Fire regimes from past to future in dry Douglas-fir forests

Fire behaviour and effects
Preliminary results

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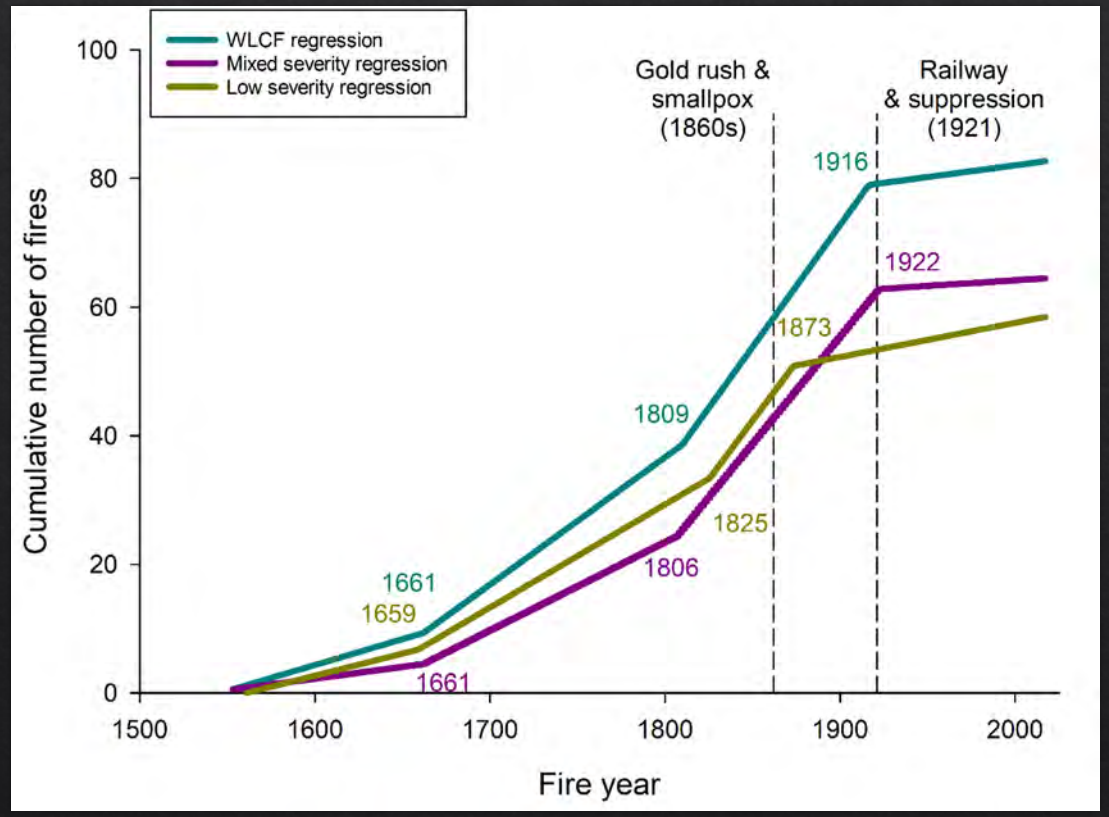
Williams Lake and Area
Community Wildfire Roundtable
Feb 20 2024

