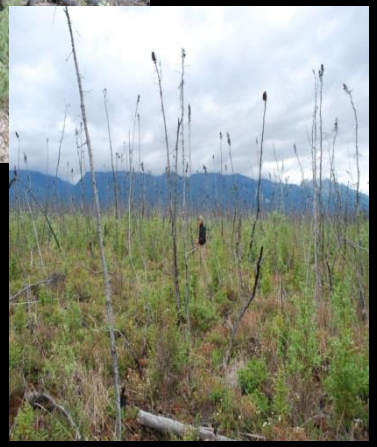
Fire severity and succession: spatial and temporal patterns and implications for herbivores

Fire severity



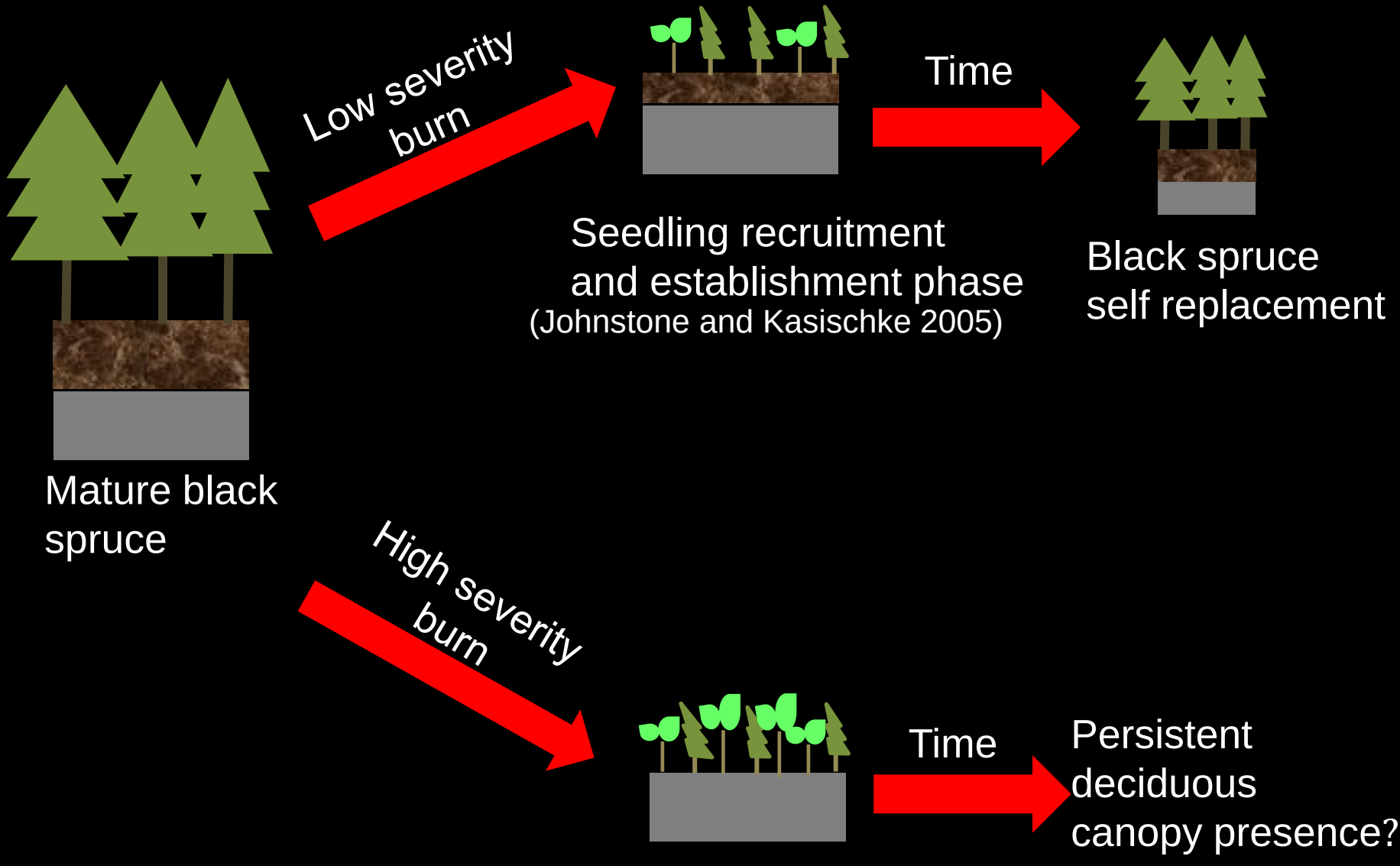
Patterns of vegetation dominance in the second decade of succession

