



Environmental impacts on forest productivity in British Columbia

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Background

Climate

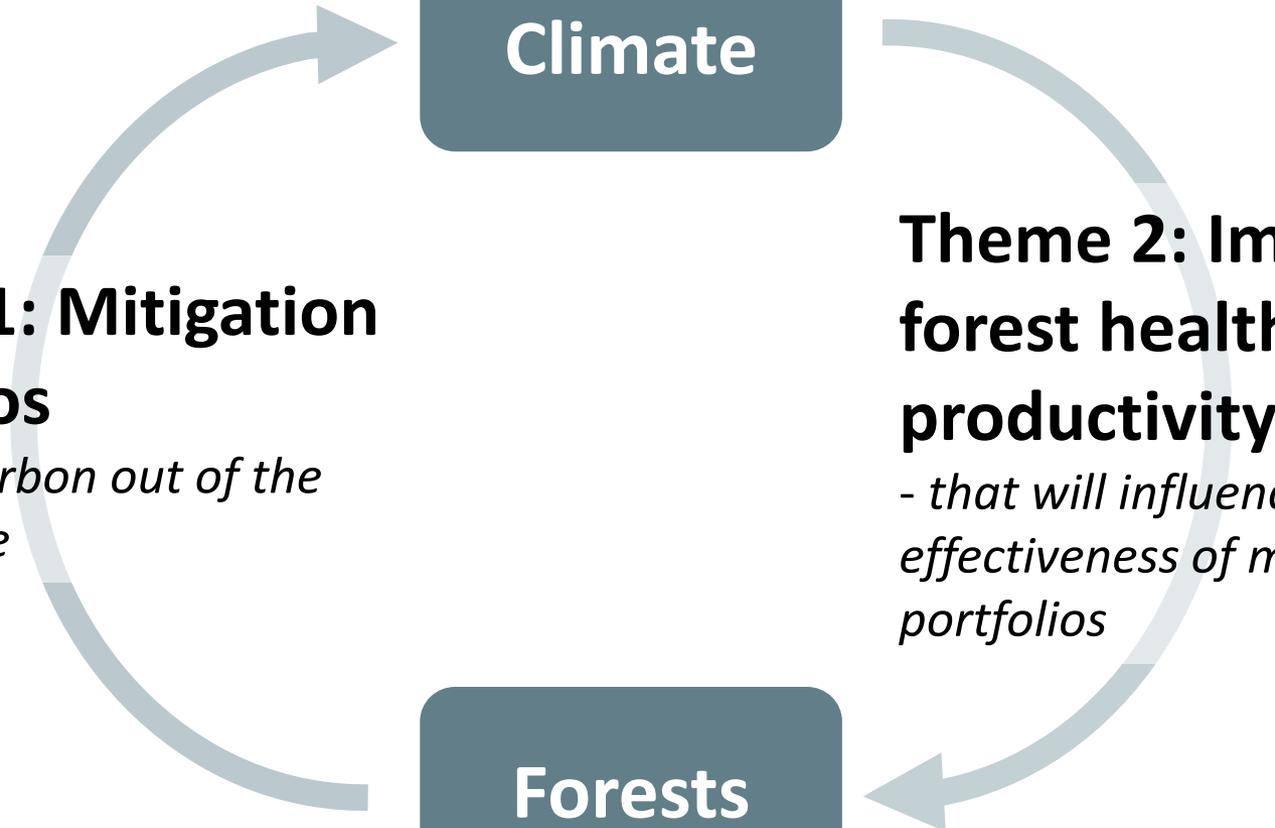
Forests

Theme 1: Mitigation portfolios

- to keep carbon out of the atmosphere

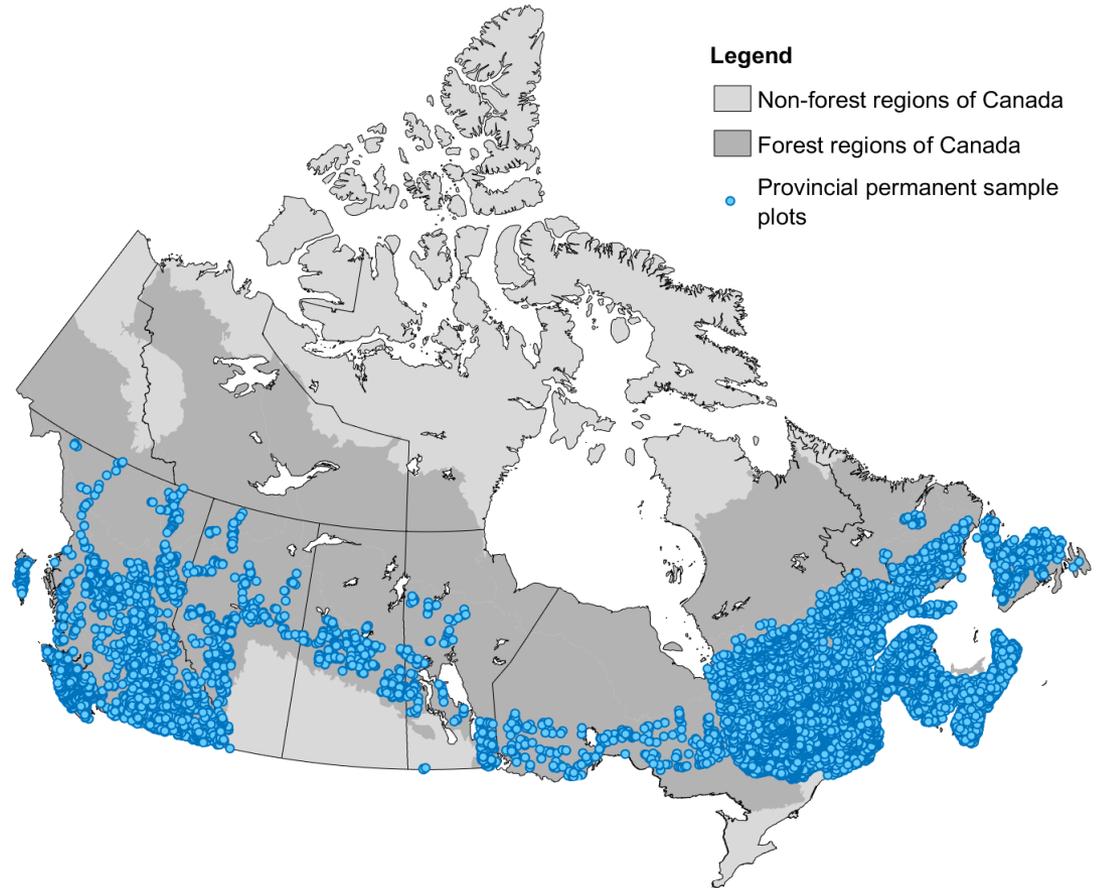
Theme 2: Impacts on forest health and productivity

