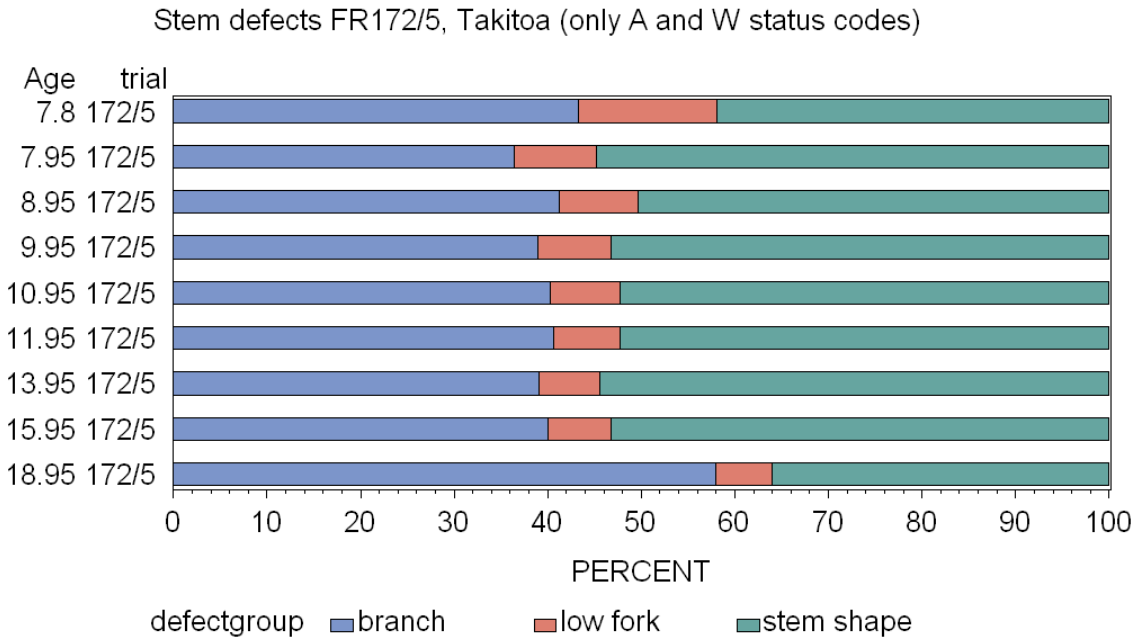
Each trial contains:

- Up to 7 seedlots
- Two silvicultural treatments
  1. Plant 500 stems/ha and leave
  2. Plant 1000 stems/ha,
     thin to 400 at mean crop ht of 7 to 8 m
     and prune to 2 m

