Mountain & Foothills Fire Regimes

An overview

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Use of fire history and fire regime information in forest/fire management

- Determine spatial variation of prob. of ignitions or prob. of burning on the landscape
- Calibrate inputs of landscape fire growth and fire regime models
- Validate fire growth model outputs
- Determine current burn deficits and overall departure from historical fire regime conditions
- Serve as benchmark values to set restoration goals
- Identify where fire refugia tend to form
- Helps setting fire mgmt guidelines and writing fire prescriptions
- Water quality protection measures!!
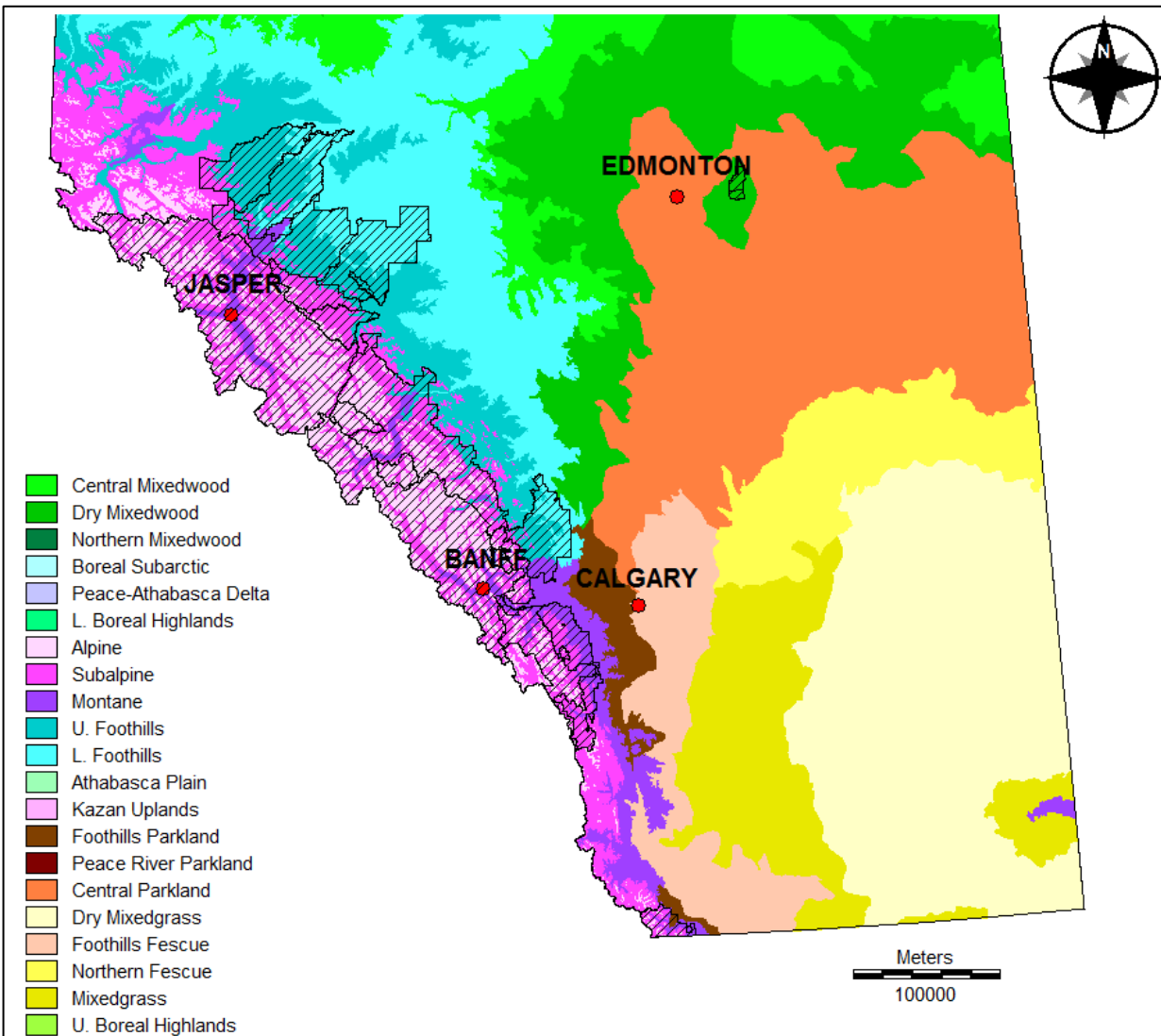
Some Definitions

- **Fire regime study:** is the understanding of the prevailing cause of forest fires, their frequency, size and spatial distribution. It also documents the season of burning, area burned by month, the annual disturbance rate of the forest (fire cycle), mean-fire-return-interval, as well as the prevailing intensity and severity of these fires.

- **Fire history study:** one of the components of the fire regime assessment. It involves the collection of tree age and fire scar data to date all fires that occurred in the past. It also uses fire occurrence reports, old newspapers and journals of explorers to date historical fires. Fires are tabulated in a chronological order to determine the fire return interval. They can also be mapped to produce a stand origin map or fire map.

- **Mean-fire-return-interval:** average time between two fire events. Varies spatially, usually with a shorter interval over a larger regional landscape, and longer intervals when evaluated at the forest stand level.

Research Objectives

- **Forest Reserves, Protected Parks and Wilderness Areas:** fire restoration program to maintain and protect biodiversity and sustain a healthy ecosystem. Need to know where and when to burn.

- **Logging industry:** harvesting practices that are more in line with natural disturbances. The study is an integral part of the Forest Stewardship Council (FSC) certification process.