TREE RING LAB *at* UBC

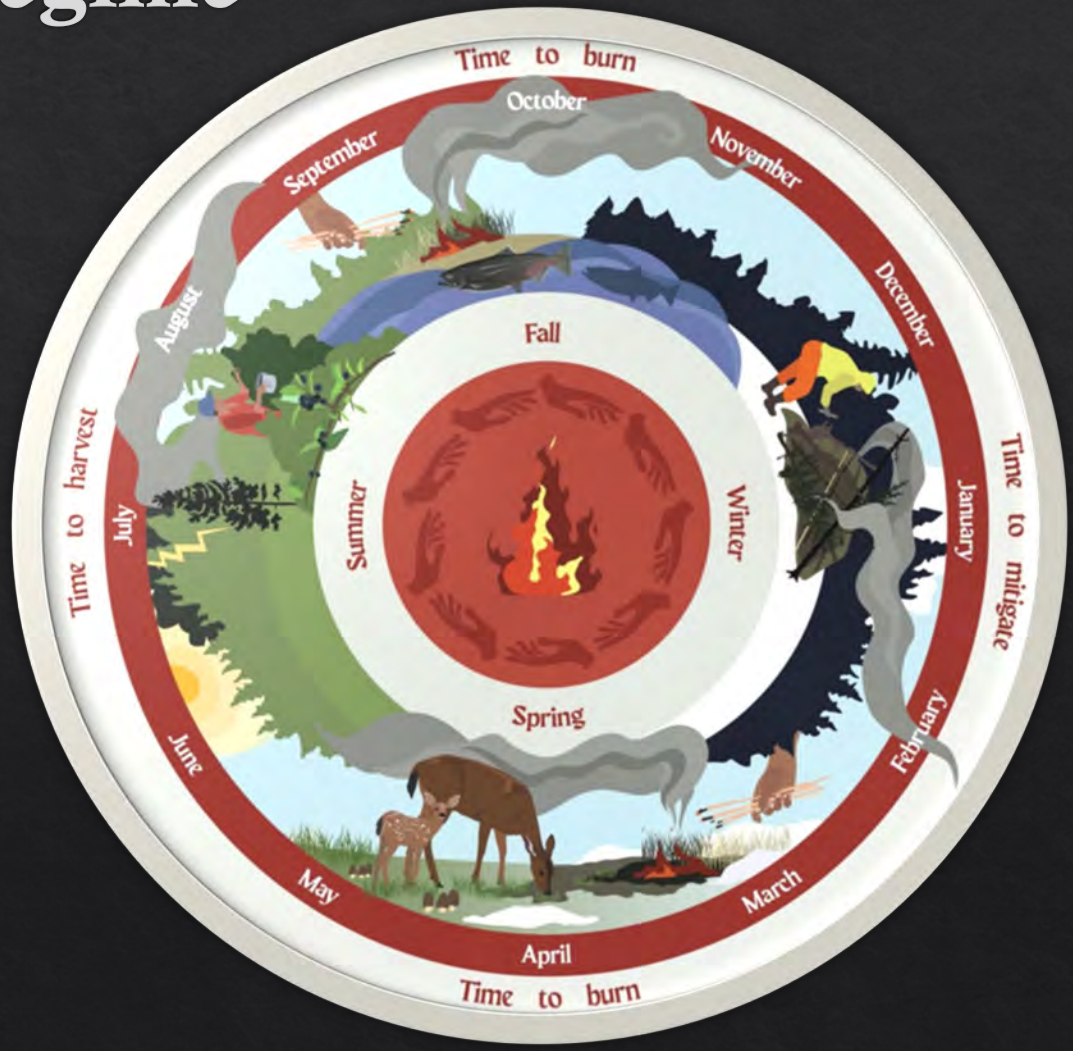
Stswecem'c Xget'tem FIRST NATION


What is now is not how it was

Disruption of Indigenous Fire Stewardship Altered the Historical Fire Regime

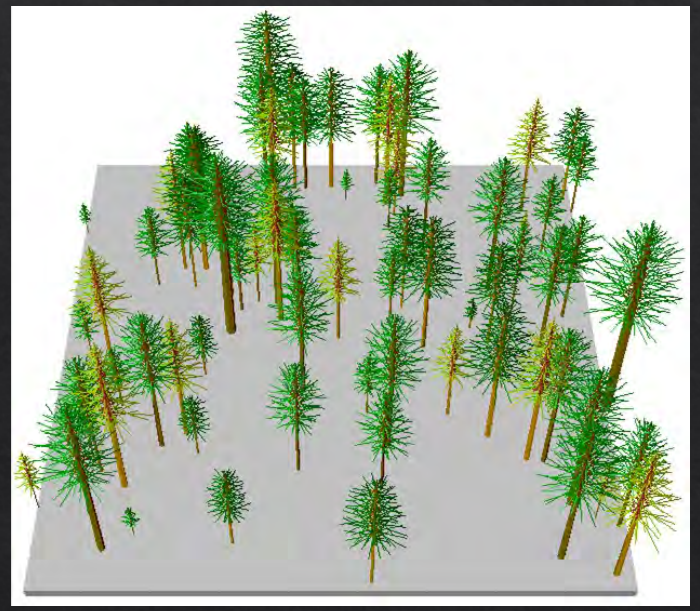


Copes-Gerbitz *et al* 2022 EA



Hoffman et al 2021 Facets

Historical Fire Regime
Frequent Surface Fire Maintained Open Forest

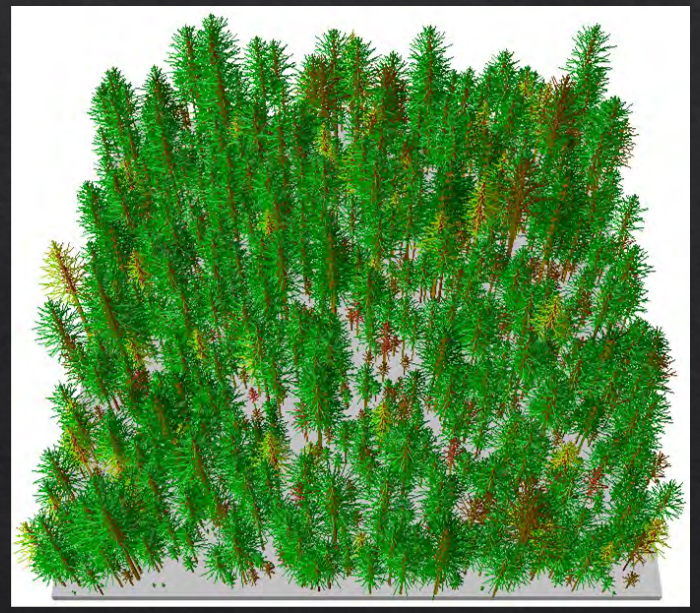


Historical fire-return interval

- 5 – 50 years

Brookes 2021 FEE, Copes-Gerbitz 2022 EA, Daniels & Watson 2003, Greene 2021, Harvey 2017 EA, Iverson 2002