Implications for herbivores

Post-fire residual organic layer depth as a metric of fire severity

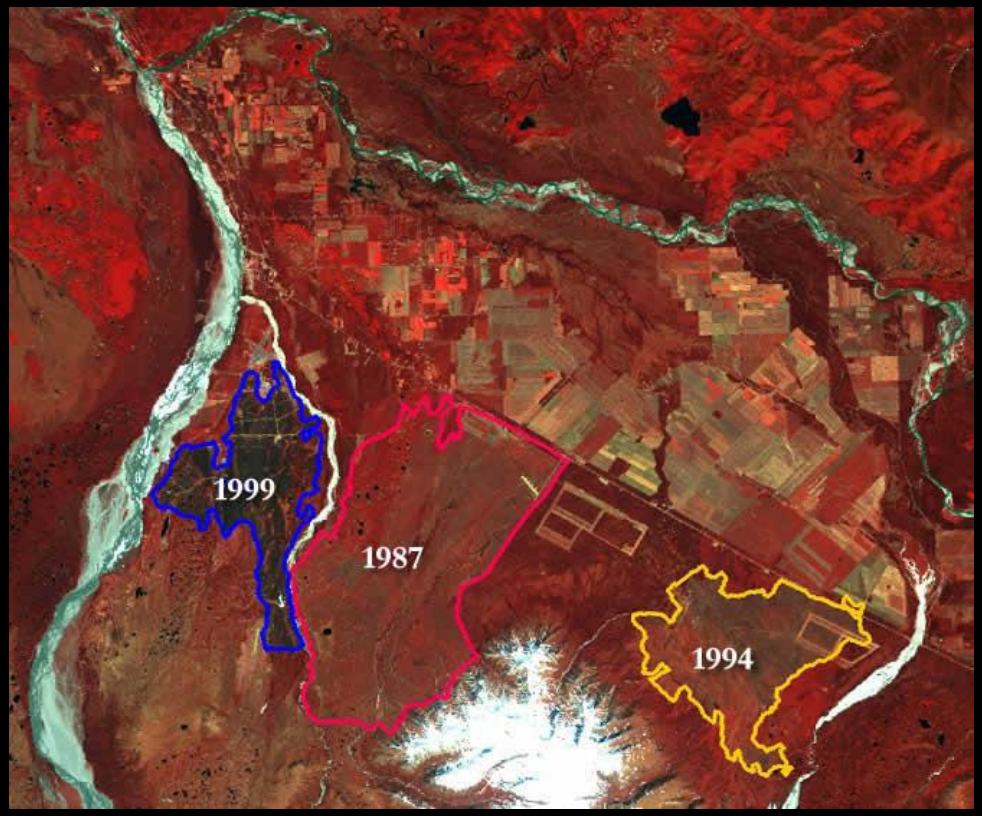
- Carbon loss
- Permafrost thaw
- Post-fire soil moisture and temperature
- Resprouting potential / seed availability
- Post-fire seedling recruitment and establishment

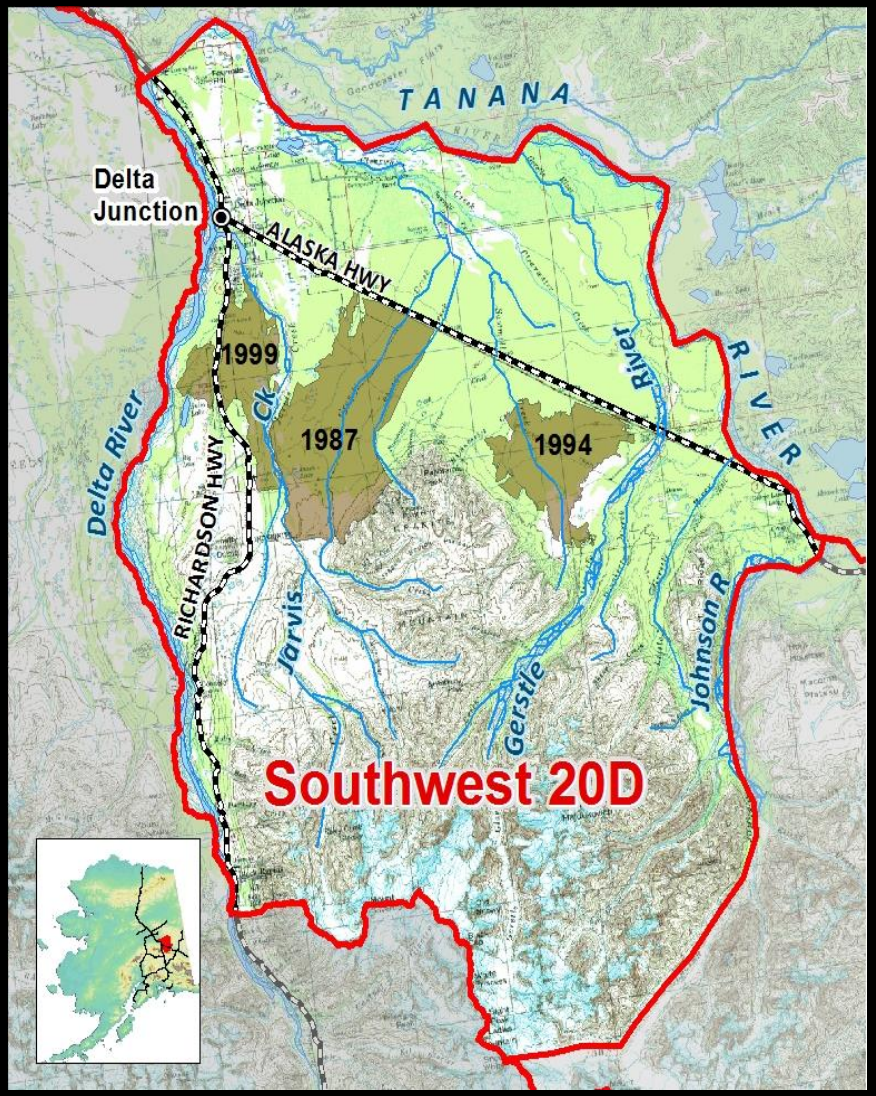
Shallow organic layer = high severity
Deep organic layer = low severity