Radiata pine trials

- Proportion of different defect codes varies with site conditions





Mean annual windspeed 8.57 km/hr

Mean annual windspeed 13.56 km/hr

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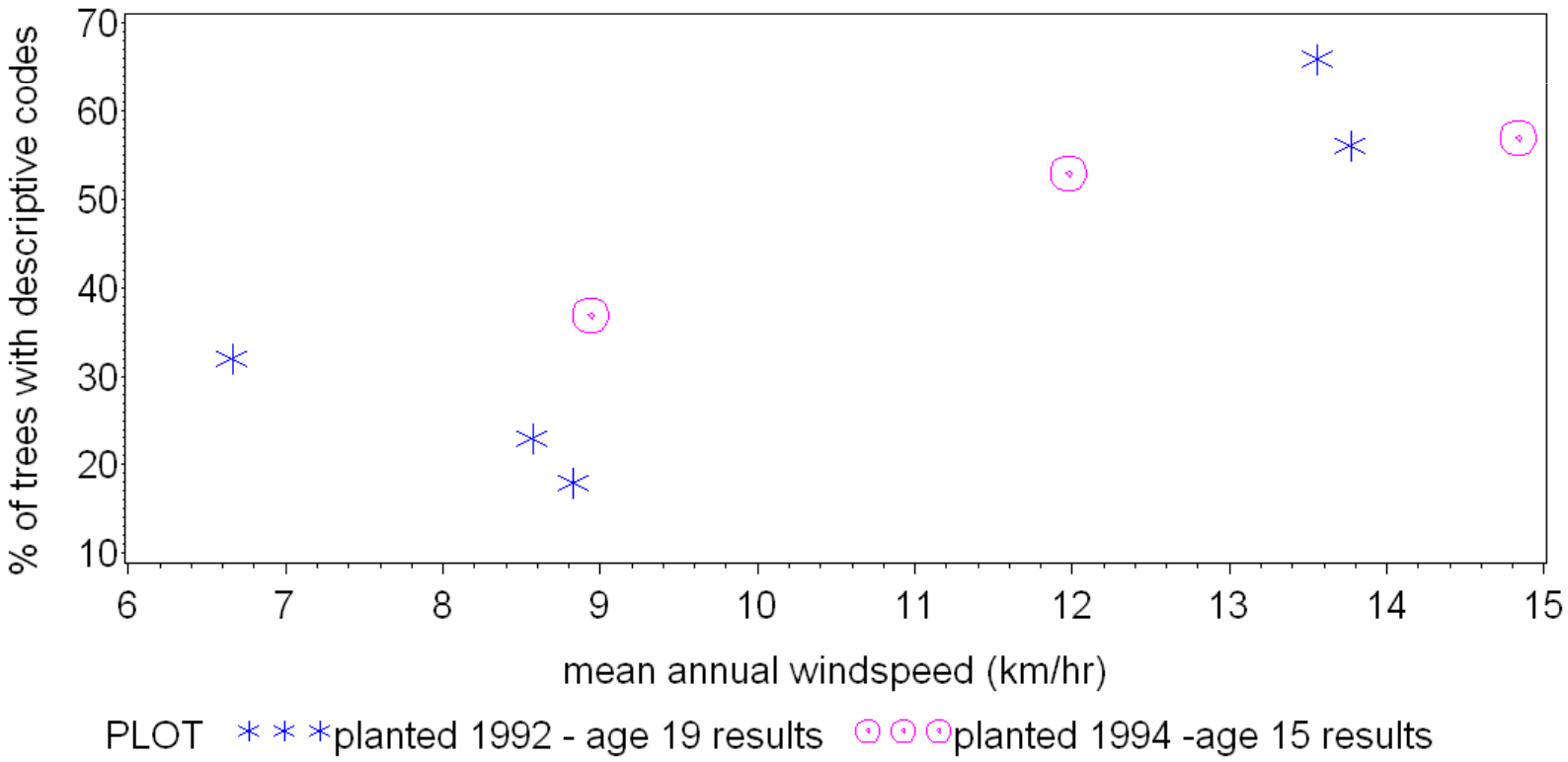
Radiata pine trials

- Proportion of trees with descriptive codes tends to increase with increasing mean annual windspeed



Radiata pine trials

- Treatment significant: 5 of 8 sites
- Seedlot significant: 4 of 8 sites

- Long-internode seedlot (selected for few branch cluster) generally more trees with “defects” than other seedlots
- Seedlots selected for high and low wood density – similar amounts of defects

