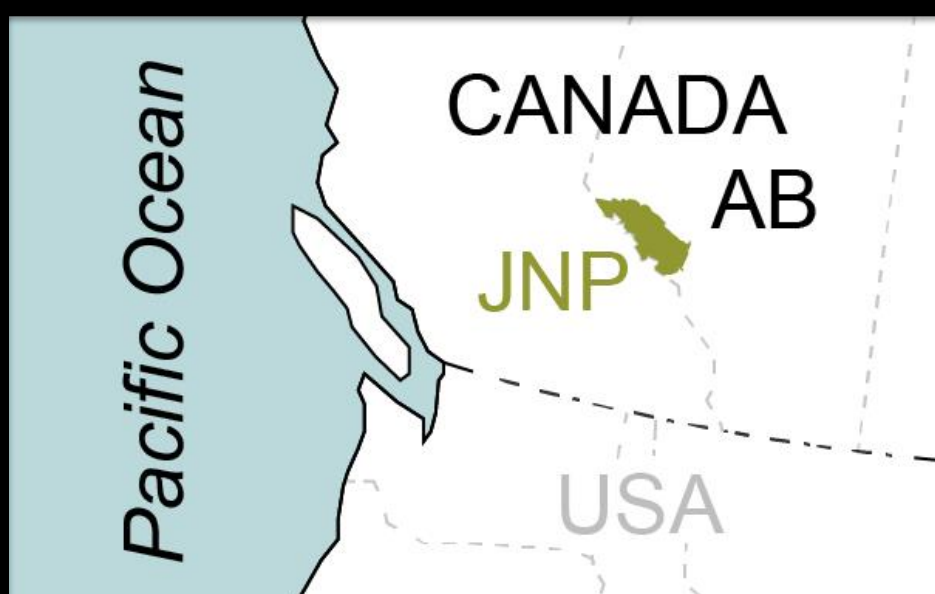


Altered Fire Regime Reduced Montane Forest Diversity



Saupra 1984



fRI *Research*
Informing Land & Resource Management

High-severity fire regime?

1997



Rhemtulla et al. 2002

Or otherwise?

1997



Rhemtulla et al. 2002

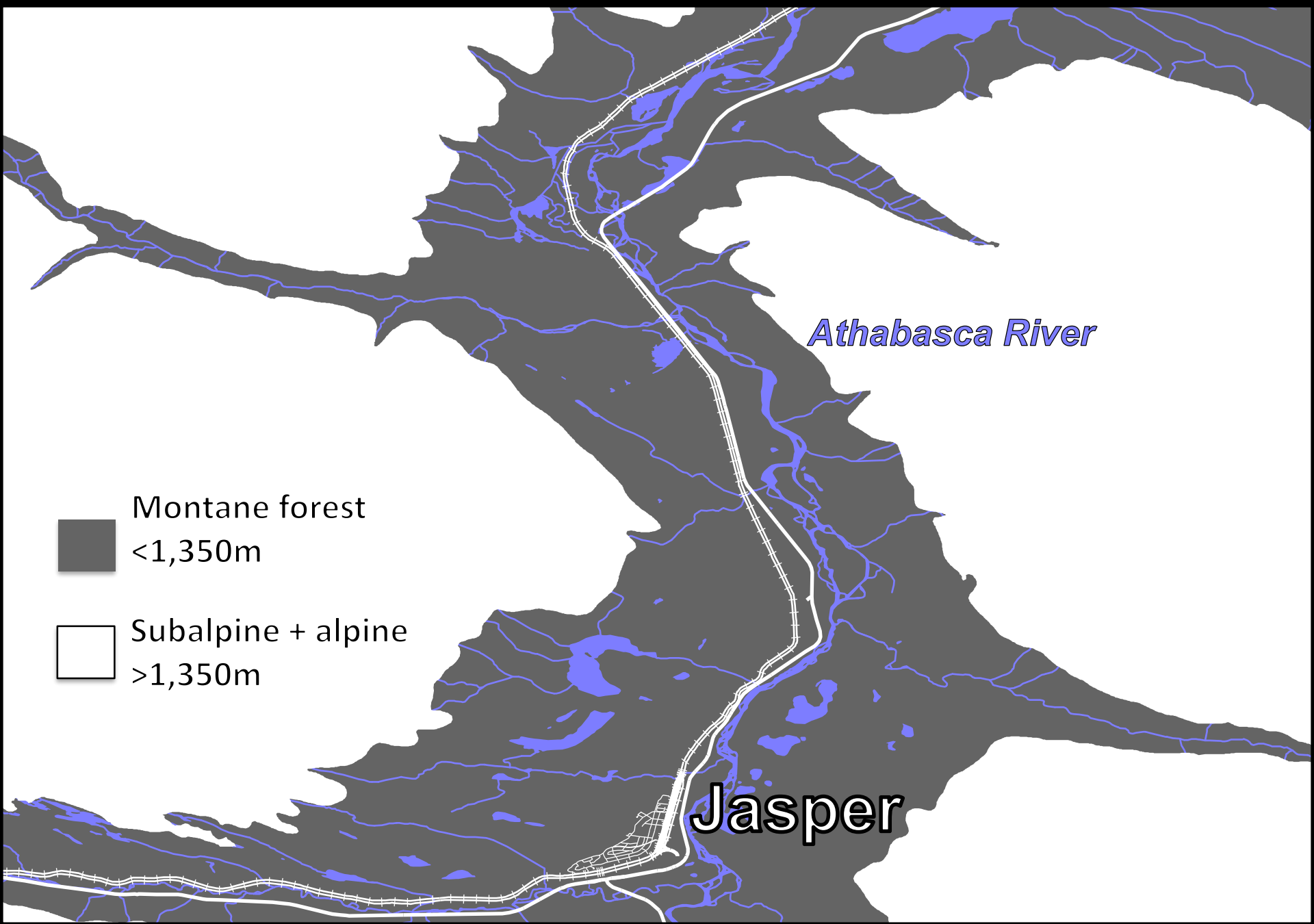
1915



Bridgland 1924

Ecosystem-specific questions

- How severe and frequent were historic fires?
- How has fire history affected forest structure and composition?
- Why has the historic fire regime changed during the 20th century?



0 10 Km



story sites (n=20)