Low severity burn
Time
Seedling recruitment and establishment phase
(Johnstone and Kasischke 2005)
Black spruce self replacement
Mature black spruce
High severity burn
Time
Persistent deciduous canopy presence?

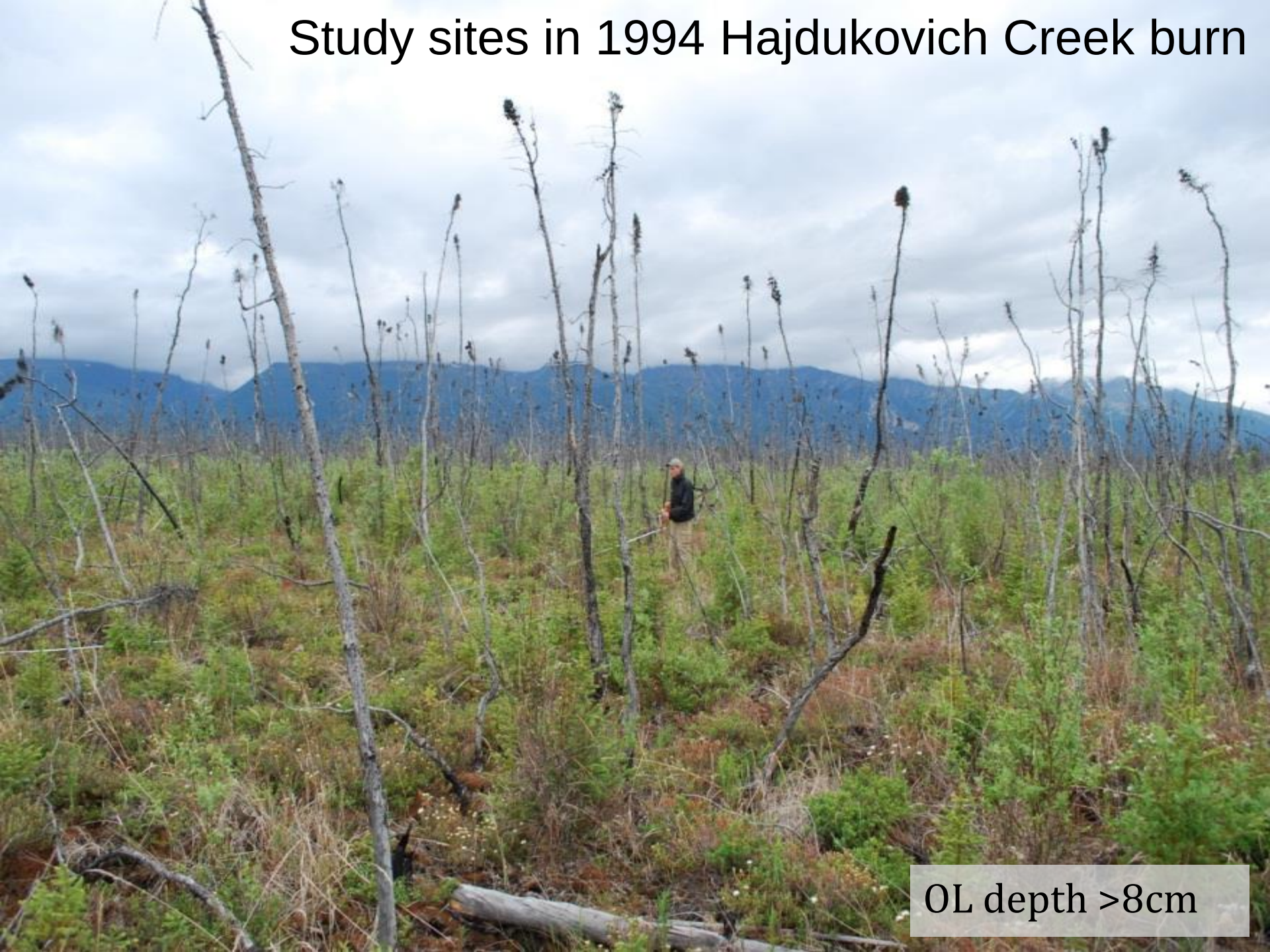
STUDY SITES

- 1987 Granite Creek Burn- GC87
- 1994 Hajdukovich Creek Burn- HC94
- 1999 Donnelly Flats burn- DF99
- 1990 Tok burn – TK90





