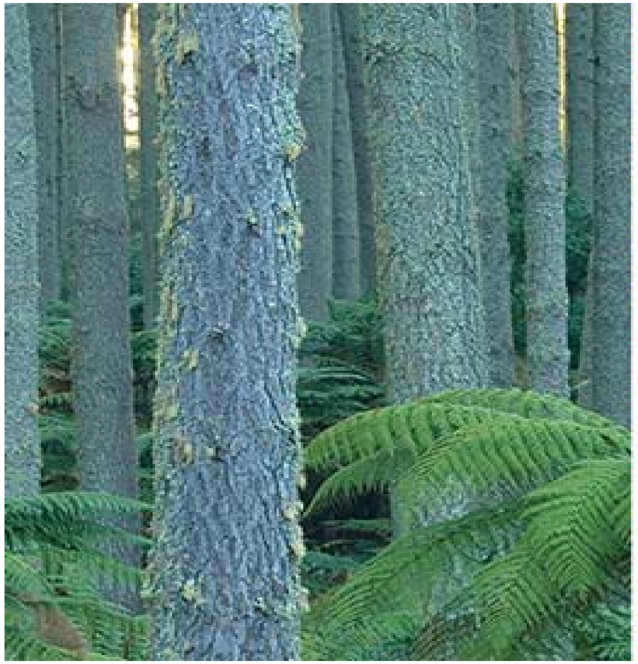
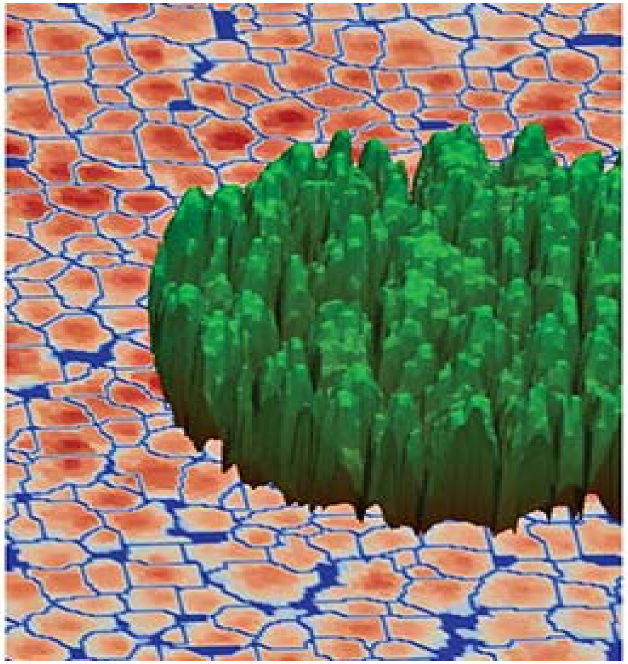
Converting research into action – modifying silvicultural practices in the light of new knowledge

John Moore





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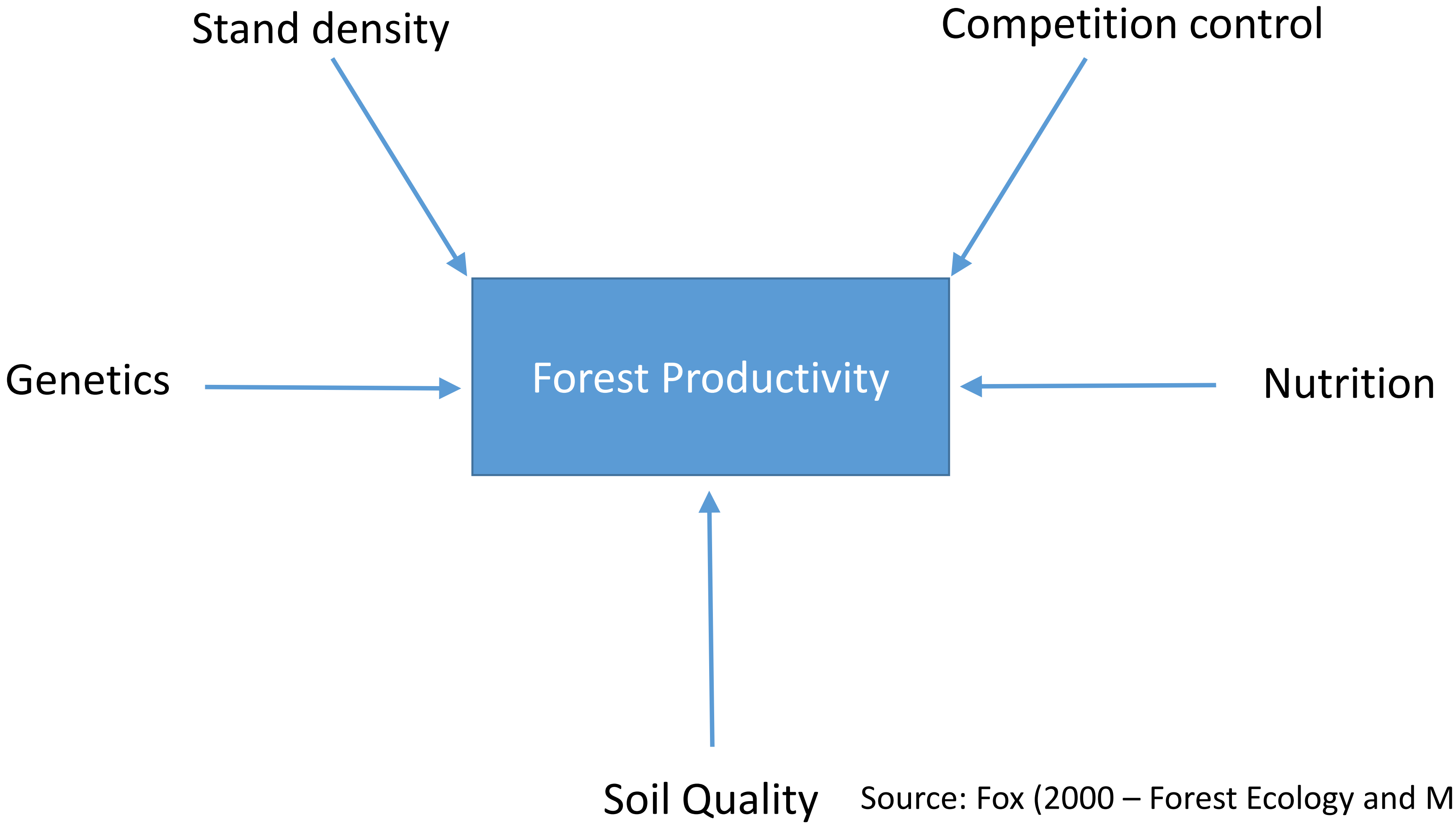
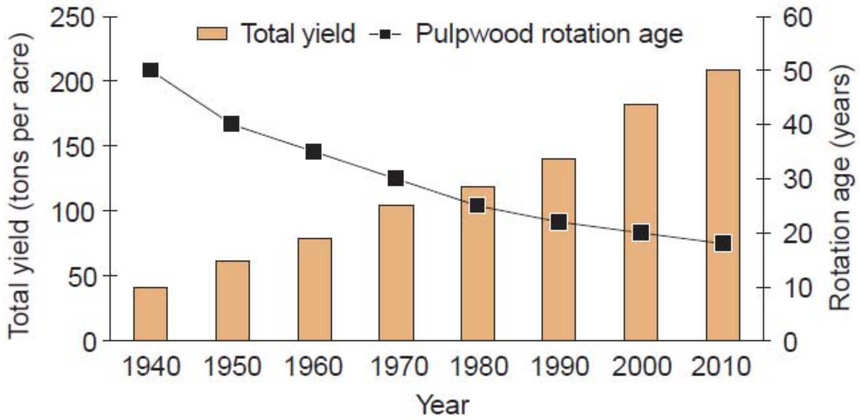
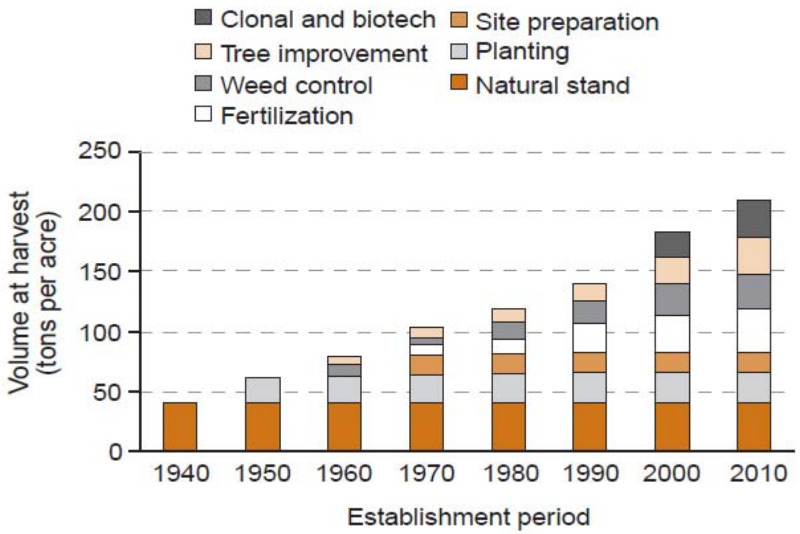
Silviculture and intensive forest management