Fire Exclusion
Prolonged Fire-free Period and Forest Infilling



Historical fire-return interval

- 5 – 50 years

Fire-free interval

- > 100 years

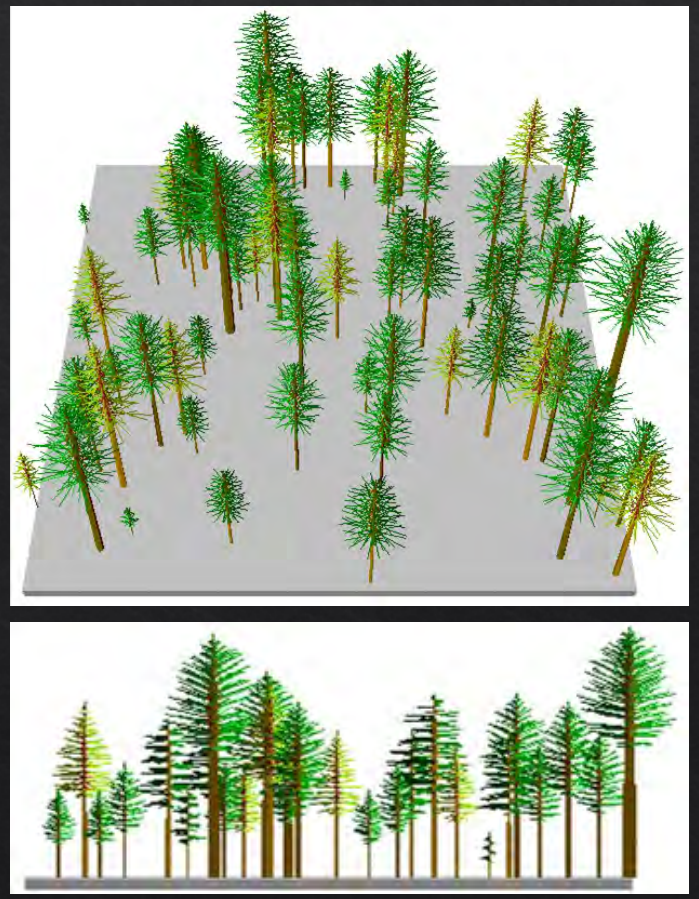
Fire deficit

- 2 – 14 missed fires

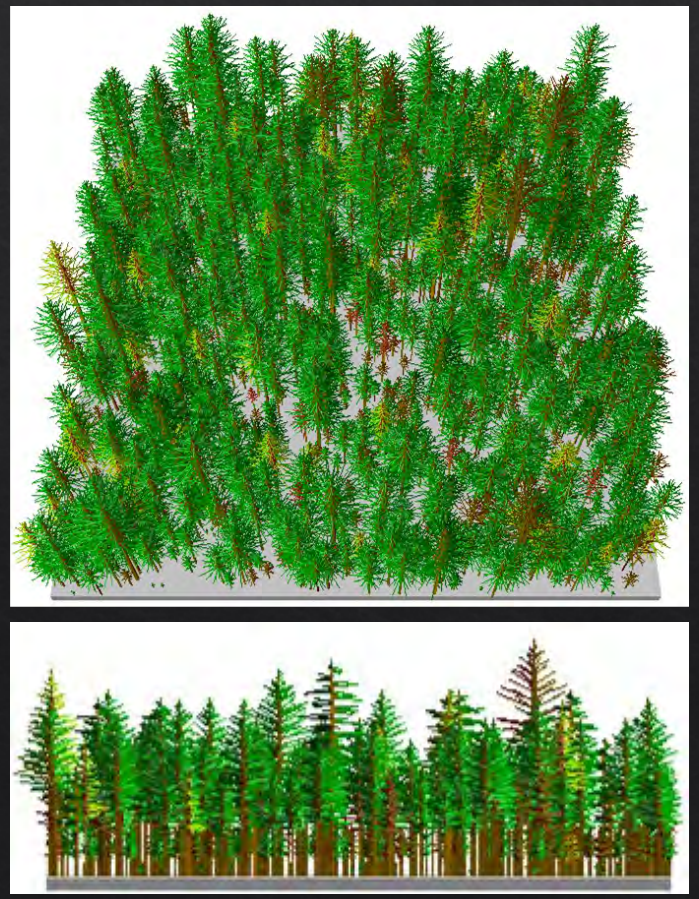
Brookes 2021 FEE, Copes-Gerbitz 2022 EA, Daniels & Watson 2003, Greene 2021, Harvey 2017 EA, Iverson 2002

Fire Exclusion
Change in Forest Structure

50 – 190 trees ha^{-1}



182 – 3,645 trees ha^{-1}



Brookes 2021 FEE, Greene 2021

Principles of Fuel Reduction Treatments

- Decrease crown density
- Increase height to live crown
- Reduce surface fuels
- Keep & promote
  big fire-resistant trees

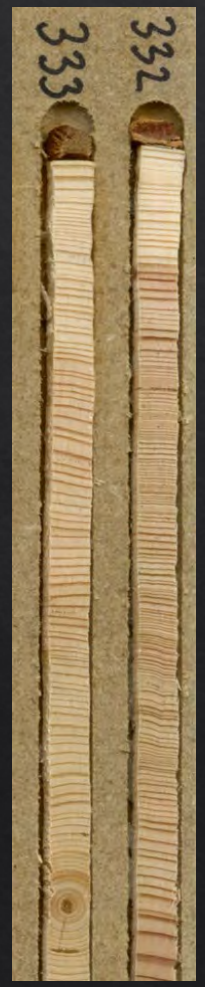
Agee & Skinner 2005 FEM

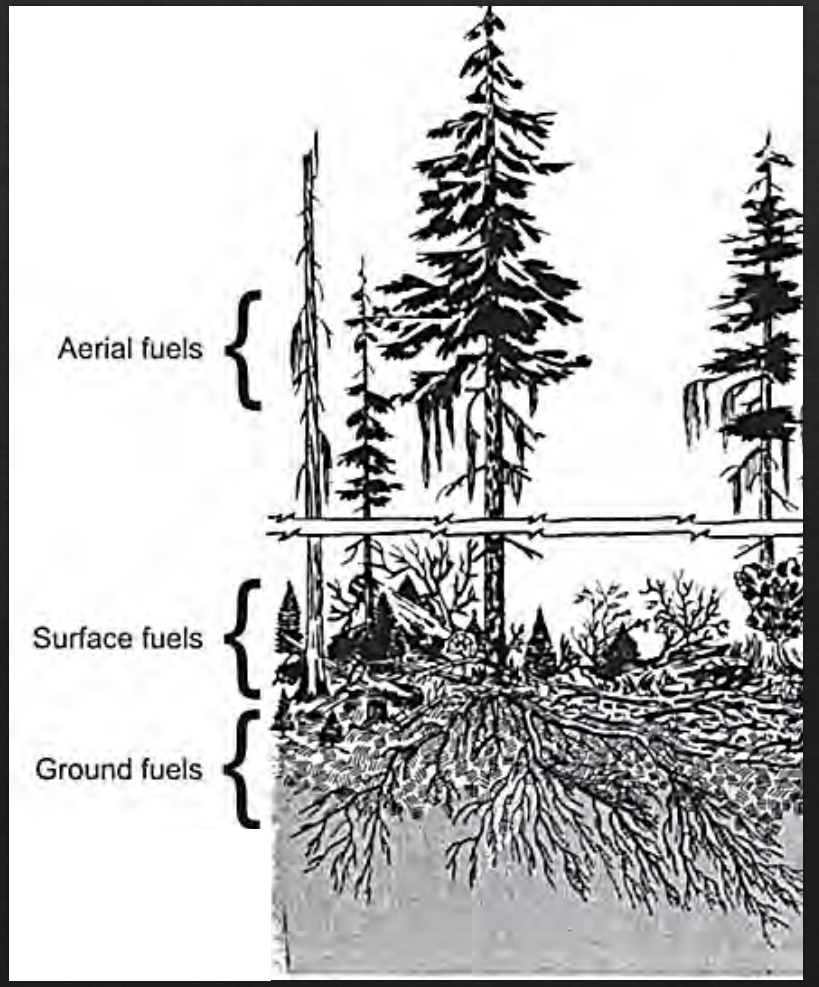
What were the historical stand structures under historical fire regimes?