- that will influence the effectiveness of mitigation portfolios



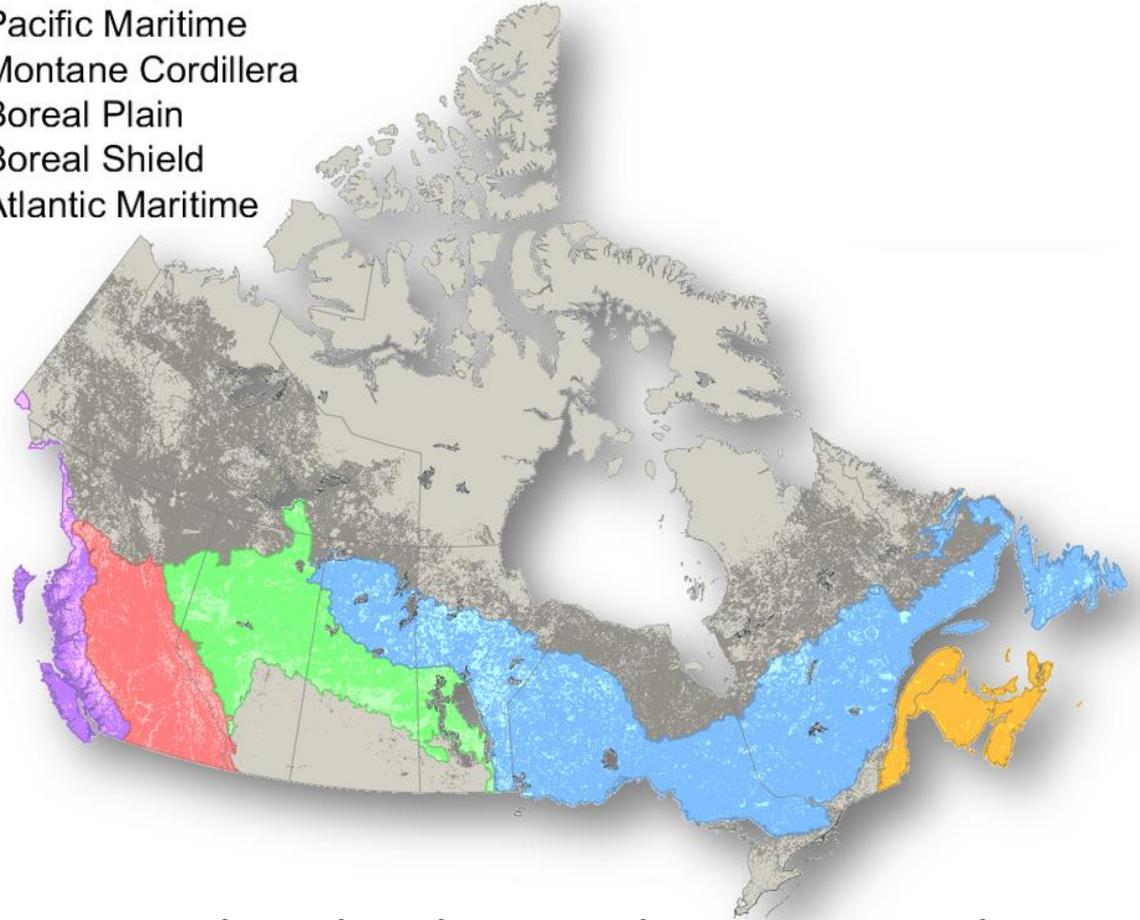
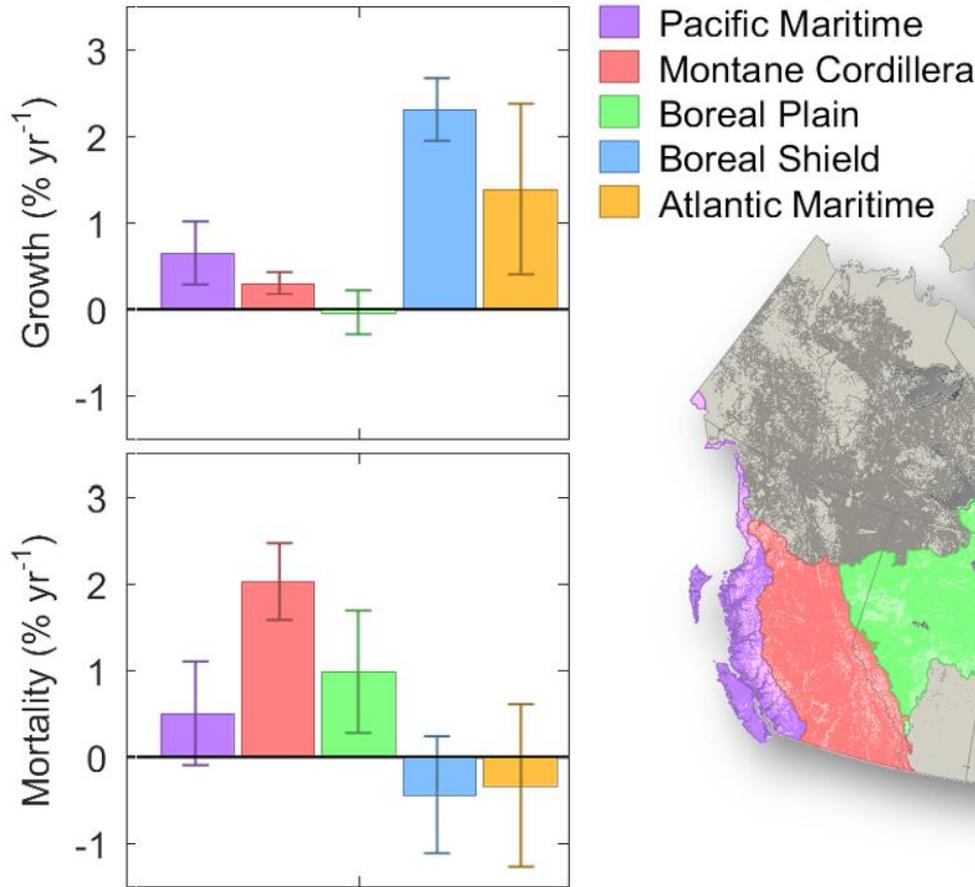
Big Picture Summary