Source: Fox (2000 – Forest Ecology and Management)

Impacts of forest management on southern pine yields



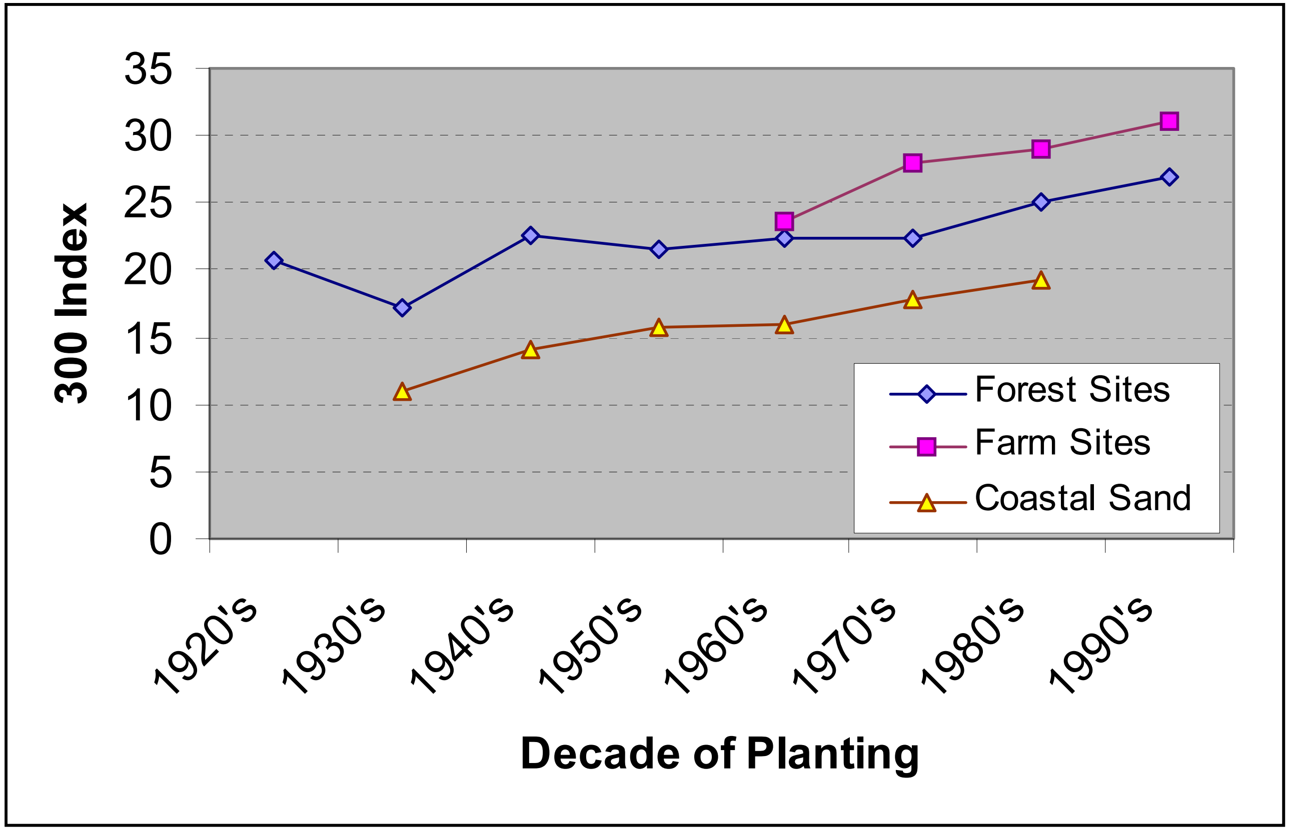


Growth rates of intensively managed pine plantations throughout the world (adapted from Sedjo and Botkin (1997), Yin et al. (1998))

Location	Species	Age	Mean annual increment (m^3/ha per year)
Costa Rica	*P. caribaea*	8	31.4
New Zealand	*P. radiata*	25	32.0
Brazil	*P. taeda*	8	24.2
South Africa	*P. taeda*	22	28.7
Swaziland	*P. patula*	10	19.4
Florida, USA	*P. elliottii*	17	14.5
Georgia, USA	*P. taeda*	9	23.1

Sources: Fox (2000) and Fox et al (2004)

Changes in radiata pine productivity over time

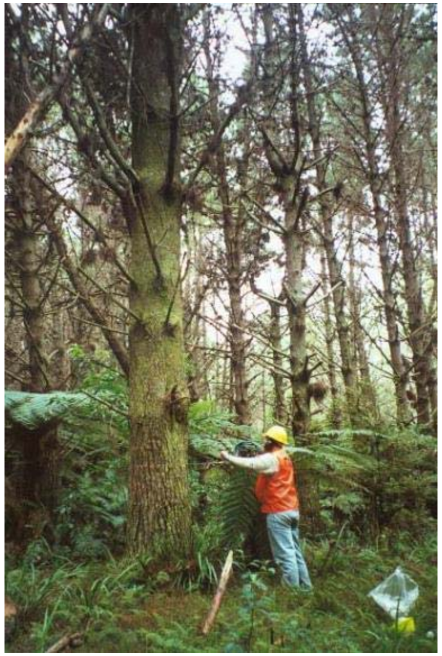


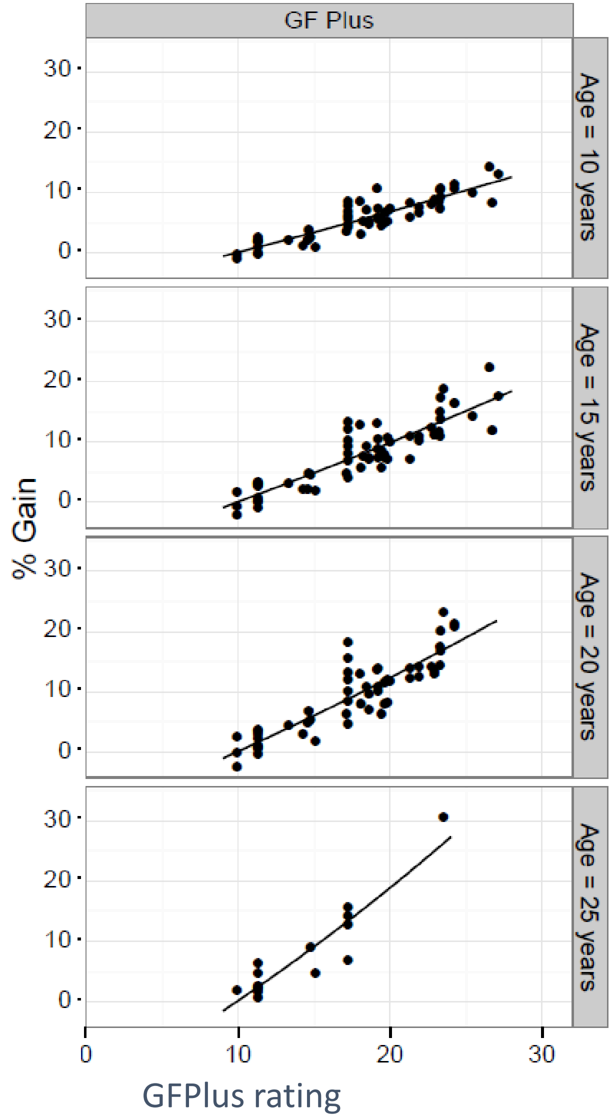
Shows impacts of changes in
- site preparation
- competition (weed) control
- nutrition
- genetic improvement
- soil quality (farm site effect)

