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Thinning as a tool to increase resistance to stressors

Dominik Roeser, Rover Liu, Sergio Alonso, Omar Mologni

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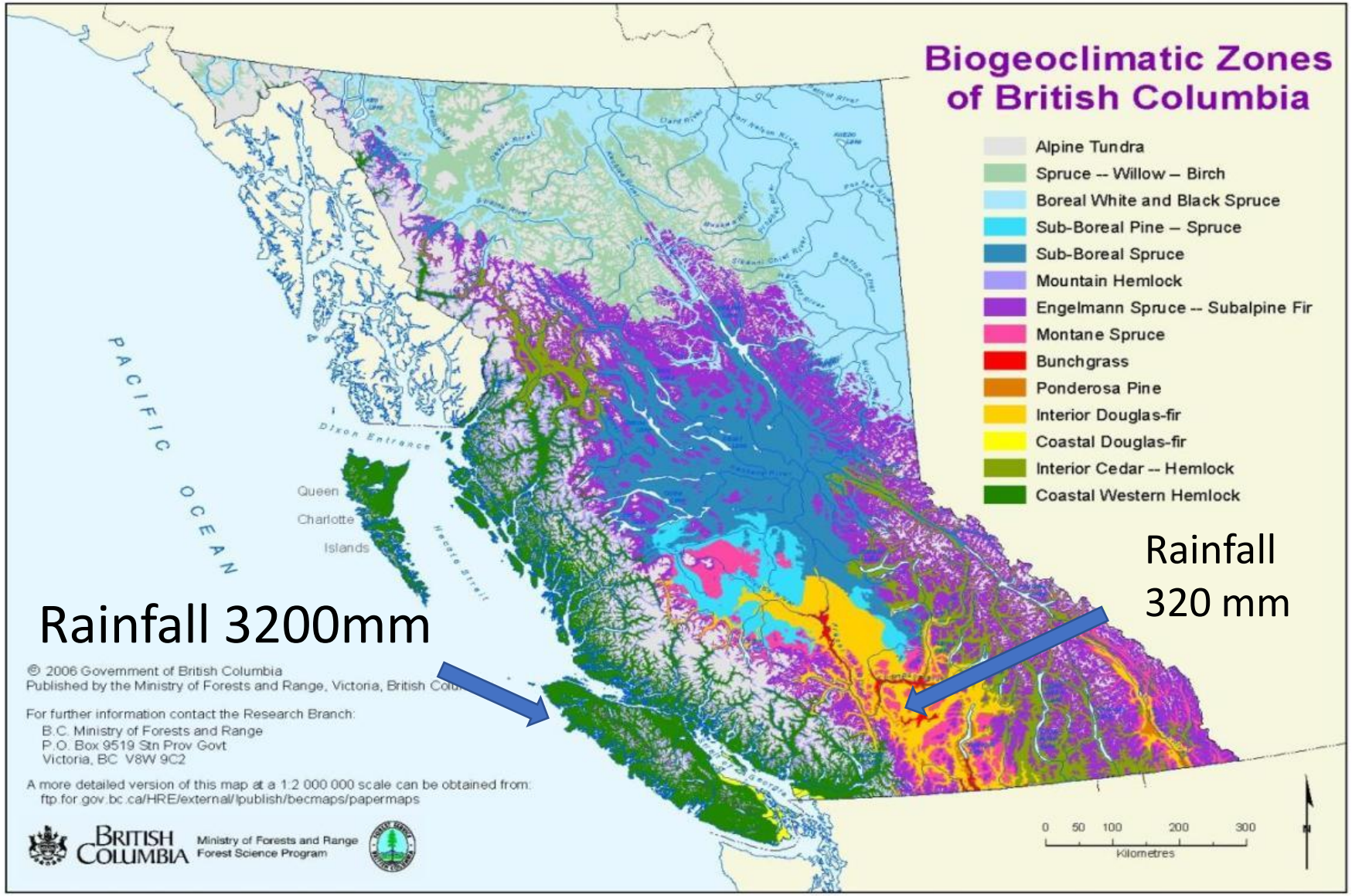
Most ecologically diverse province in Canada



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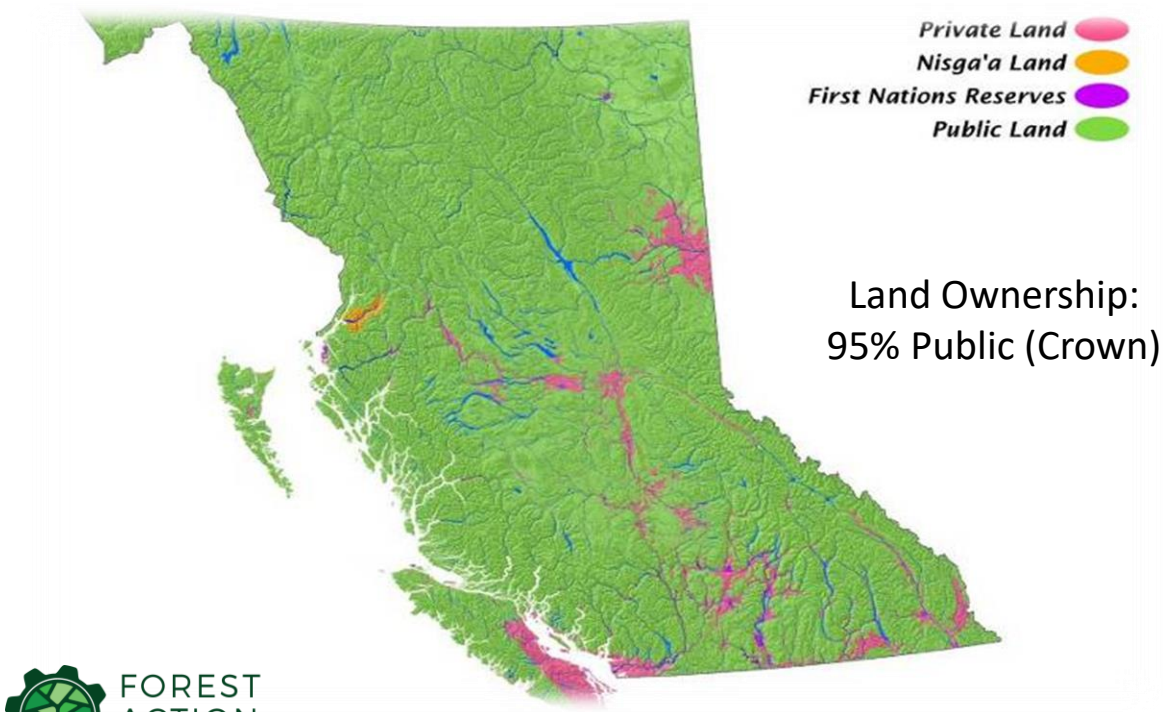
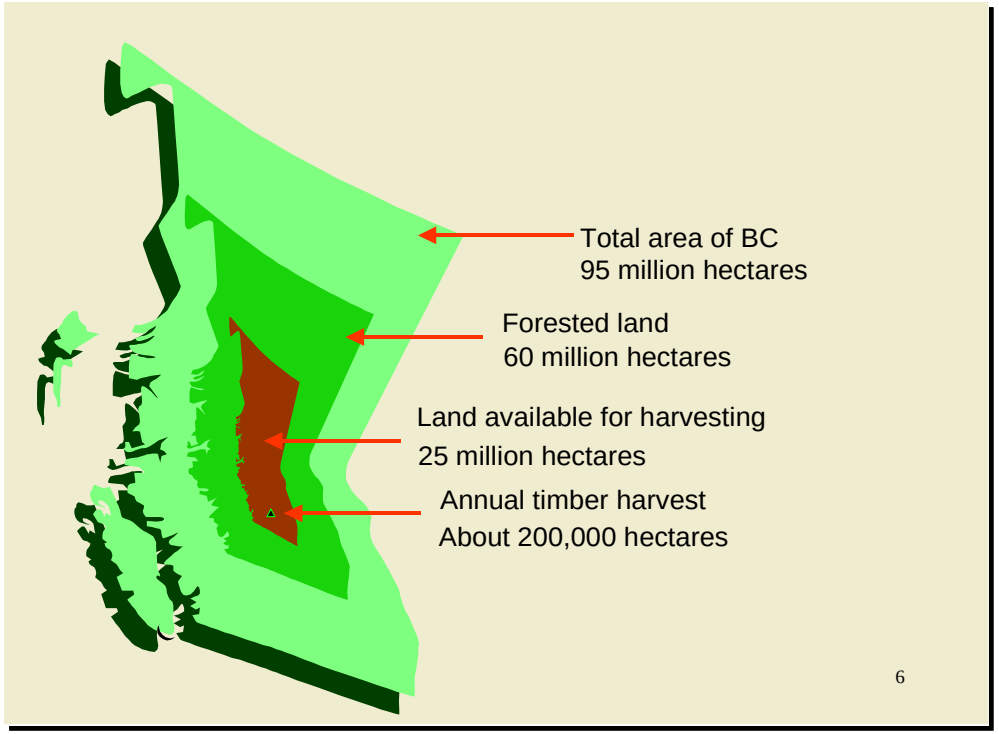
BC Forests