Montane forest

<1,350m

Subalpine + alpine

>1,350m

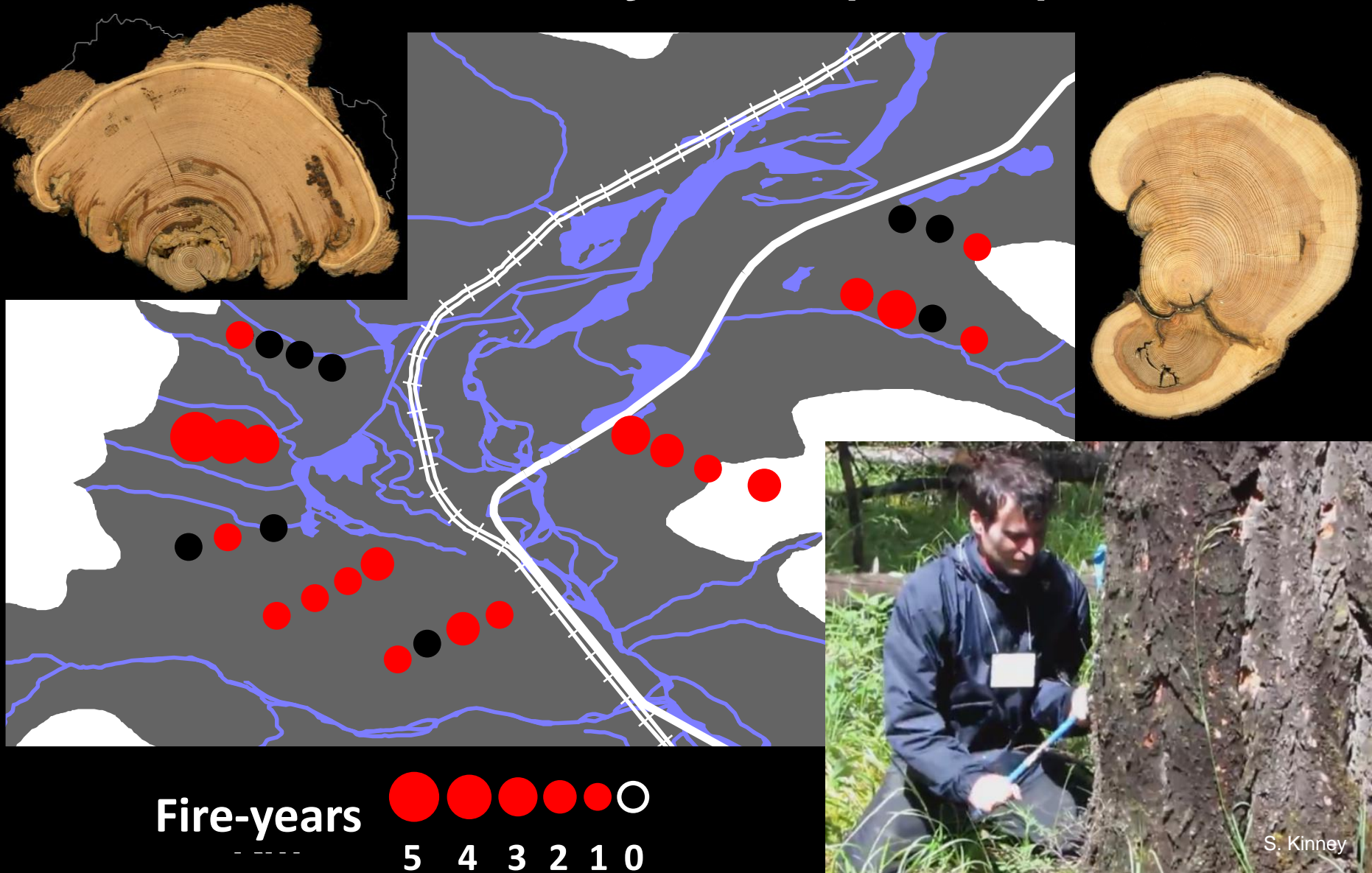
Athabasca River

Jasper

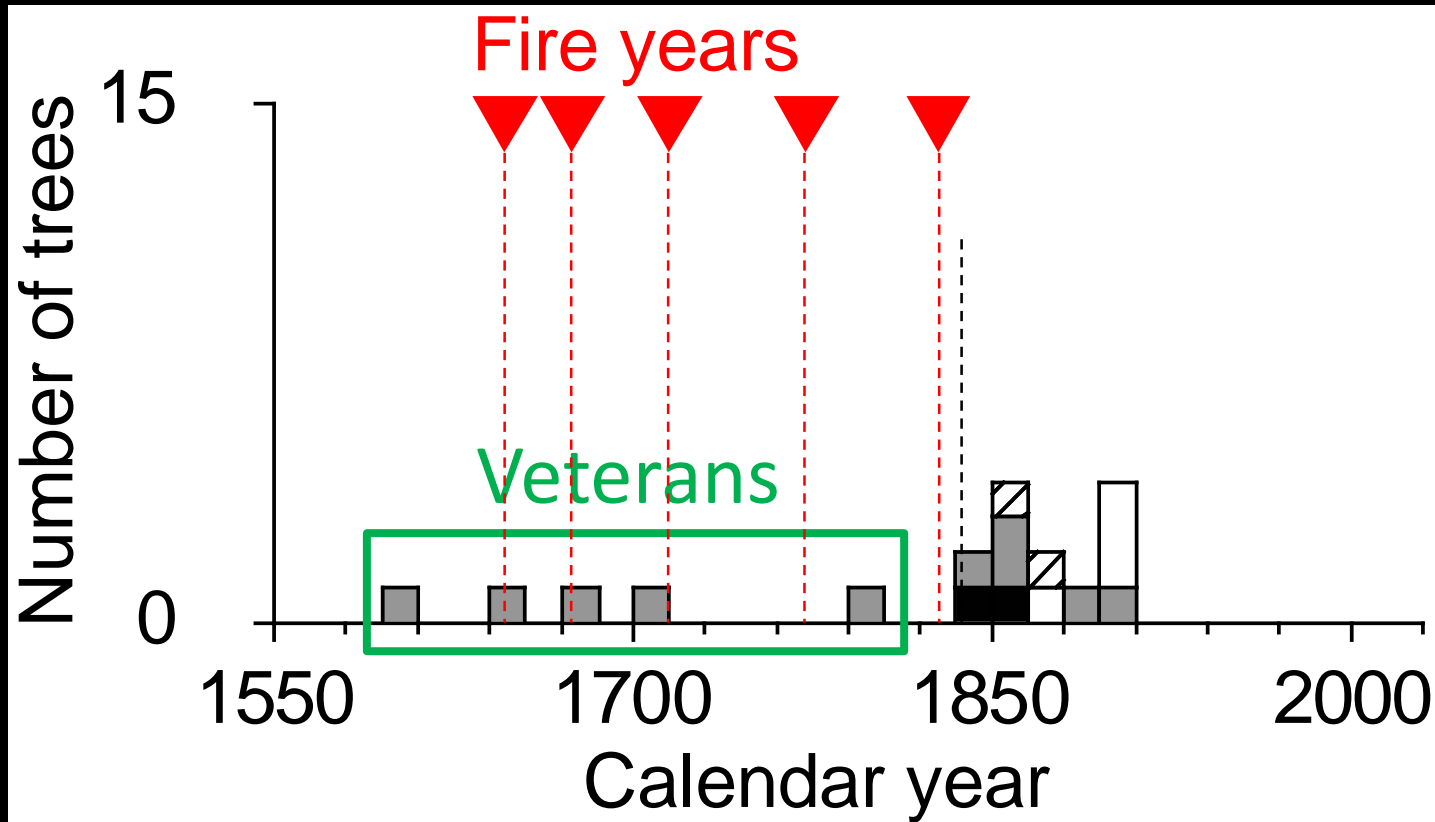
0 2 Km



Detailed fire history sites (n = 29)