Are historical or contemporary stand structures more resistant to crown fire?

Tree-Ring Analyses
Reconstruct Historical Stand Structures

- Sample plots (n=54)
  - 19 SXFN
  - 17 WLCF
  - 18 Knife Creek
- Nested sub-plots
  - Stand structure & Tree age
  - Fire history
  - Fuels

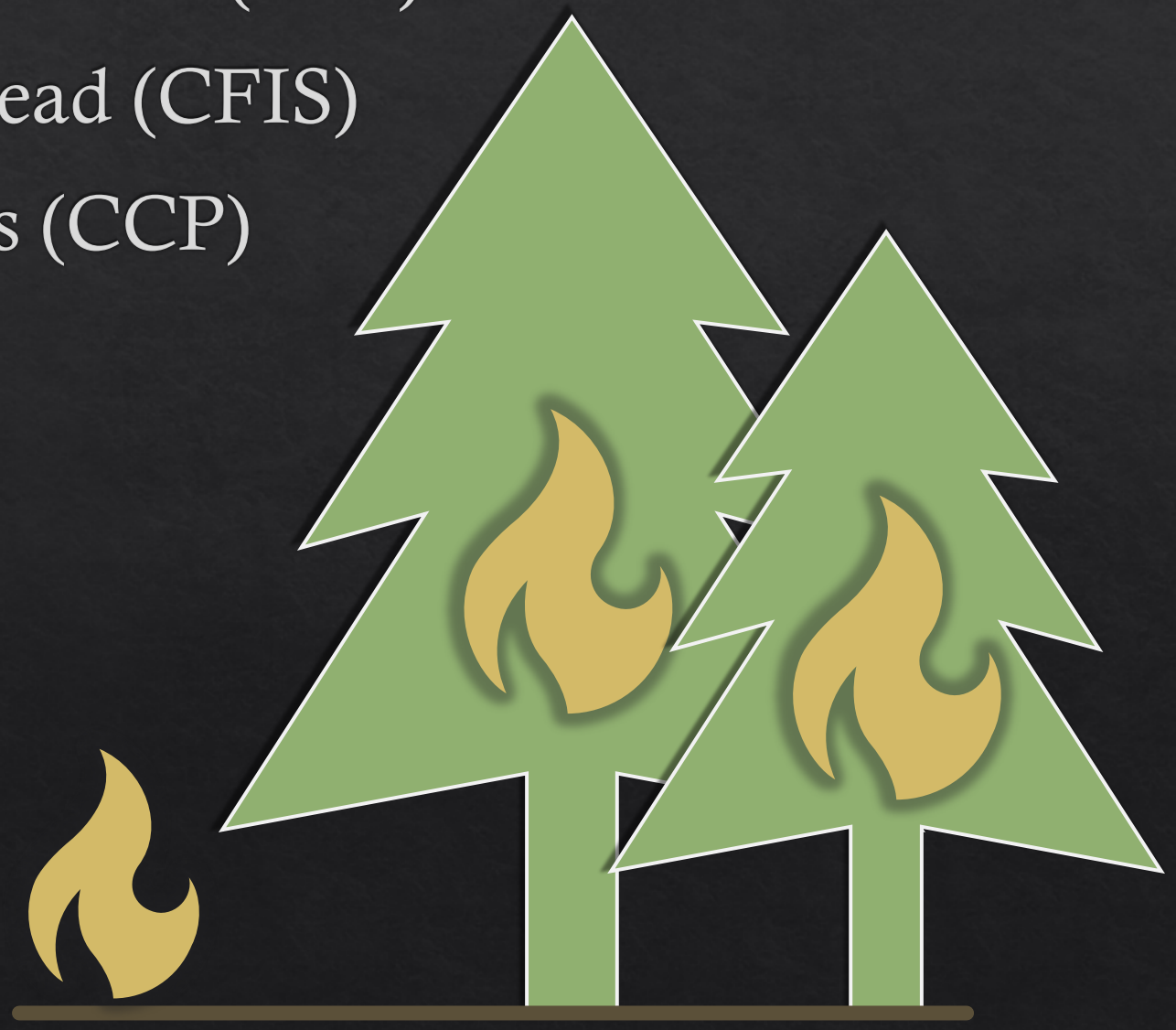




Barrows 1951 USFS

Fire Behaviour Models

- Canadian Fire Behaviour Prediction (FBP)
- Crown Fire Initiation and Spread (CFIS)
- Canadian Conifer Pyrometrics (CCP)