- How has environmental change affected growth and mortality?
- Use field plot data collected by provincial agencies and industry to analyze relationships
- One of the biggest studies of its kind
 - 37,000 observations in BC
 - 60,000 observations across the rest of Canada



Big Picture Summary

- Ecozone-average time trends (specifically attributed to environmental change)



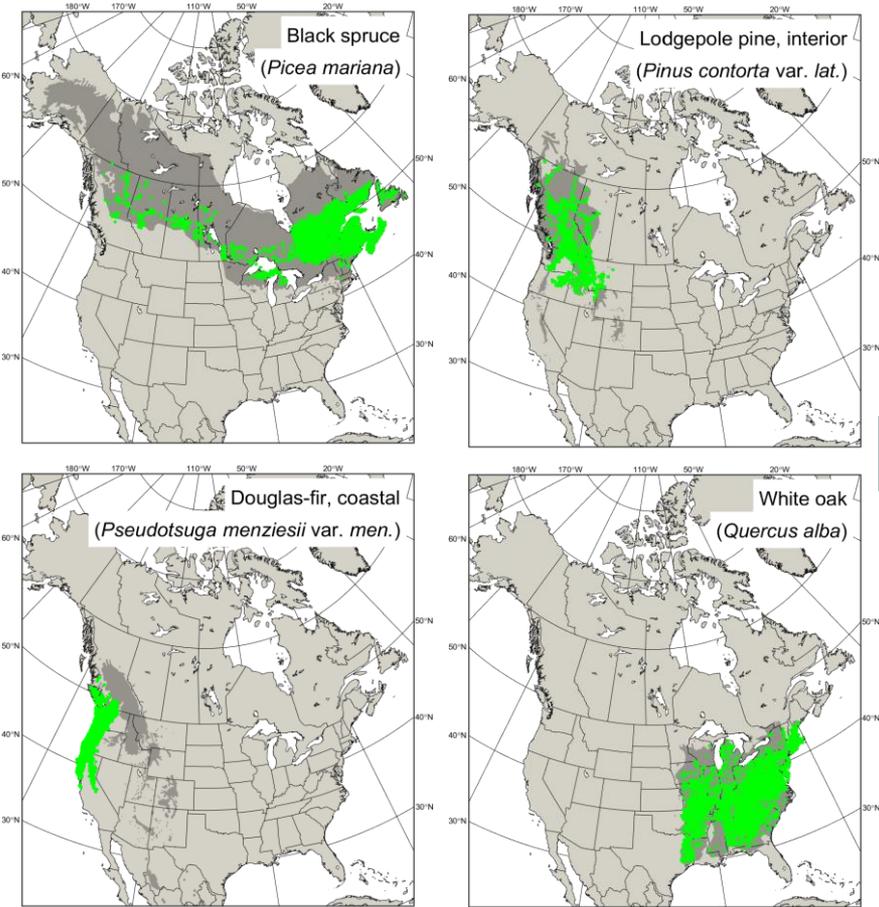
- Dry conditions in interior British Columbia weakening growth enhancement, causing increased tree mortality

Hember et al. 2017. Increasing net ecosystem biomass production of Canada's boreal and temperate forests despite decline in dry climates. Global Biogeochemical Cycles.

