Adapting to incremental and threshold climate change impacts to forests

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CLIMATE ADAPTATION FLAGSHIP
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Pine beetle turning B.C. forest into greenhouse gas gusher: Scientists

Margaret Munro , Canwest News Service
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VANCOUVER - The tiny mountain pine beetle has transformed British Columbia's vast pine forests into a major source of greenhouse gases, federal scientists say.

By the time the unprecedented infestation ends, the rice-sized beetles will have killed so many trees an extra billion tonnes of carbon dioxide will be wafting through the atmosphere, researchers from the Canadian Forest Service report in the journal Nature on Thursday.

That is five times the annual emissions from all the cars, trucks, trains and planes in Canada, says lead author Werner Kurz, who warns the beetle's impact goes far beyond the B.C. border.

Forests, along with oceans and grasslands, are critical sinks that soak up carbon dioxide from the atmosphere. Carbon dioxide is one of major heat-trapping gas linked to climate change.

"This piece of real estate is no longer contributing to the uptake," Kurz says of B.C.'s central interior forests. "To the contrary, it is currently a net source." This is because dead trees release carbon as they rot and burn.

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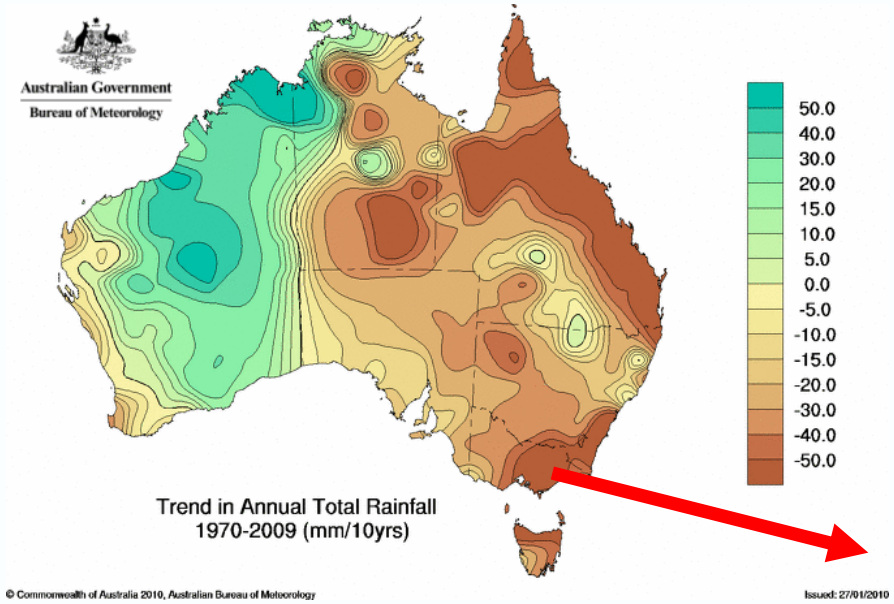
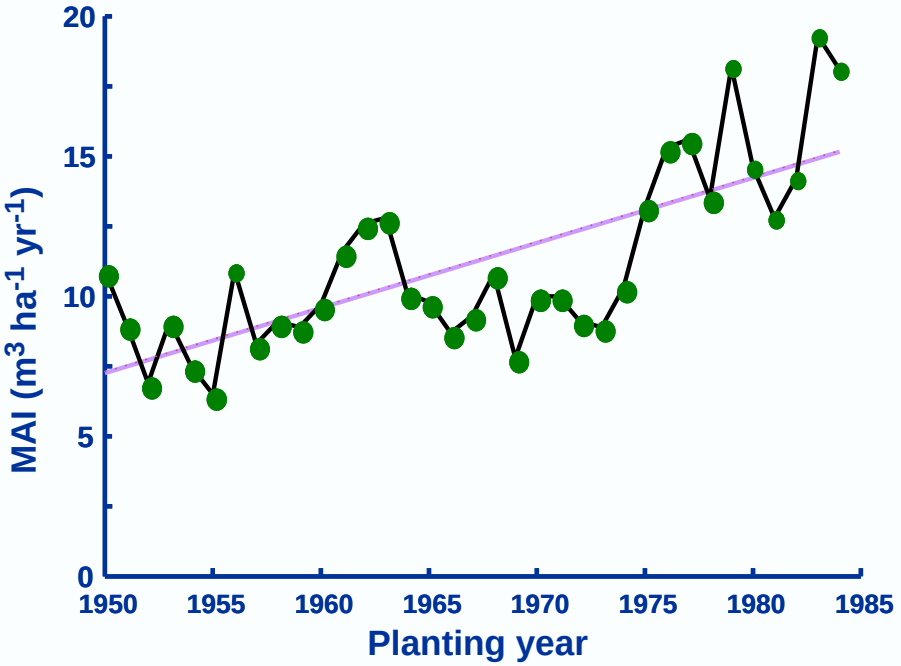
Despite declining trends in rainfall forest production has been rising