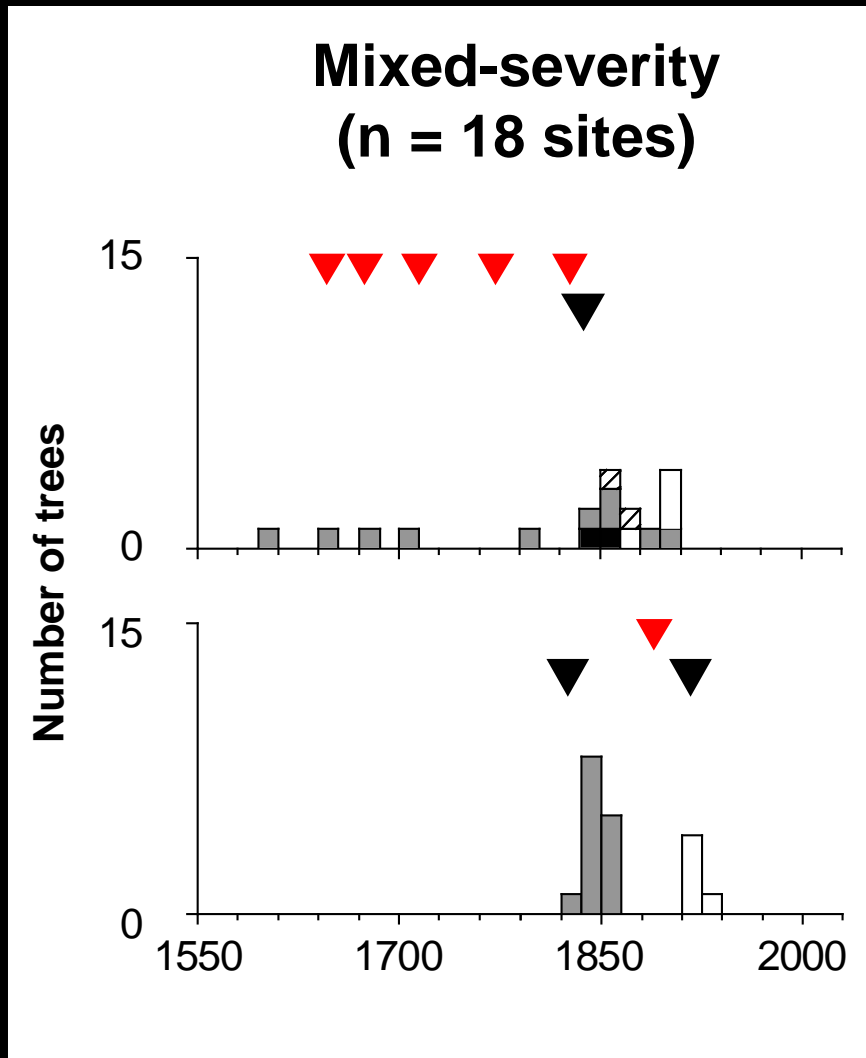


Evidence of mixed-severity fires through time



Tree: ■ lodgepole pine □ hybrid spruce
 ■ Douglas-fir ▨ trembling aspen

Mixed- *versus* high-severity fire histories

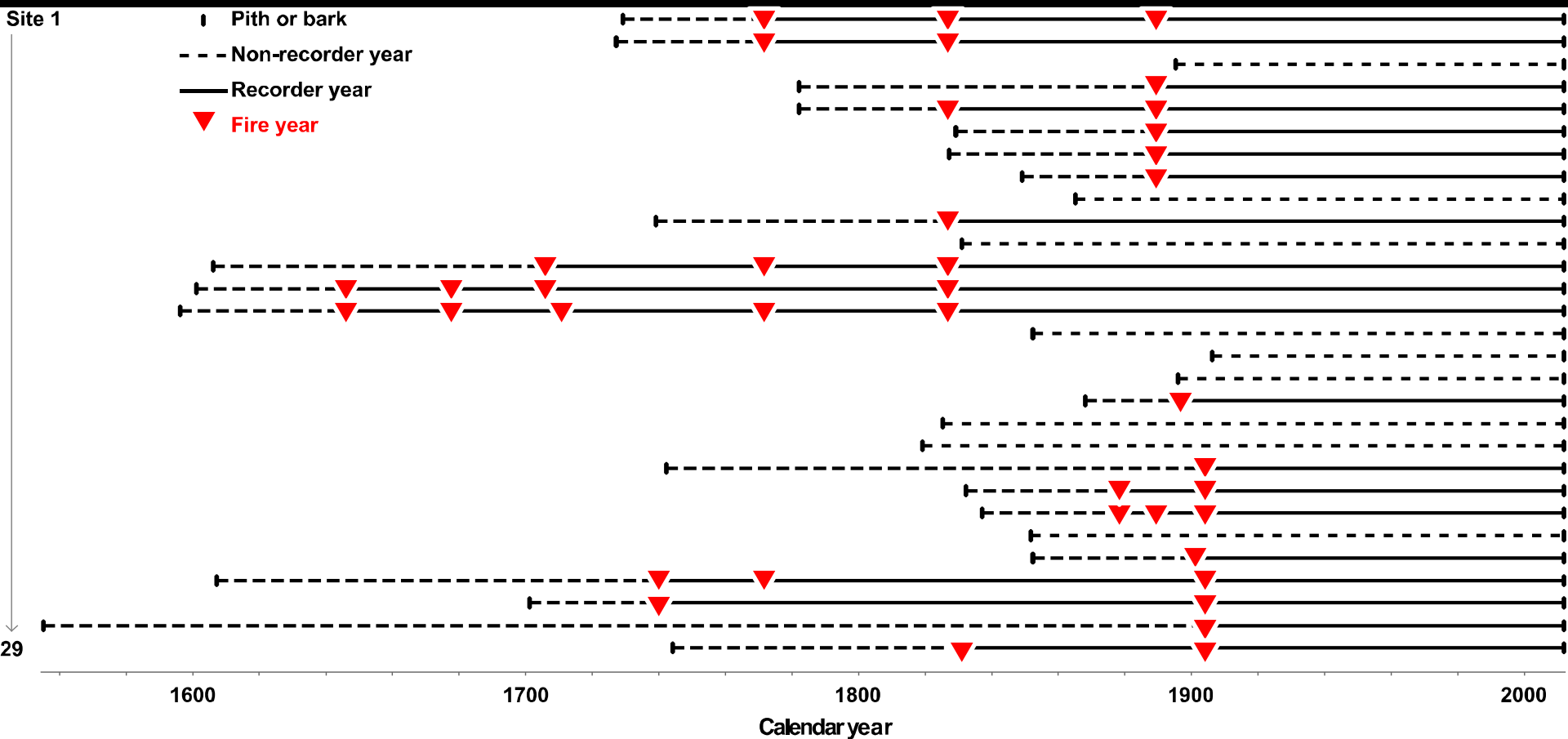


Lower-severity fires: Fire-scar record

Scars at 20 of 29 sites

For 11 sites with multiple scars:

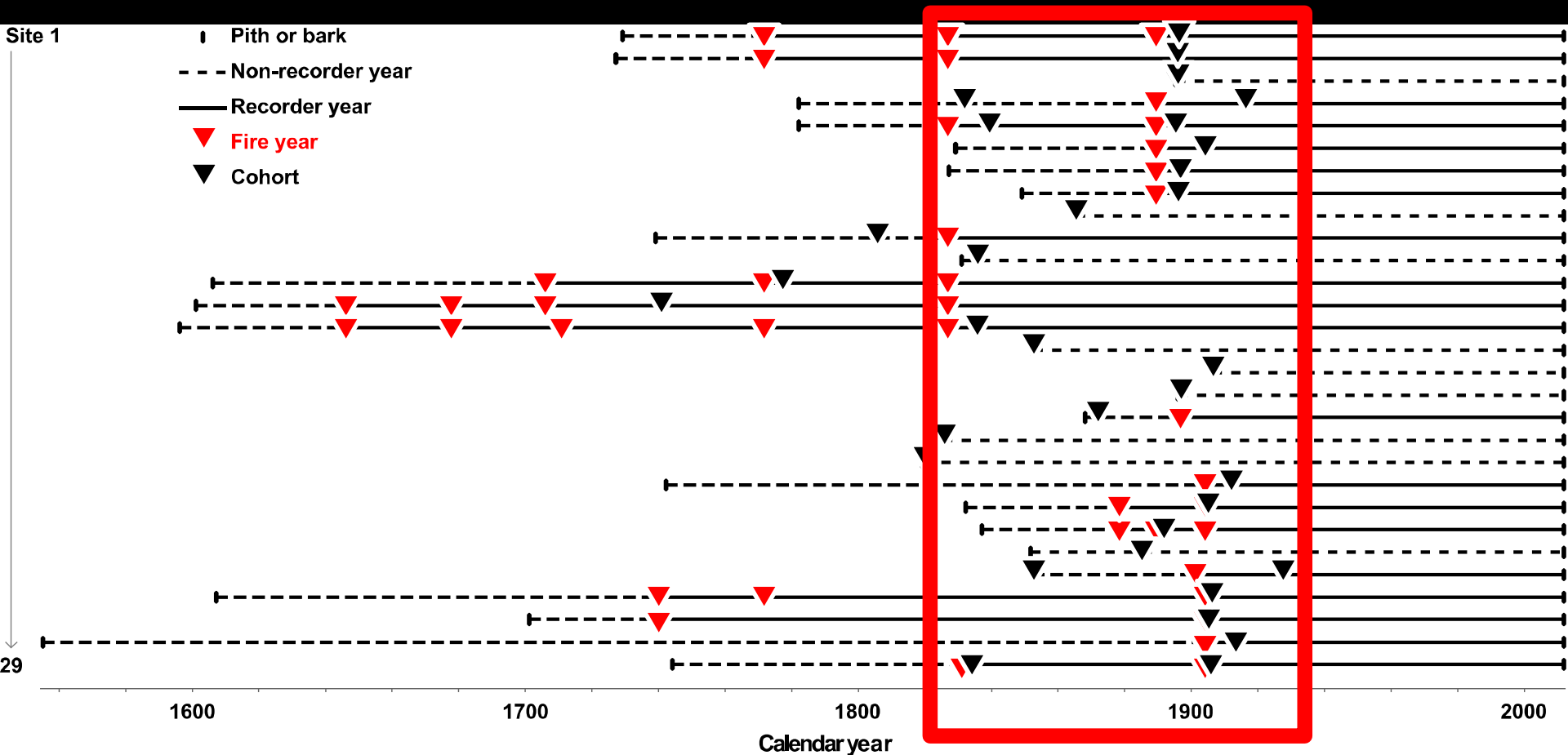
Fire intervals = 11-165 yrs , mean return interval = 60 yrs