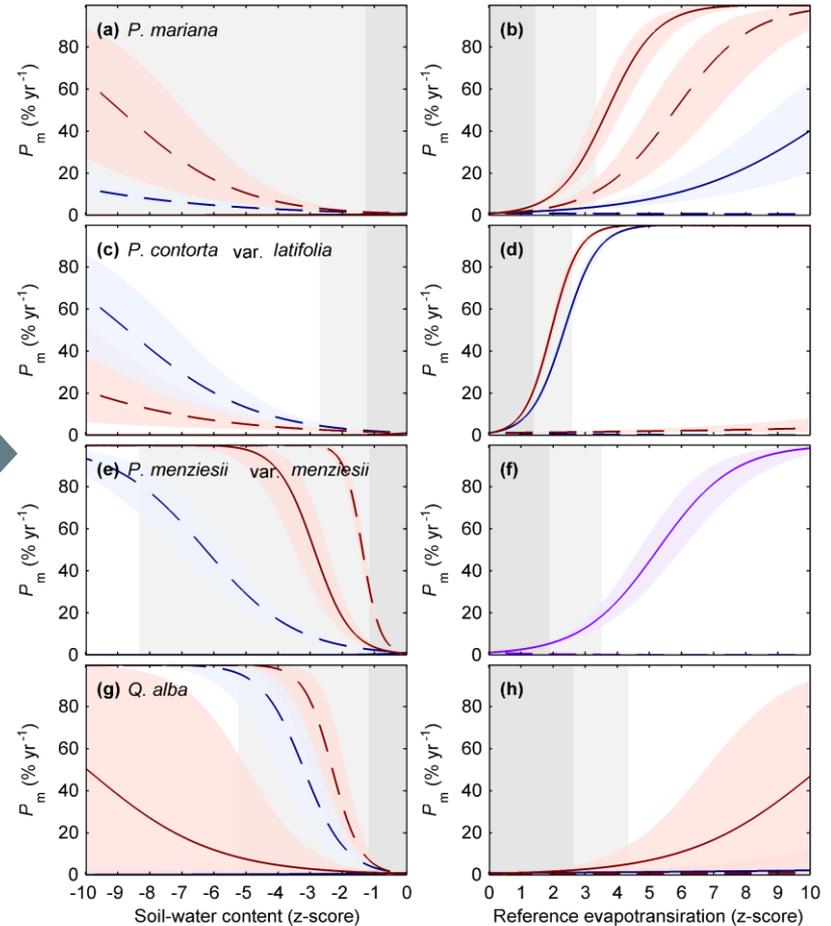
Demand for more Detailed Modelling

- Accounting for drought-related tree mortality

Species mortality data



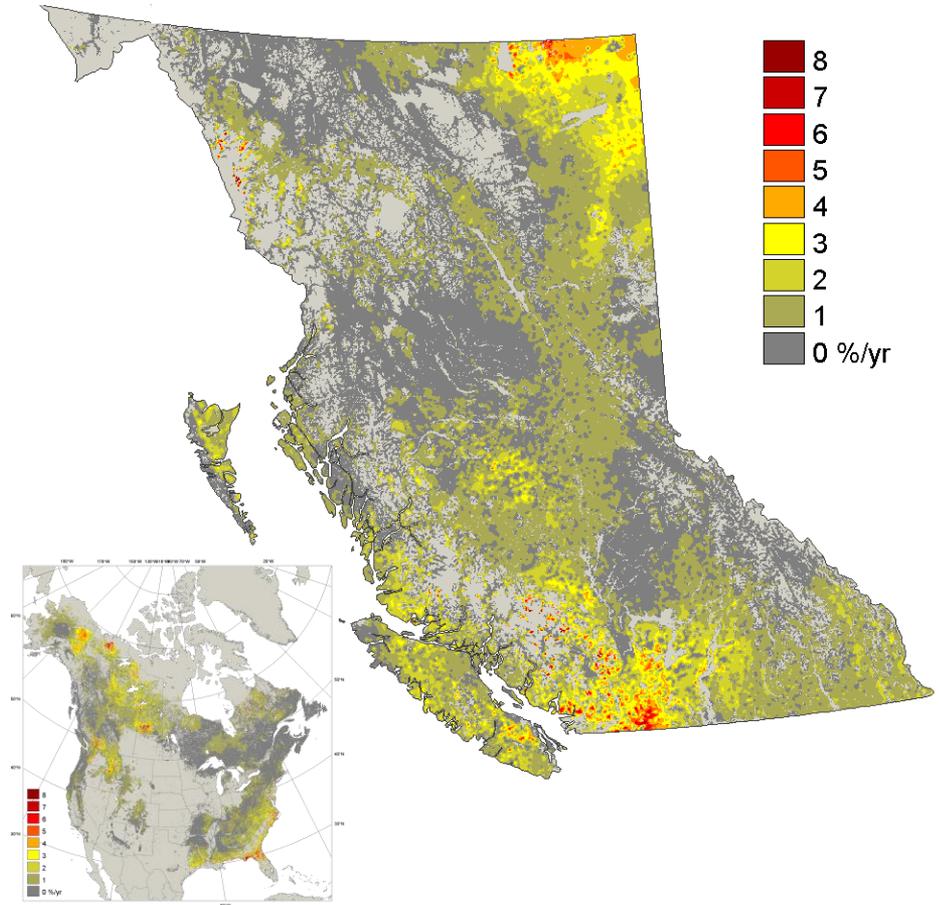
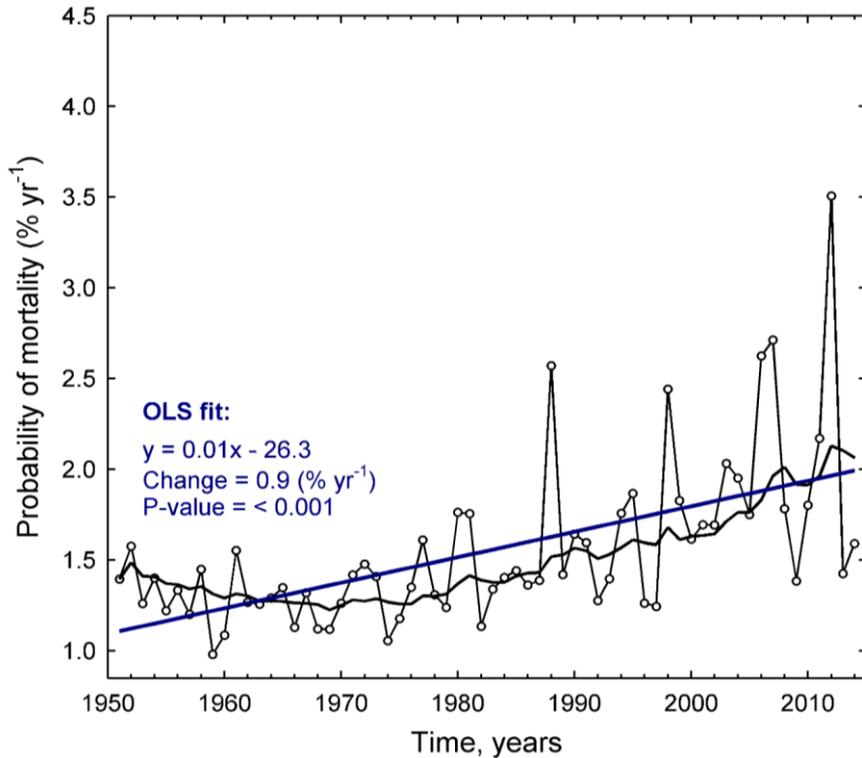
Drought vulnerability curves



Hember et al. 2017. Relationships between individual-tree mortality and water-balance variables indicate positive trends in water stress-induced tree mortality across North America. *Global Change Biology* 23:1691–1710.

Demand for more Detailed Modelling

Change in mortality due to drought (1951-2015)