- **FireSmarting:** fuel reduction program – need to know where, how much and how frequently fuels should be reduced. Also very important with public education program…. **with knowledge comes understanding and acceptance**.
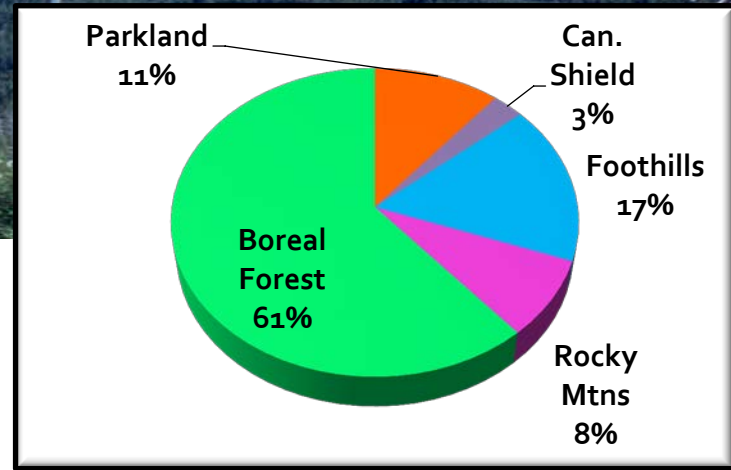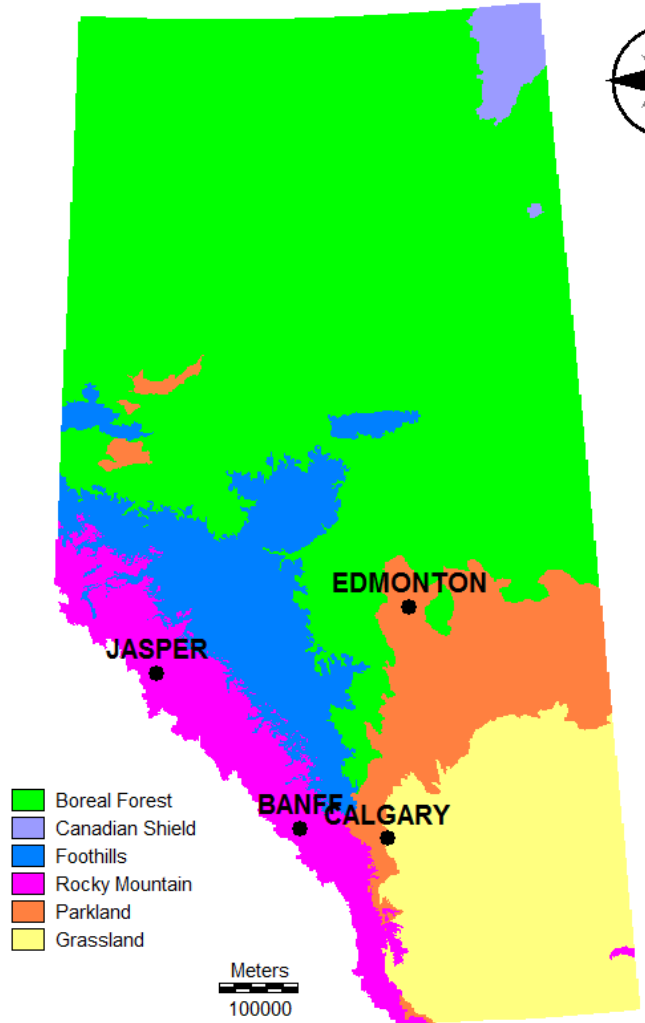
Fire History Studies

Map legend:
- Central Mixedwood
- Dry Mixedwood
- Northern Mixedwood
- Boreal Subarctic
- Peace-Athabasca Delta
- L. Boreal Highlands
- Alpine
- Subalpine
- Montane
- U. Foothills
- L. Foothills
- Athabasca Plain
- Kazan Uplands
- Foothills Parkland
- Peace River Parkland
- Central Parkland
- Dry Mixedgrass
- Foothills Fescue
- Northern Fescue
- Mixedgrass
- U. Boreal Highlands

Jasper N.P.,
Hinton Pulp FMA,
ASRD FMUs: E4, E5,
E11, R11,
Banff N.P,
Kananaskis Country,
Spray Lake Sawmills
FMA,
Whitegoat & Siffleur
Wilderness Areas,
Waterton N.P.,
Cypress Hills P.P.,
Elk Island N.P.,
Blackfoot-Cooking Lk
Rec. Area
**42,662 km² or 16,472
mi²**

Natural Regions of Alberta

Natural Regions of Alberta

Pie chart:
- Can. Shield 3%
- Foothills 17%
- Rocky Mtns 8%
- Boreal Forest 61%
- Parkland 11%

Map legend:
- Boreal Forest
- Canadian Shield
- Foothills
- Rocky Mountain
- Parkland
- Grassland

Cities: EDMONTON, JASPER, BANFF, CALGARY

Meters 100000

Natural Subregions are stratified using the combined elements of topography (elevation gradient), climate, geology, vegetation, soil and physiographic features.

WEATHER — TOPOGRAPHY — FUEL
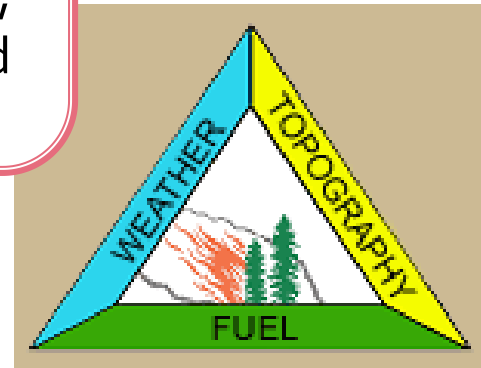
Each Natural Region and Subregion has a unique fire regime signature

Mountain Subalpine Landscape

- High intensity -stand replacement
- High severity
- Mean fire size remains small:
< 1000ha (2500 ac.)
- Max. size: up to 10,000 ha
- Long intervals
- Fire cycle > 100yrs
- Effect of topography on fire distribution and spread pattern is significant
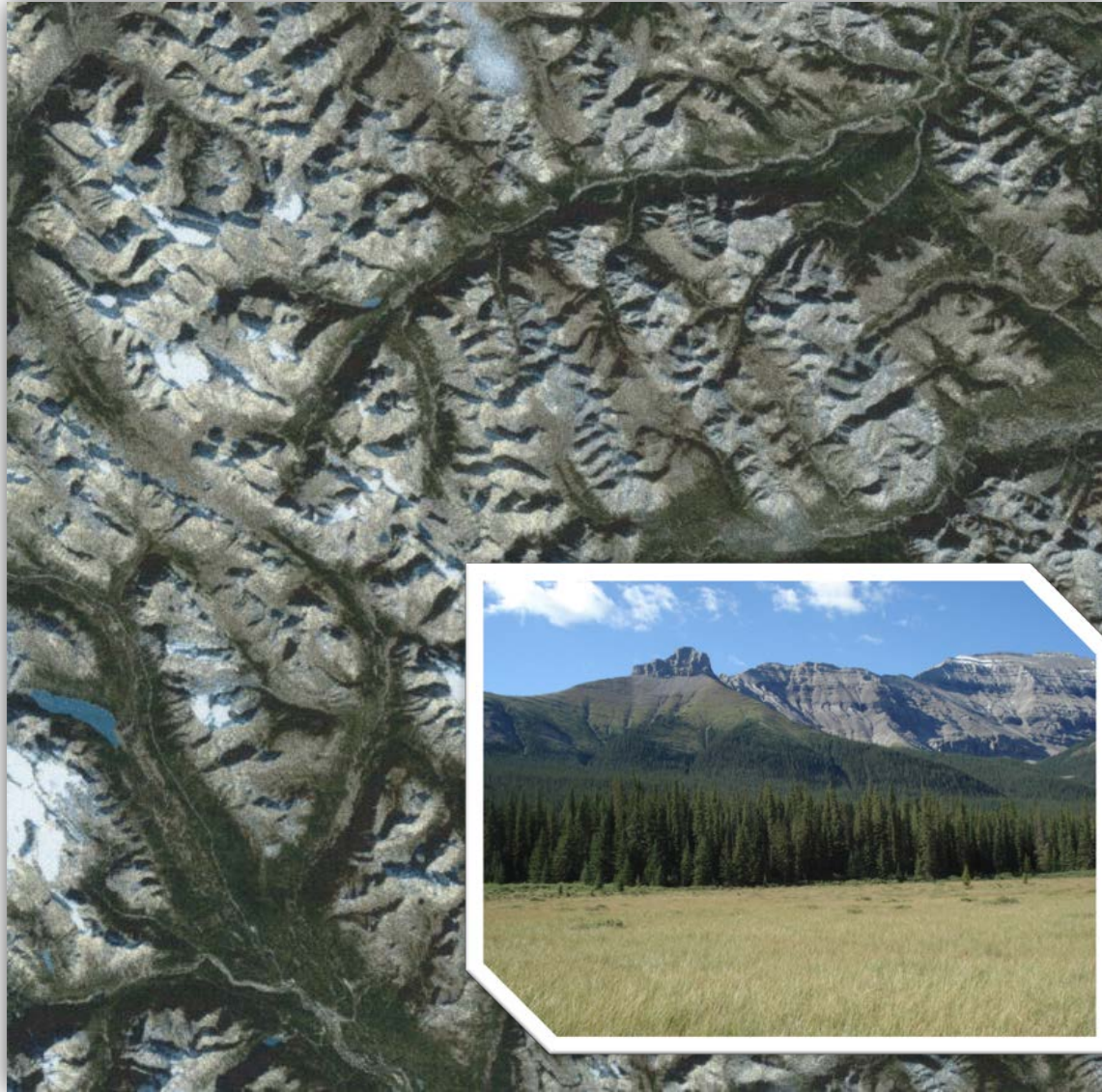
# Foothills / Montane Landscape