Moderate- to high-severity fires: Cohorts

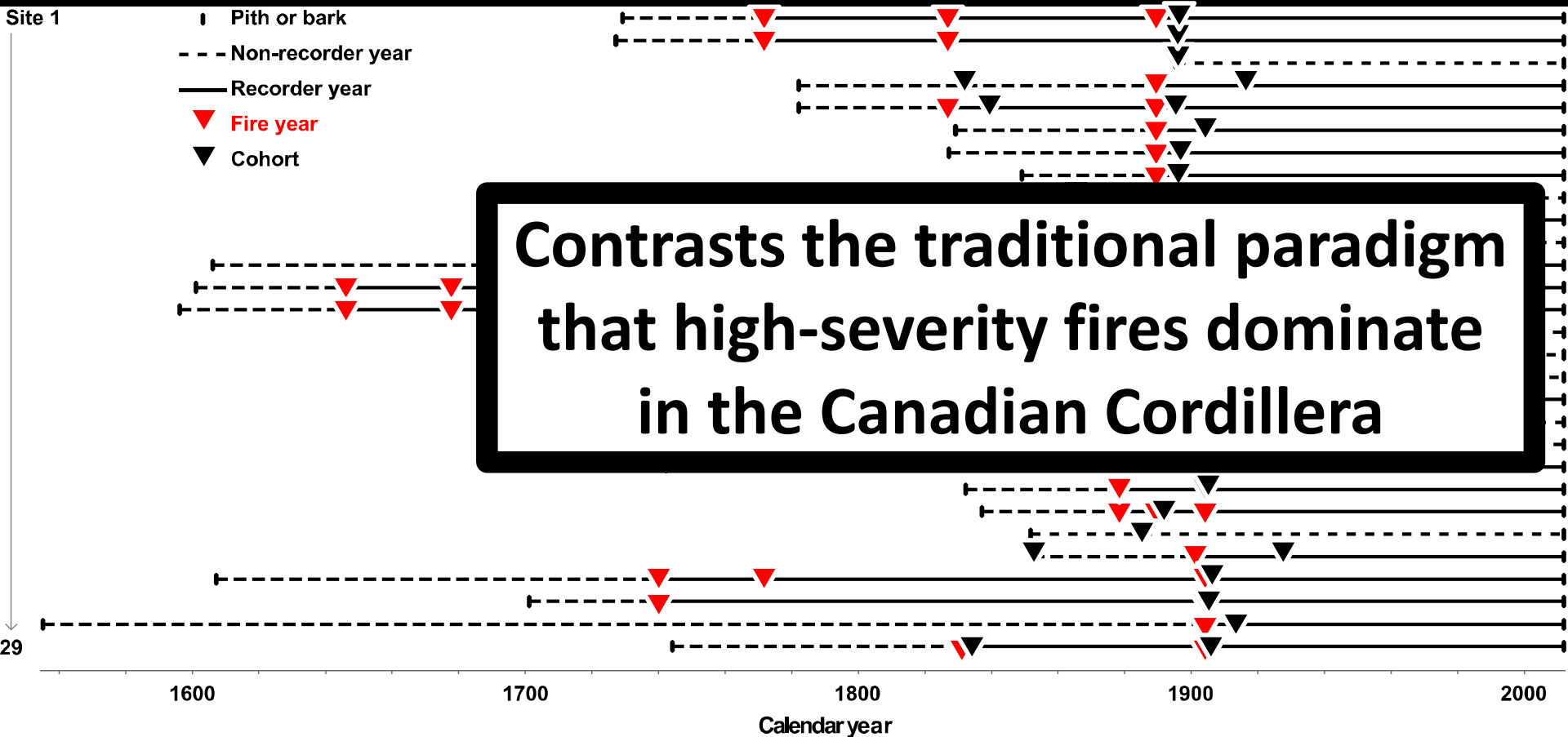
≥ 1 post-fire cohort at all 29 sites

Cohorts at 17 sites after fires in 1827, 1889 and 1905



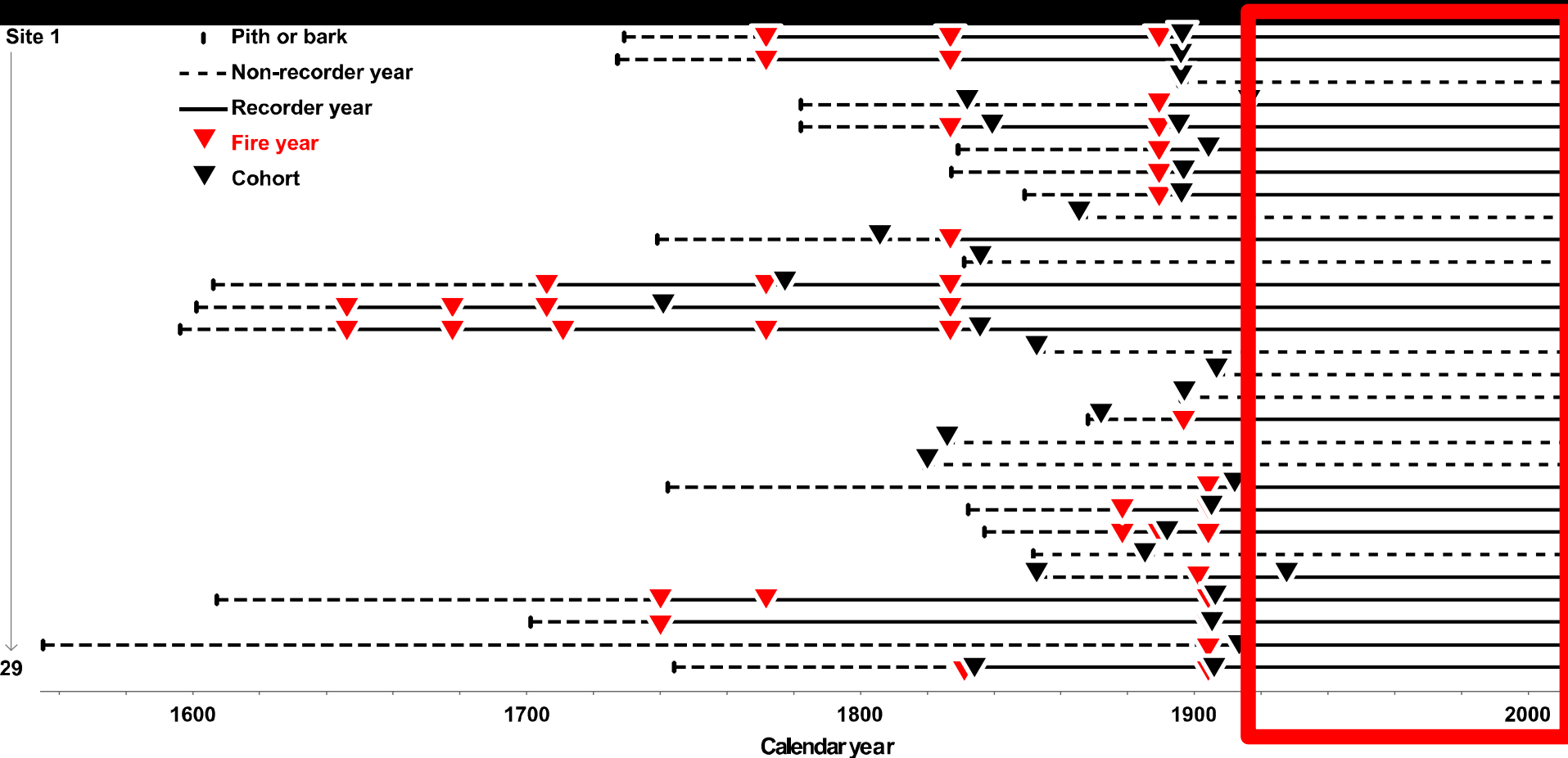
Historic mixed-severity fire regime

Scars + cohorts = variable fire frequency and severity



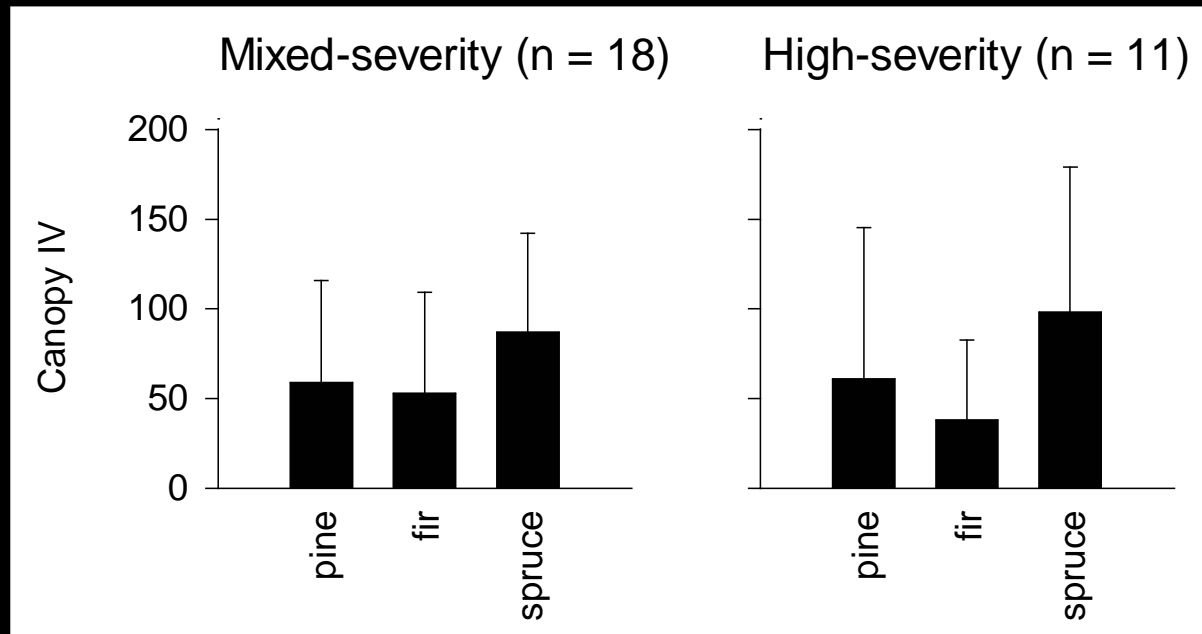
Historic mixed-severity fire regime

Lack of fire after 1905 is unprecedented



How has fire history affected forest structure, composition and dynamics?

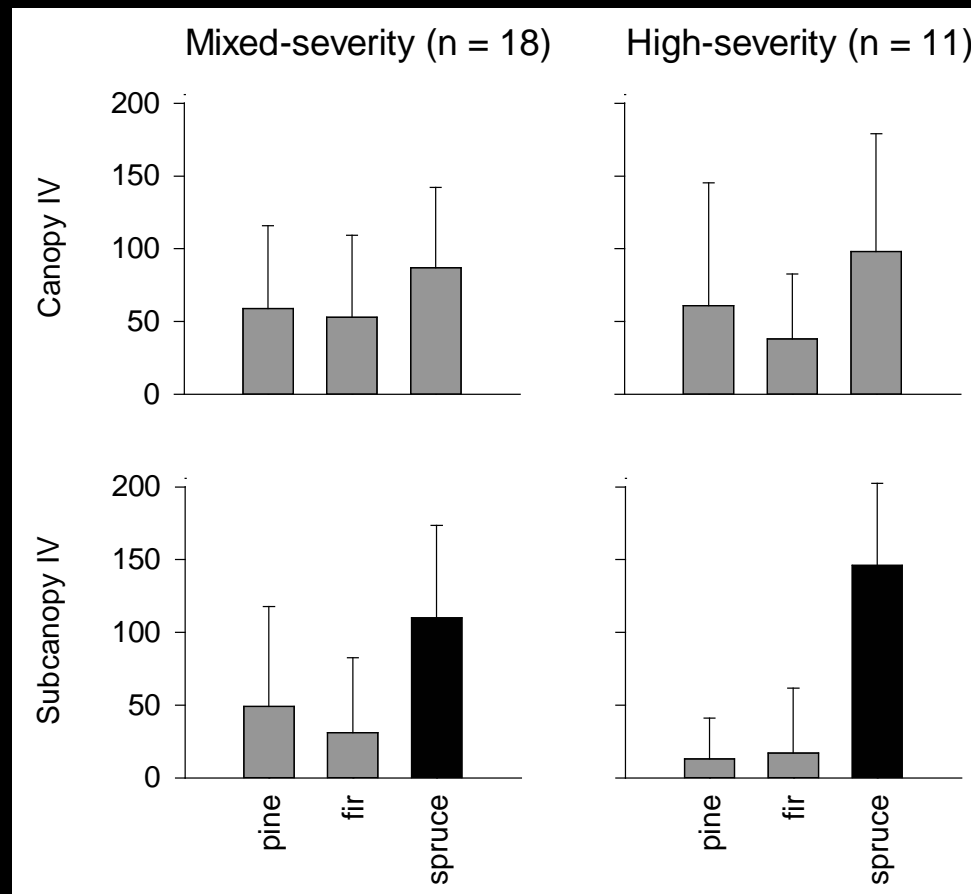
Regardless of fire history, canopy composition was mixed
Pine, fir, spruce co-establish after low-high severity fires



We cannot differentiate mixed- vs high-severity fire history from canopy composition.

