



Development of  
sapstain and  
degrade after  
storm damage  
in stands of  
*Pinus radiata*

**AIM:** To monitor the development of sapstain, wood degrade, and bark beetle incidence following storm damage in stands of *Pinus radiata*.

**PURPOSE:** To provide forest managers with reliable information on periods available for log salvage following such events.



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## The setting: Golden Downs Forest, Nelson

- Wind storm 30 July 2008 (SE part of forest)
- Heavy snow 15 Aug 2008 (widely distributed)



Two types of damage: (1) fallen trees with many roots still buried (the majority);  
(2) trees with stems broken or snapped off



## Experimental Design

- 5 plots across forest  
(ages 13-19 years, mainly sapwood;  
1 plot wind damaged, rest snow)
- 5 sampling intervals
- 4 pre-selected fallen trees per plot per  
sampling interval
  - ◆ 2 still rooted
  - ◆ 2 snapped (real or simulated by  
cutting off at rooted base)
- 5 discs equidistant along each stem  
(2-3 m apart)
- Funnel traps plus short billets placed  
on ground to monitor bark beetles

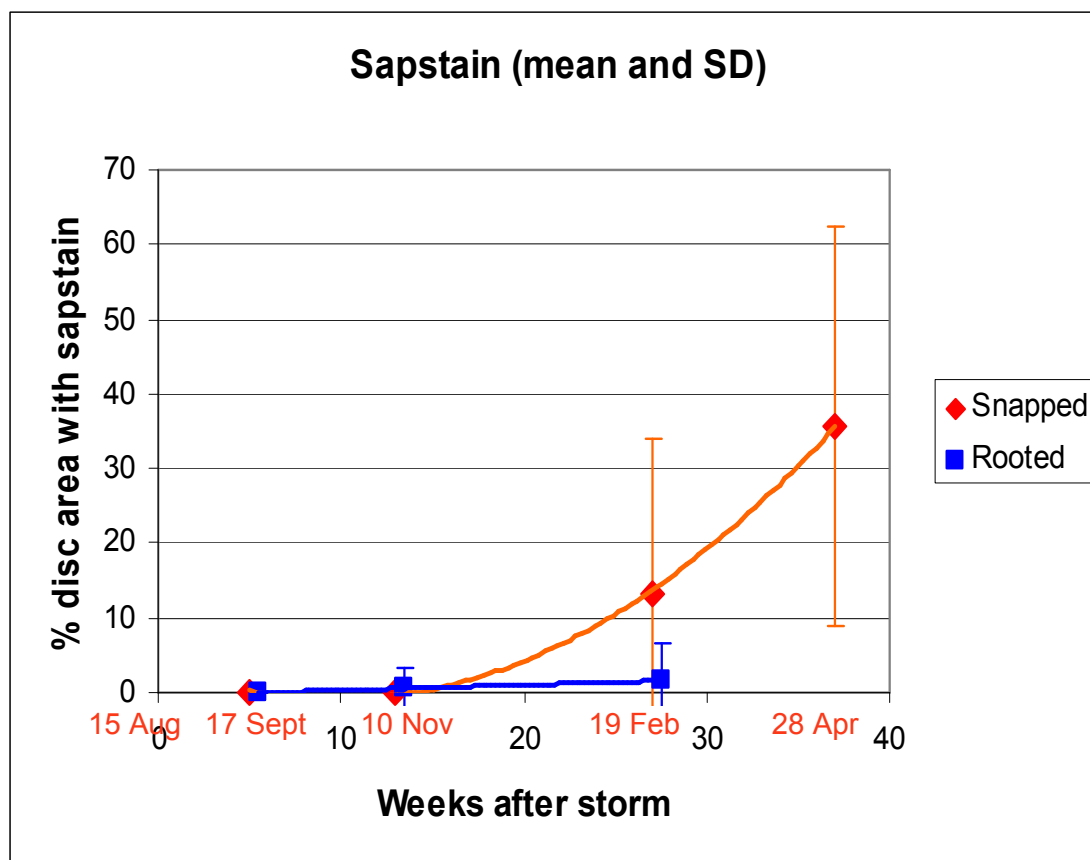


## Laboratory treatment of discs

- Discs photographed
- % sapstain severity estimated on each disc by one person (ie. % cross-section area affected; assessment data will be replaced by computer-generated values from photographs)
- % moisture content determined (oven dry weight basis)
- Fungal isolates cultured from subsamples from Discs 1 and 4