- Mixed intensities partial to full stand replacement
- Mixed severity
- Mean fire size: ~ 1400ha (3500 ac.)
- Max. size: 20 to 50,000 ha
- Short intervals
- Fire cycle: 30 – 50 yrs
- Effect of topography on fire distribution and spread pattern is not as significant

Effect of Topography on Burning Patterns

Topographic stand age model developed for Banff National Park and Kananaskis Country concluded:
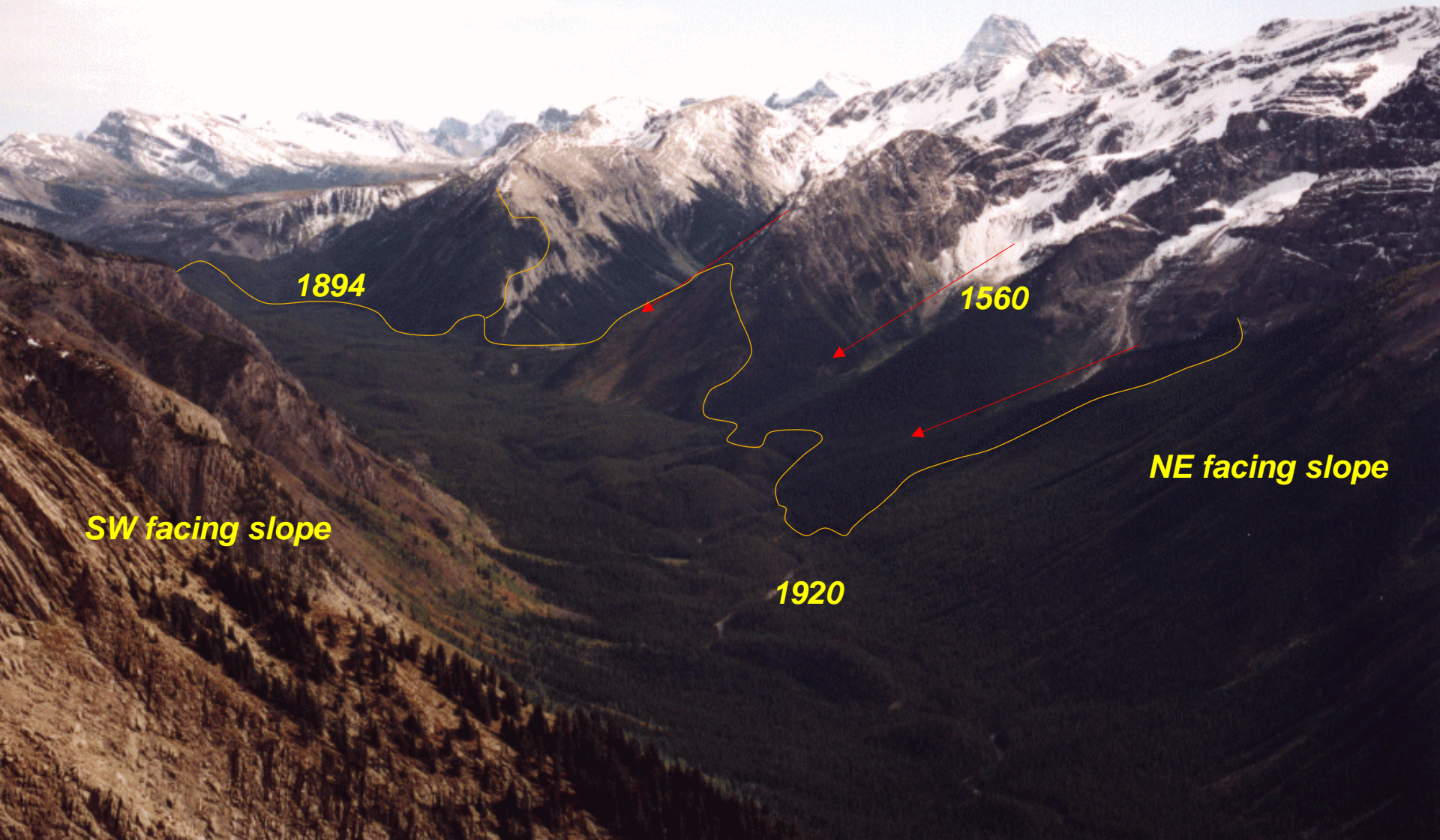
64% of stand age patterns in the Subalpine and 70% of stand age patterns in the Montane are explained by:

1. *Valley Orientation*
2. *Elevation*
3. *Proximity to the Continental Divide*
4. *Aspect*
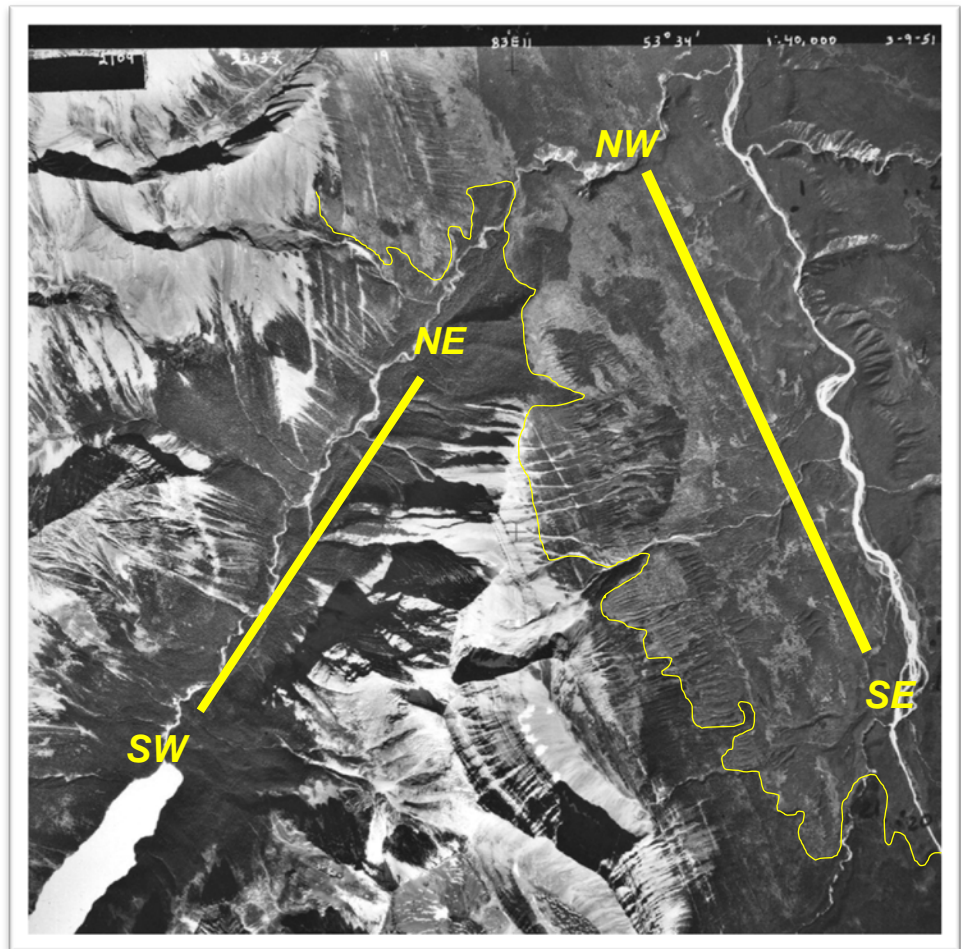
Fire refugias

Simpson River, Mount Assiniboine Provincial Park - BC
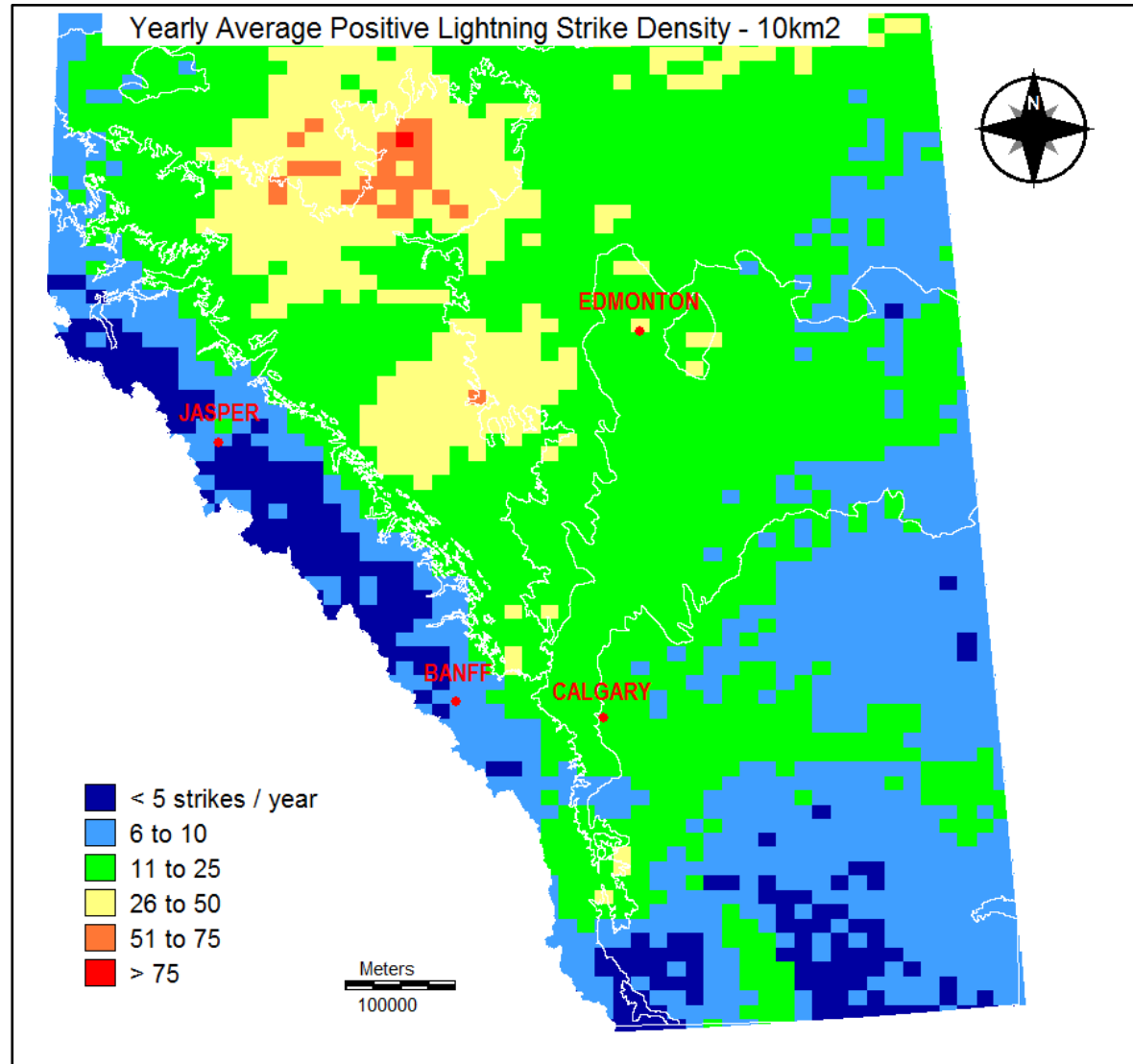
Fire Severity Differences

Subalpine

Low vegetation complexity
Long fire intervals
Higher burning severities

Montane / Foothills

High vegetation complexity
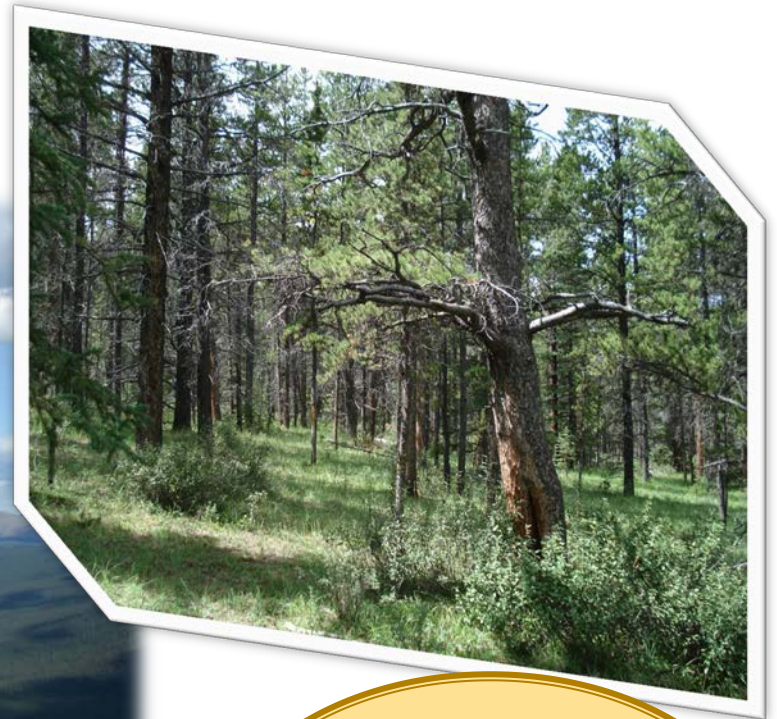Short fire intervals
Lower burning severities

Lightning Strike Shadow

- Lightning fires are not randomly distributed.