Does not show effects of stocking changes over time

Source: Mark Kimberley

Genetic gain





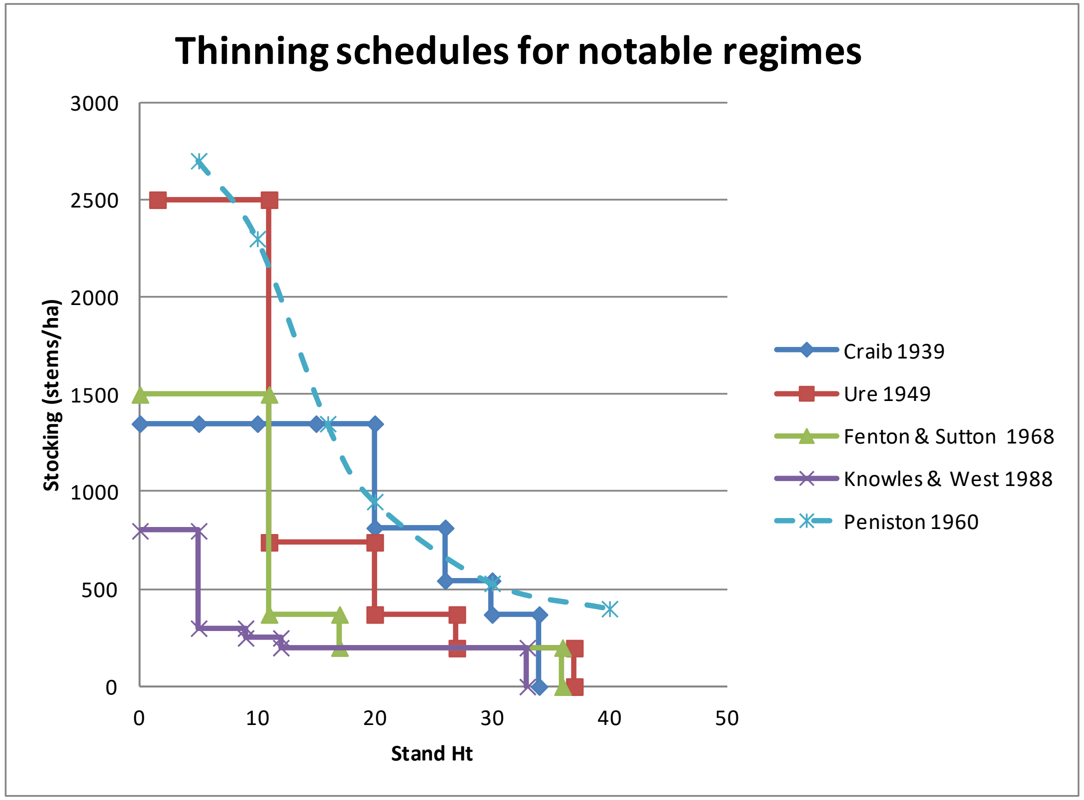
27% gain in stem volume at harvest (30 yrs)

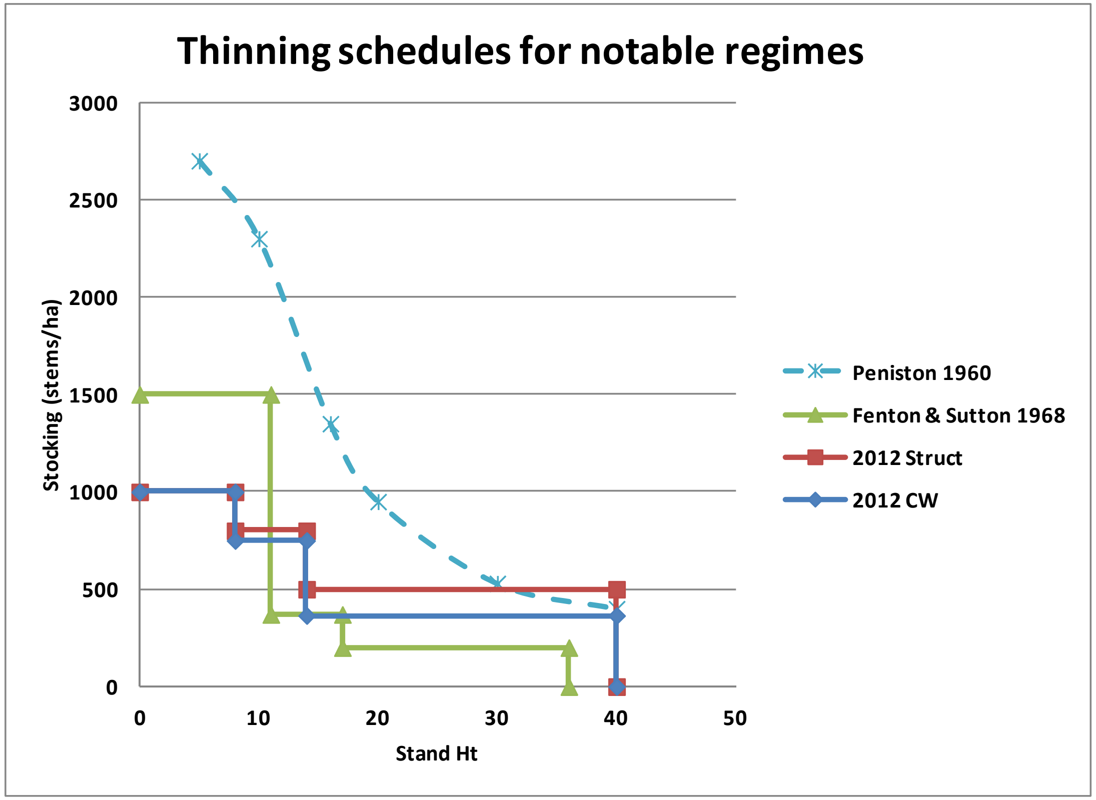
33% gain in stumpage at harvest

300 Index increases by:

- 1.67% per unit of GF Plus growth

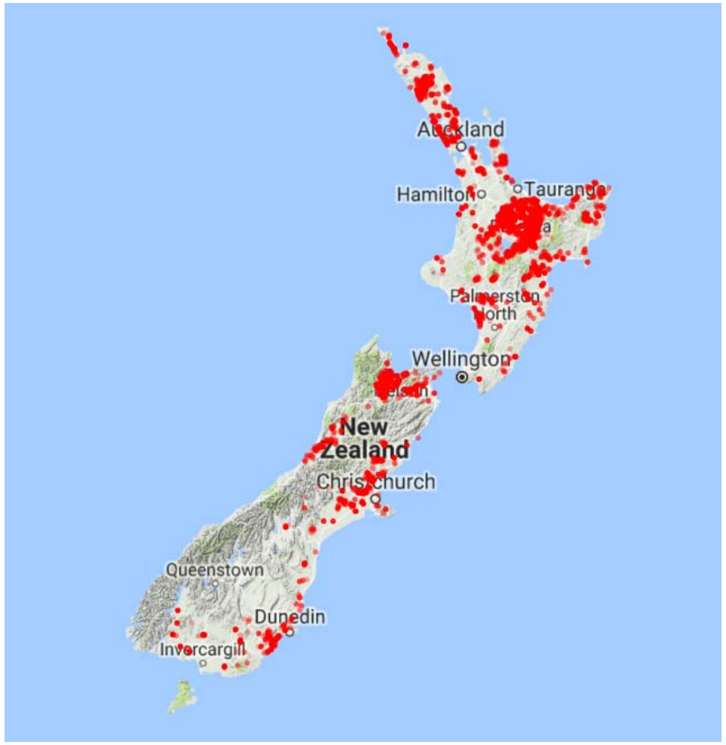
Stocking control is a key determinant of yield