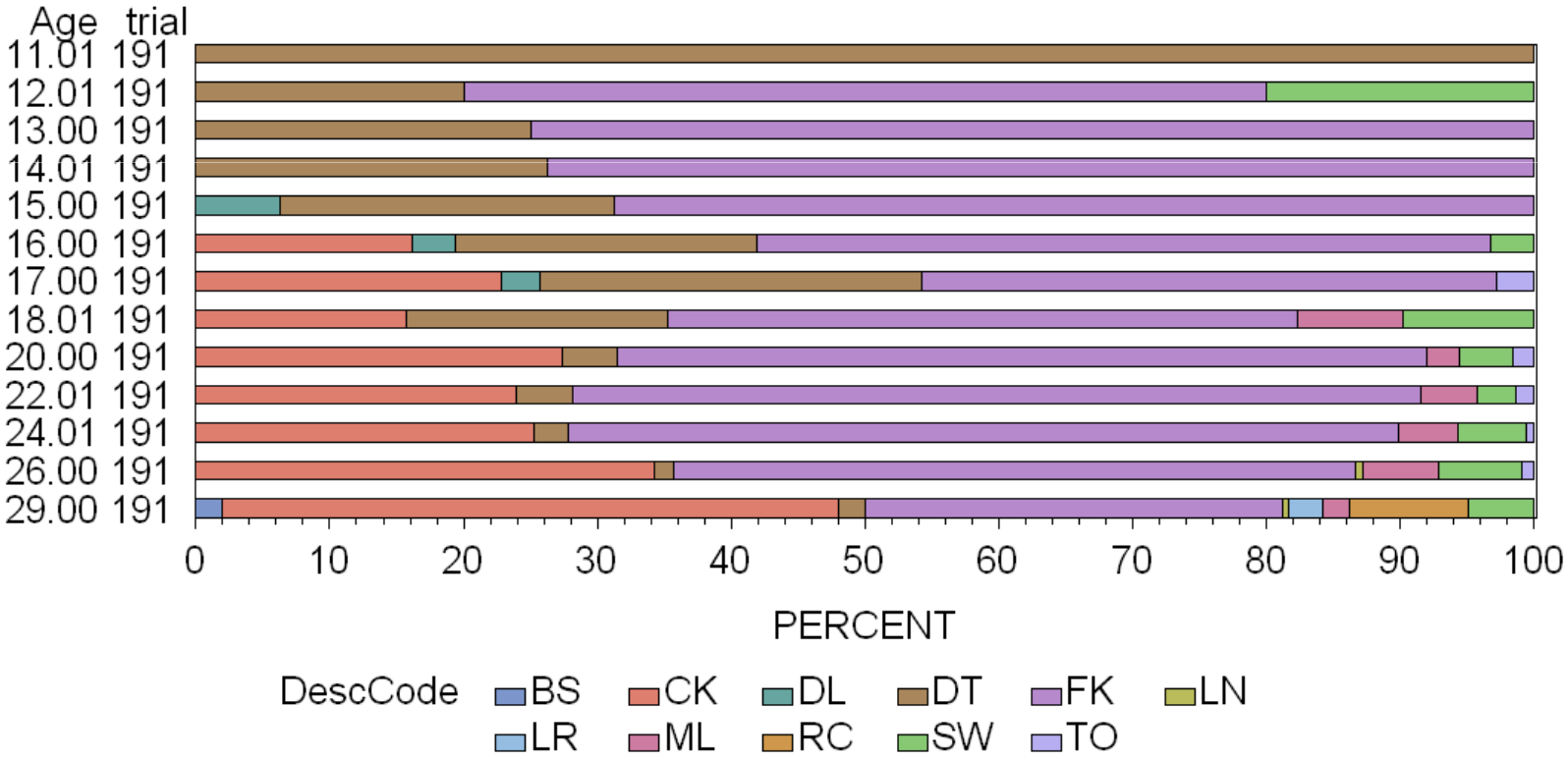
Douglas-fir trial in North Island

Douglas fir trial

- Site: mean annual windspeed 8.34 km/hr
- Planted 1982
- Thinned once at age 10.93 years
- Final stocking either 250, 500 or 750 stems/ha
- Unpruned or pruned regimes
- Pruning regimes combination of:
- Crown remaining after pruning lift: 4, 6 or 8 m
  - Nominal prune height 6 or 12 m (did not reach 12 m)
  - Stems pruned 250 or 500 sph