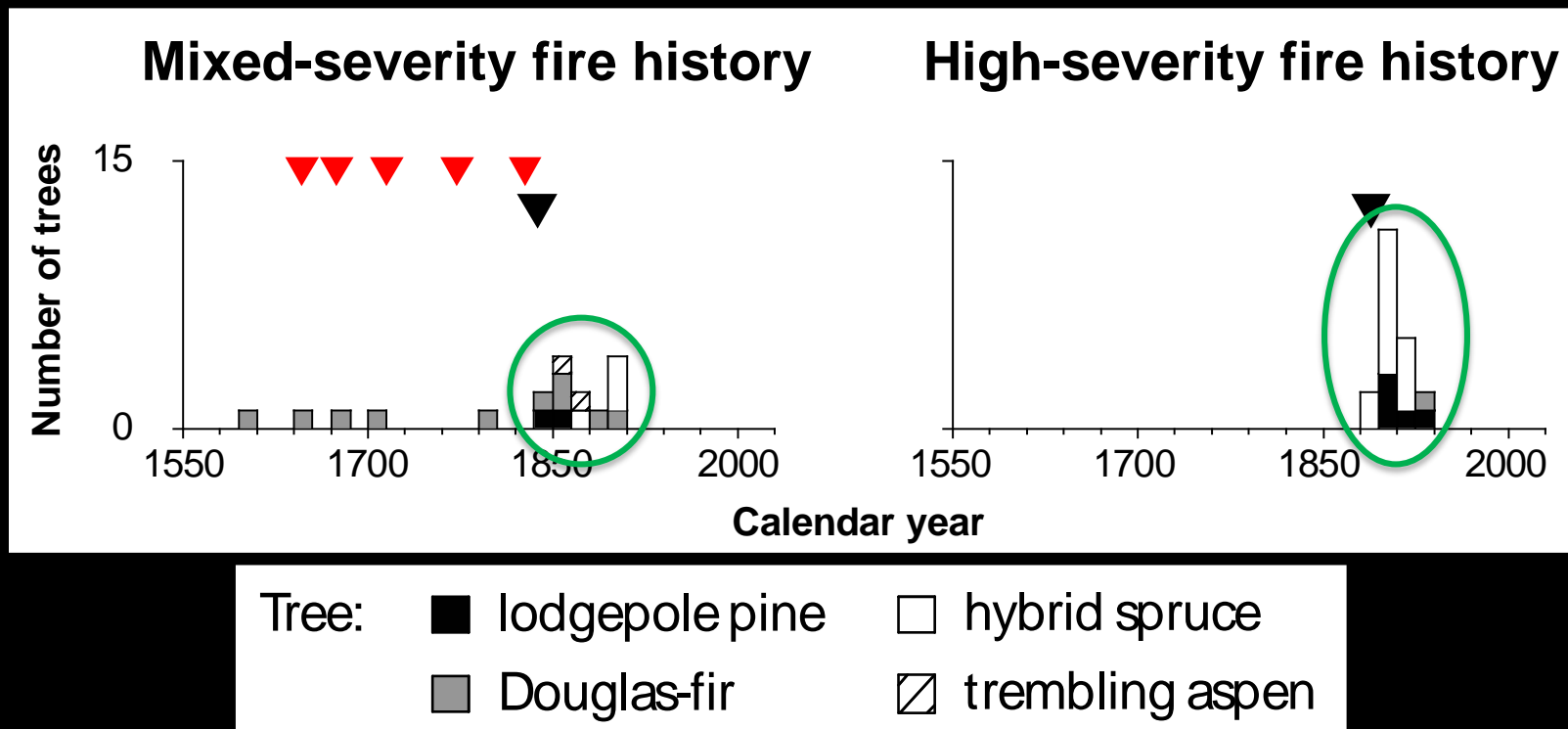
How has fire history affected forest structure, composition and dynamics?

Regardless of fire history, canopy composition was mixed
All subcanopies were strongly dominated by spruce



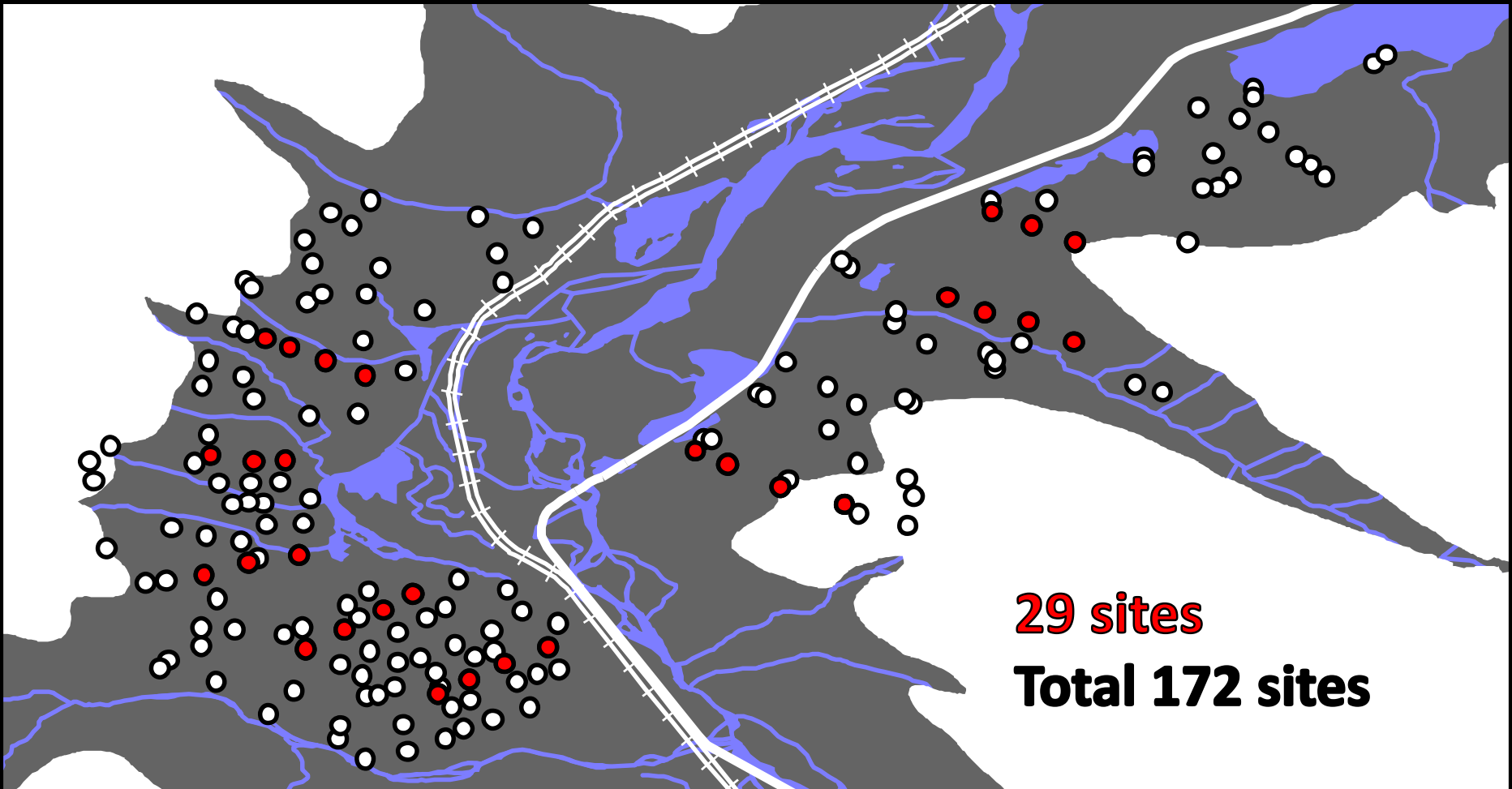
How has fire history affected forest structure, composition and dynamics?