- Not a perfect linear correlation between lightning fire ignitions and lightning strike density.

-Areas with no to very few lightning fire ignitions are correlated with zones of low strike density.

- Areas o f high ignitions correspond with strike density zones that are mod. to very high.

Yearly Average Positive Lightning Strike Density - 10km2

EDMONTON

JASPER

BANFF

CALGARY

< 5 strikes / year
6 to 10
11 to 25
26 to 50
51 to 75
> 75

Meters
100000

Traditional burning

11+ fires
1905, 1892, 1875,
1856, 1804, 1820,
1795, 1778, 1768,
1765, 1725

15 Severe Fire Seasons since 1840's

1. 1843 – 45
2. 1848 – 50
3. 1863 – 64
4. 1867 – 68
5. 1869 – 70
6. 1875 – 77
7. 1885
8. 1888 – 89
9. 1894 – 96
10. 1909 – 10
11. 1913 - 15
12. 1917 - 19
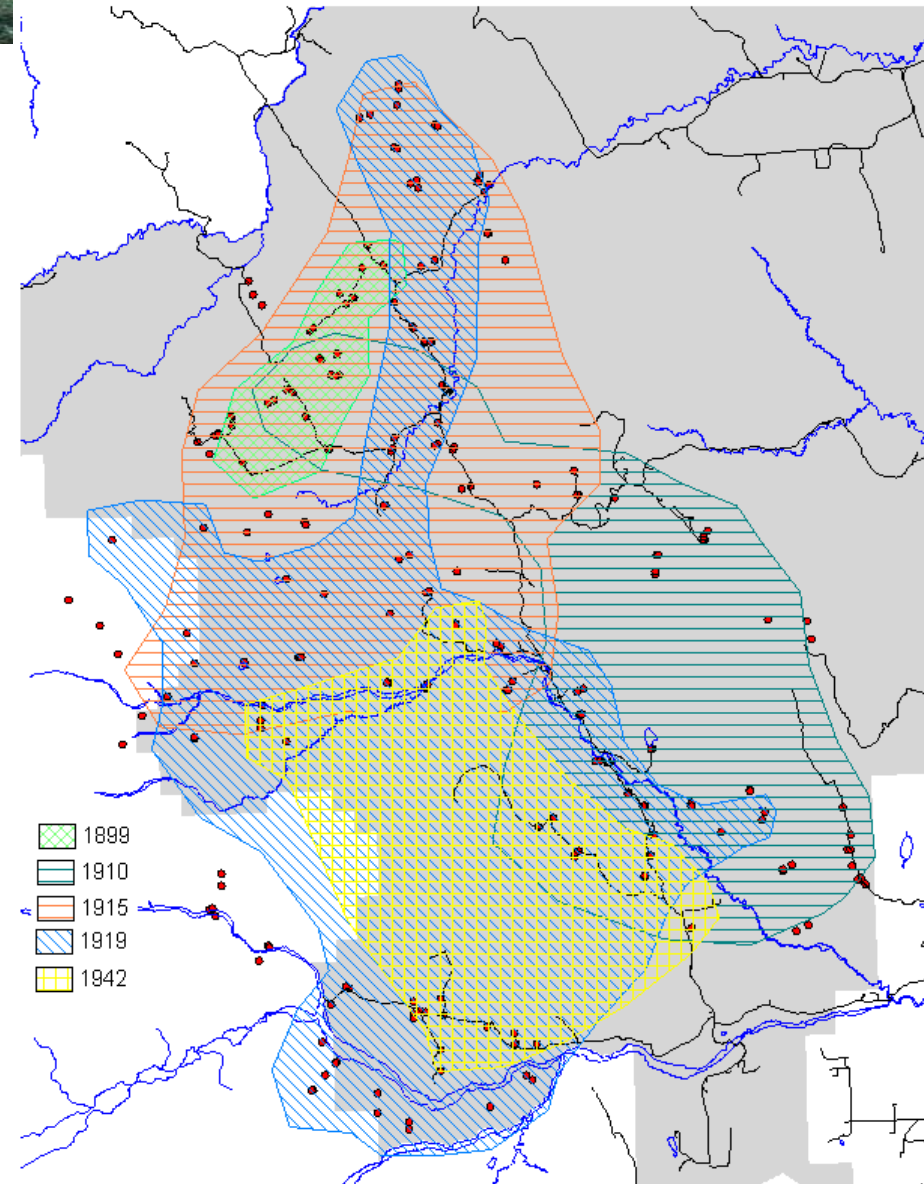13. 1924 – 25
14. 1927 – 29
15. 1934 - 36

2003 Verendrye Fire, Kootenay N.P.

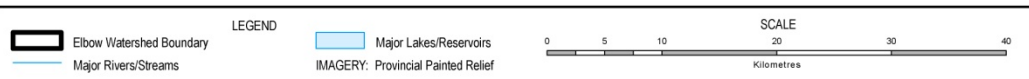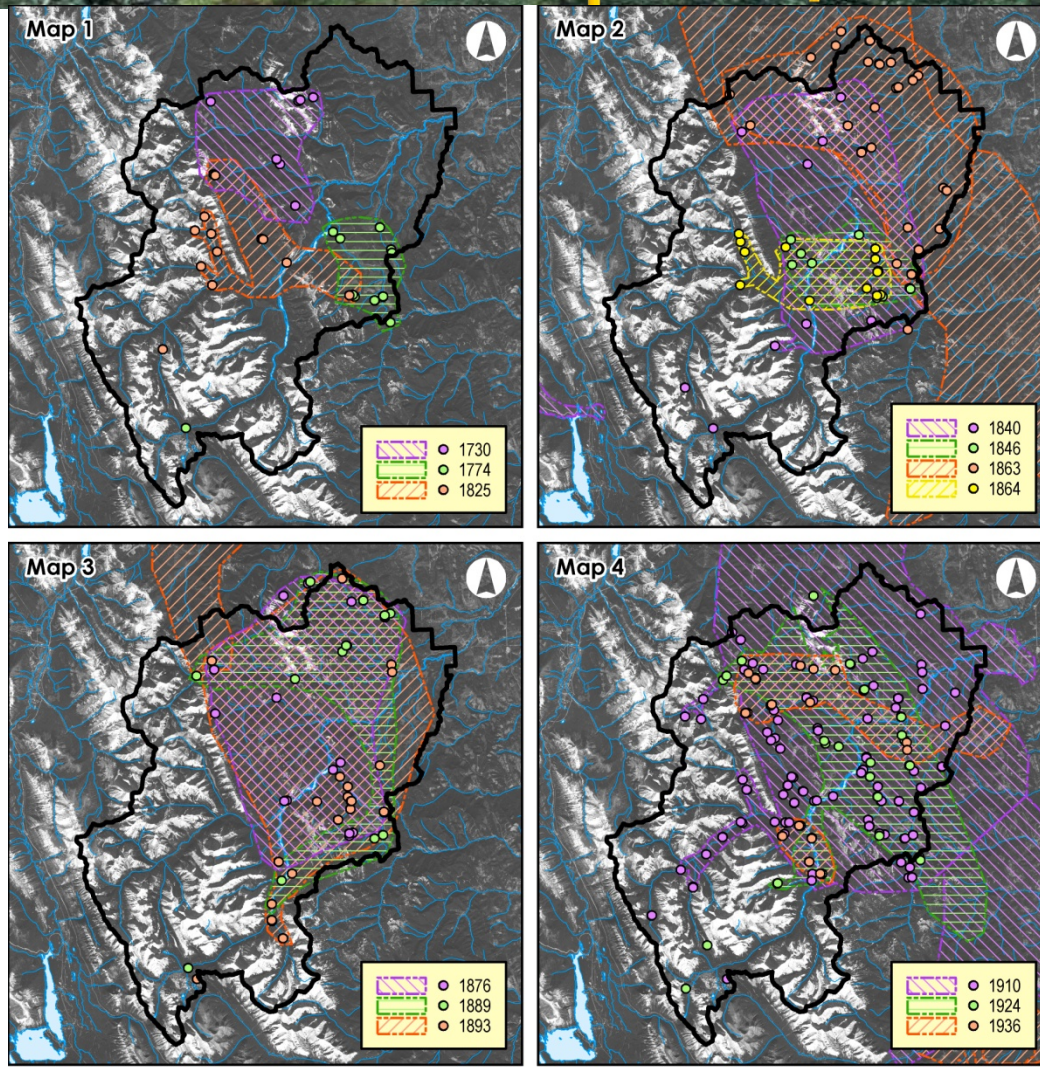# Historically: MFRI 10 yrs, FC 40 yrs