Study sites in 1994 Hajdukovich Creek burn




OL depth 4-8 cm


OL depth 0-4 cm

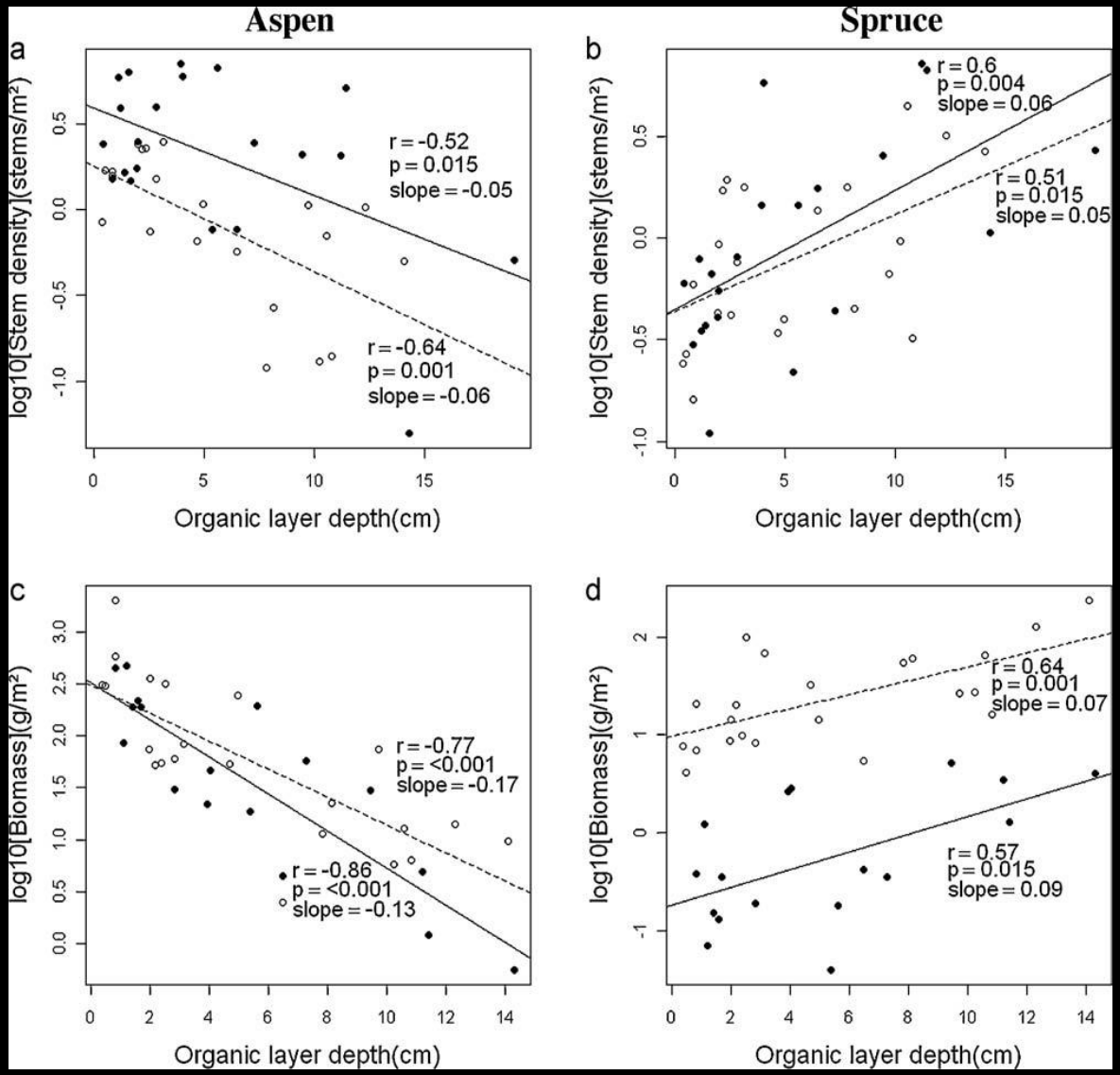
Changes in stand density and biomass from 8 yrs to 14 yrs post-fire

Aspen

- Stem density decreased by 60 %
- Biomass per unit area increased ~2 fold
- Average individual biomass increased ~ 3 fold