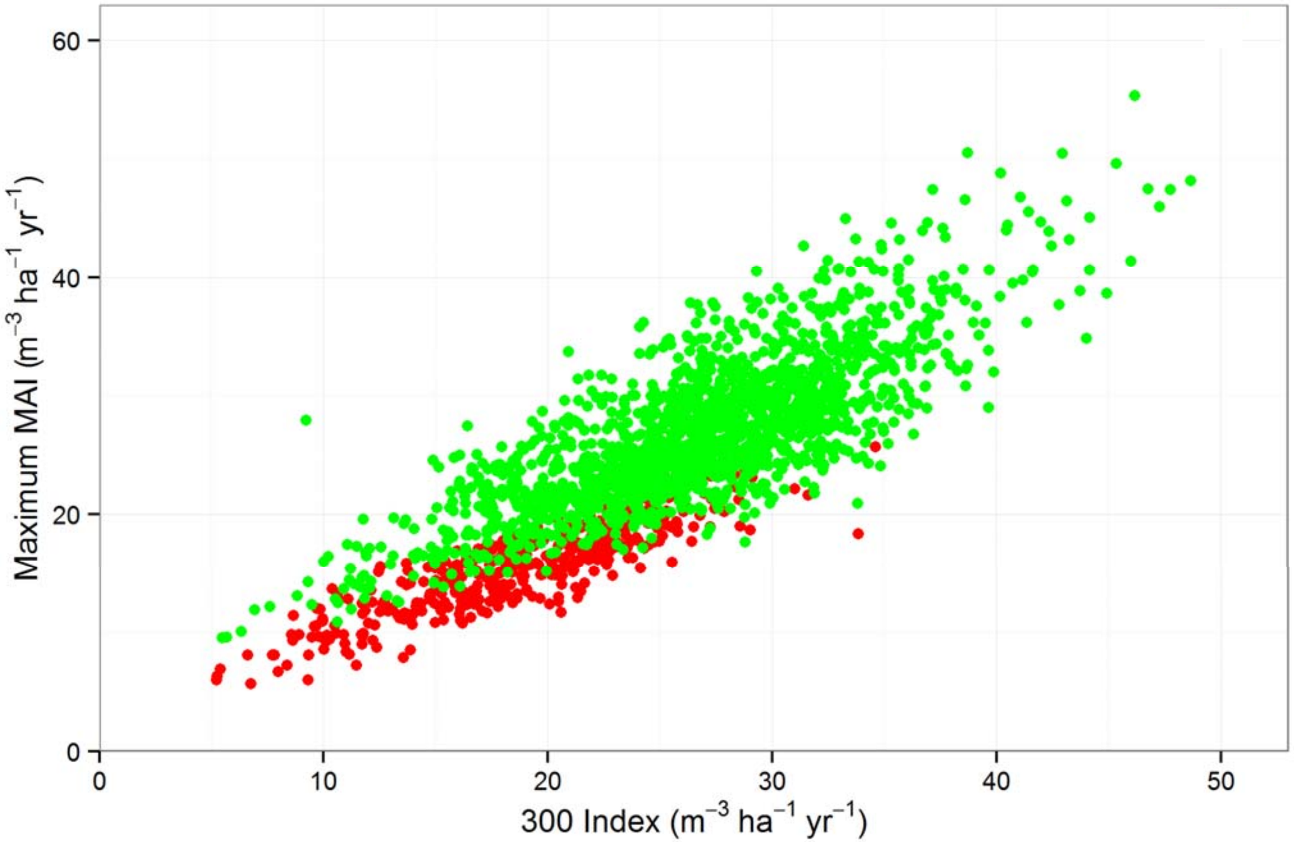




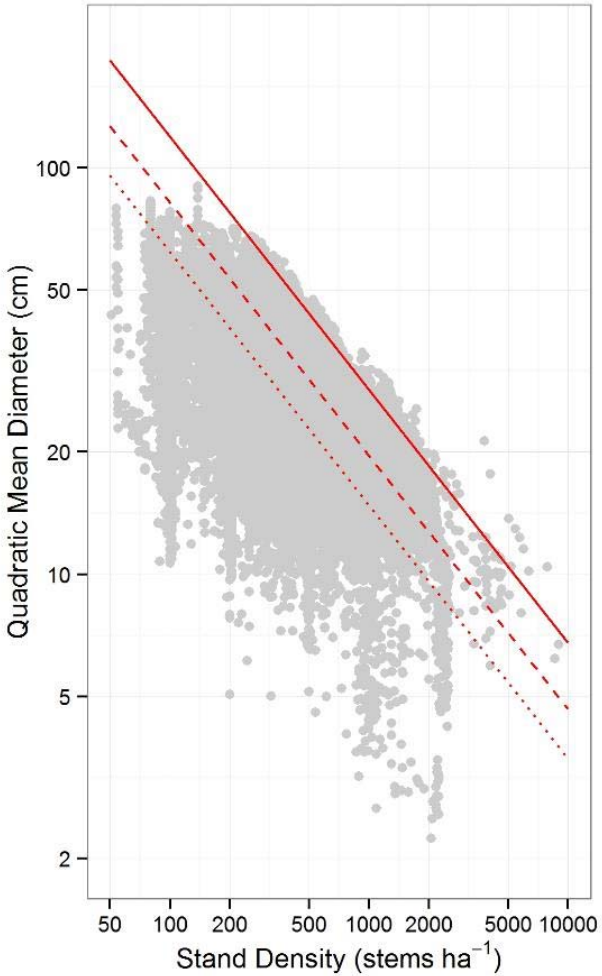
Source: Graham West

Differences in MAI for a given site productivity mostly reflect variation in stocking





Do thinning schedules need to be modified for improved genetic material?



- Thinning is often scheduled on the basis of stand height
- Treatments that aim to boost productivity generally have a larger effect on diameter growth than height growth
- Should thinning be scheduled on the basis of SDI rather than height to prevent a slowdown in growth due to excessive completion among trees?
- Will self-thinning and stand dynamics in general differ in stands grown from improved seedlots and clonal material?

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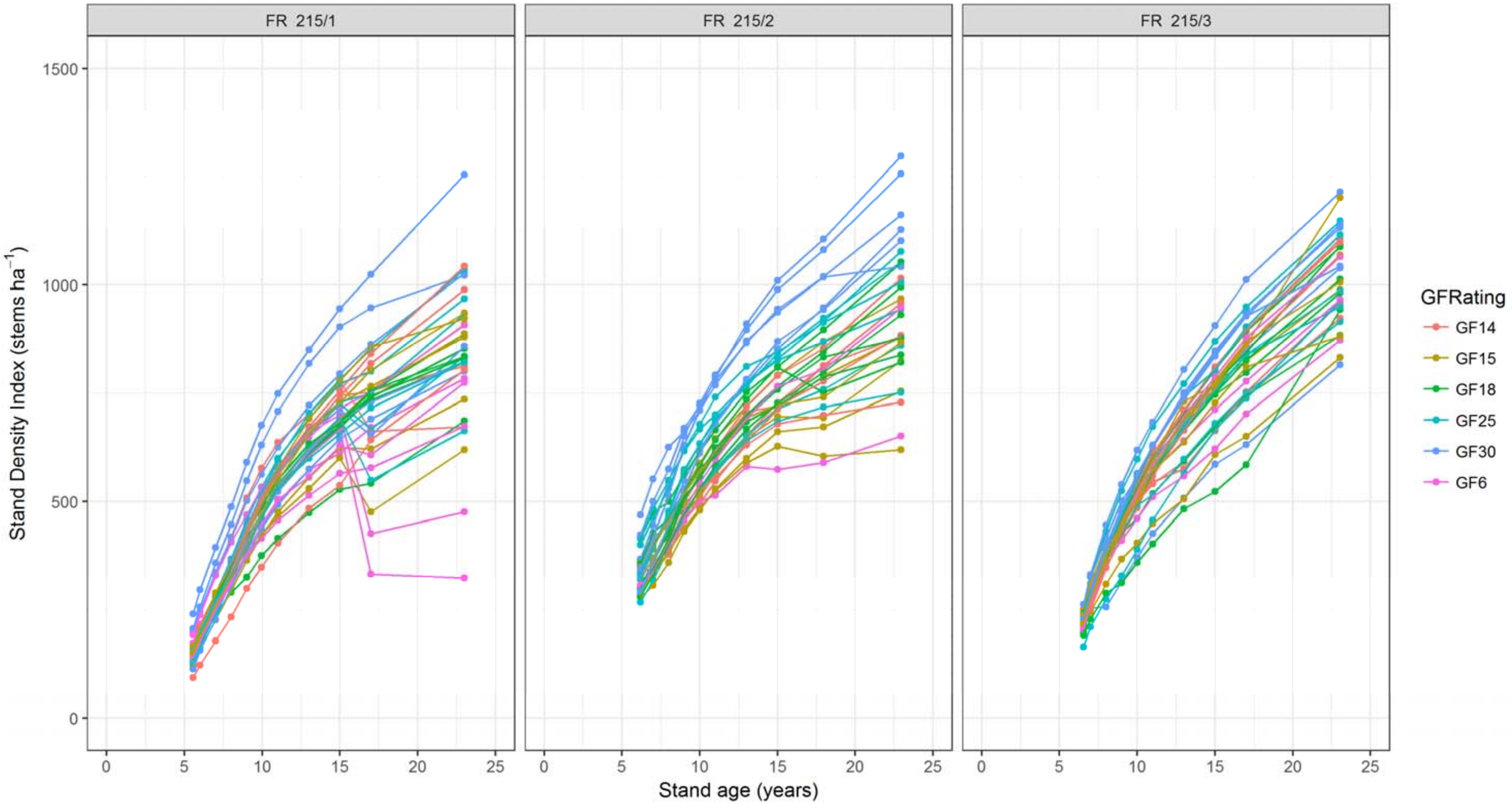
Evolution of SDI in 1994 special purpose breeds trials