All subcanopies were strongly dominated by spruce
Despite small size, similar in age as canopy trees



**Subcanopy spruce persist in absence of fire
and form ladder fuels increasing fire hazard**

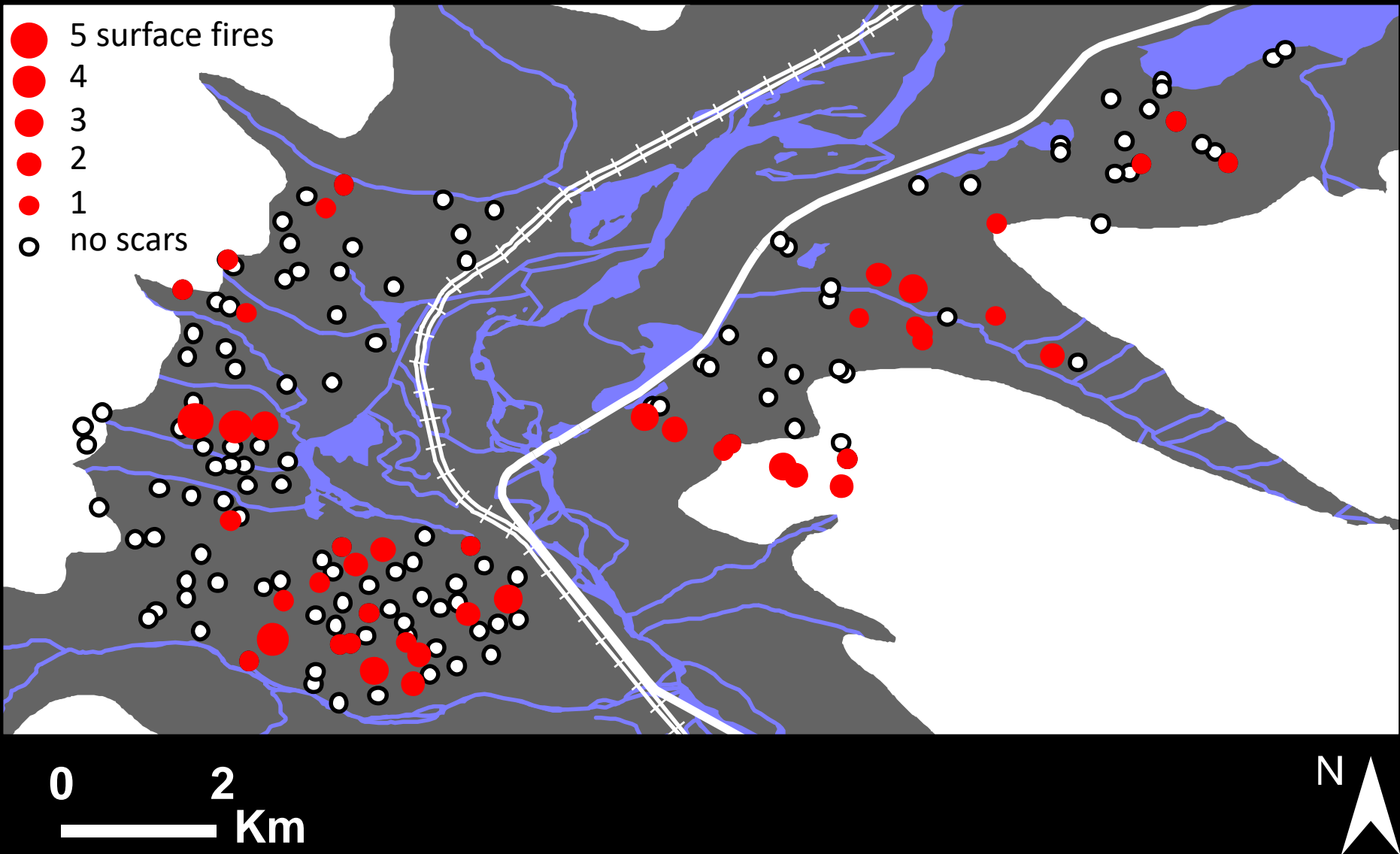
Why has the fire regime changed?



0 2
Km



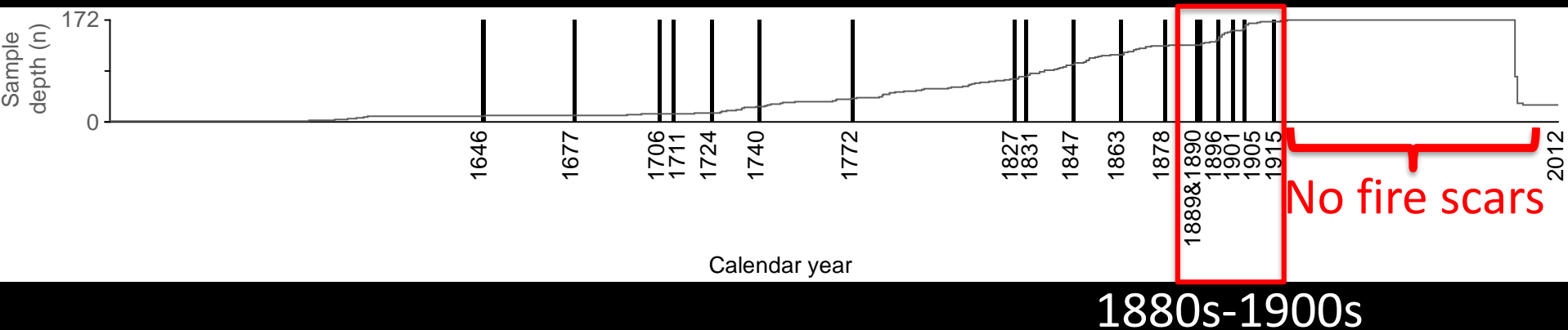
Why has the fire regime changed?



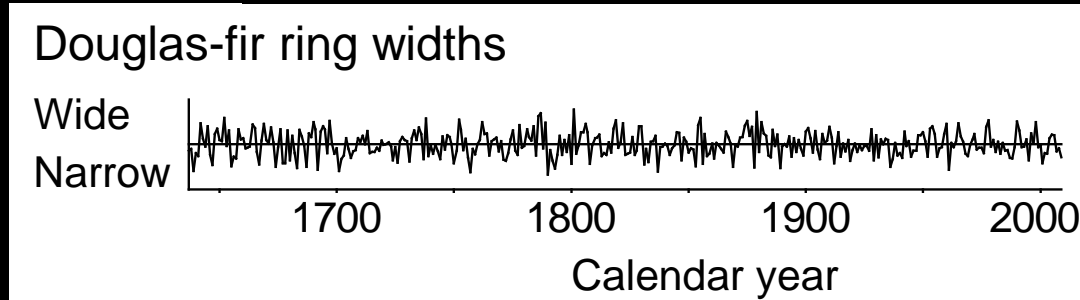
Fires-scar record: 18 fires from 1646-1915

No fires after 1915 yet 45 sites with fire-scarred trees

Why? Two hypotheses: climate or human impacts

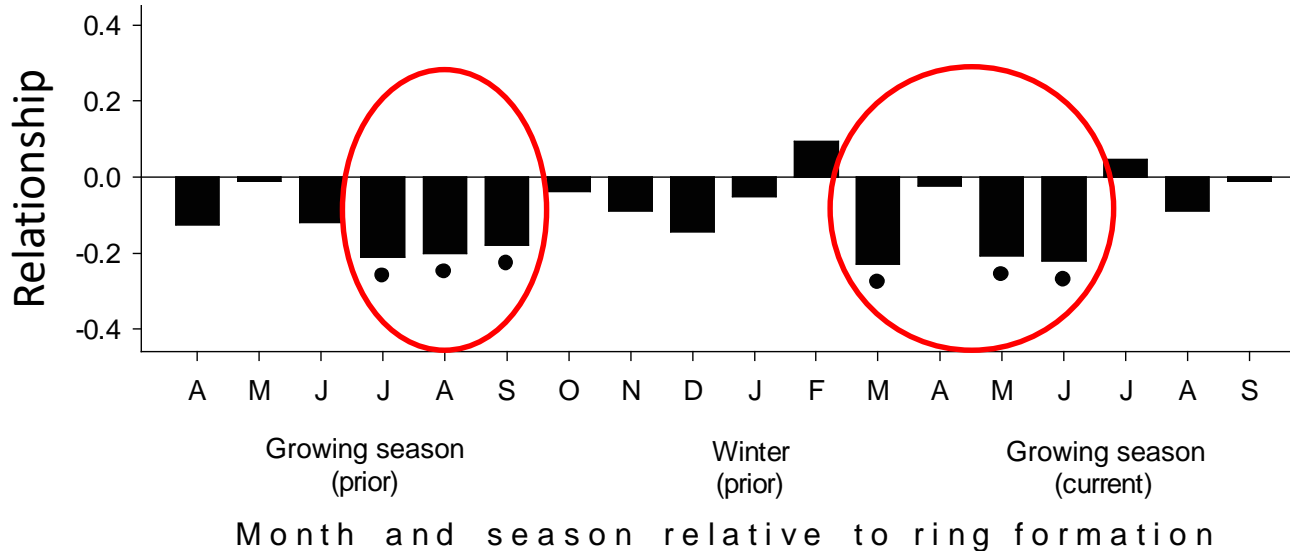


Local Douglas-fir: drought indicator



- 1637-2011

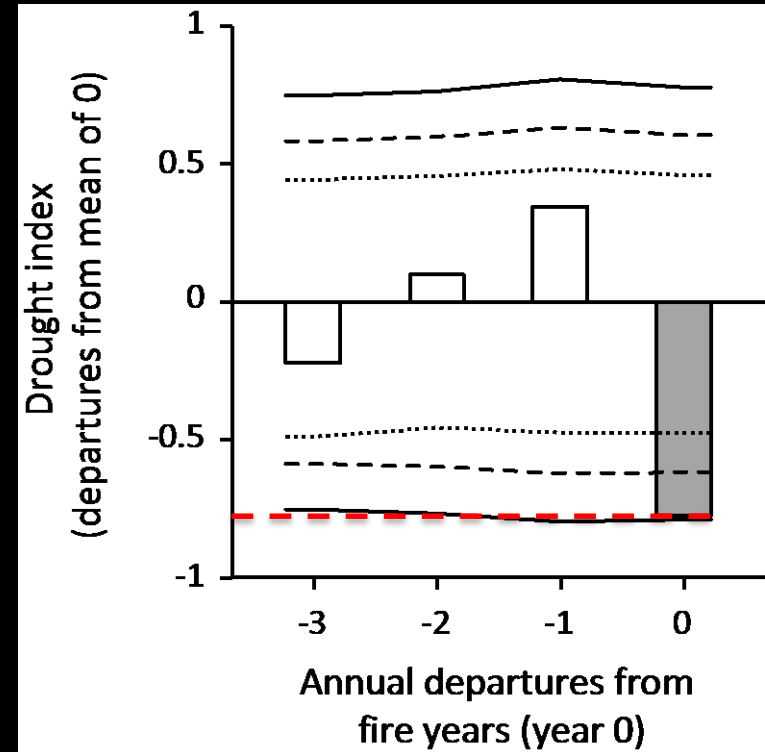
Douglas-fir tree rings vs. heat-moisture (1902-2009)