Spruce

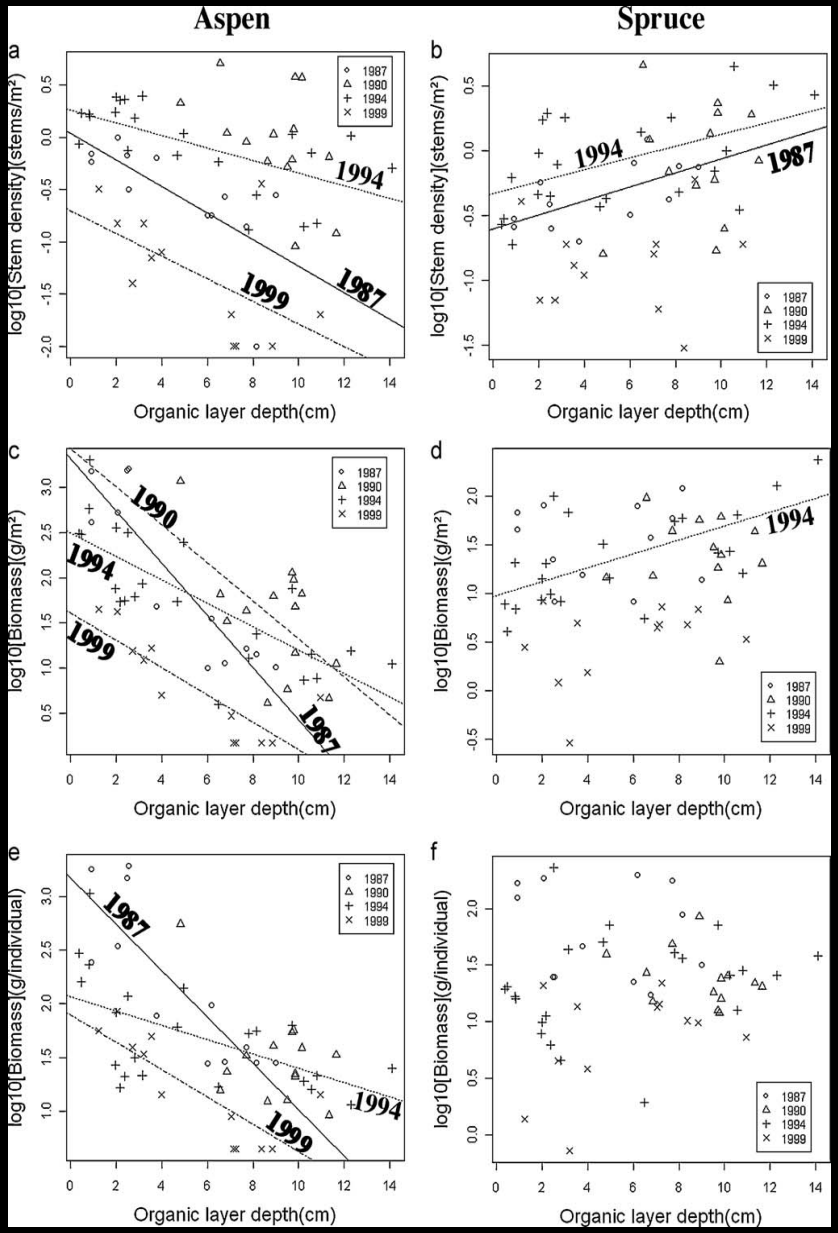
- Stem density was unchanged
- Biomass per unit area increased 40 fold
- Average individual biomass increased ~ 30 fold