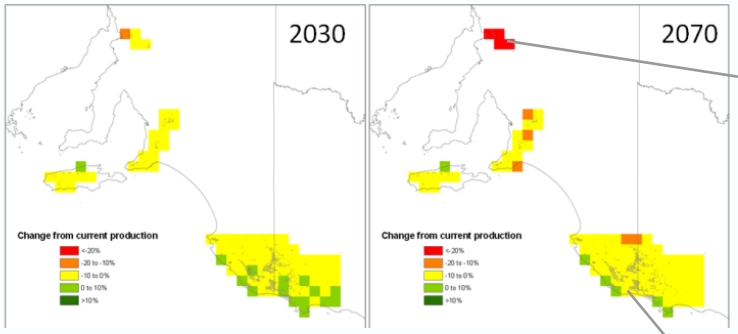


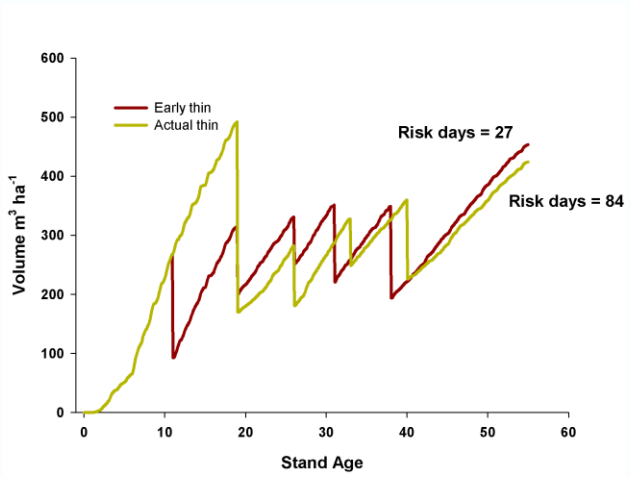
Positive long-term trend in production *Pinus radiata*
Lieshout *et al (1996)*

Climate change impacts: incremental adaptation?