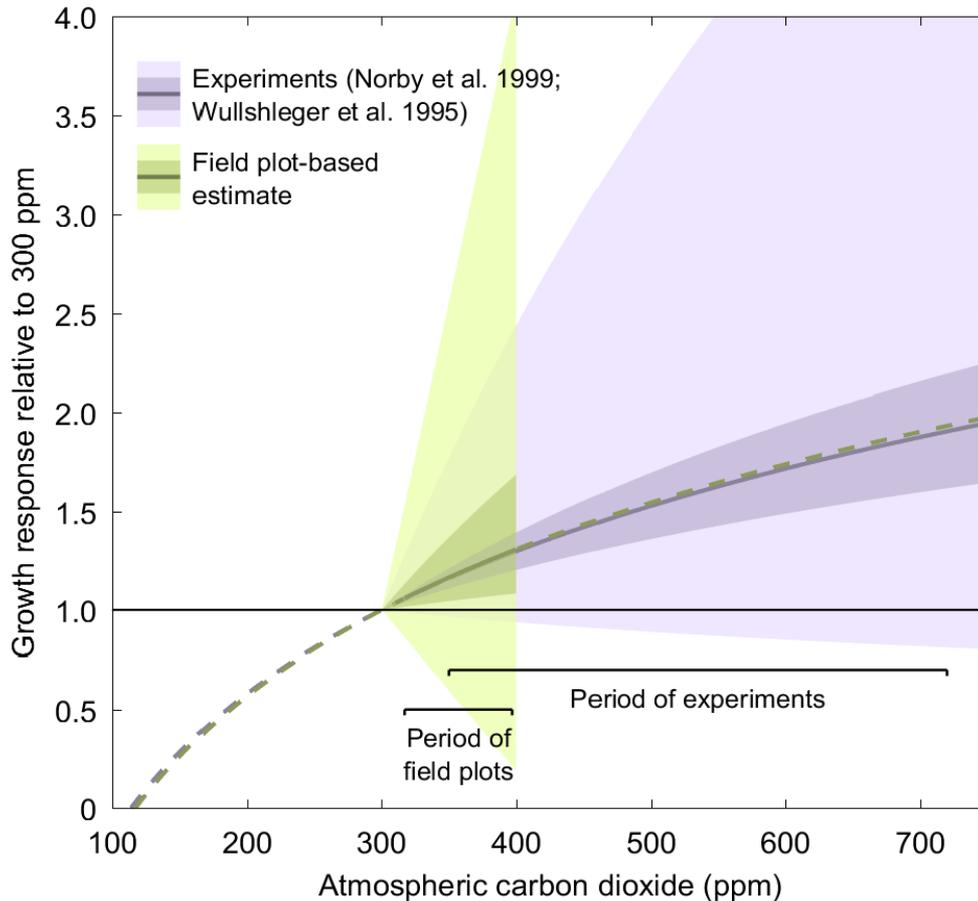


- Drought has increased the rate of tree mortality

Hember et al. 2017. Relationships between individual-tree mortality and water-balance variables indicate positive trends in water stress-induced tree mortality across North America. Global Change Biology 23:1691–1710.

Demand for more Detailed Modelling

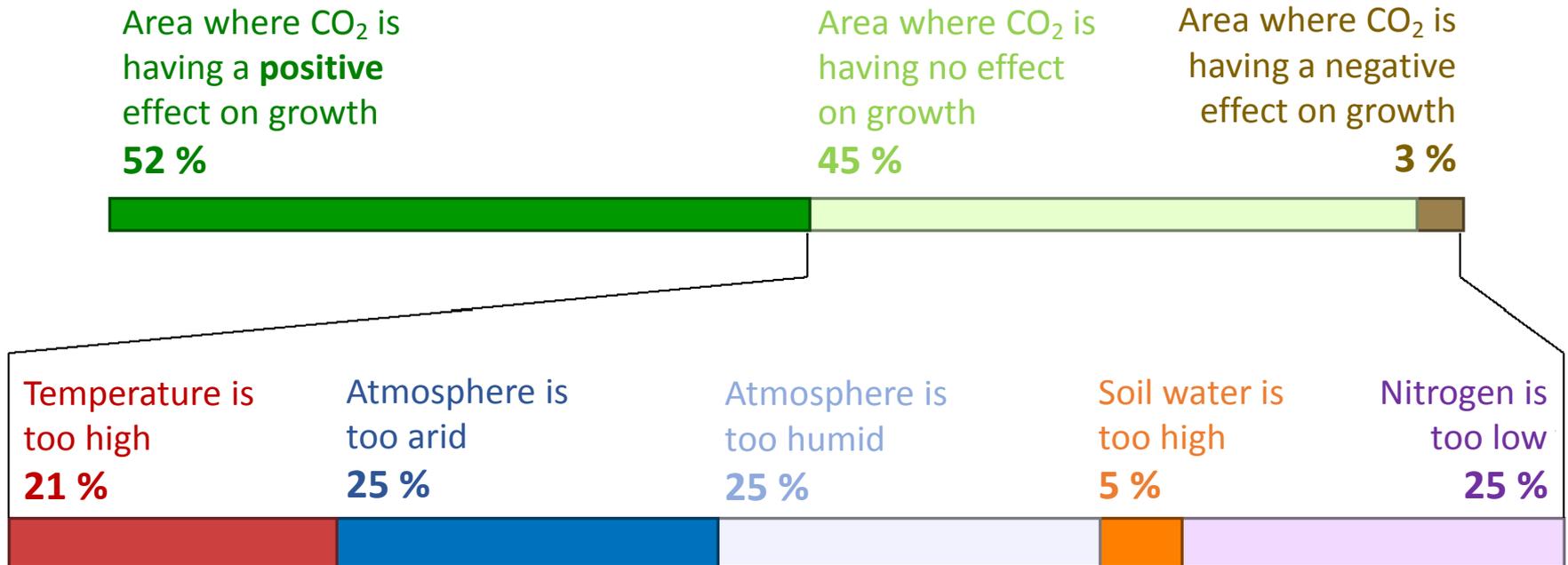
Sensitivity of tree growth to CO₂: Comparing results from field observations of lodgepole pine vs. experiments



- Need to account for global change factors
 - e.g. carbon dioxide (CO₂) concentration
- Are trees carbon limited?
- Consistent with experiments:
 - On average, growth increases with atmospheric CO₂
 - Very high variability