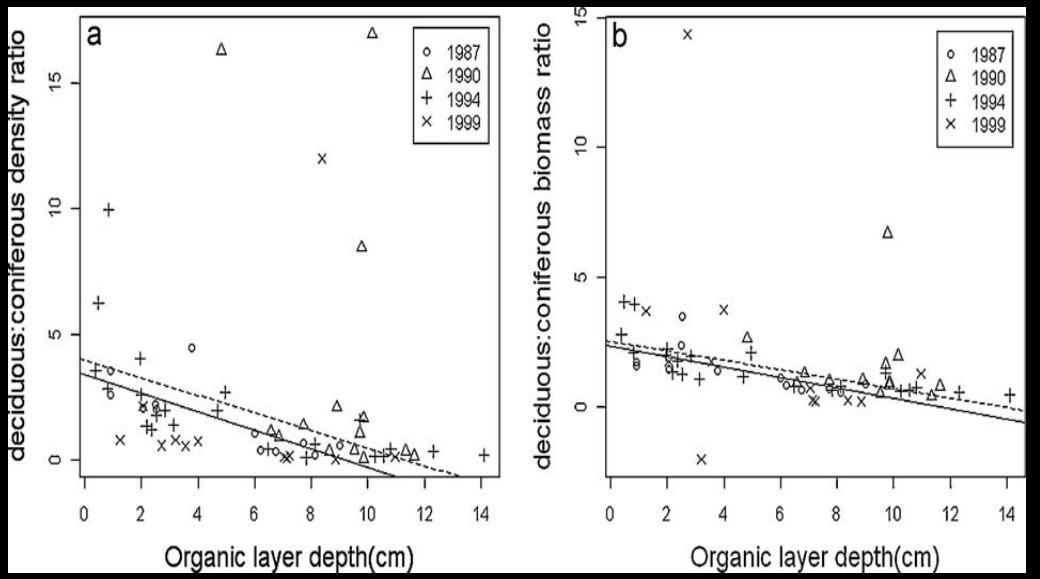


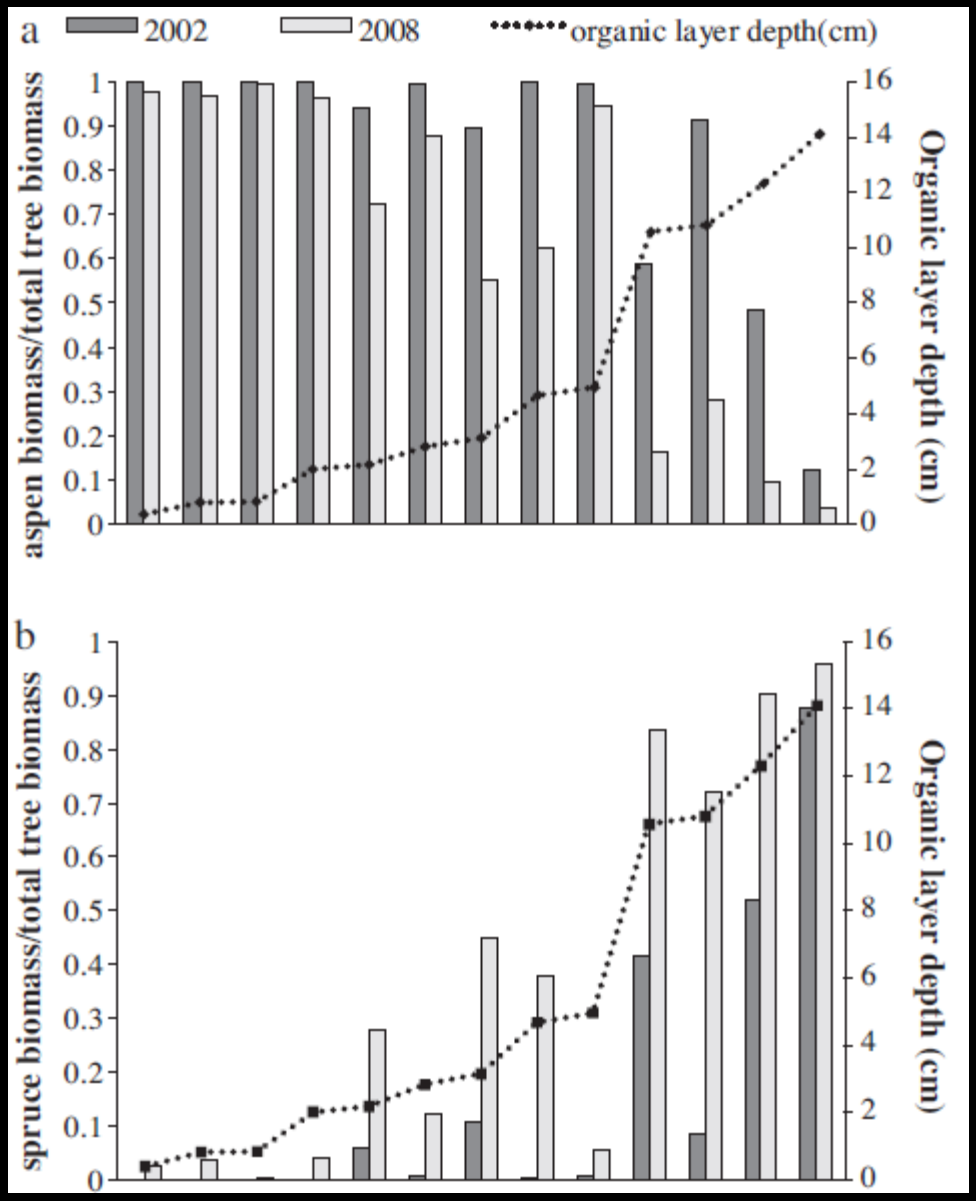
Shenoy et al. 2011, FEM 261, pp 381-90

Fire severity effects on species recruitment and establishment patterns are persistent