Fire Behaviour Models

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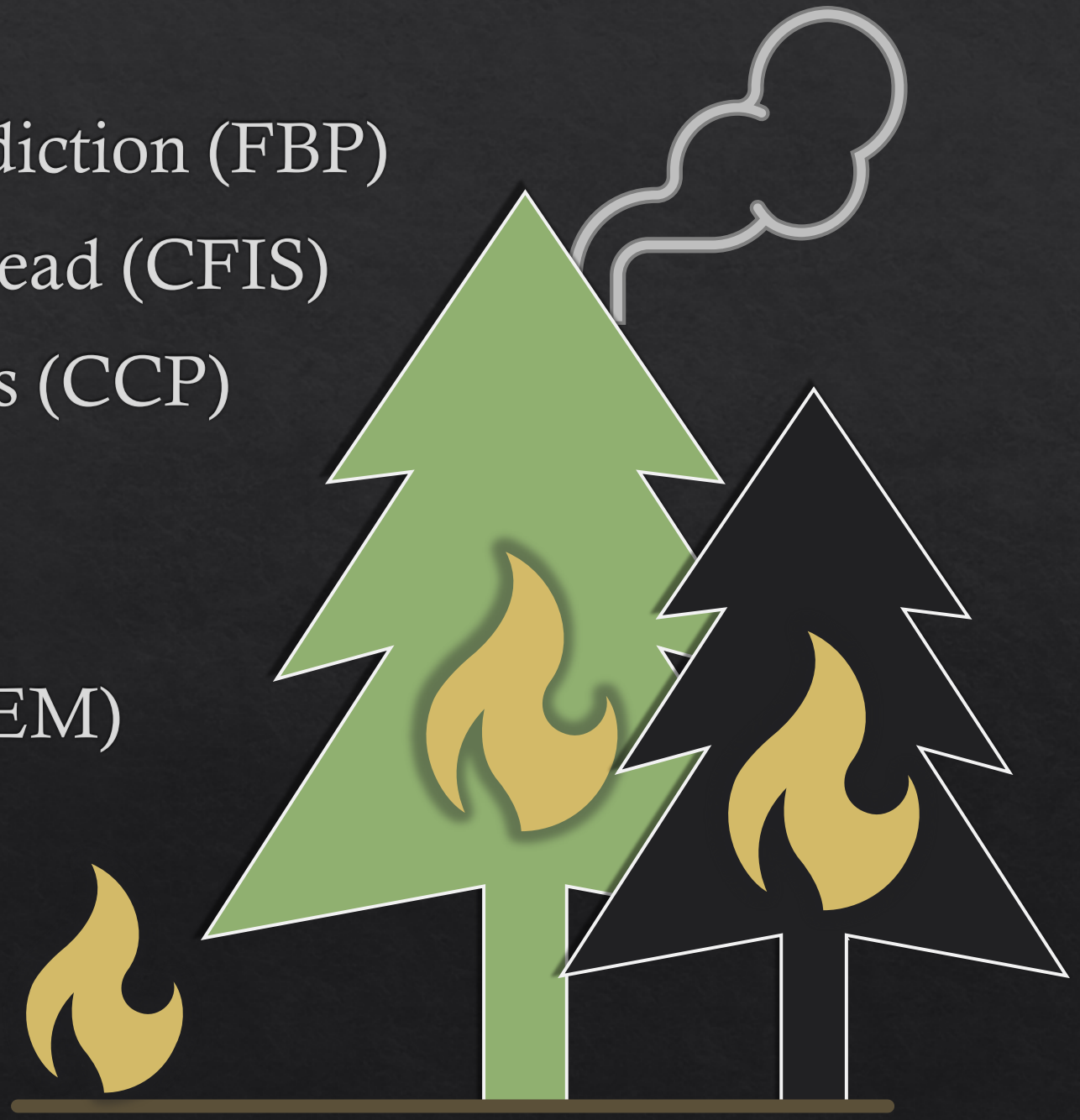
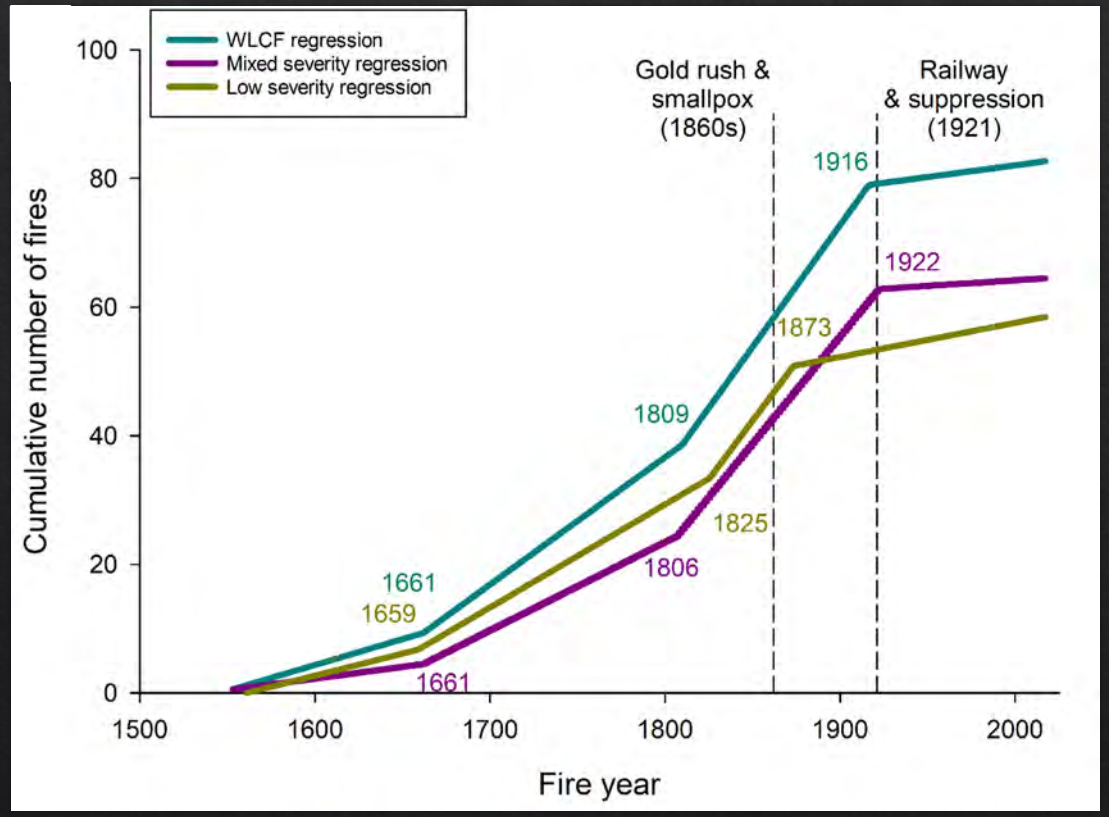
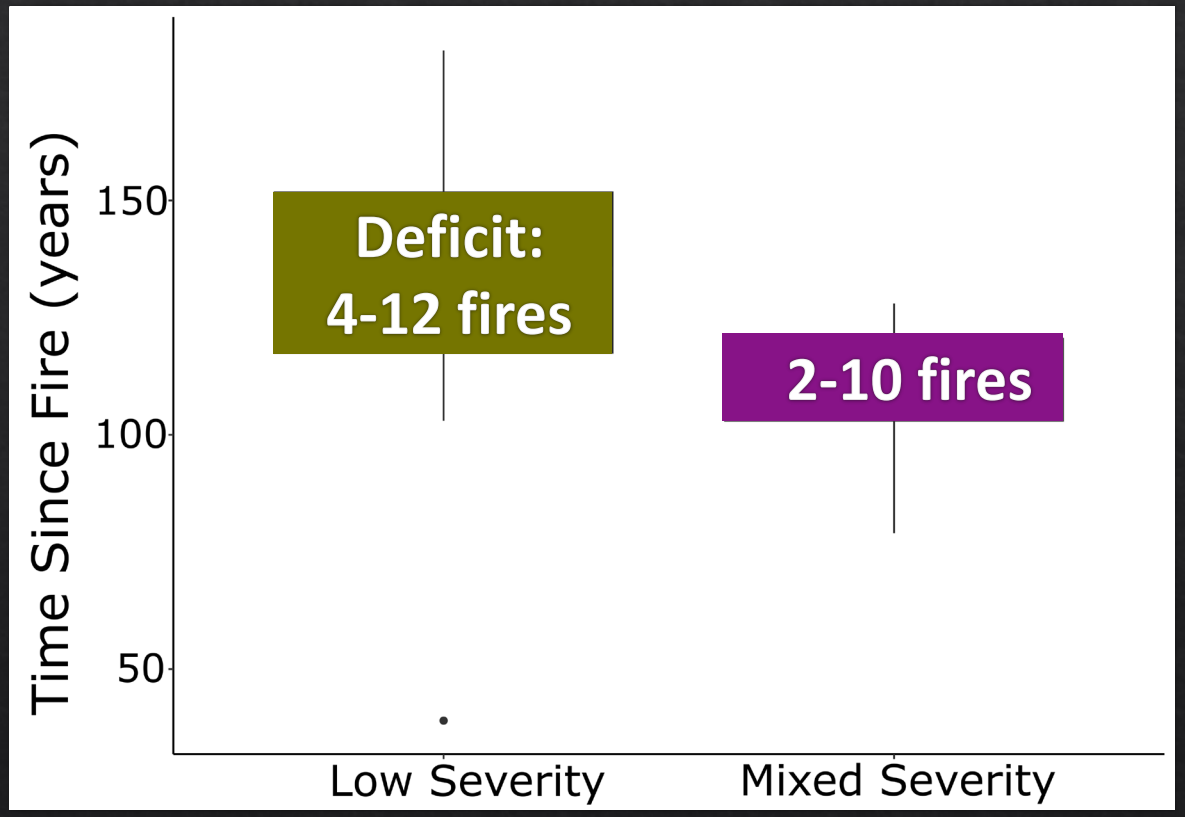
Fire Effects Model