Estimated fire perimeters - 1800's

Legend:
- 1850
- 1864
- 1877
- 1889
- 1895

Estimated fire perimeters - 1900's

Legend:
- 1899
- 1910
- 1915
- 1919
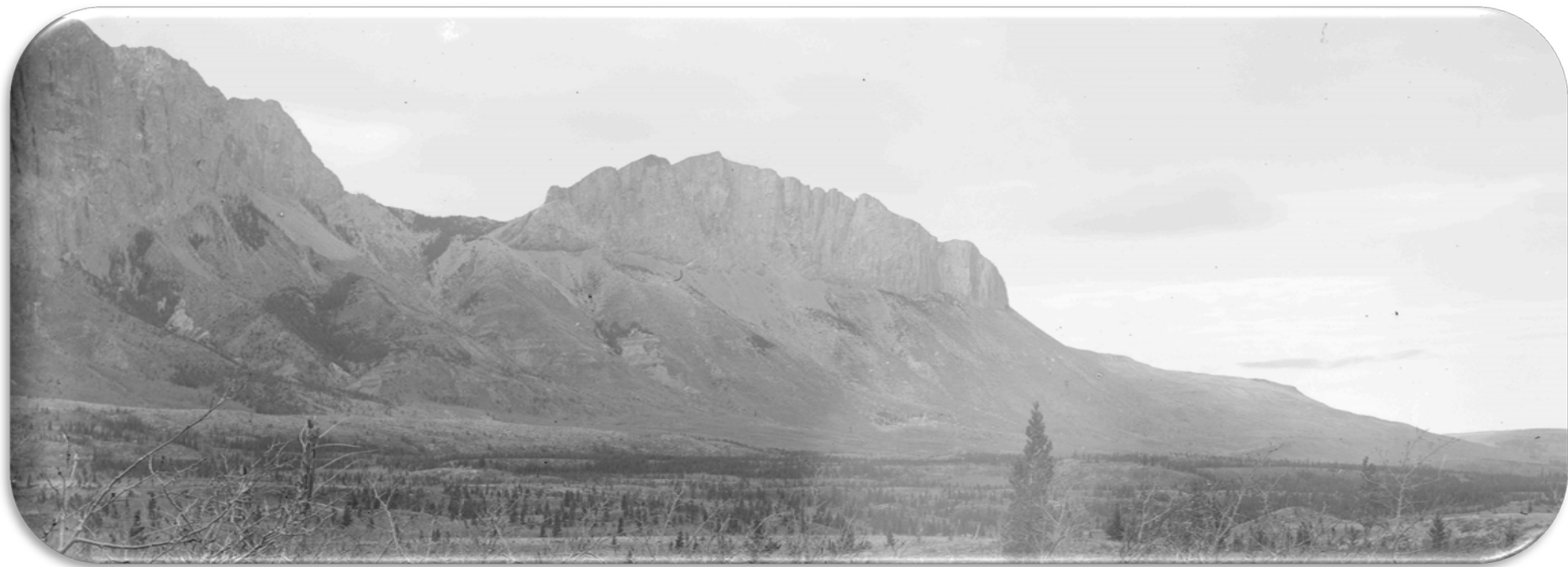- 1942
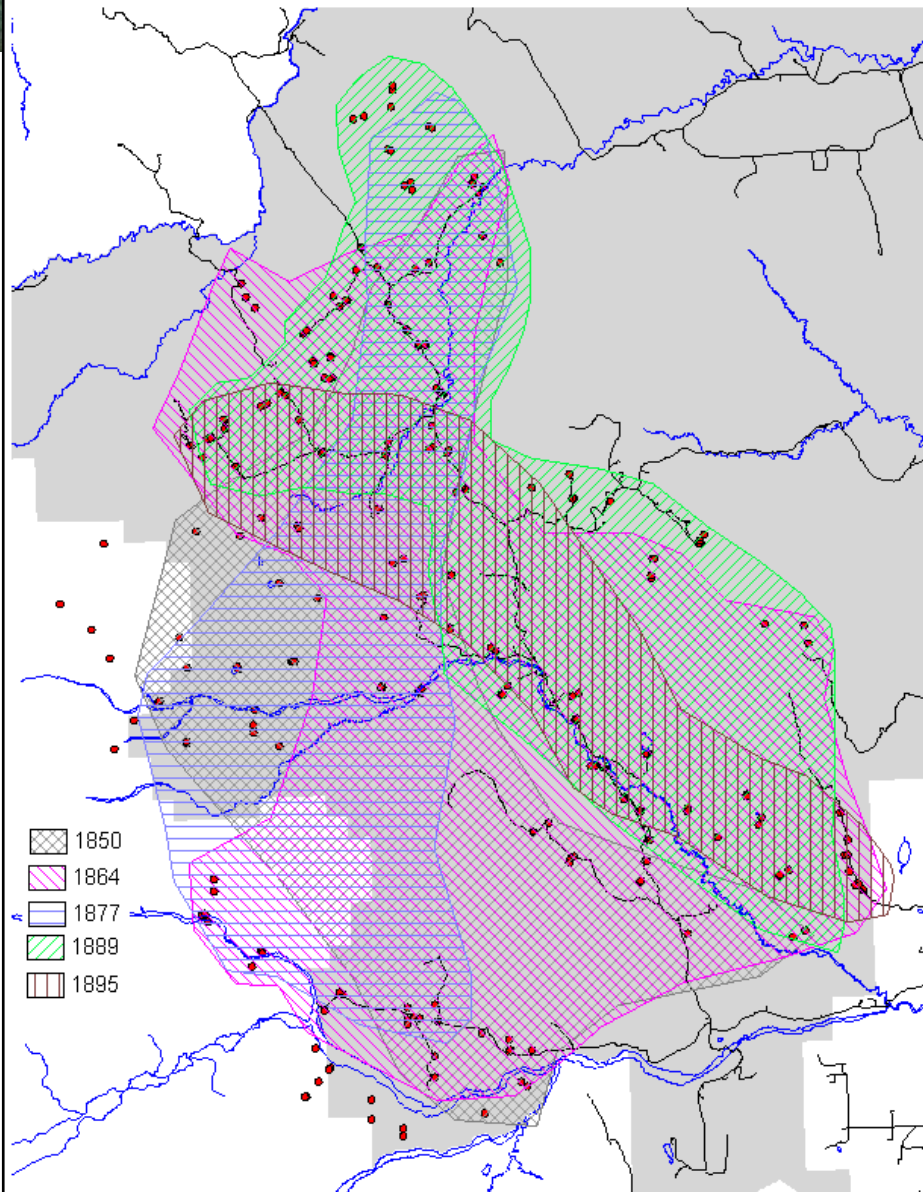
Fire spread dynamics at the interface of Subalpine / Foothills