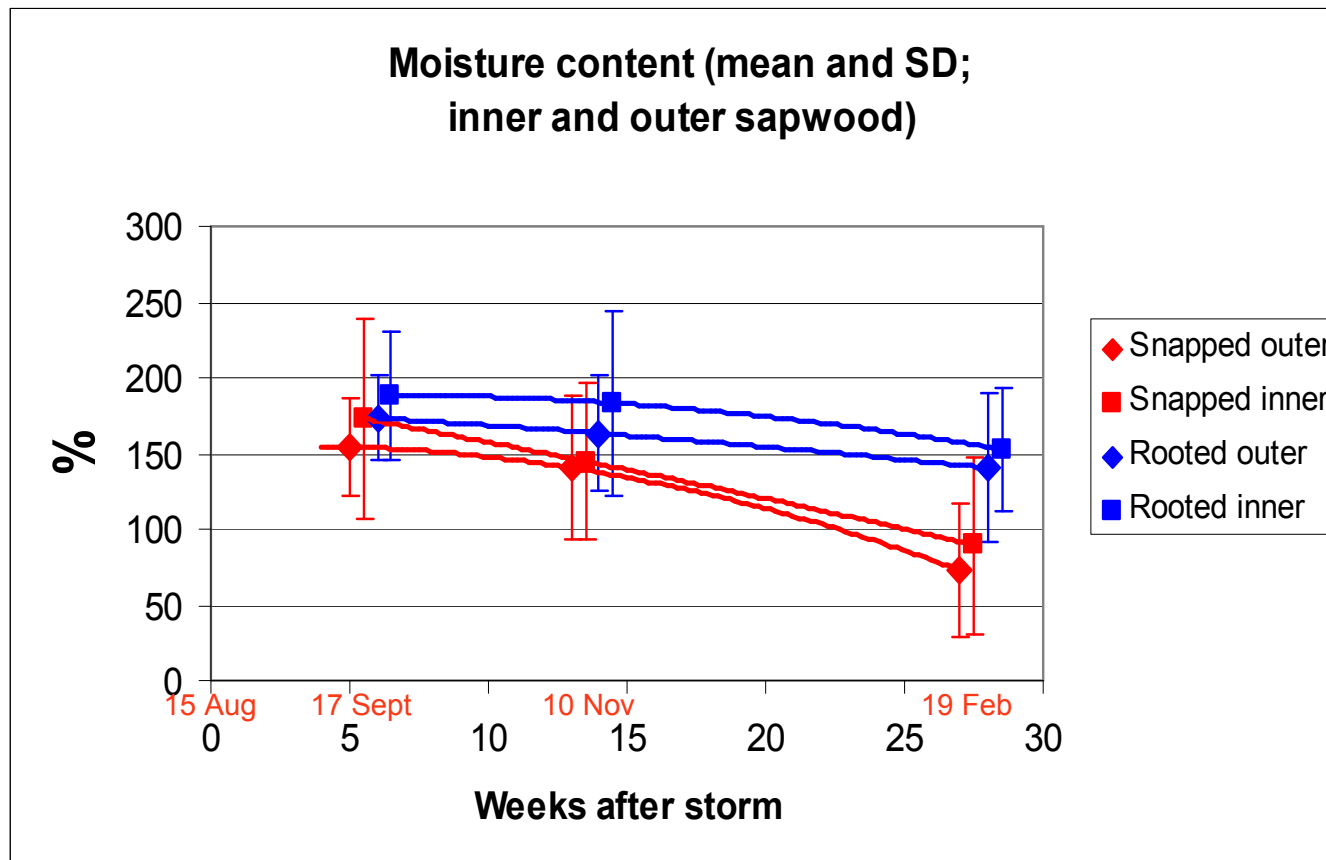
## Provisional results to date



- Sapstain developing faster in snapped than rooted trees
- Even in snapped trees, it took 25 weeks (ie. 6 months), to reach mean 10% sapstain



## Stem Moisture Content



- Stems drying more slowly in rooted trees
- Even in snapped trees it took 20-25 wks (5-6 months) for MC to fall below 100%
- Drying appears more rapid in outer sapwood (both snapped and rooted trees)

## Bark Beetles



- Bark beetles were trapped in large numbers (during Sept-Jan) over the hot spring-summer following storm damage
- High beetle attack occurred in the small billets (Aug-Nov), confirming plentiful beetle populations early in the monitoring period
- However, attack to study trees was first recorded in the third survey (27 weeks, 19 Feb), at low incidence (3 of 100 discs)
- By the fourth survey (37 weeks, 28 April), 44% of discs from snapped trees showed evidence of beetle attack
- Beetle attack in small billets occurred where there was contact with ground or wood debris; such local environments were infrequent among the fallen trees

## Fungi



- Unidentified decay fungi were first detected in trace amounts in the second survey (13 weeks); impact is assumed to be negligible
  - Decay fungi were present in 10% of 39 discs during the third survey (27 weeks, 19 Feb); this is comparable to the rate of sapstain development in snapped stems
  - Therefore, although incipient decay fungi are not readily visible, it is possible that sapstain may be used as a surrogate indicator; both are inhibited in the same way by high moisture content
  - Early activity of decay fungi will be terminated by suitable log processing
  - Sapstain and decay fungi are being identified where possible
- Bark beetles may introduce some but not all of these fungi; they were not associated with 70% of 93 discs with sapstain (harvests 3 and part 4)

## Provisional findings

- Confirmation that degrade develops only after stem moisture content falls below 100%
- On average, there has been no serious sapstain, decay fungus or insect attack during the first 5-6 months after storms
  - In fact, in rooted trees (the majority), sapstain is still developing. Larger trees will presumably behave similarly.
- This accords with the outcomes from two other published windthrow events, in 1964 and 1975, both in Canterbury, where rooted trees were salvaged for up to a year after the storm.





## Provisional findings

- However, this study is providing the first systematic quantitative record in New Zealand
- It appears that even for snapped trees, the 'sapstain index' (Colin Zeff) may not be applicable when salvaging after storms.
- This may be because of:
  - ▶ the very large proportion of rooted trees which take longer to dry
  - ▶ the low incidence of debarking compared to harvesting and log handling damage (bark undoubtedly reduces drying and protects from fungal spores)





## Further Questions

- What is the effect on salvage period of:
  - ▶ timing of storm (ie. season)?
  - ▶ region (eg. North Island)?





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