- Forests dominated by conifers: 83% of the forested area
- Most common: lodgepole pine, spruces, true firs, hemlocks, and Douglas-fir
- Forests over 140 years old: 22.6 million hectares (41% of B.C.'s forests)



Land Ownership:
95% Public (Crown)



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Insect pests – major threat to midterm fibre supply

Photo credit: Allan Caroll

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Photo: L. Maclauchlan

Photo credit: Allan Caroll

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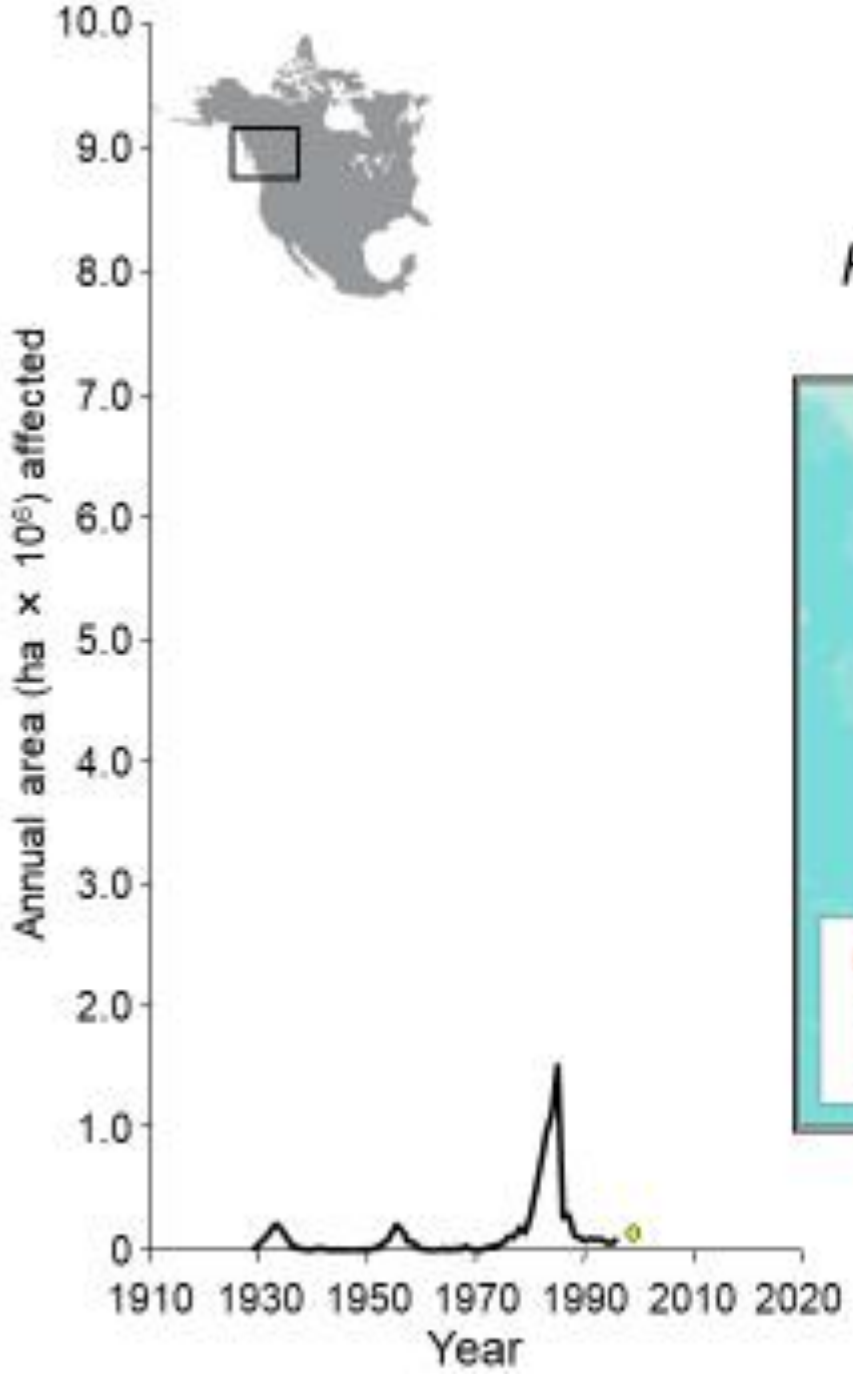
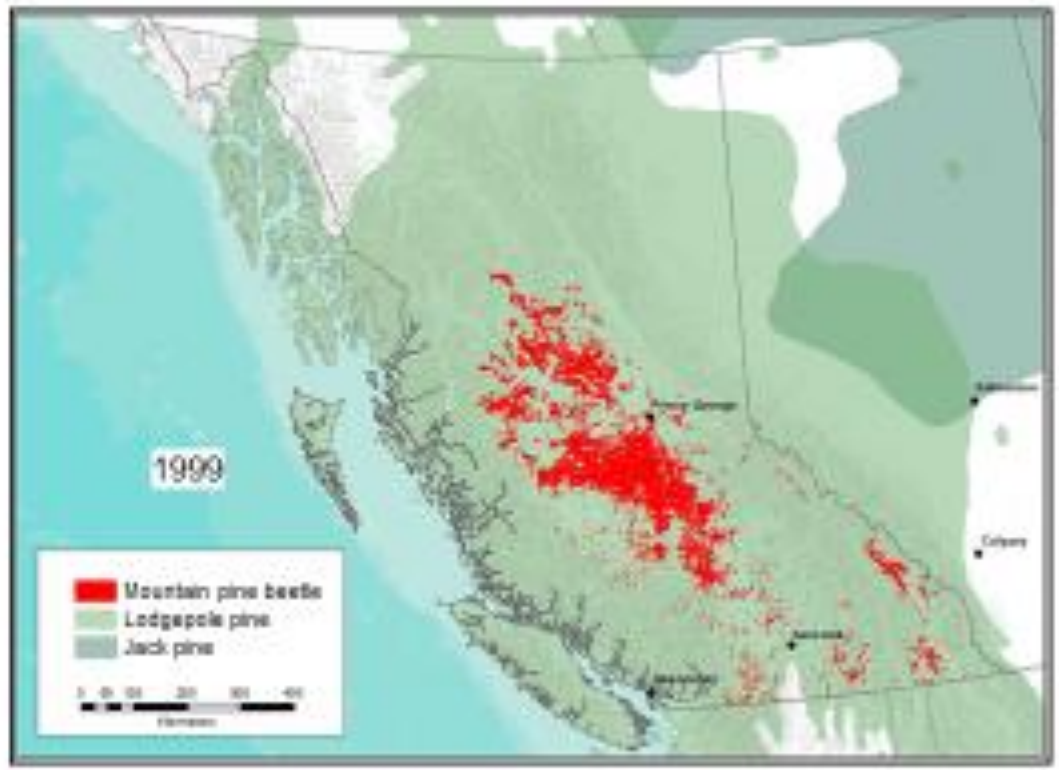