- Climate-growth analysis
- Negative relationship
- Good drought indicator

Fires burned during droughts

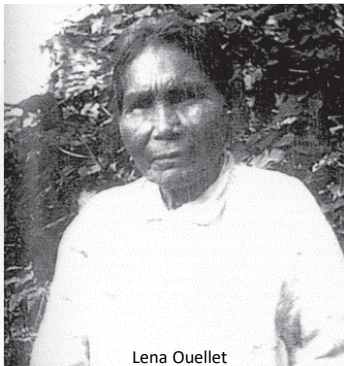
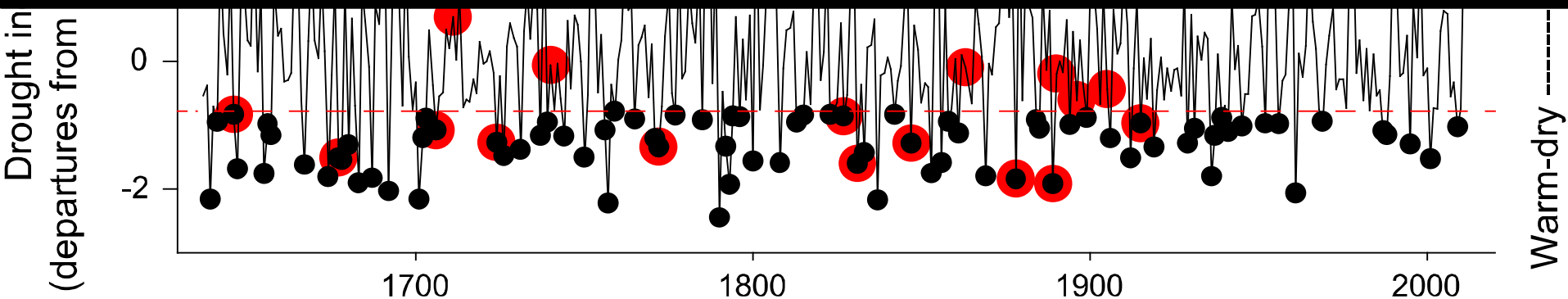
- Mean index value during fire years versus simulated confidence intervals
- 18 fires from 1646 to 1915
- **Negative indices = narrow rings**
- **Narrow rings = dry conditions**



Climate *versus* human impacts?

20th C climate was conducive to fire, yet no scars

Human impacts exceeded climate controls to explain lack of fires



Explaining the altered fire regime: Homogenized stands and landscapes

1915



Bridgland 1924

1997



Rhemtulla et al. 2002

Explaining the altered fire regime: Homogenized stands and landscapes

- Strong evidence of historic mixed-severity fire regime
- Detailed reconstructions needed to differentiate mixed- and high-severity fire histories
- Lack of fires over 20thC:
 - shifted forest composition and structure
 - increased fire hazard within stands
- Human impacts exceeded climate to control 20thC fire
- Homogenized landscapes and reduced forest resilience

Altered mixed-severity fire regime has homogenised montane forests of Jasper National Park

Dendrochronologia 48 (2018) 10–19



Contents lists available at [ScienceDirect](#)

Dendrochronologia

journal homepage: www.elsevier.com/locate/dendro



Human influences superseded climate to disrupt the 20th century fire regime in Jasper National Park, Canada

Raphaël D. Chavardès^{a,*}, Lori D. Daniels^a, Ze'ev Gedalof^b, David W. Anderson^c

^a Forest and Conservation Sciences Department, University of British Columbia, Vancouver, BC, Canada

^b Department of Geography, University of Guelph, Guelph, ON, Canada

^c Bandaloop Landscape-Ecosystem Services, North Vancouver, BC, Canada

Thank you for your attention

Acknowledgments

Parks Canada

Healthy Landscapes Program at fRI Research

Hinton Wood Products (West Fraser Mills)