Silviculture is more than maximising productivity

Productivity and yield

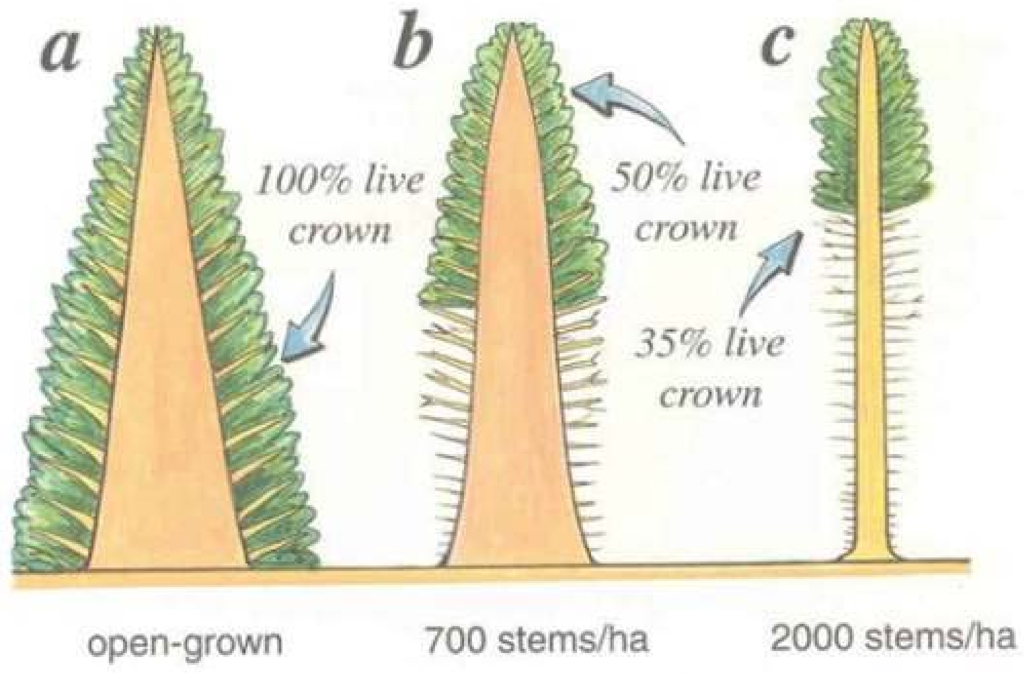
Other ecosystem services

- Carbon
- Water
- Biodiversity

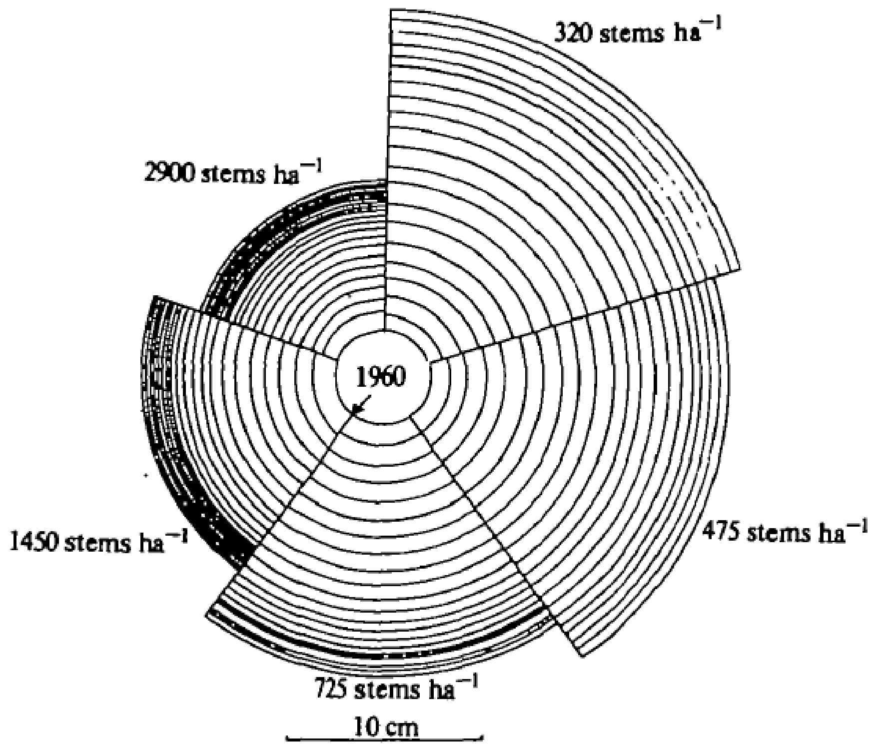
Biotic and abiotic risks

Quality and uniformity

Silvicultural control of wood quality

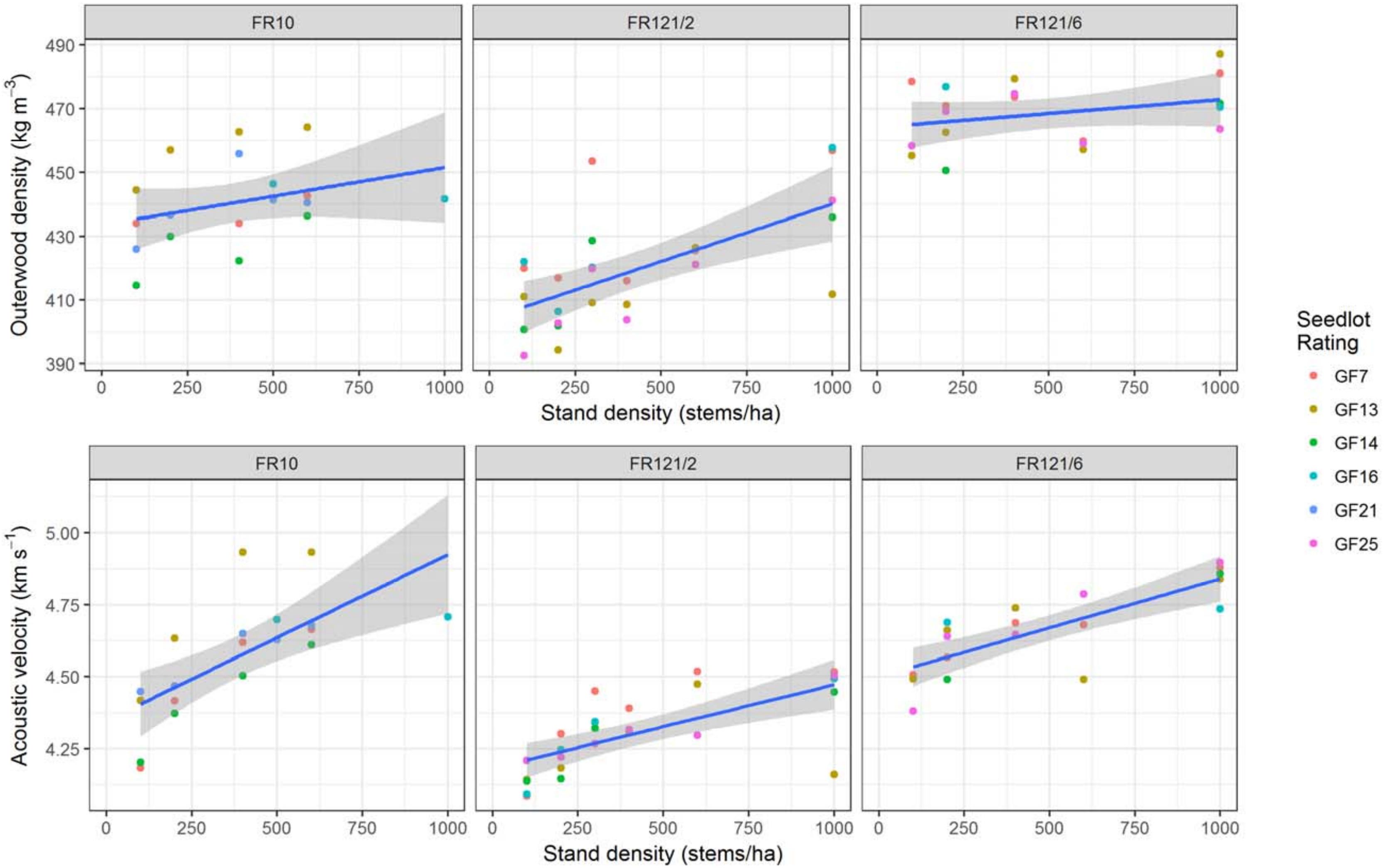


Source: Josza and Middleton (1994 – Forintek report)



Source: Savill and Sandels (1983 - Forestry)

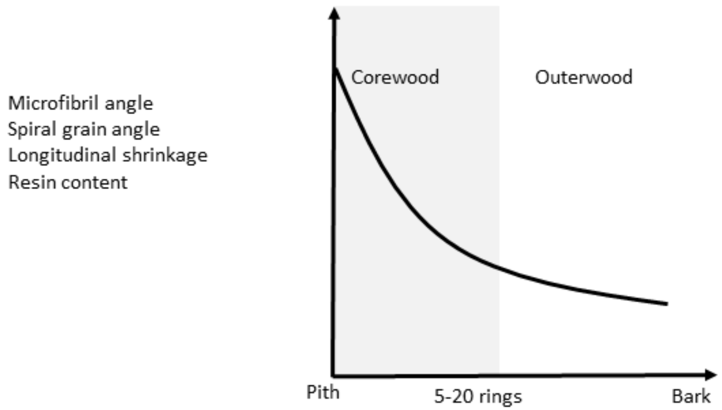
Wood property assessment in silviculture-breeds trials

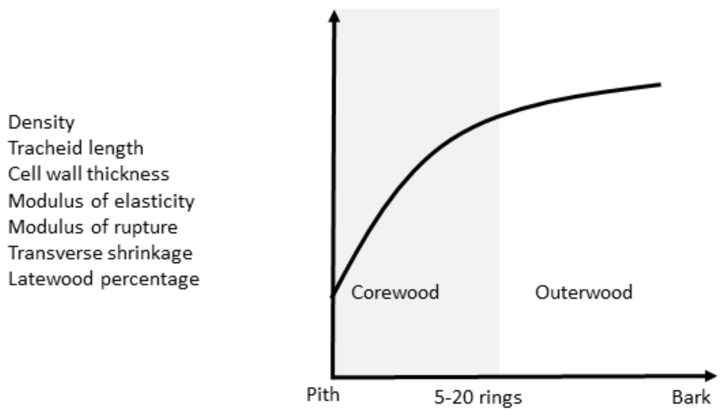


Pruning – an investment in improving wood quality, but what is the return?

- Pruning has been an integral part of radiata pine silviculture since the late 1960s
- Radiata pine clearwood is sought-after because it is a good finishing timber, is able to the be thermally and chemically modified and wide boards can be produced
- To grow large diameter pruned logs, stand density has to be reduced which entails sacrifices in yield