The synergy:

Favorable climate x abundant hosts



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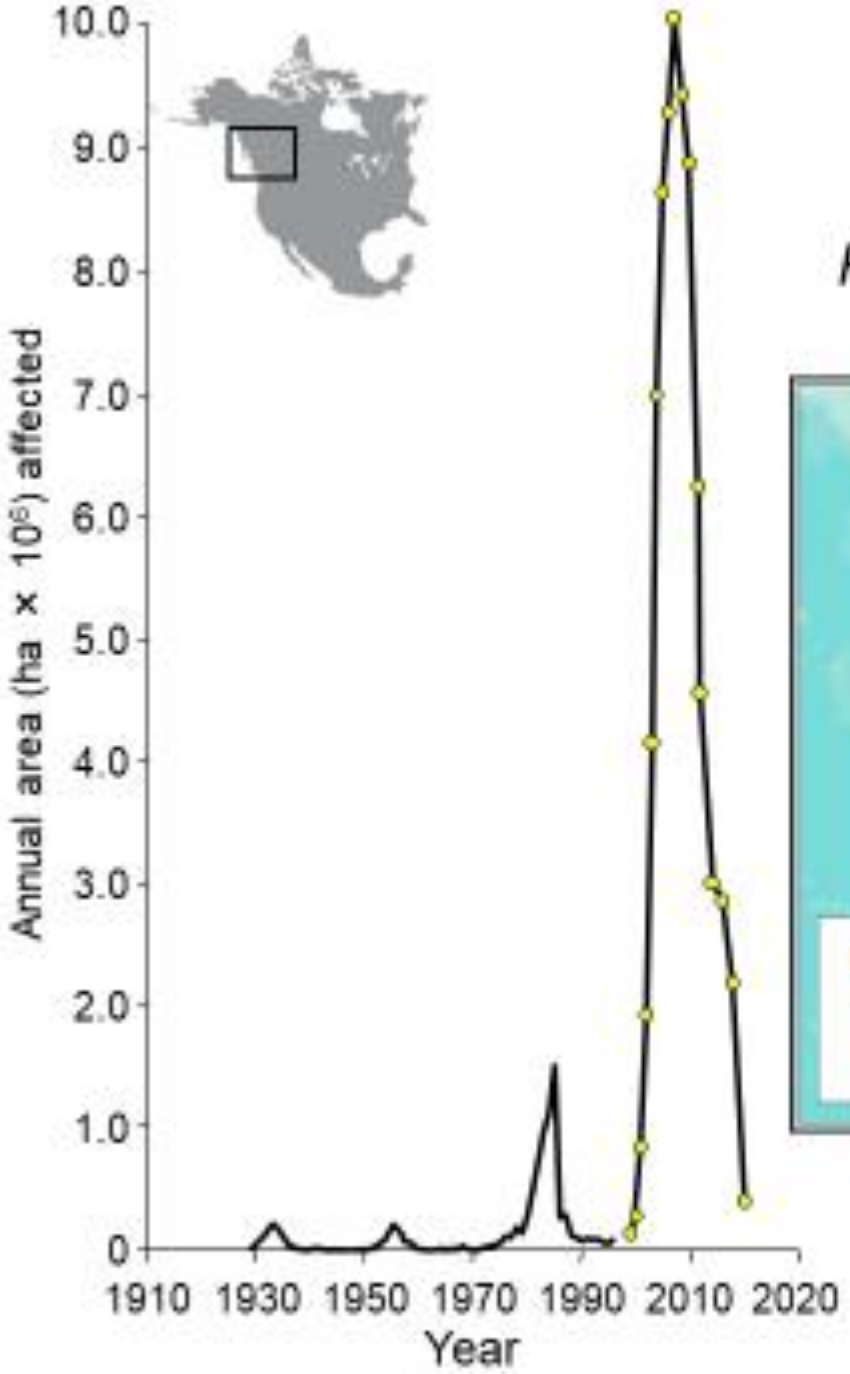

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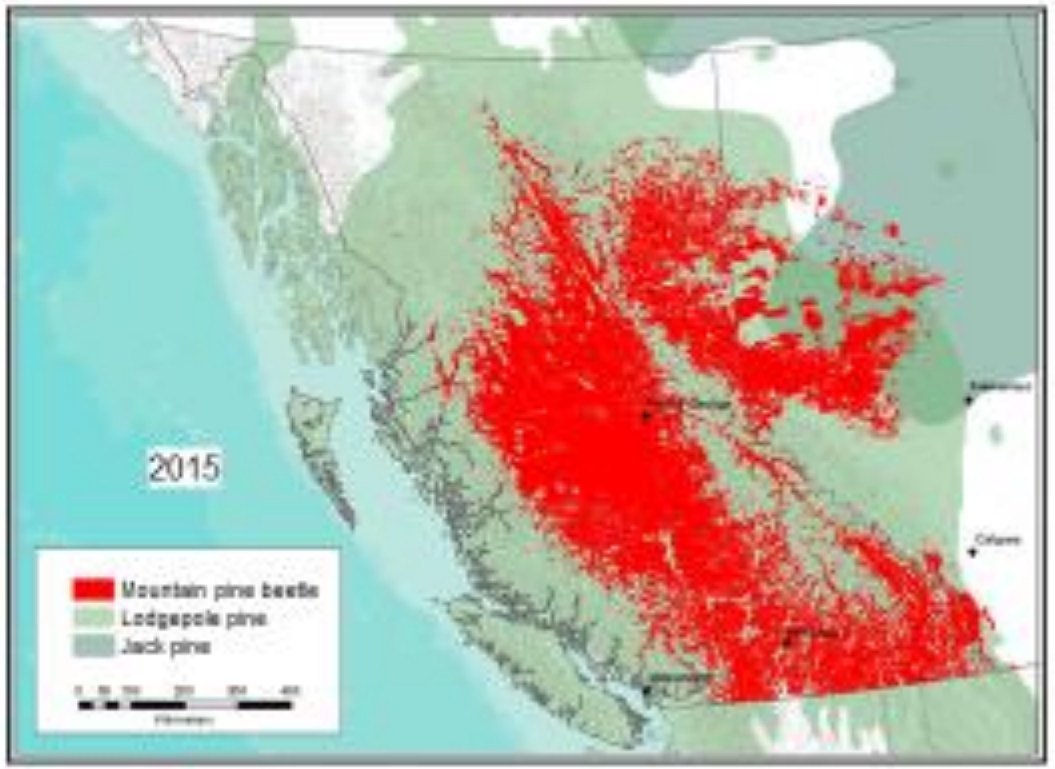