Fire severity- species composition relationships across multiple burns



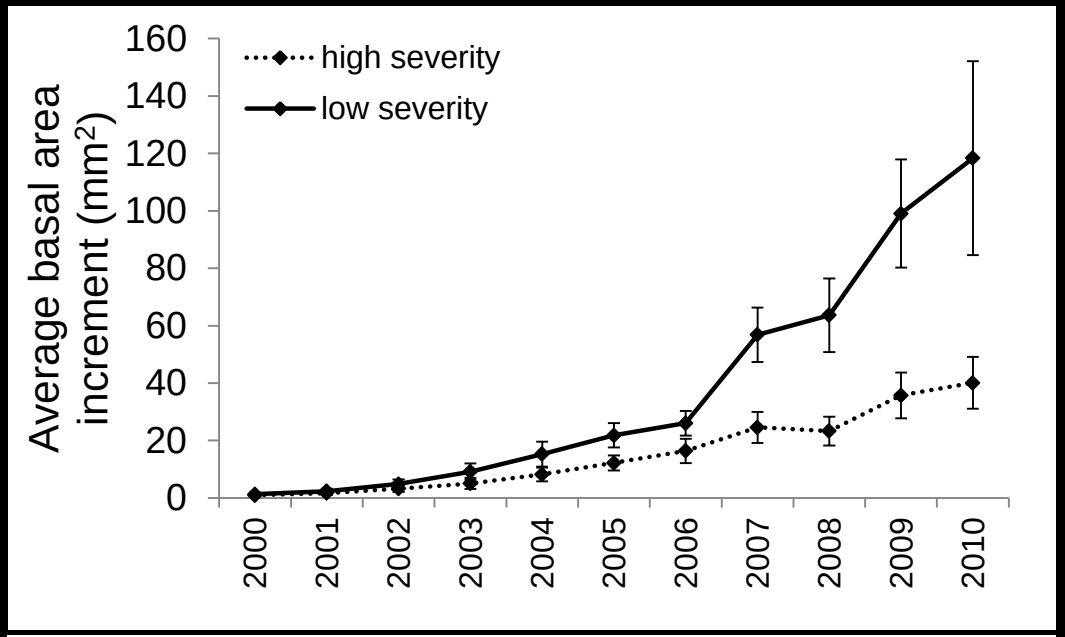




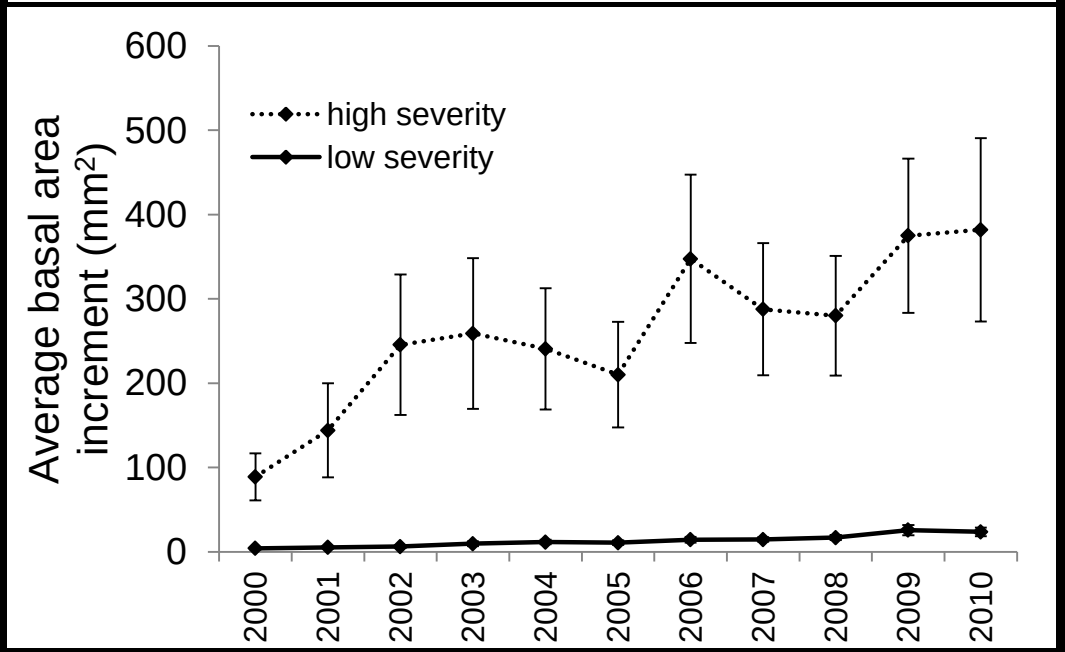
Shenoy et al .2011

Divergent successional trajectories are developing at two ends of the fire severity spectrum

Growth rates of black spruce and aspen in low versus high severity sites (HC94 burn)