  - This is acceptable provided the premium for pruned log grades is sufficient to offset the loss in total volume
- Ultimately, the decision to prune is complex and requires analysis of a number of factors

Corewood – a challenge for short rotation conifers





- Practices that enhance productivity mean that target tree diameters can be reached in a shorter period of time
- This results in trees which have a greater proportion of their total volume comprising corewood
- Corewood is defined as the inner region of the tree where the change in wood properties with increasing radial distance from the pith is greatest
- In radiata pine it is frequently defined as the innermost 10 rings from the pith

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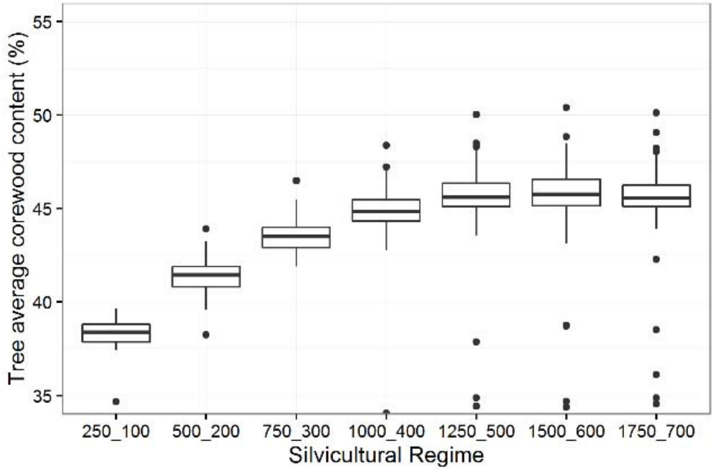
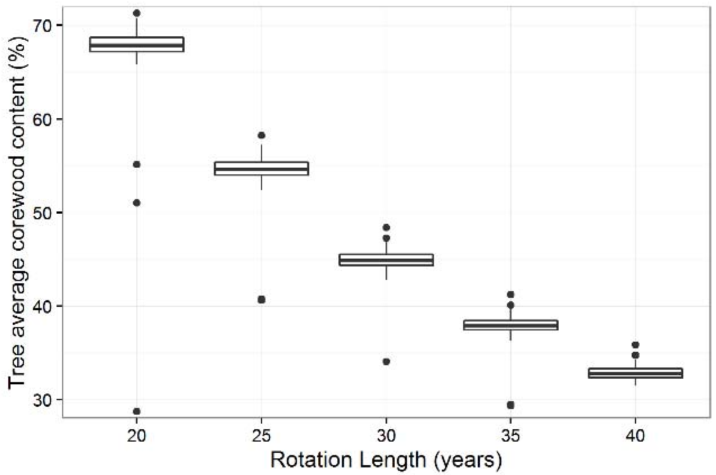
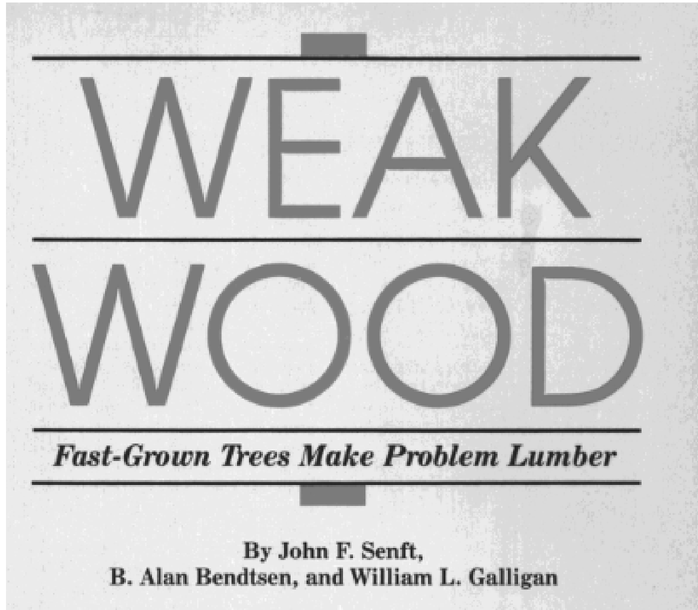
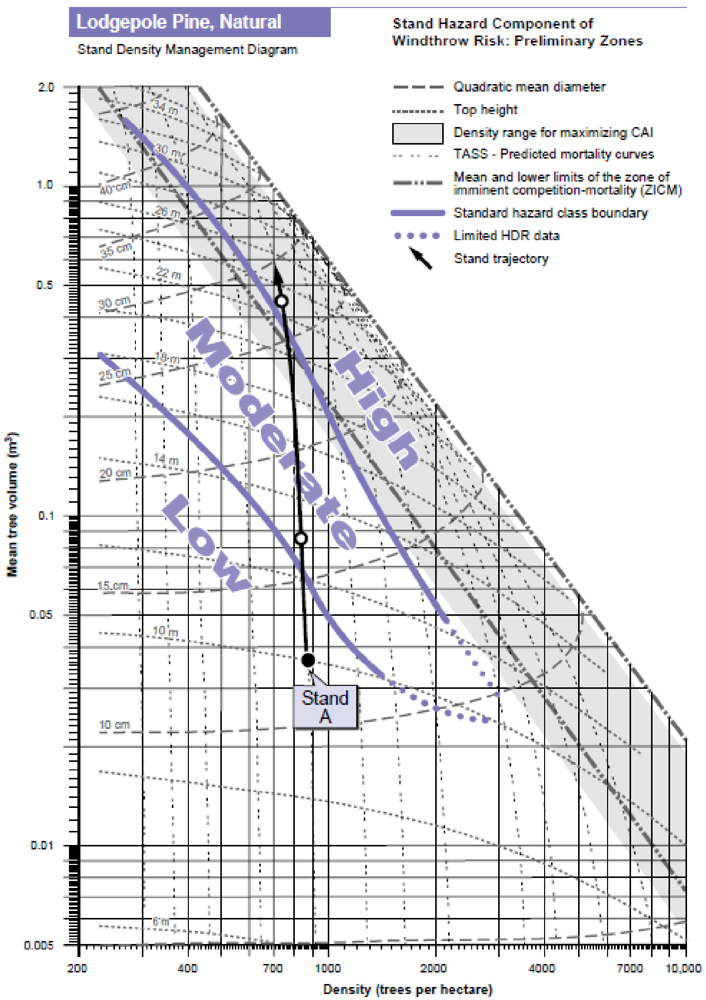
Stand density and rotation length affect corewood content