- 18 million ha affected
- 60% mortality of all mature pines in BC
- Unprecedented outbreak

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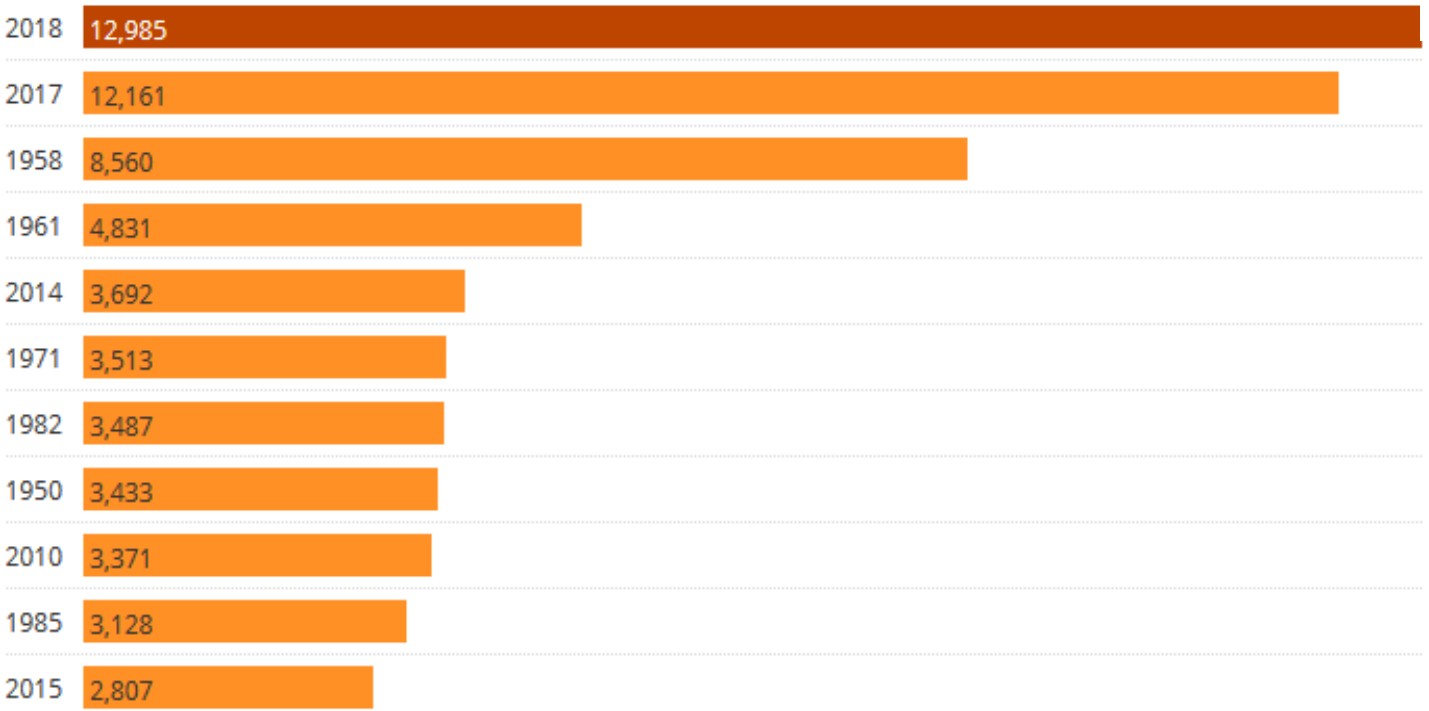
Top 10 fire seasons in BC since 1950

Chart shows number of square kilometres burned in wildfires each season. Does not include false alarms, nuisance fires or training fires.



2018 data is current as of Aug. 29

Chart: Bethany Lindsay, CBC News • Source: B.C. Wildfire Service

news

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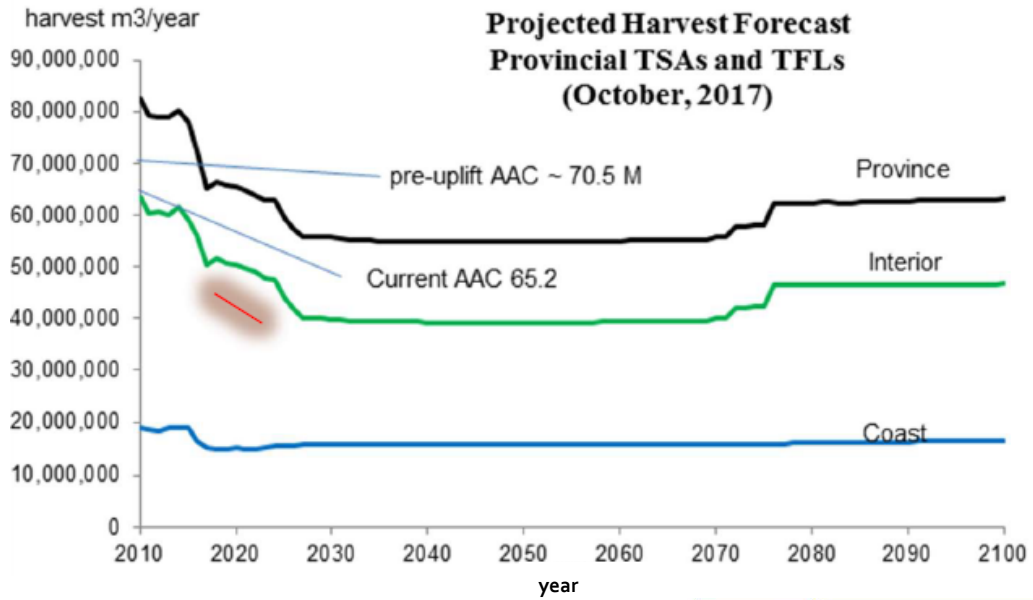
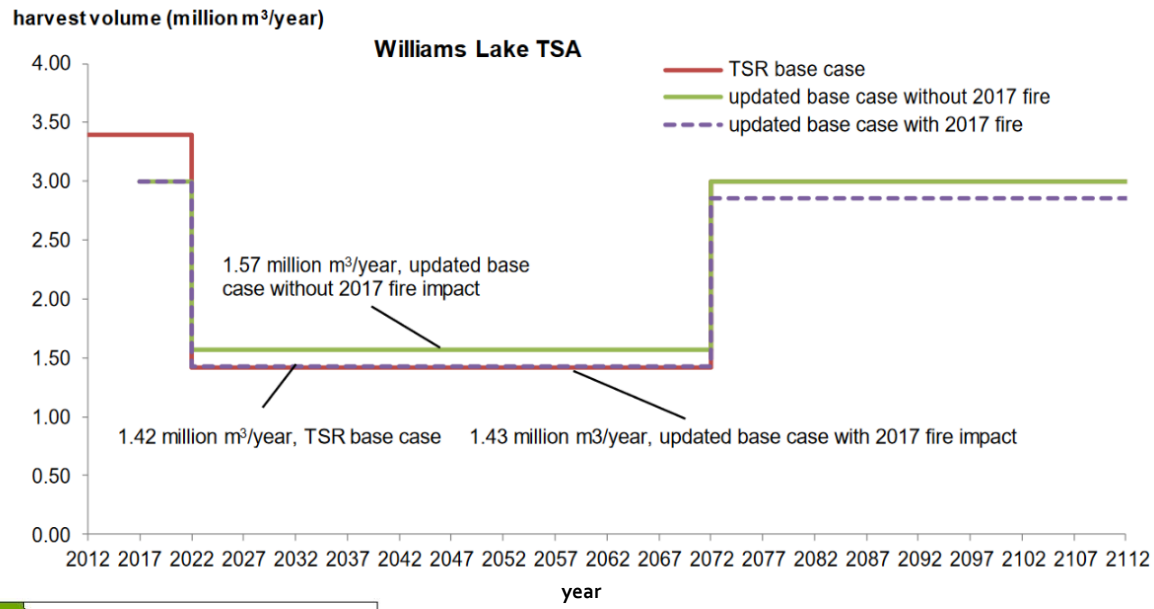
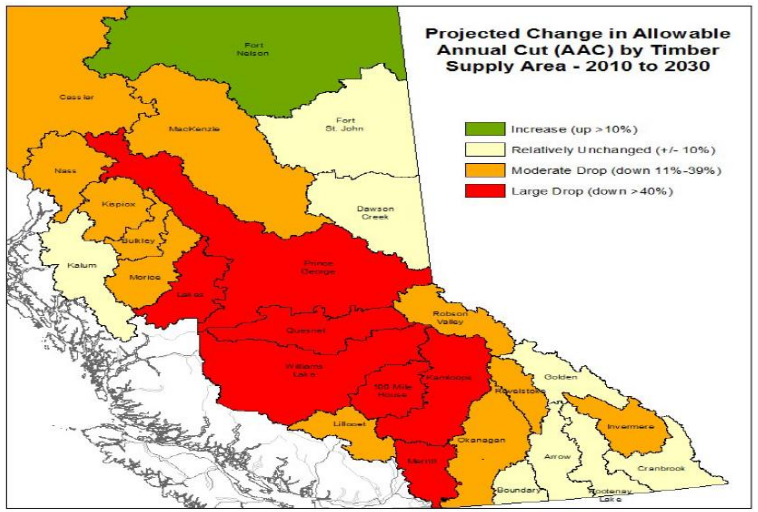
Fibre supply impacts