CSIRO Mk3.5

percentage change in production, all soil surfaces averaged





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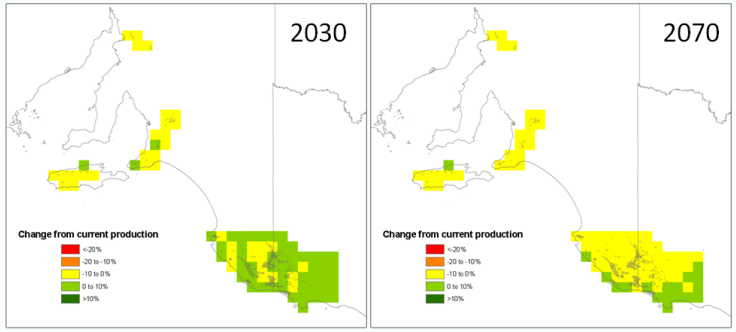
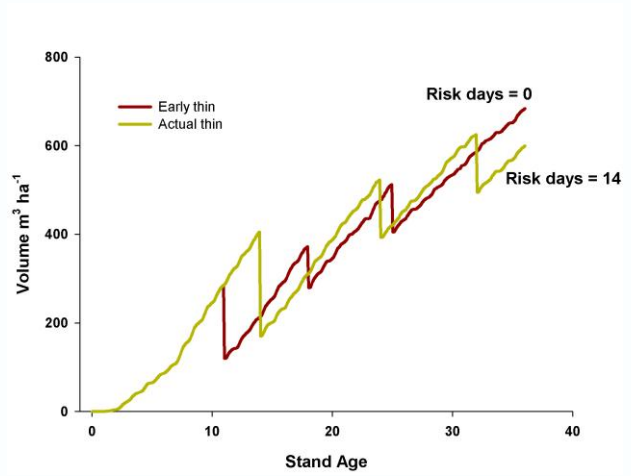
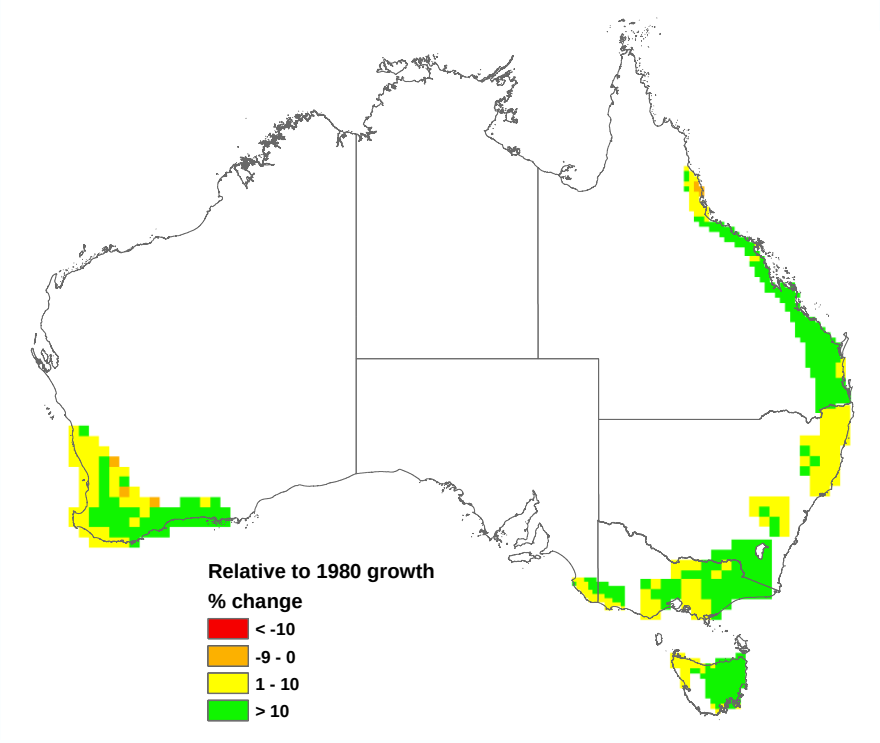
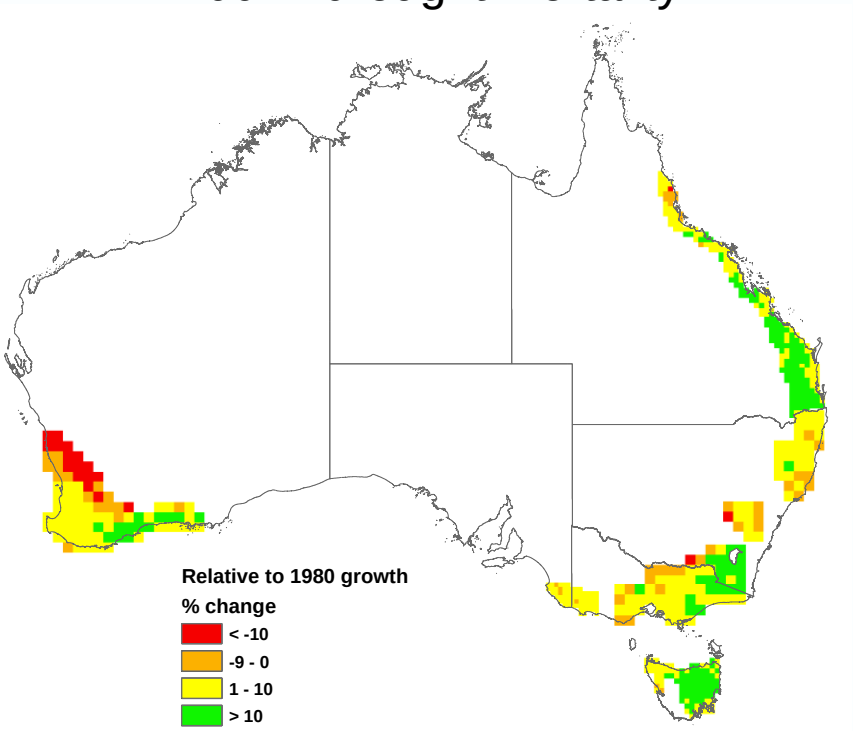




Incremental *vs* step changes



Add in drought mortality



Battaglia et al 2009

Challenges predicting drought effects on production and mortality

Predicting future production

- Downscaled future climates (likelihood of these)
- Production as function of interactions of environmental conditions
- Elevated CO2 effects
- Spatial uncertainty in environmental conditions