The Montane in the 1890's

Bow Valley – Mount Yamnuska
July 16 1890, MacArthur Surveying Party

Photo credit: Mountain Legacy Project

The Montane in 1914 JNP

Fire History (Tande 1978)

1678, 1714, 1727, 1758*, 1780, 1797, 1807, 1834, 1837, 1847*, 1858, 1861, 1869, 1878, 1889*, 1905

The vegetation mosaic is the result of a mixture of frequent low-intensity fires Interspersed with higher intensity fires. **MFRI: 15 years**

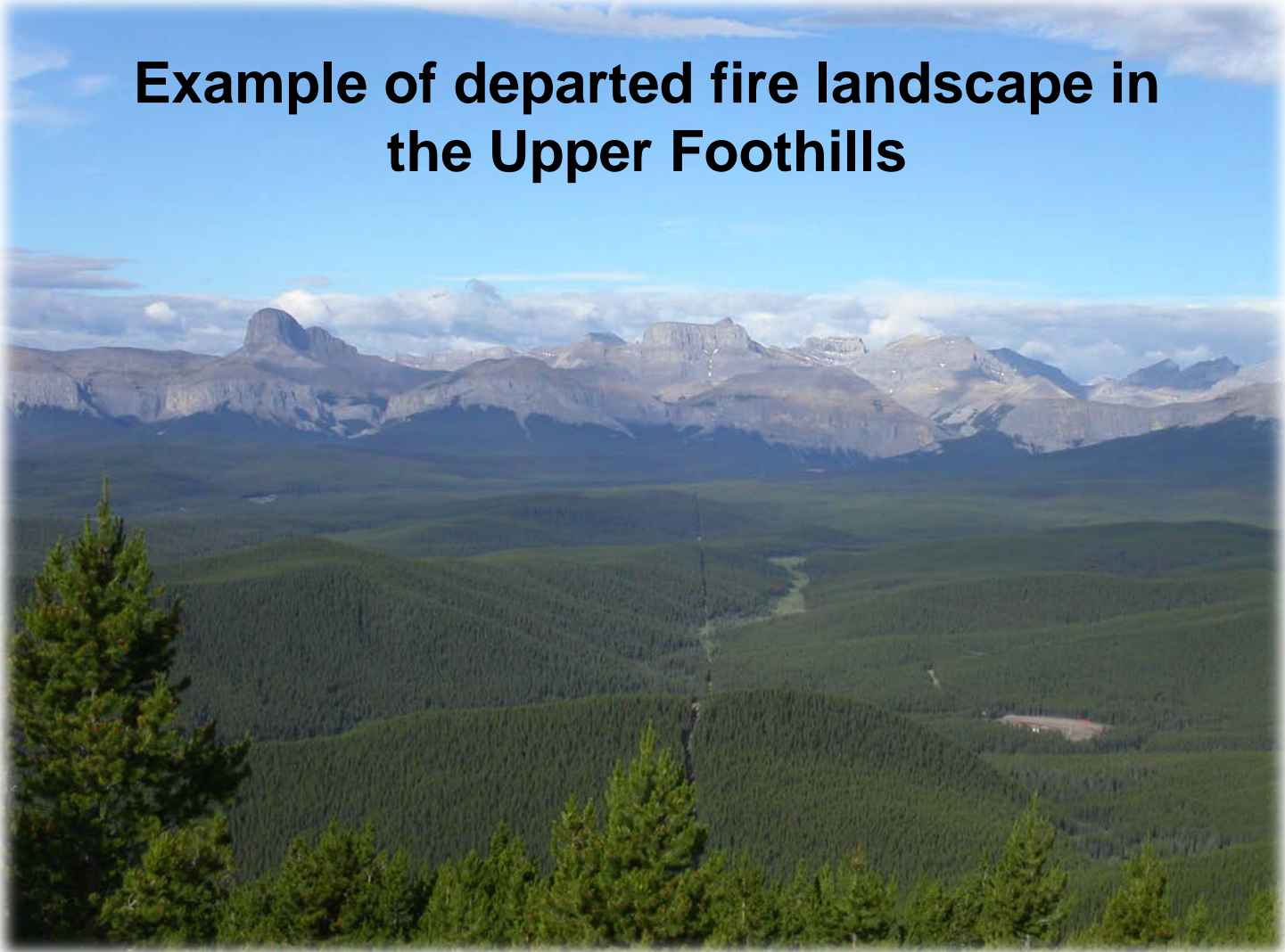Photo credit: The Lens of Time by White & Hart (2007)