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Source: British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development

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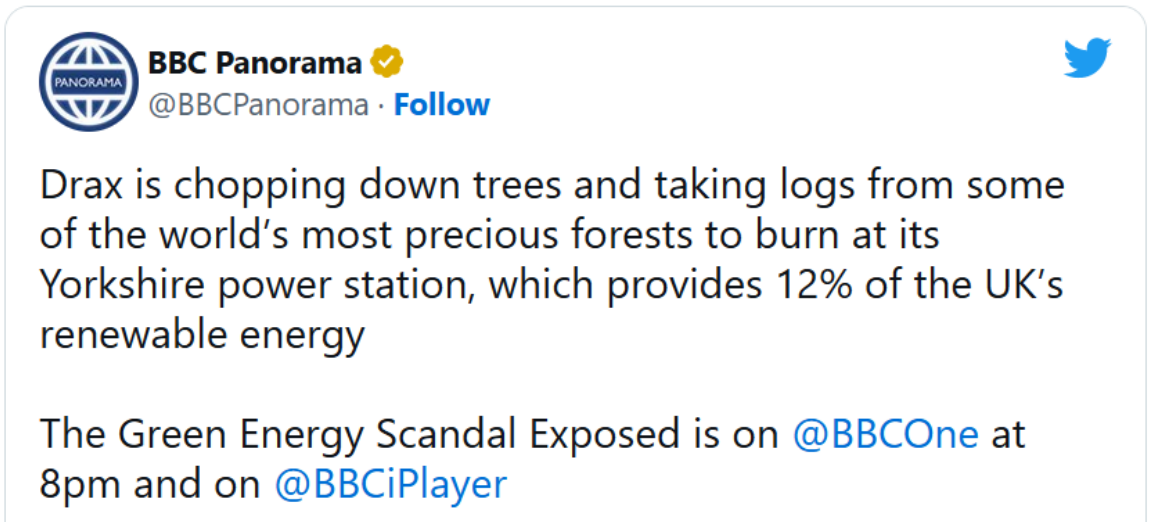
EXPERT BLOG › ELLY PEPPER

BBC Reveals Drax Logging Old-Growth Forests for Biomass

October 03, 2022 | Elly Pepper



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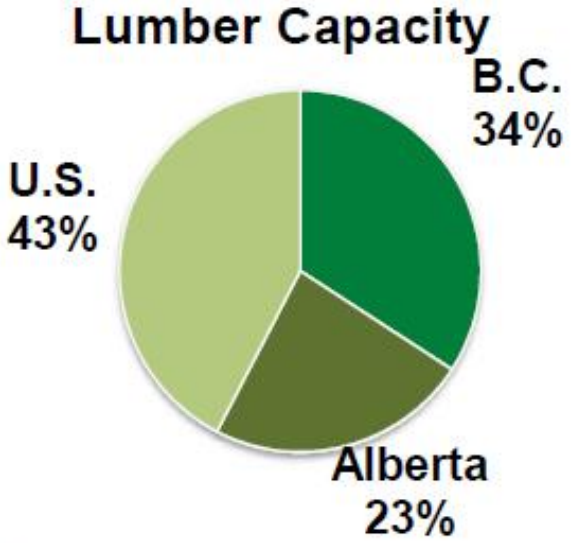
Fibre supply challenges



Source: Jeff Mycock/Westfraser

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OBJECTIVE

The research program aims to provide data, tools and practical solutions to improve the resilience of Canadian forests to various disturbances and sources of stress, thereby contributing to the health of these ecosystems and the well-being of the communities that depend on them.

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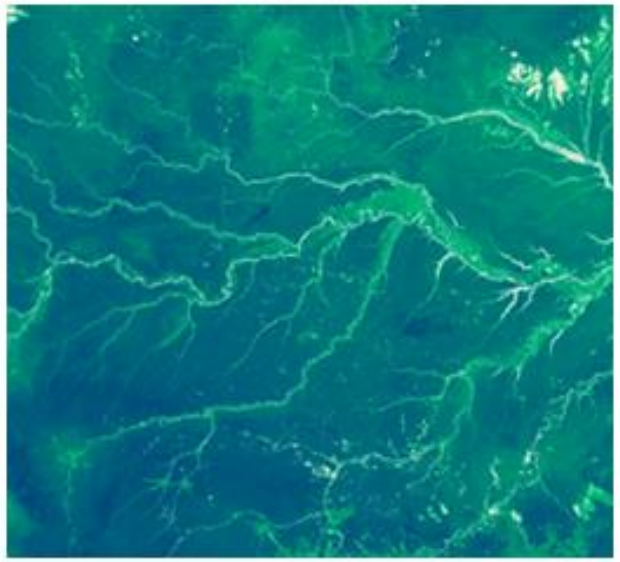
RESEARCH THEMES



Observe

Collect data using innovative tools to assess the growth and vigor of trees, and thus allow more flexible and adaptive management strategies in the face of climatic stresses and disturbances.