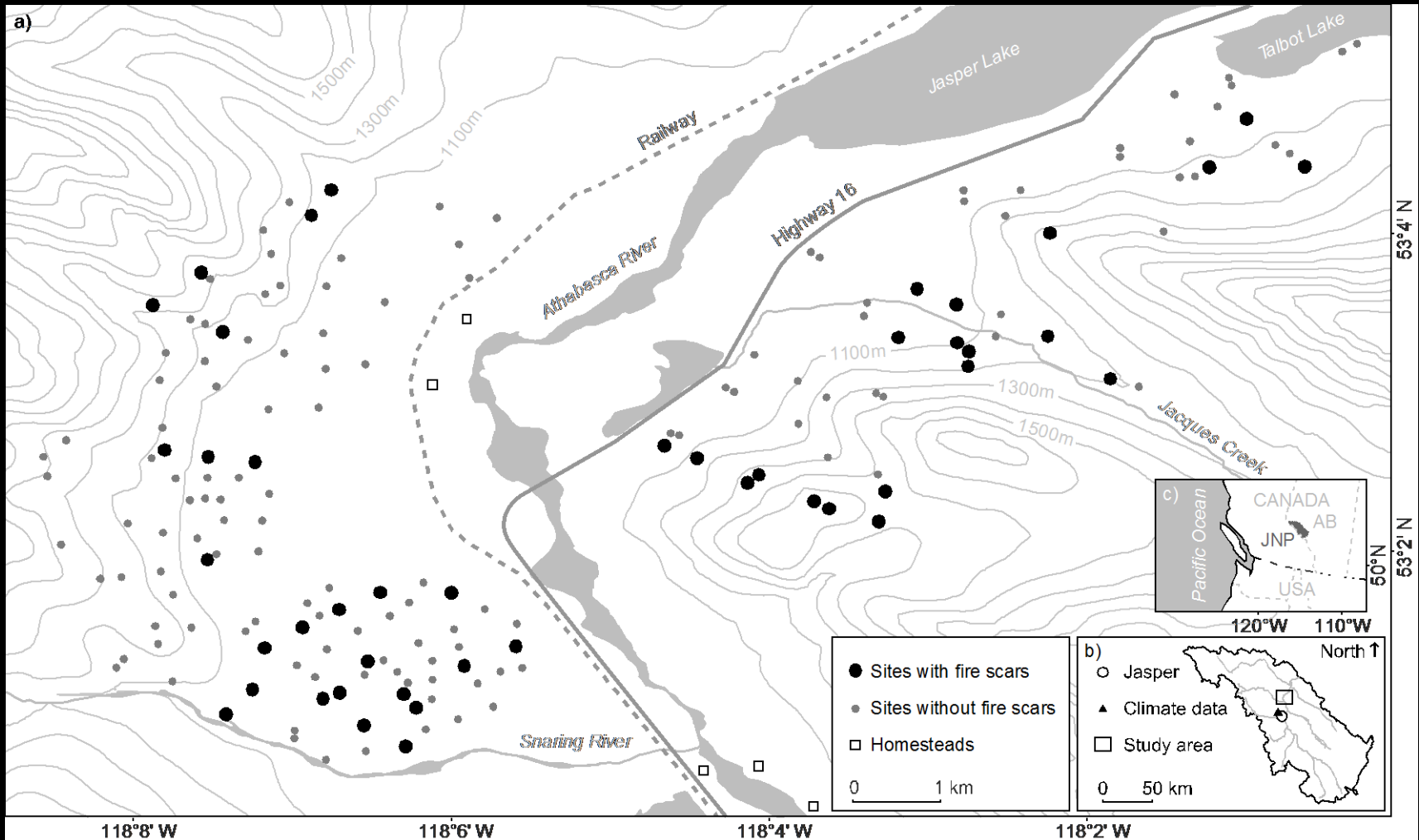
Alberta Newsprint Company

Natural Sciences & Engineering Research Council of Canada

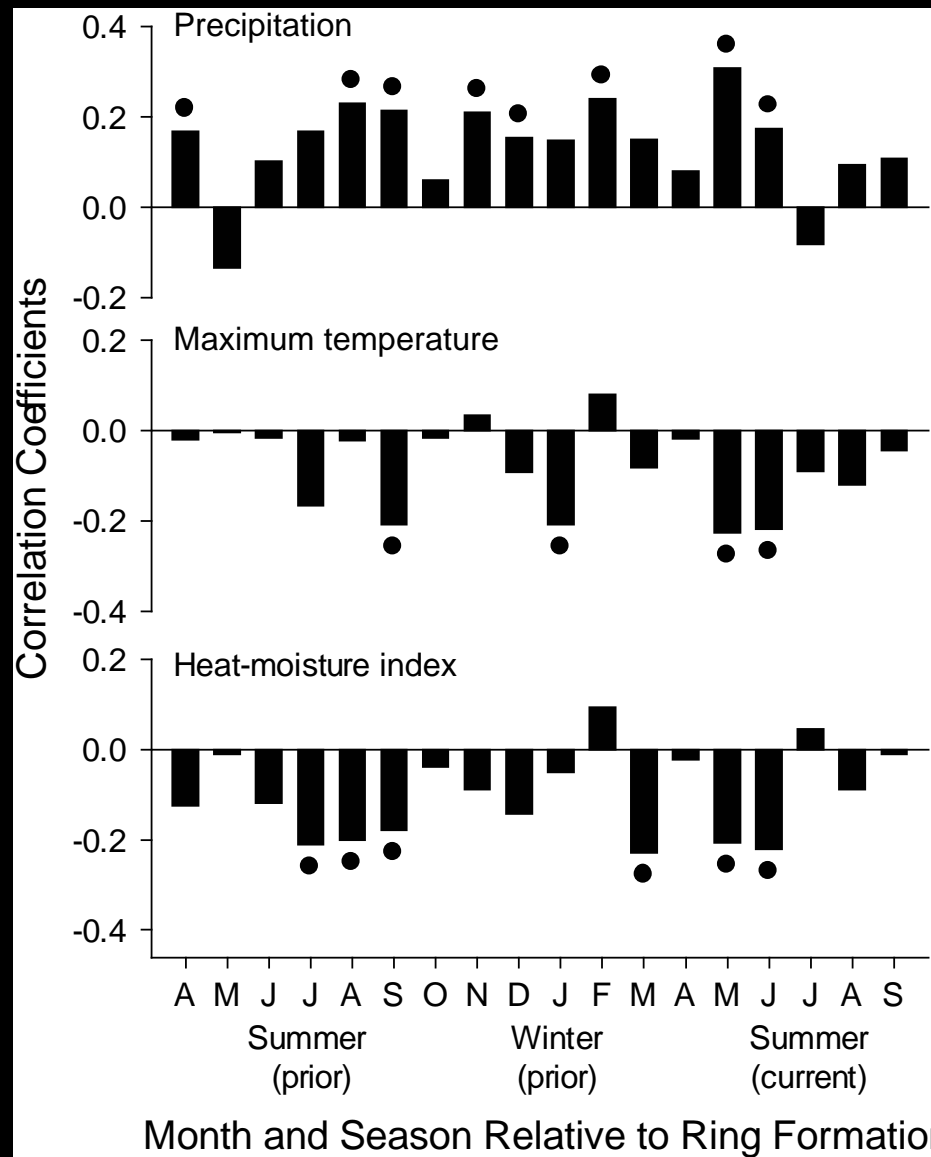
Tree-Ring Laboratory at the University of British Columbia

Musqueam First Nation & UBC Faculty of Forestry

Fire history and homesteading



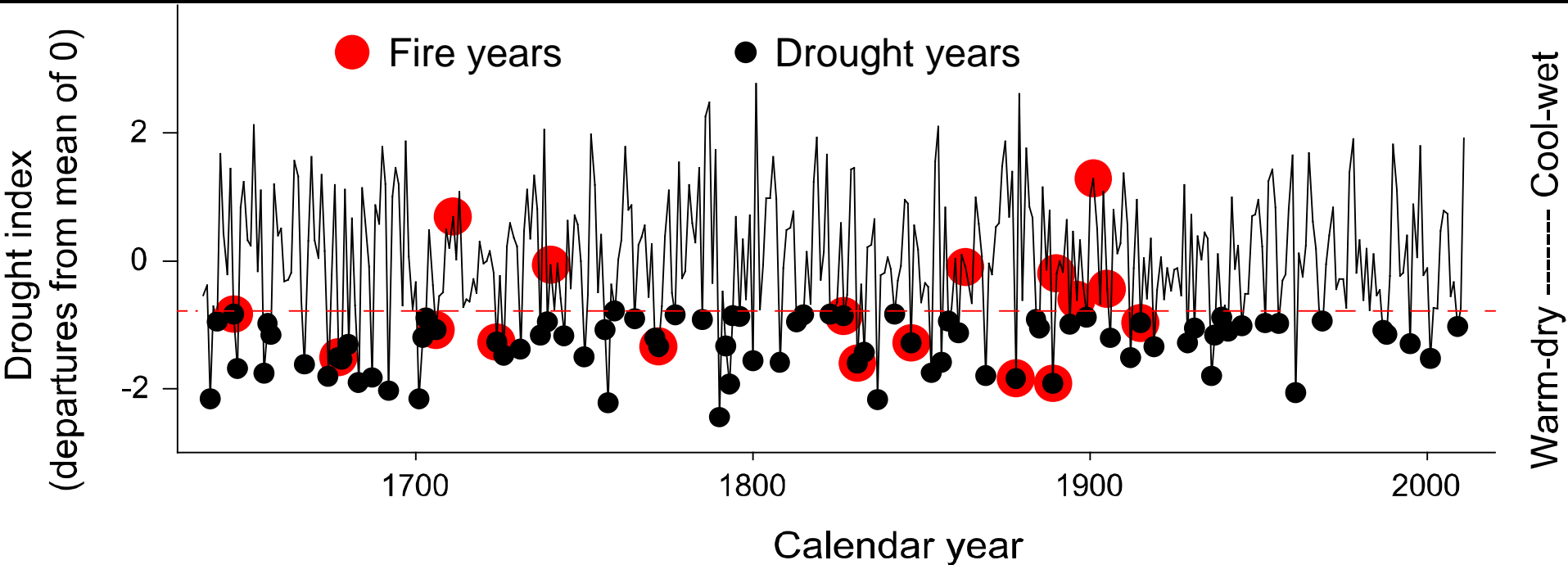
Local Douglas-fir: drought indicator



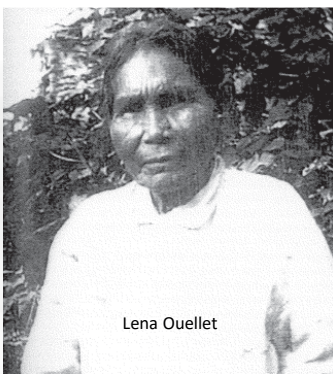
Climate *versus* human impacts

20th C climate was conducive to fire, yet no scars

Fire exclusion–suppression explain lack of fires



Glenbow Alberta Museum & Archives



Lena Ouellet

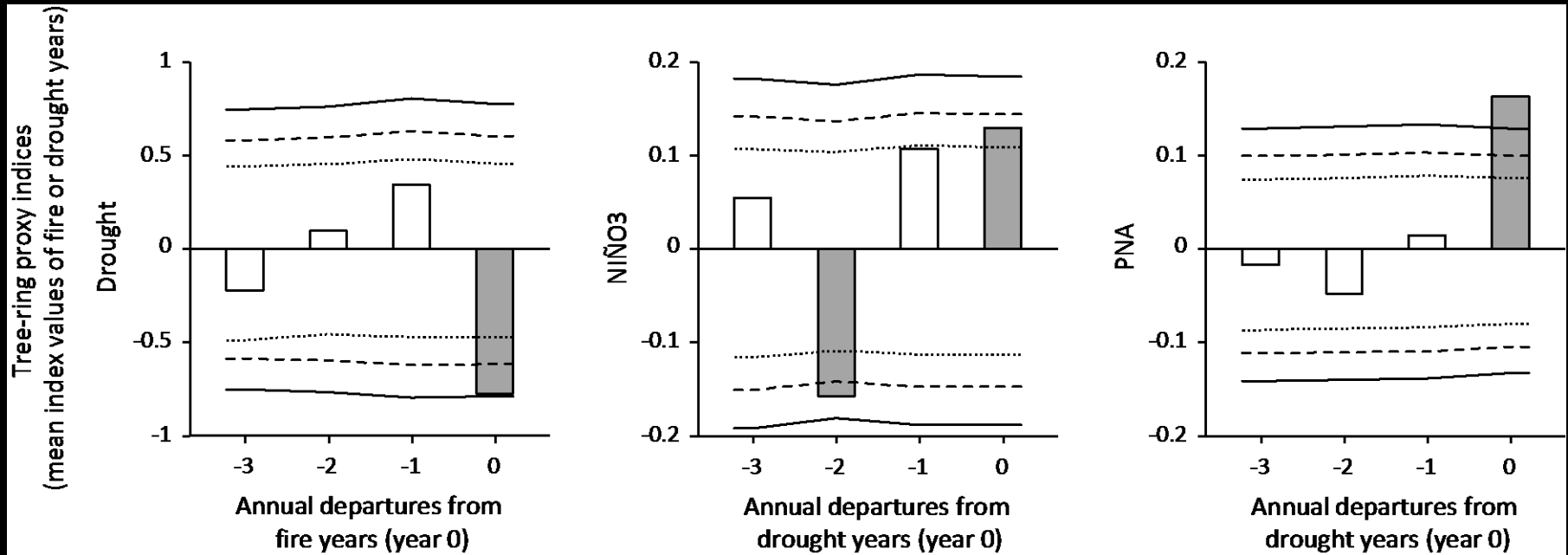
Jasper Yellowhead Museum & Archives



Coulson



Fires burned during droughts...



Drought years associated with El Niños & positive mode of Pacific North American pattern