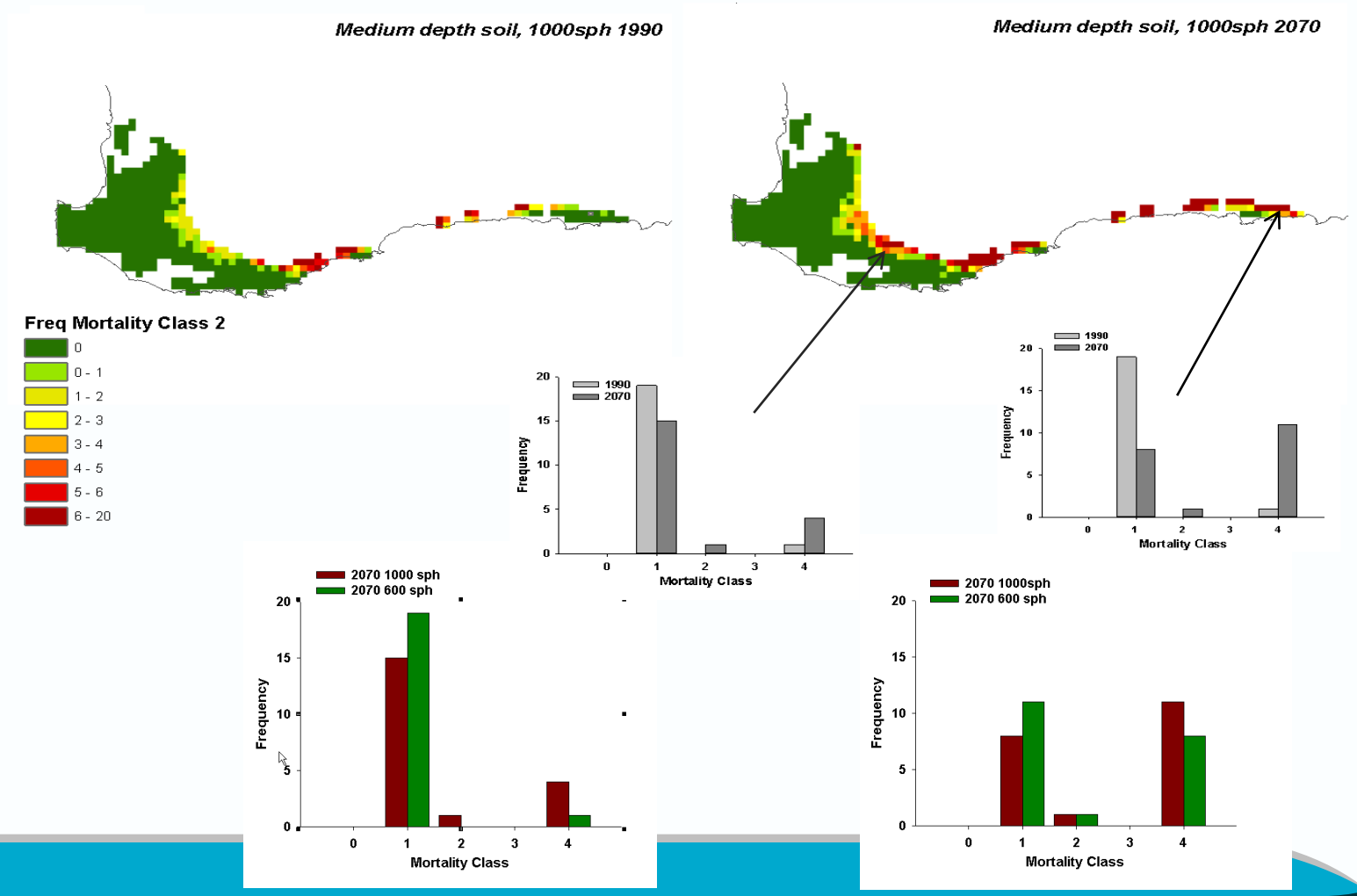
- Data Rich

Predicting future drought mortality

- All factors to left!
- Thresholds of mortality
- Distinguishing hydraulic failure from carbon starvation and secondary attack as drivers of tree death
- Profound effect of individual genetics on mortality risk
- Current stand state and prior events important determinant of damage and mortality

- Data poor
- Probabilistic outcomes

Probabilistic modelling of impact



Conclusions

- Climate change will manifest in both incremental and step change responses
- Without considering both forms of change, we will underestimate the potential impacts
- Different analyses and tools will be required to inform forest managers

Thank you

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