Anticipate

Improve growth models and prediction methods to account for climate reality and synthesize the multiple risks of disturbance that forests face.

Adapt

To test innovative silvicultural treatments and forest management strategies adapted to the new socio-environmental reality, thus working to ensure the sustainability of the fiber supply across Canada.

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Looking ahead

It is almost impossible to maintain forest resilience against the negative impacts of changing climate in the long term with the current silvicultural methods (Mina et al., 2021).

There is demand for developing an adaptative and innovative silviculture approach to adapt the forests to the ever-changing disturbance regimes (Mina et al., 2021, Achim et al. 2021)

But what is resilient?

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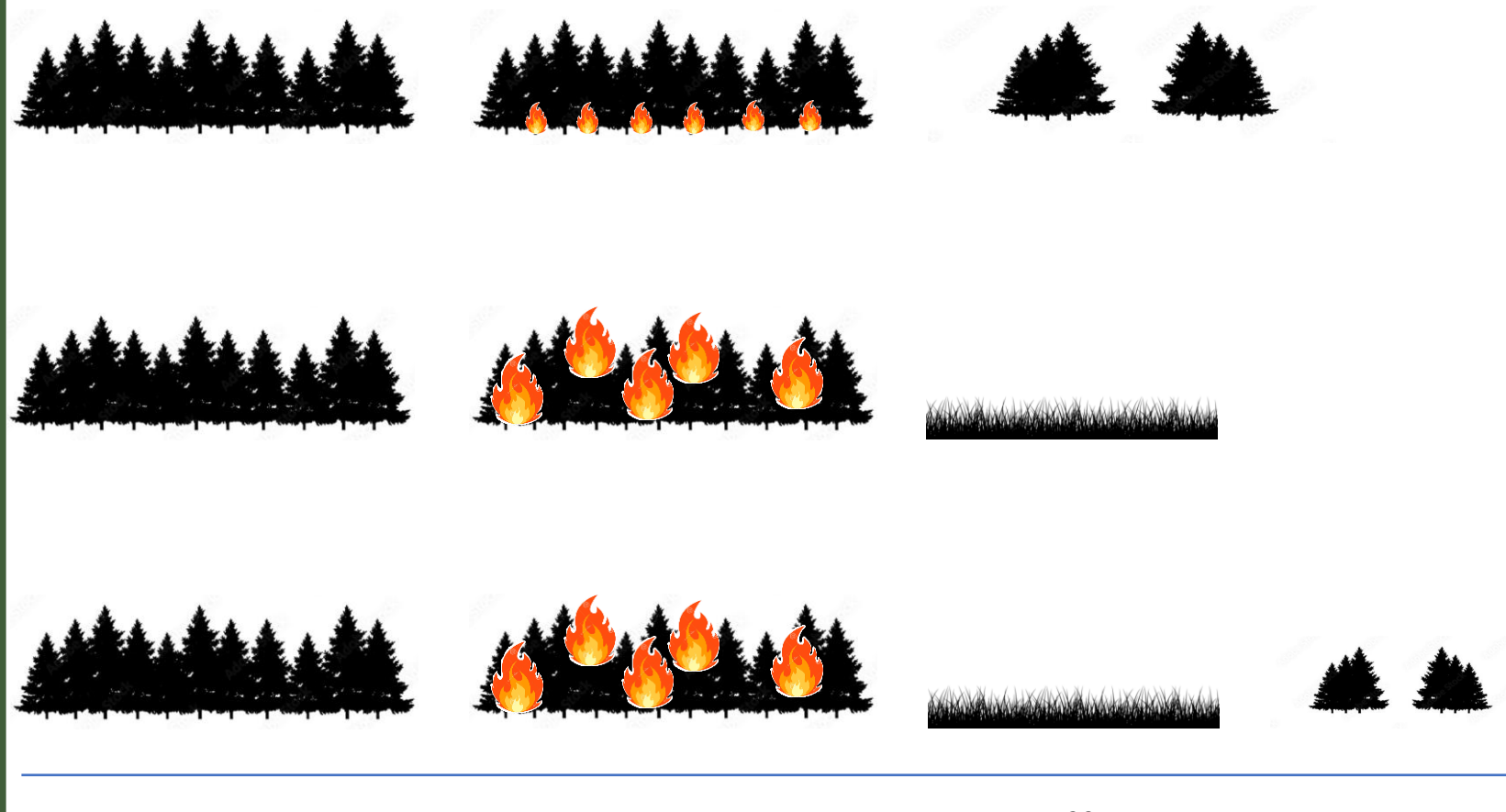
But what is resilient?

3 conceptual scenarios for a resilient stand

1. Resistant thus resilient

2. Neither resistant nor resilient

3. Not resistant but resilient



Hlásny and Dobor, L. (2021)

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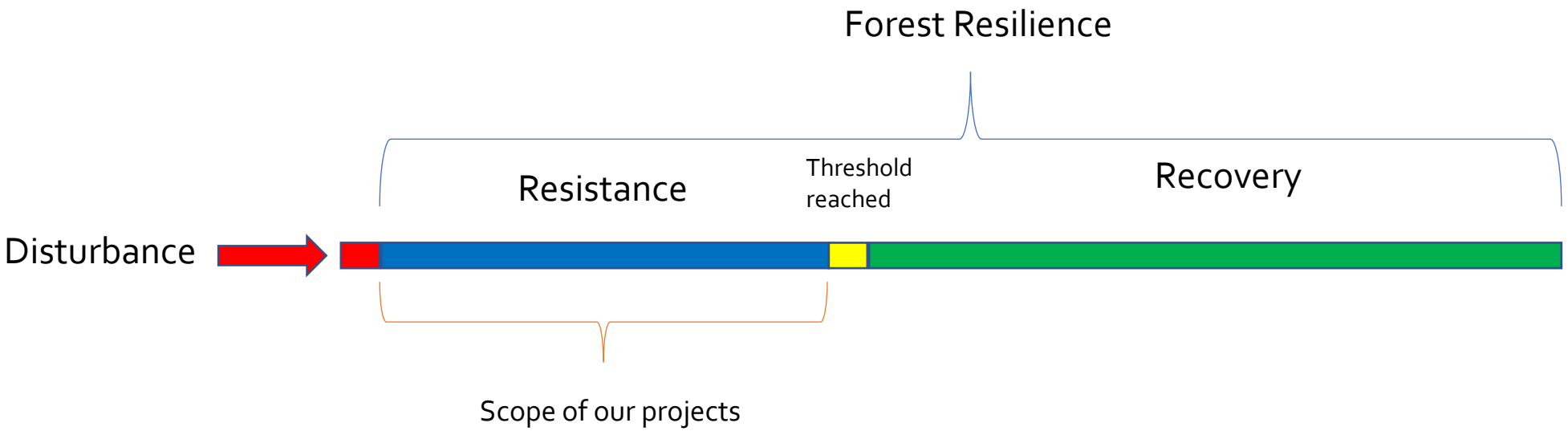
Our approach: Resistance