Stand density has a significant impact on wind damage risk



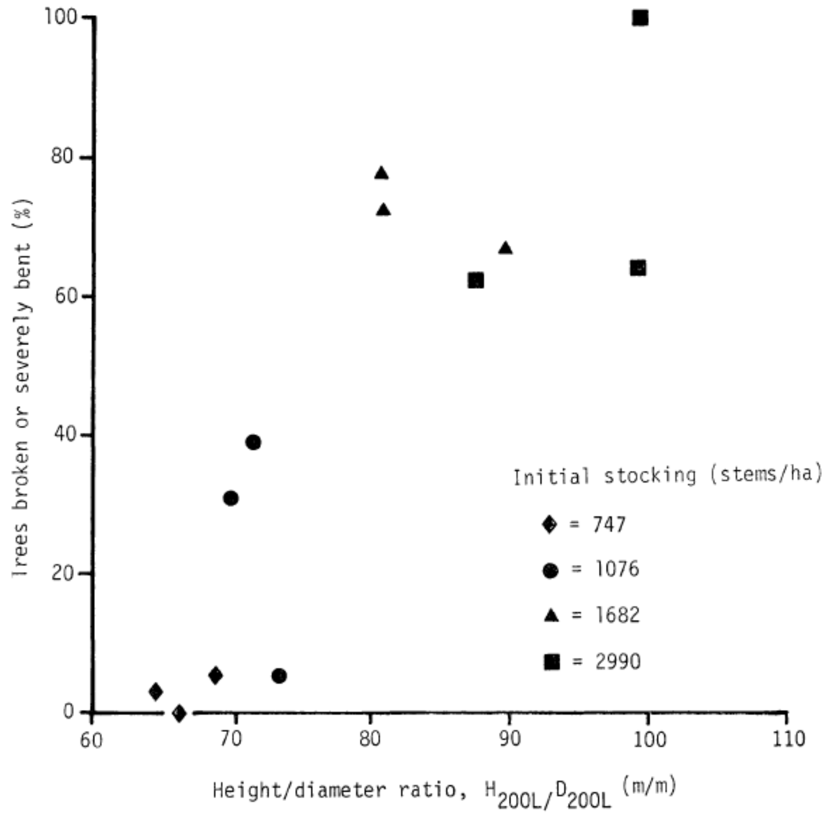
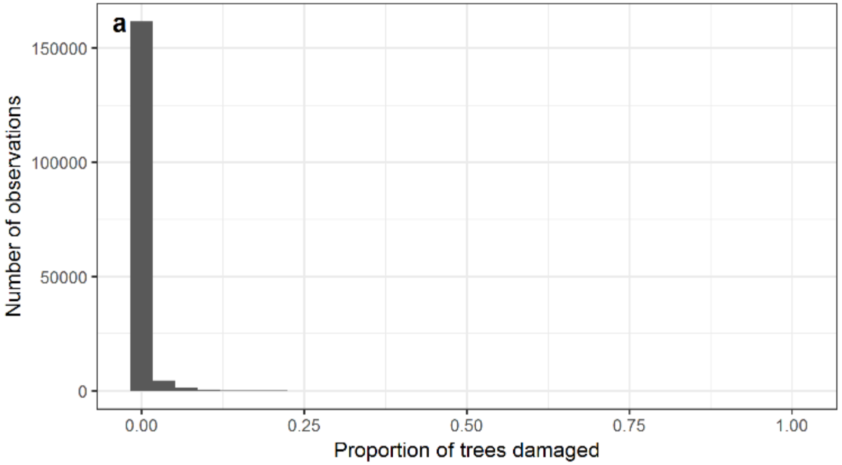
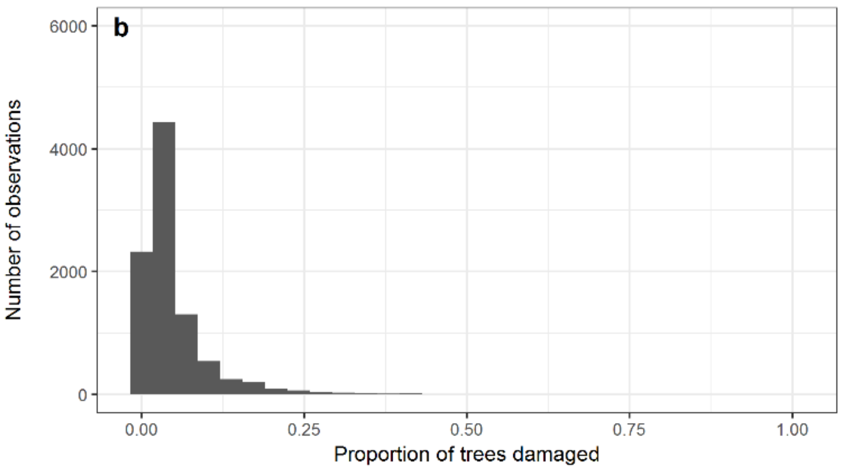
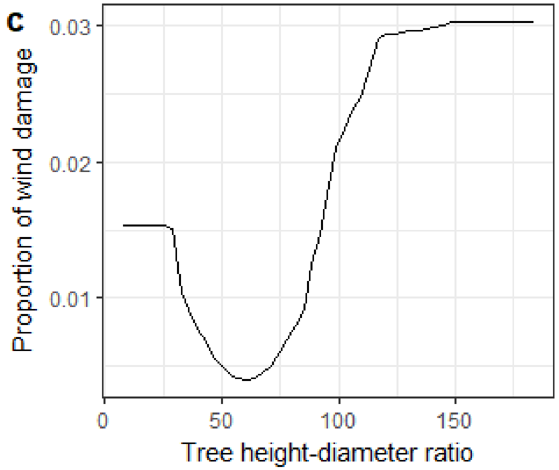


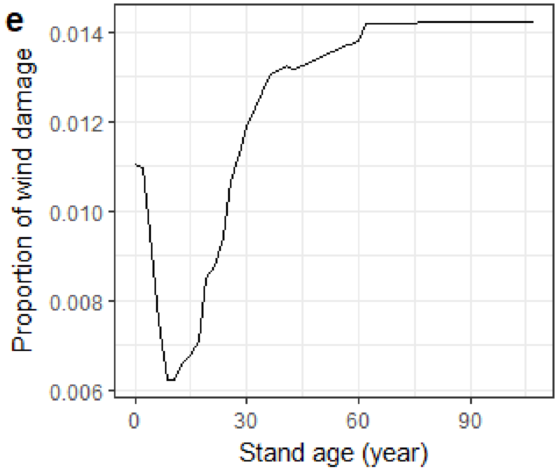
FIG. 1—Height/diameter ratios in relation to damage caused by Cyclone Alby in a spacing trial with **P. radiata** at Bussell's Plantation in Western Australia (Age 10 yr; Hd = 20 m; for other details **see** Trial C in Appendix 1)