Demand for more Detailed Modelling

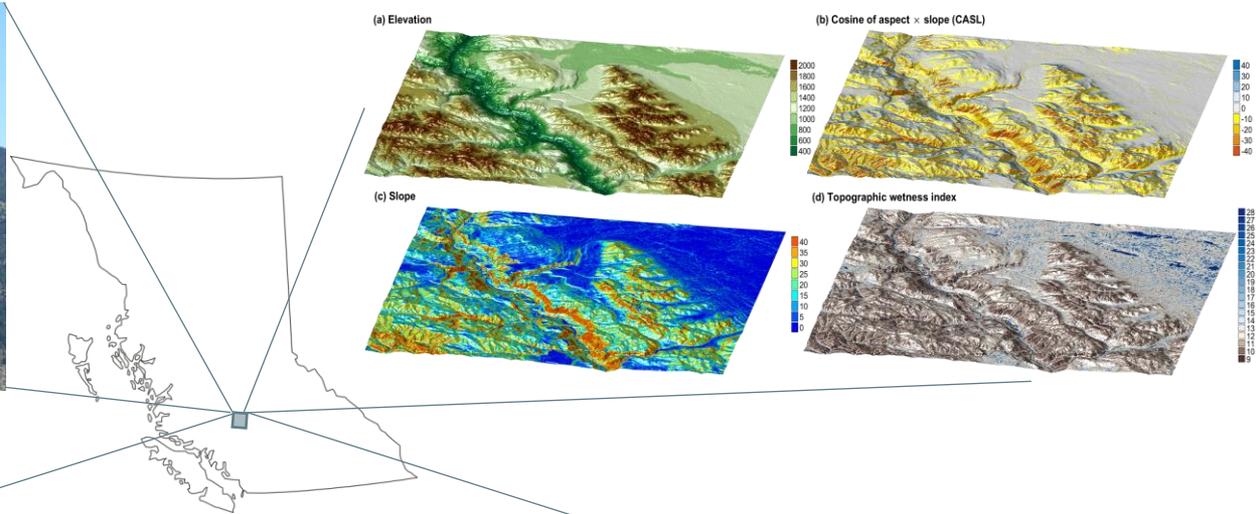
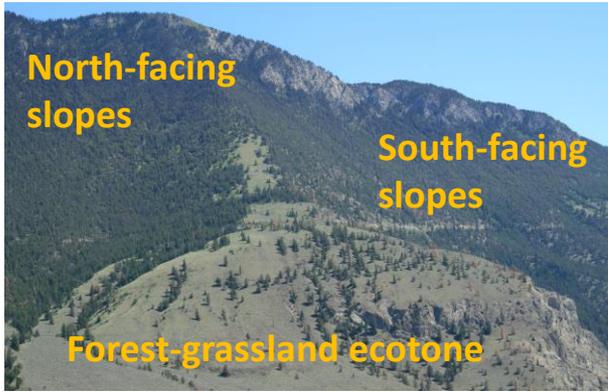
Predicting where CO₂ will, and will not, benefit lodgepole pine



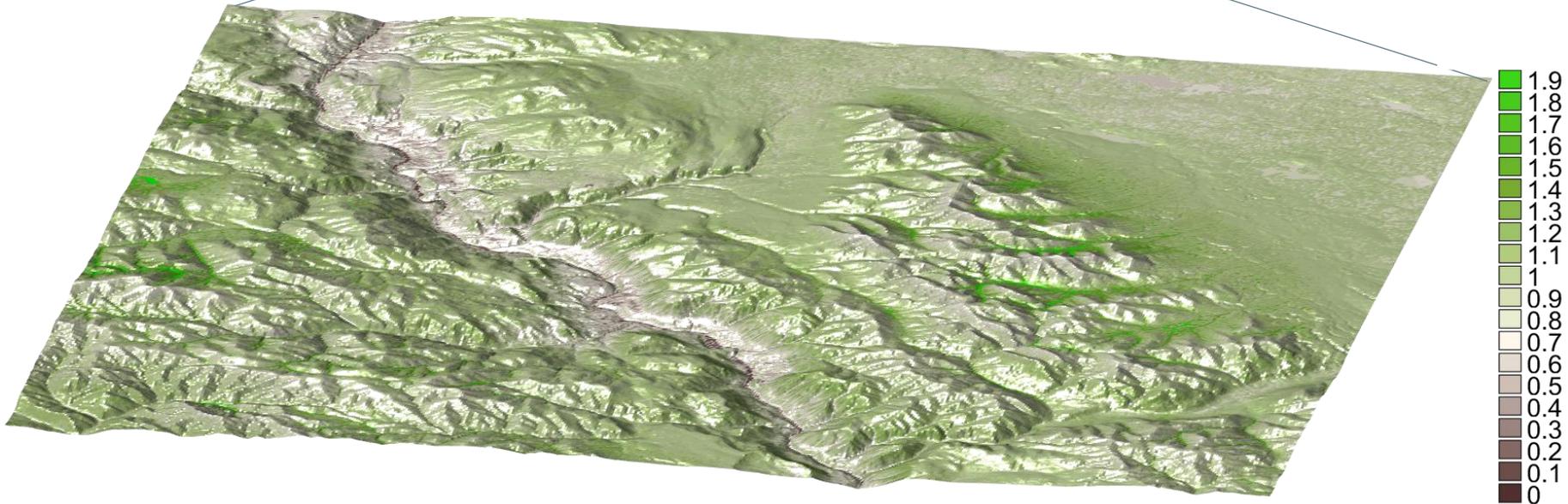
- CO₂ responses depend on levels of heat, water, and nutrients
- Quantifying and mapping these interactions remains a challenge

Demand for more Detailed Modelling

- Accounting for local-scale variation in site conditions



Predicted growth rate of lodgepole pine



Recap & Looking Forward

What's been done

- A big picture summary of time trends in forest growth and mortality
 - At the scale of ecozones
 - Based on observations!
- Advancing the capacity to predict environmental impacts on trees
 - Drought vulnerability curves
 - Global change factors
 - Local-scale variation