Carbon Hill Station

Bridgland - 1914

Ecosystem Condition Departure

Example of departed fire landscape in the Upper Foothills
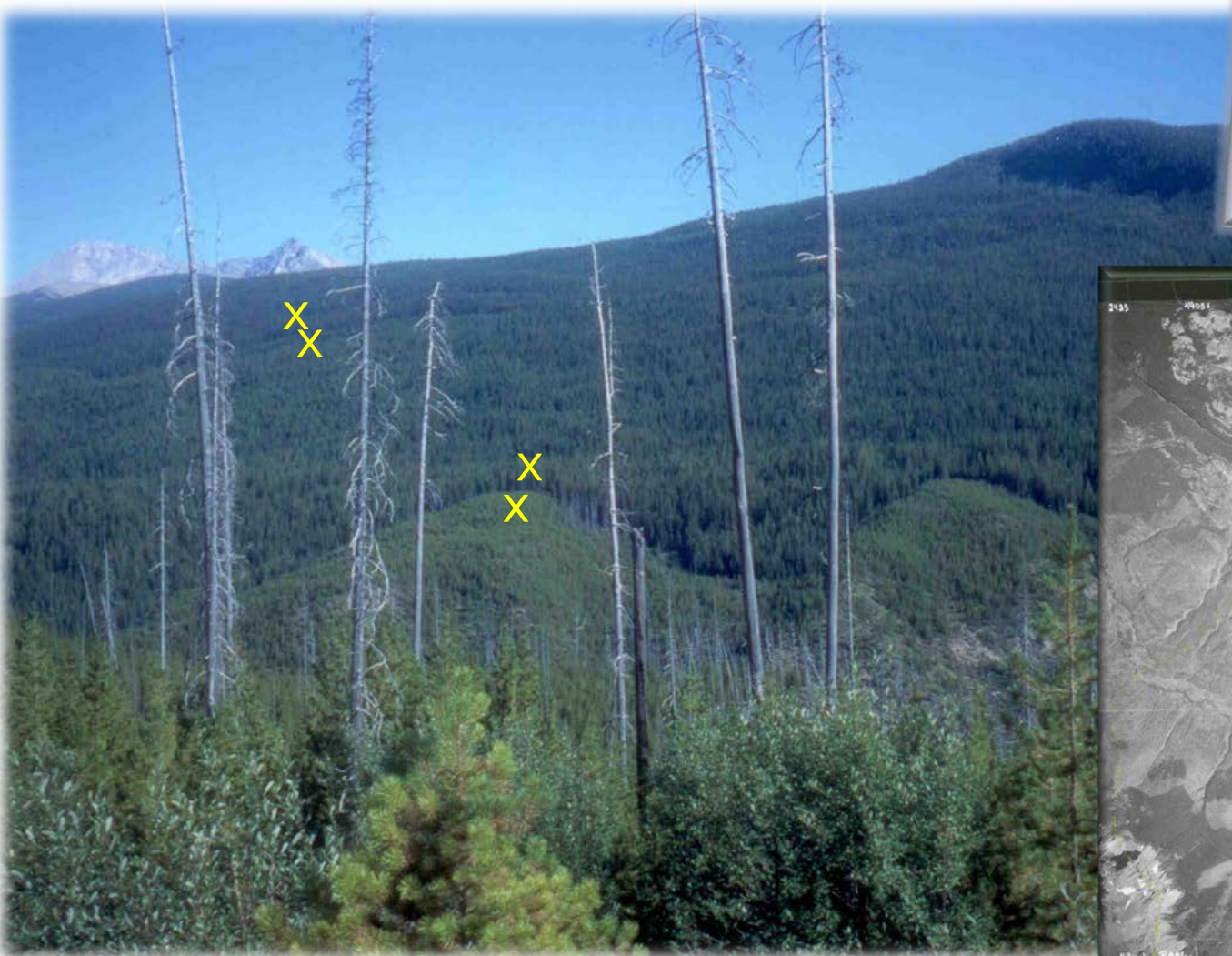
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  - Dr. Brad Hawkes

Fire Evidence
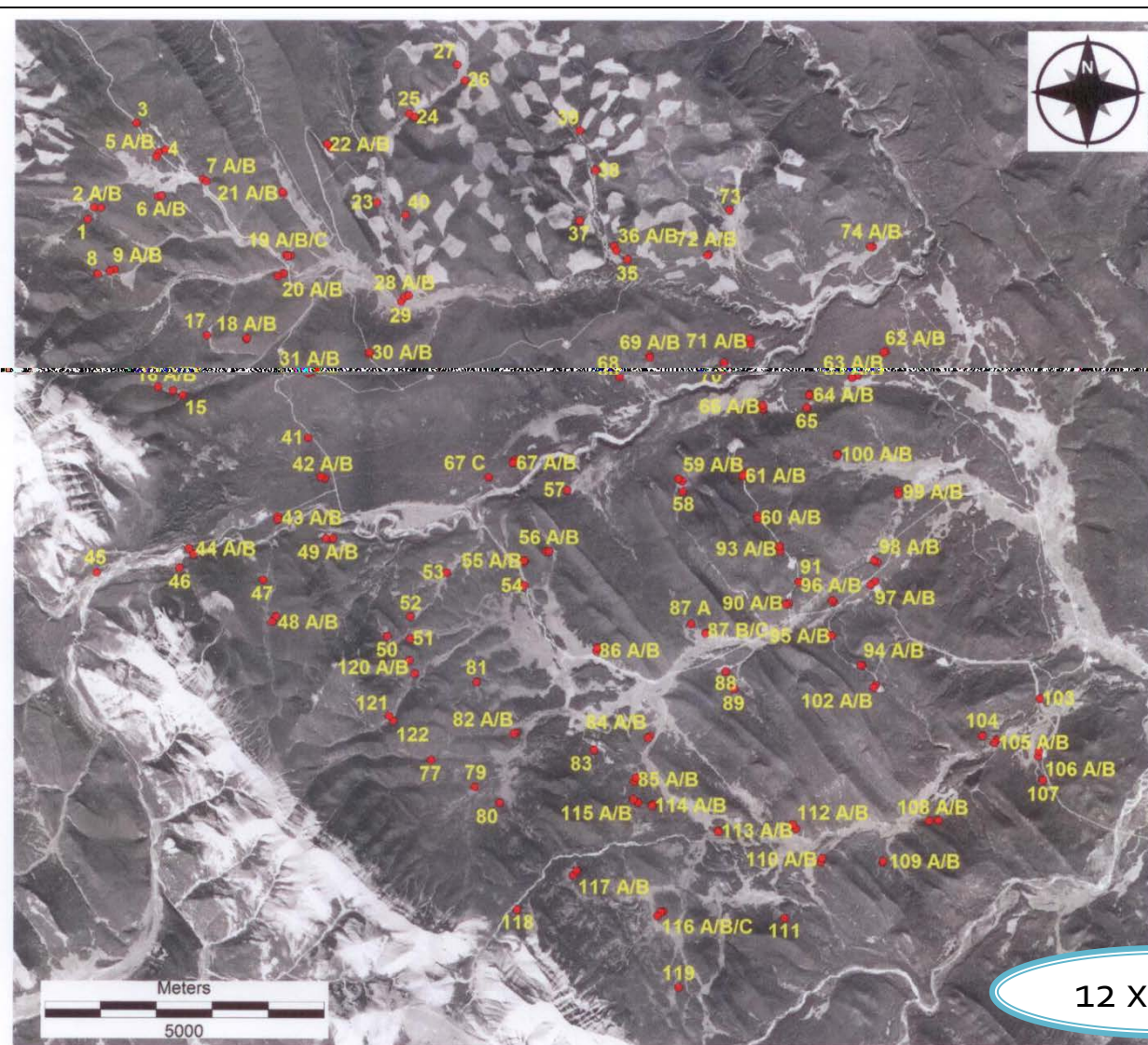
Fire Evidence

Burnt stump

Release

External and Internal scar

Sample plot density

Sampling units:
- Ghost-Waiparous to Little Red-Deer
- Jumpingpound to Sheep River
- Elbow headwaters
- Highwood River to headwaters of the Oldman

870 plots,
3446 trees,
1 plot every 1 to 3.6 km²

12 x 15 km