- First Order Fire Effects (FOFEM)



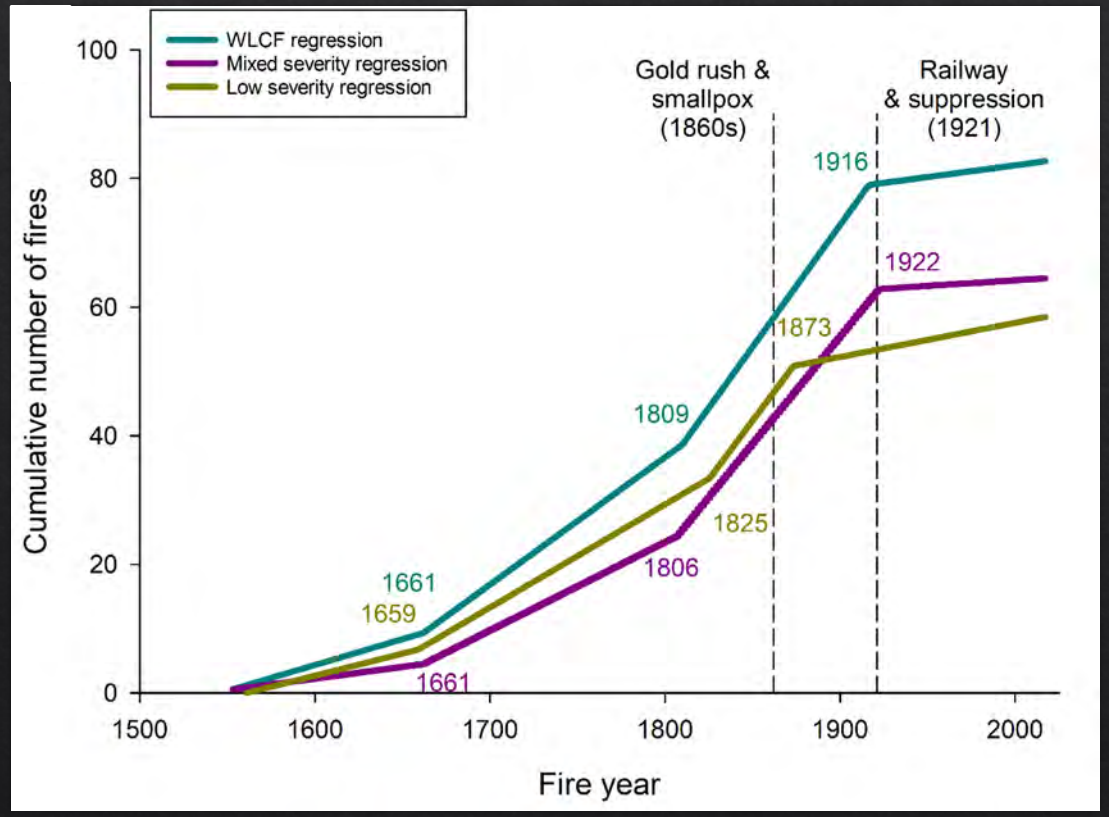
Onset of Exclusion Differs by Fire Regime