Douglas fir Trial

- Fork, most recorded defect. Crook also common

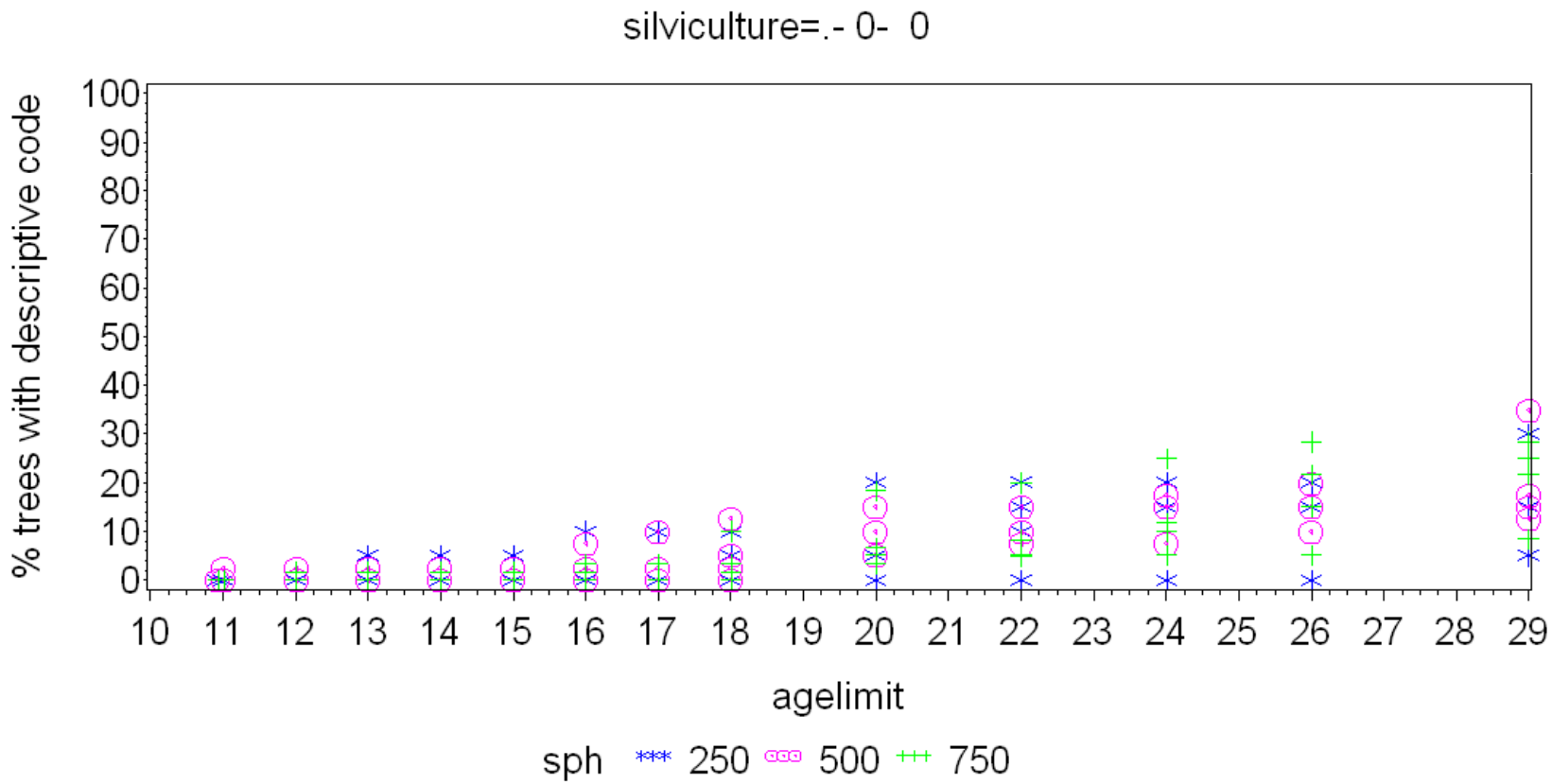


Douglas-fir Trial

- No significant difference with treatment
- On average 9% of trees have a descriptive code at age 20 years, and 18% by age 29 years

Douglas-fir trial

- Time trend in descriptive codes for unpruned plots with different final crop stockings



How to integrate descriptive codes into forest management tools?

- Tree growth model
  - Add a descriptive code to the individual tree
    - At a thinning step in order to constraint the thinning
    - At each step depending of age/ tree density/genetic
    - In connection with a wind model to model the wind breakage probability
- Wood quality model
  - Add a descriptive code to the individual tree
    - To integrate a decrease in wood quality due to tree form

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How to integrate descriptive codes into forest management tools

- GIS system
  - To display the risk zone for worst tree form

- Perception from New Zealand industry
  - Too difficult to integrate branch response to damage into modelling systems
  - They already have “fudge-factors” that account for this type of loss

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