Nimmo, D. G., mac Nally, R., Cunningham, S. C., Haslem, A., & Bennett, A. F. (2015). Vive la résistance: reviving resistance for 21st century conservation. *Trends in Ecology & Evolution*, *30*(9), 516–523. https://doi.org/10.1016/J.TREE.2015.07.008
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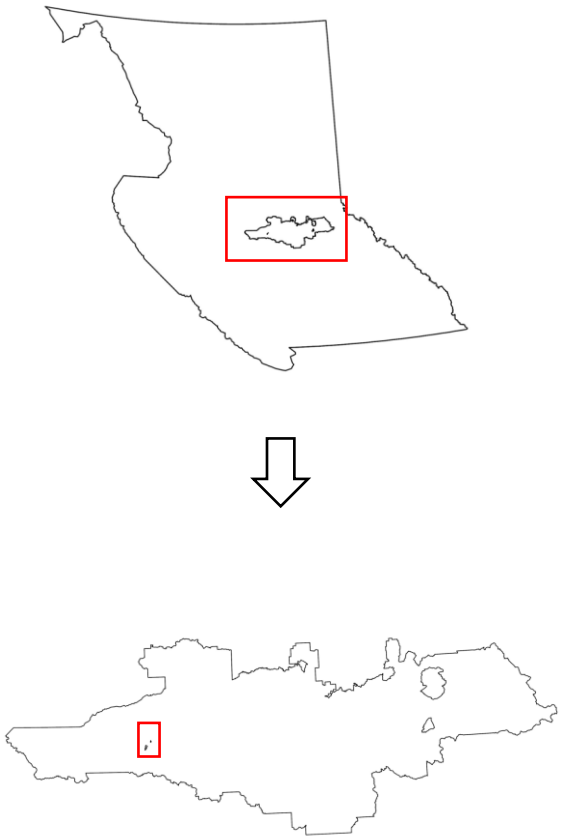
Case Study Area



Species composition:

- 90% Lodgepole pine
- 10% Spruce
- All between 120-140 yr

Irregular shelterwood

- Treated in 2009
- 50% canopy opening
- 30*50m patches

Originally implemented to maximize timber production while meeting the requirement for Cariboo Habitat

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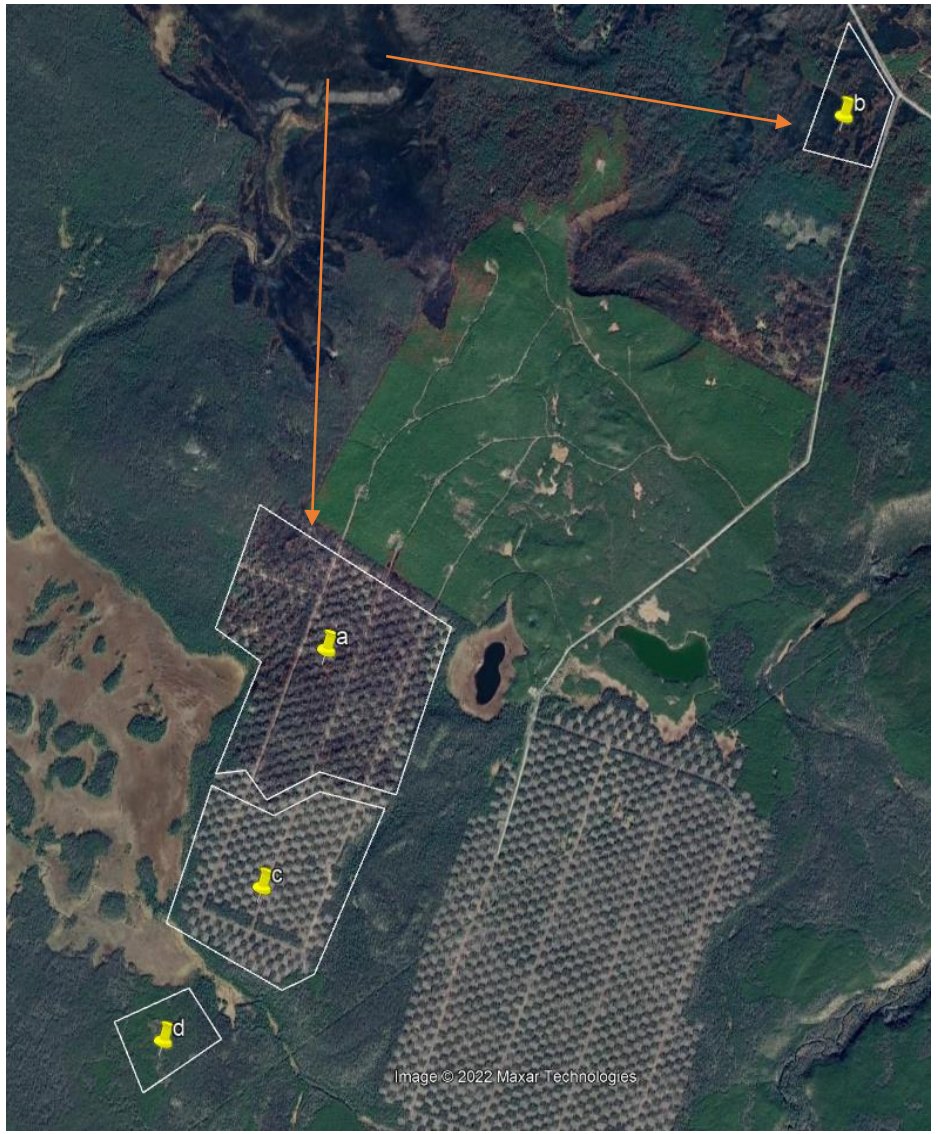
Case Study Area

Controls:
Stand B: untreated-burnt
Stand D: untreated-unburnt

Fire Behaviour:

- Ran in the direction of the red arrows
- Burnt stand A and B in the same day
- Naturally extinguished by precipitation



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Research Questions

Did the irregular shelterwood treated stand show higher resistance compared to the untreated stand?

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Research Questions

1. Were more live trees observed in the treated stand than the untreated stand?
   - How large is the difference?
   - What other differences are observed?

2. Is treatment (stand structure) a statistically significant variable in increasing post-fire survival rate?

3. How do common fire behaviour models compare to reality?

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How do we implement resistant stand structures in practice?

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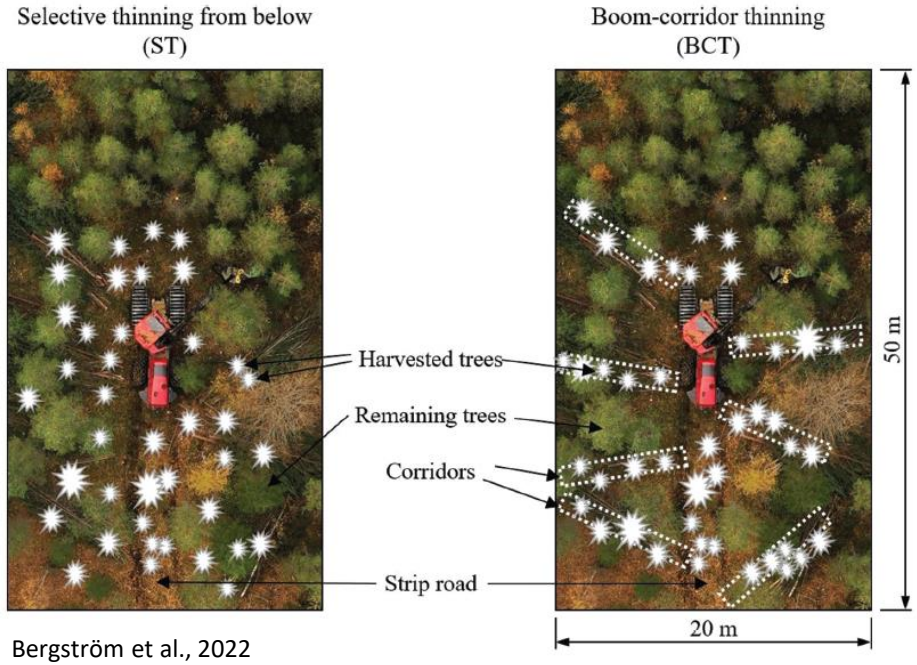
European small-scale harvesters