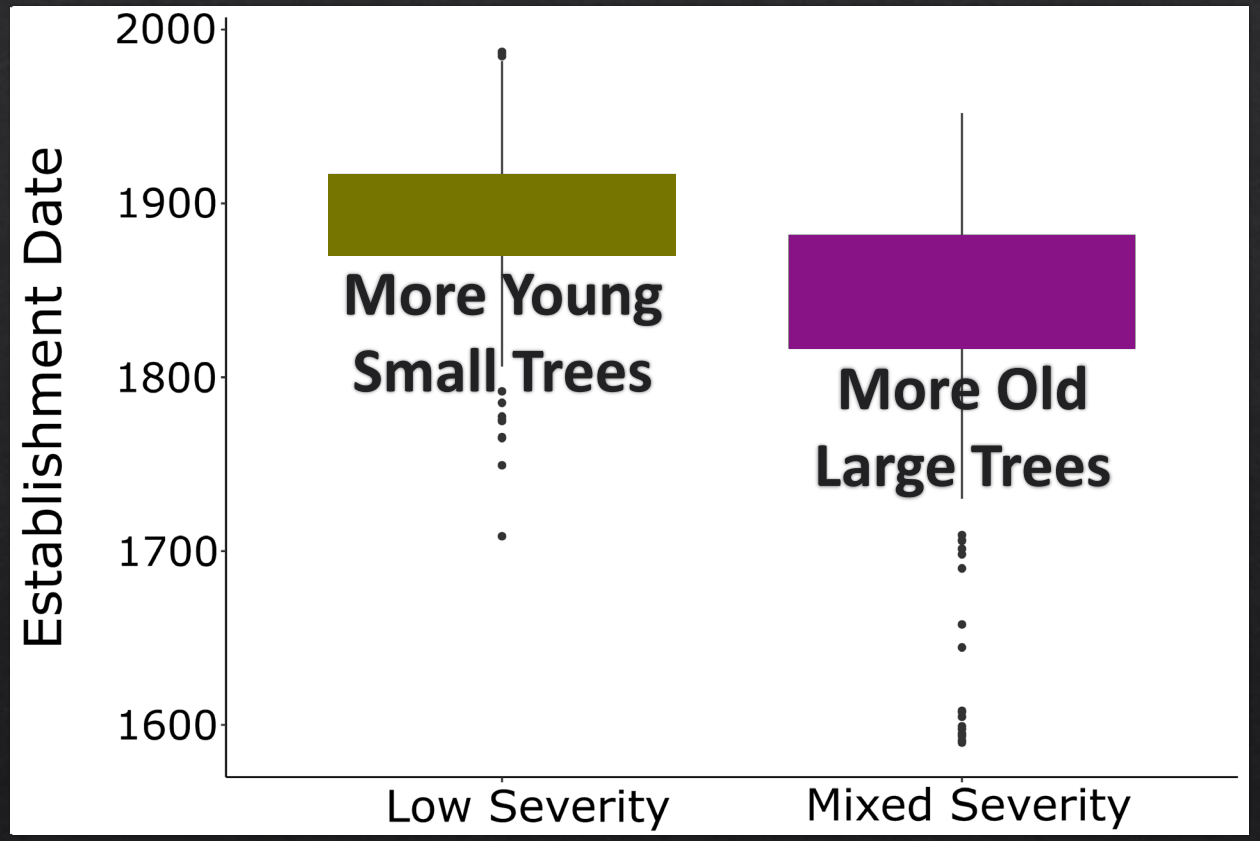




Copes-Gerbitz *et al* 2021 EA

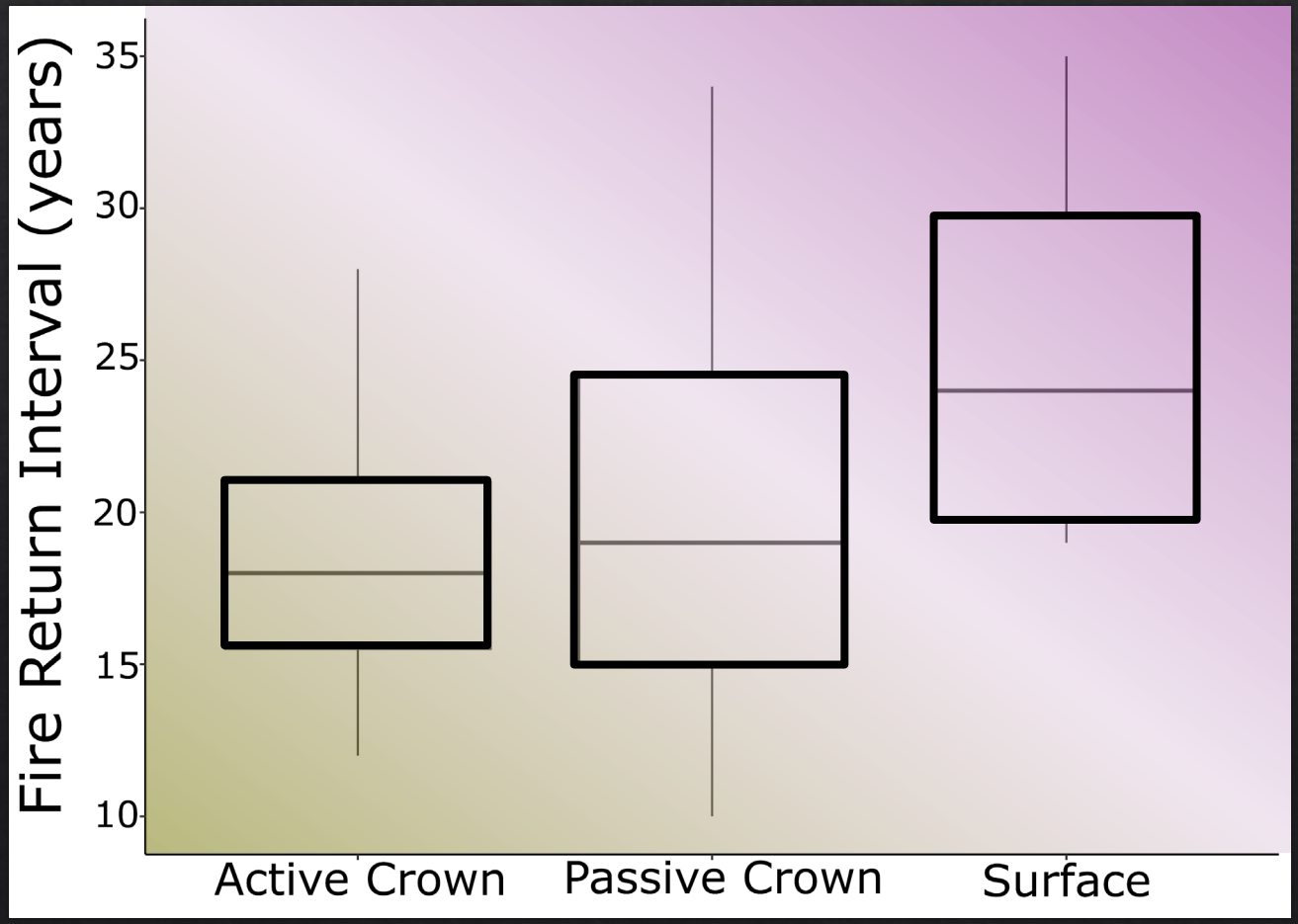
Forest Structure Differs by Fire Regime





Copes-Gerbitz *et al* 2021 EA

Contemporary *versus* Historical Fires



Historical Low-Severity Regime

- Short return intervals
  Frequent surface fire
- **Regime shift to crown fire**

Historical Mixed-Severity Regime

- Variable return intervals
  Surface with passive crown
- Sustained surface and
  passive crown fire

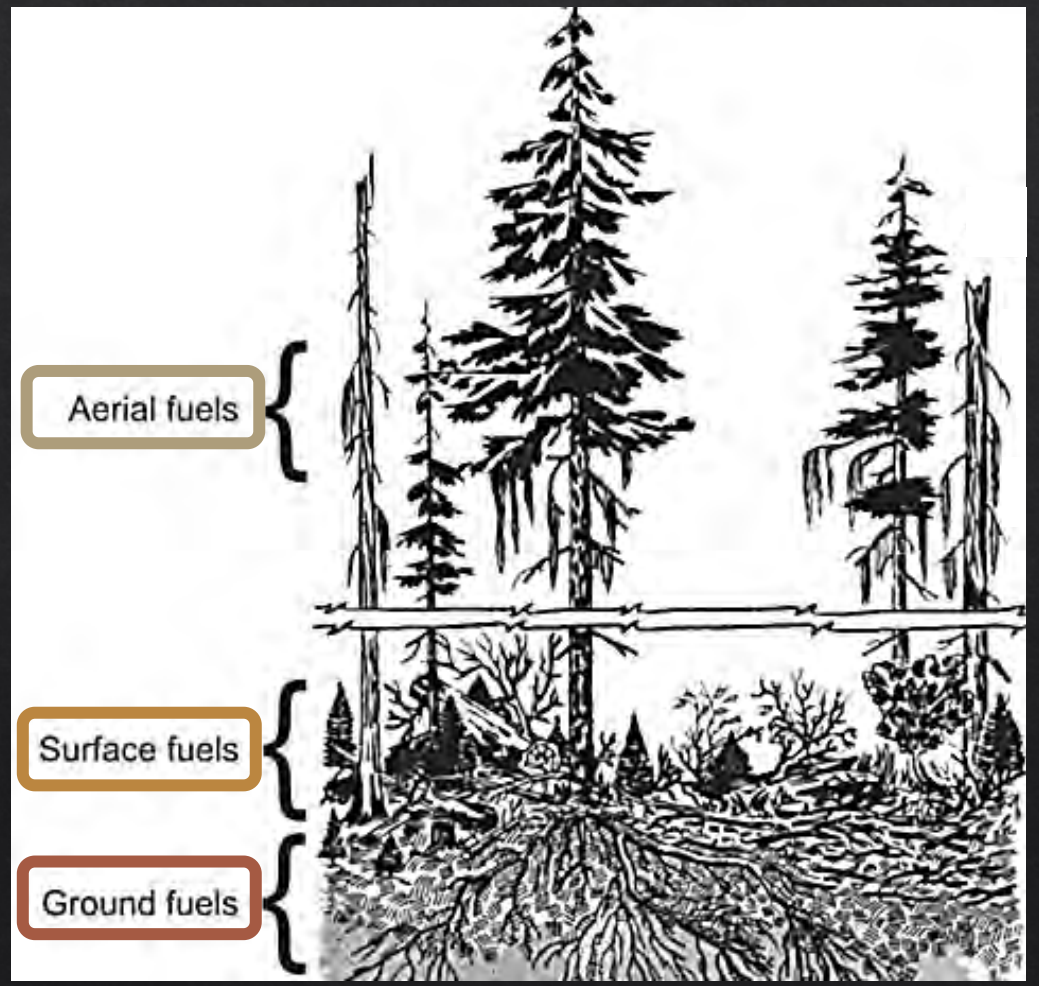
Summary of Predicted Fire Effects

Consumption
46-99%

22-90%

51-100%

66-68%



Barrows 1951 USFS

Emissions
402 T CO_2e ha^{-1}

Tree Mortality
81%

Fire regimes from past to future in dry Douglas-fir forests

- Low-severity fire regimes are shifting to high-severity crown fire
- Mixed-severity fire regimes susceptible due to deficits and accumulated fuels
- Proactive fuels treatments restore forest structures to avoid a regime shift

Thank you

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Acknowledgements: Stswecem'c Xget'tem First Nation,
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BC Wildfire Service, Canada Wildfire, field & lab assistants

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Canada Wildfire

British Columbia · Forests, Lands and Natural Resource Operations · WILDFIRE SERVICE

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FIRST NATION

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