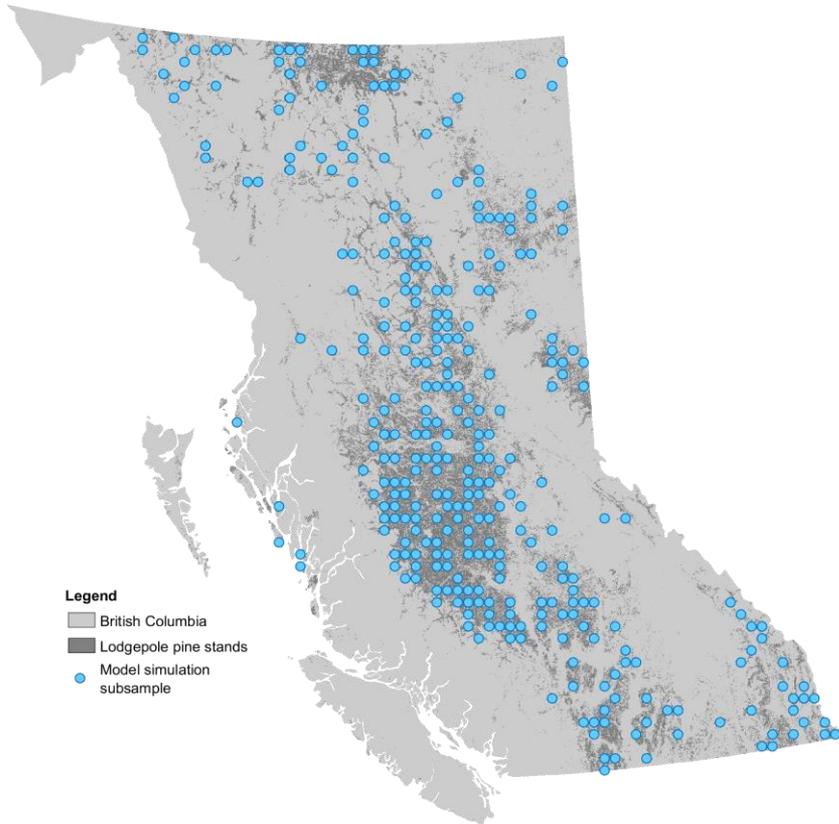
What we are doing

- Bringing it all together

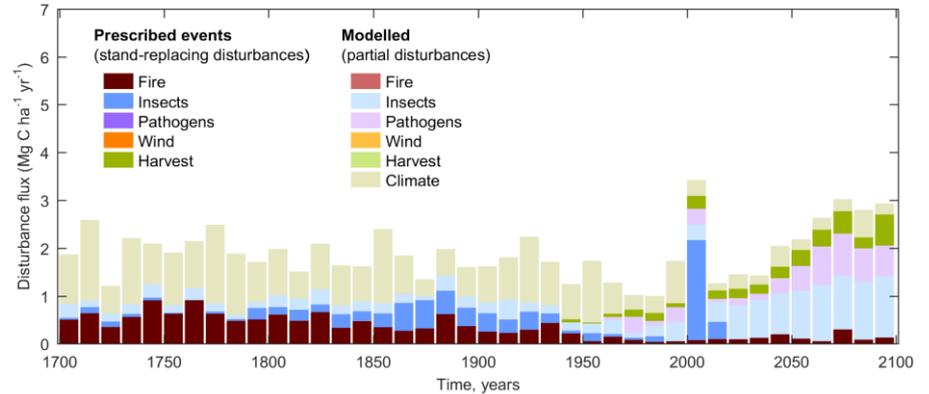
Bringing it all together

- Combining environmentally-sensitive, species-specific models of growth and mortality to simulate forest biomass dynamics

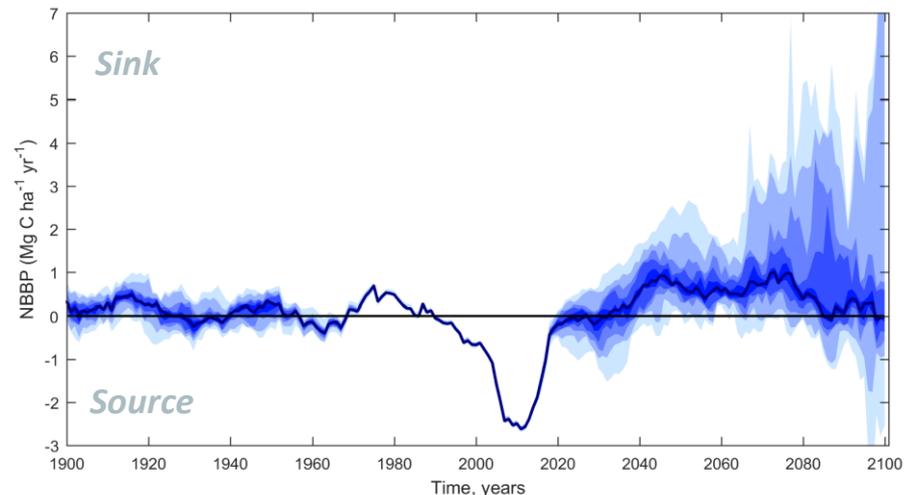
e.g. lodgepole pine stands



Forest health indicators



Carbon balance indicators





Thank You

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 Natural Resources Canada / Ressources naturelles Canada


Canada



**Pacific Institute
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