Sergio Franco

Alternative harvesting layout



Bergström et al., 2022

CT operations in Western US

Sabrina St-Onge

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Common approaches to CT operations

Resistance to: fire, wind, drought, insects & pathogens		Align with results from other studies Possibility for long-term studies
Productivity analysis		Economics Operations
Stand quality analysis • Damage to residual trees? • Soil impacts? • Fine woody fuels?		Ecosystem services/values • Biodiversity • Habitat • Carbon Growth & yield

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Harvester & forwarder productivity analysis

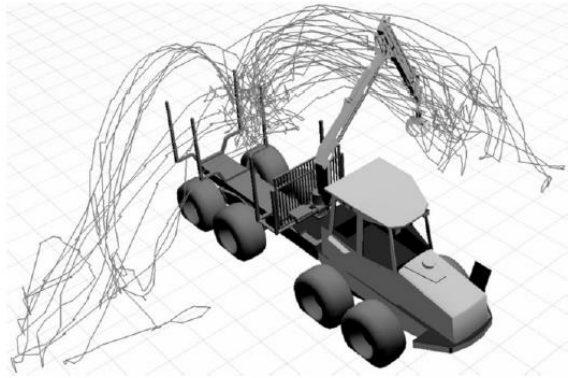

Fig. 8 Calculated boom tip movement patterns based on recordings of the joint angles and telescopic opening Lindroos et at., 2015

Data sources

- Automatic harvester data
  - On-Board-Computer + GNSS
- Detailed time studies
  - Video analysis at work element level
  - Piece count/cycle
- LiDAR inventory
- Scaled volumes

Study of factors affecting productivity

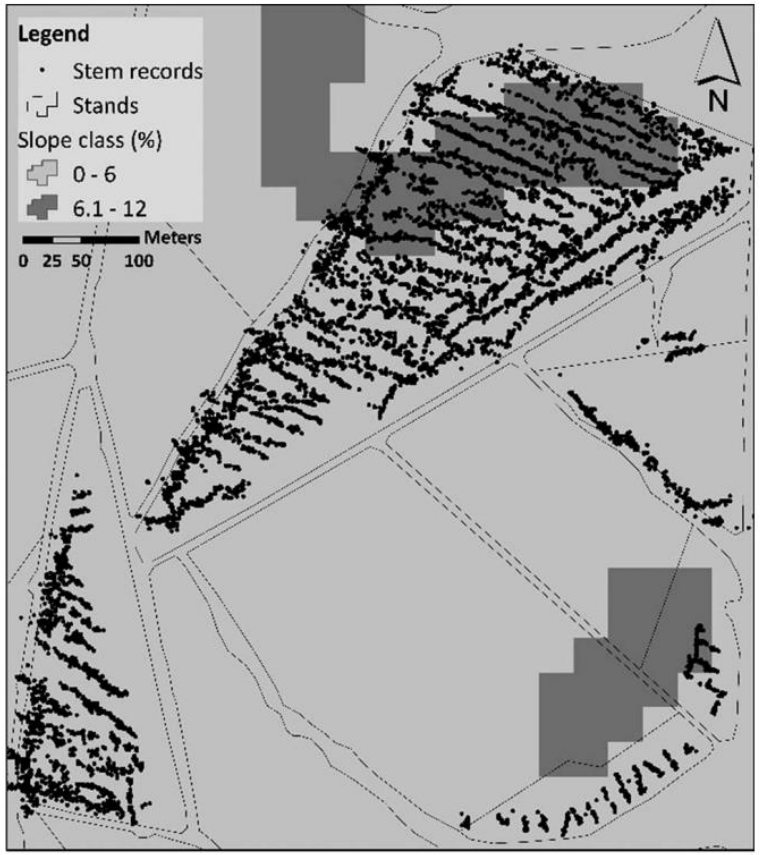

Figure 2. Part of the study areas, showing stem records, stand boundaries and slope map. Olivera et al., 2016

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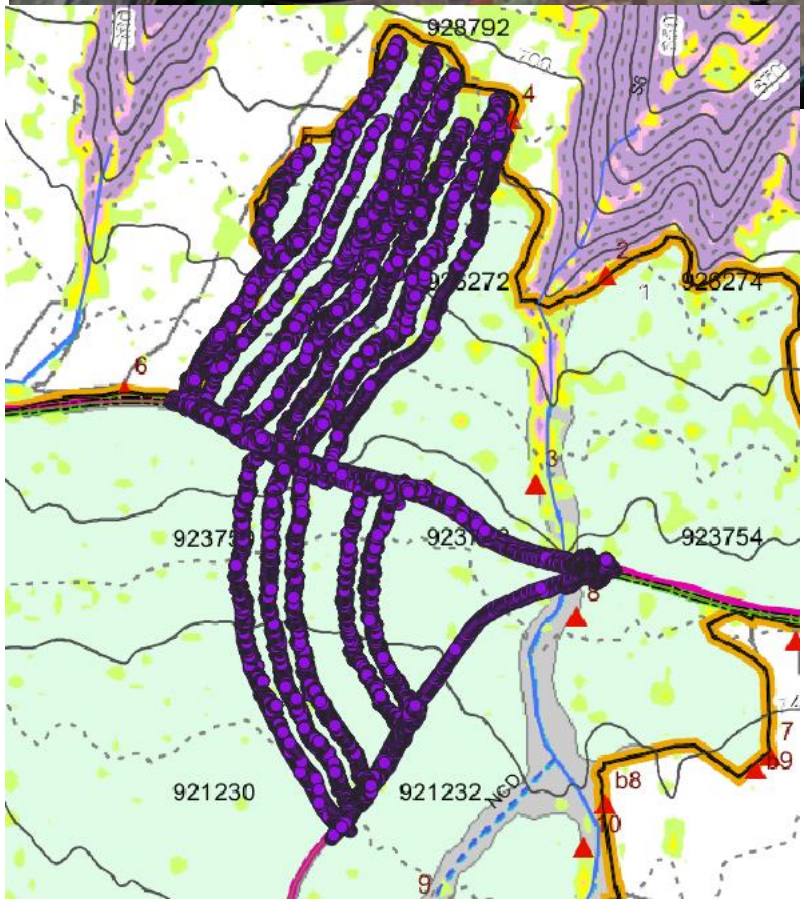

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Post-harvest fuel accumulation

Recently thinned

3 years after thinning

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Associated research questions

- Can we determine when is appropriate to leave fine woody debris on trails and when should they be removed considering fire risk?
- Can we prescribe thinning treatments beyond the current recommendations in BC?
- What is the appropriate way of bringing new technology to BC?

Operational challenges:

- Lack of reliable forest inventory
- Stand selection
- Training of foresters & operators
- Economics
- Short-, medium- and long-term quality control

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Thank you

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