Wind damage in radiata pine permanent sample plots

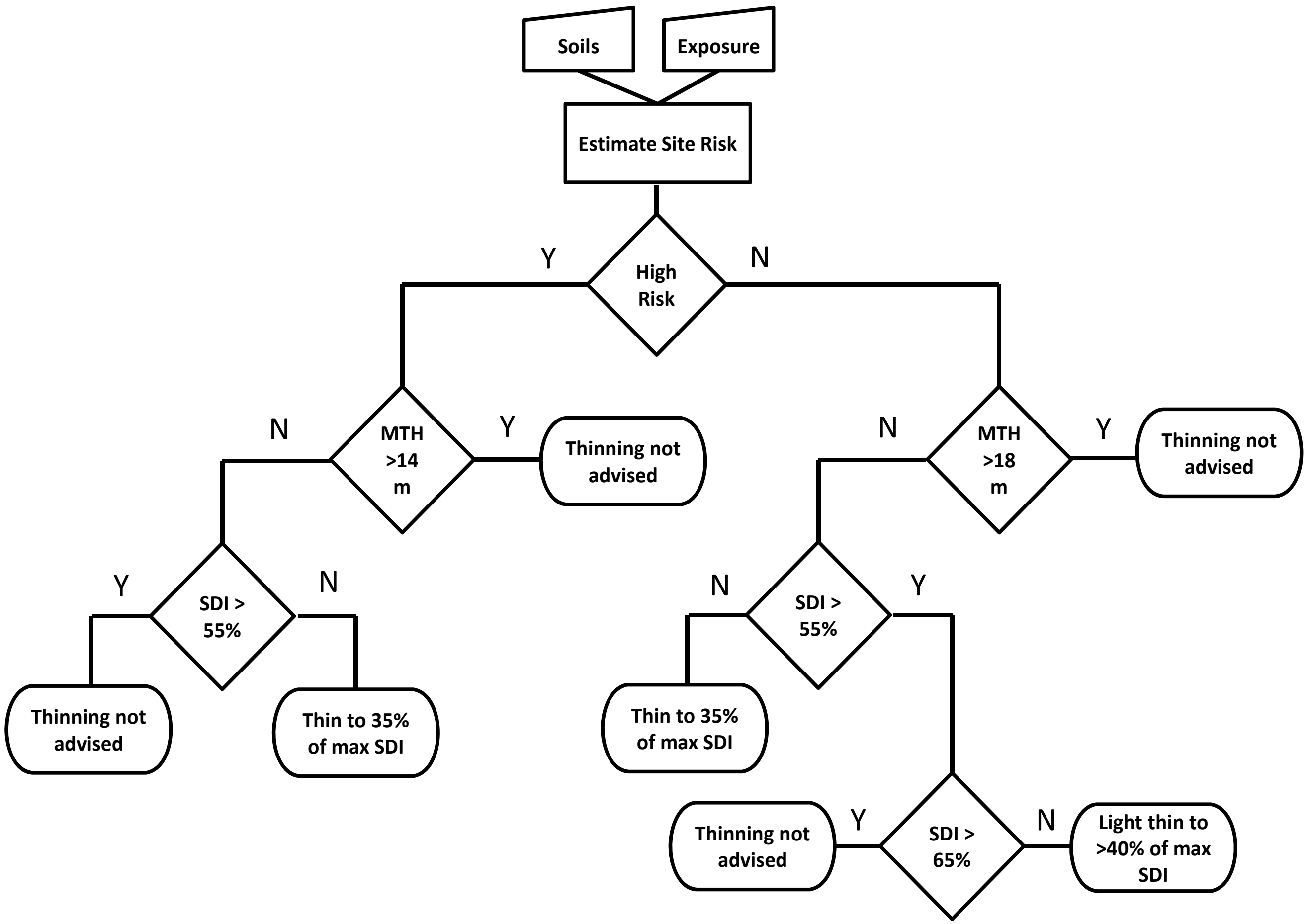




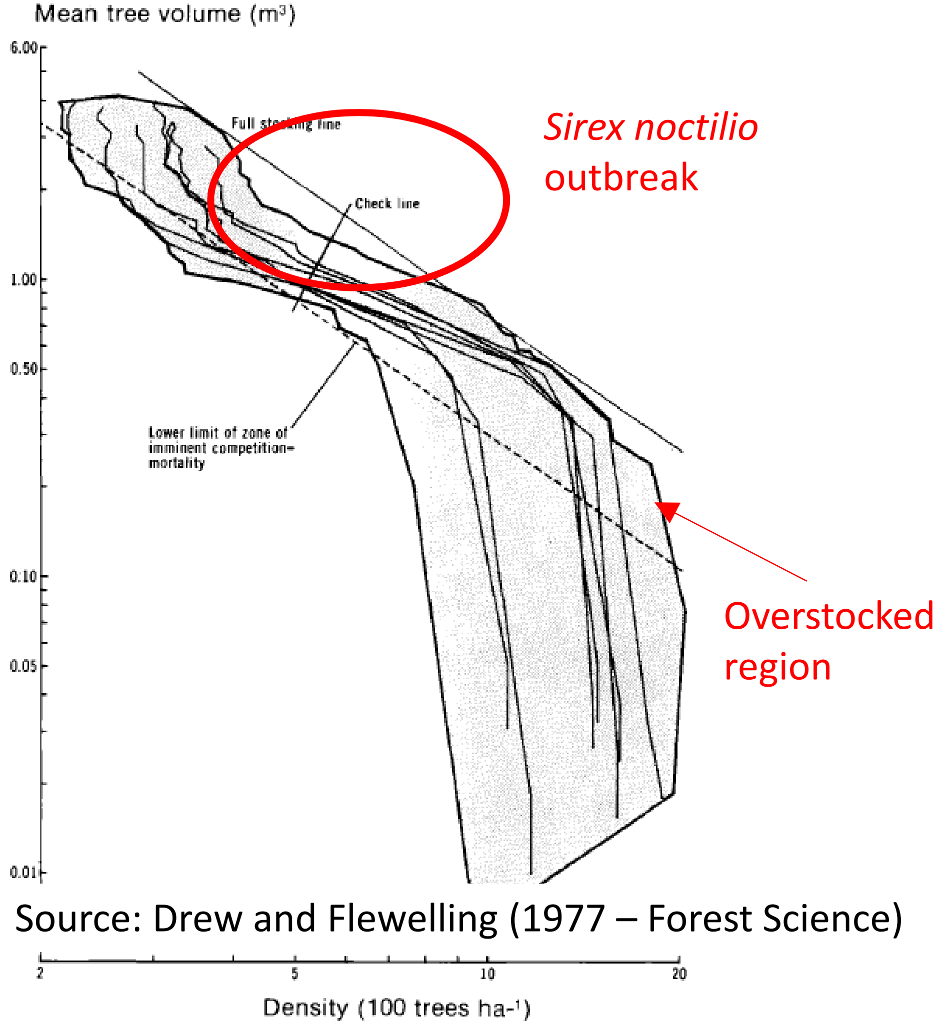




Thinning decisions in the face of wind damage risk



Overstocked stands are detrimental to forest health



The challenges for modern silviculture

- There are a large number of demands on the modern silviculturalist
  - Balance the goals of increasing productivity, with those of maintaining or enhancing wood quality and ensuring that stands are resilient to abiotic and biotic risks
  - Need to understand the impacts of new genetic material and new practices on growth and wood properties and to design suitable regimes

- Research trials and models are valuable tools for testing ideas and codifying knowledge

- Silviculture is both an art and a science – judgement comes from experience and from engaging with others

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Acknowledgments

- Scion and industry colleagues for discussions on these topics over many years
- FGLT and RPBC for financial support for the end-of-rotation assessment of the silviculture-breeds and special purpose breeds trials
- Scion field staff who have worked tirelessly to maintain and measure our large network of field trials and the forest companies who host these trials and provide considerable in-kind support for data collection

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