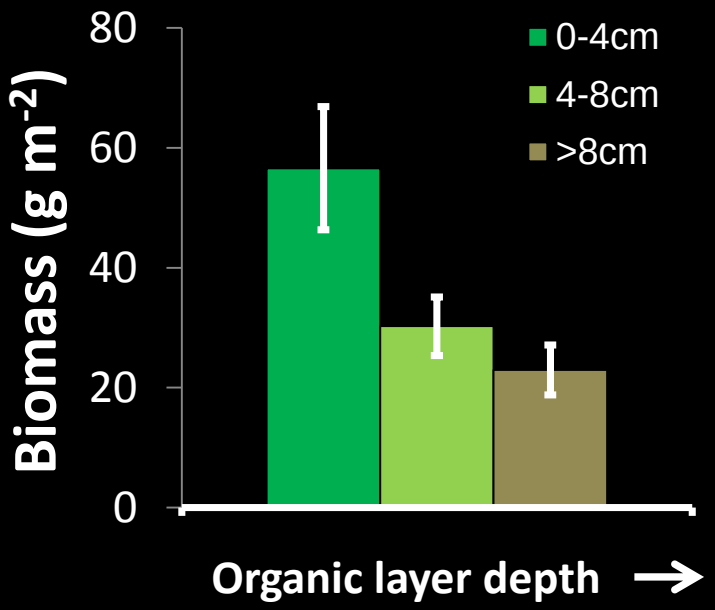


Black spruce



Aspen

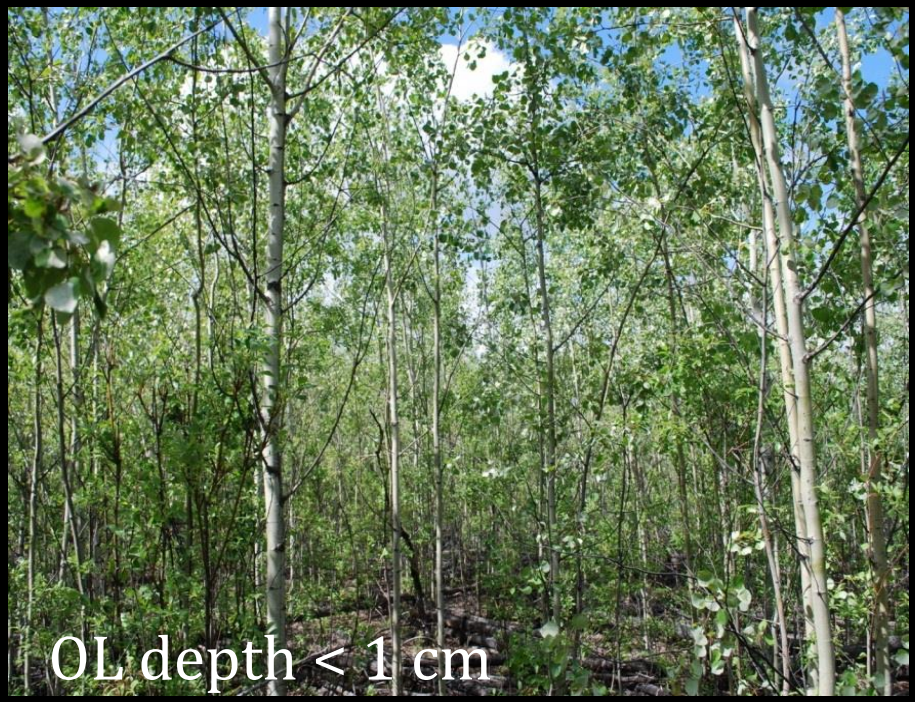
Willow biomass



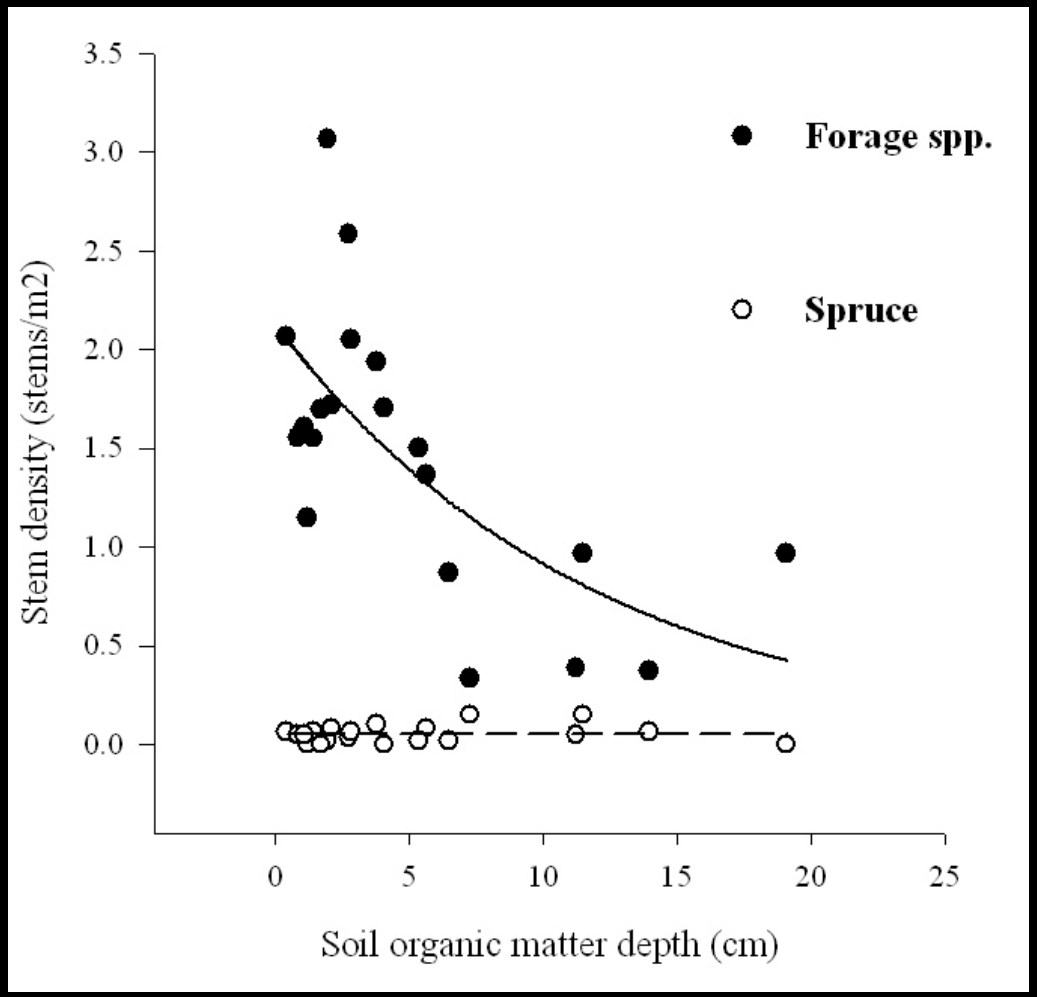
Persistent shift in forest composition

Low severity

High severity



Forage availability in HC94 burn



In high severity sites:

↑ Density of forage species (aspen, willow, birch)

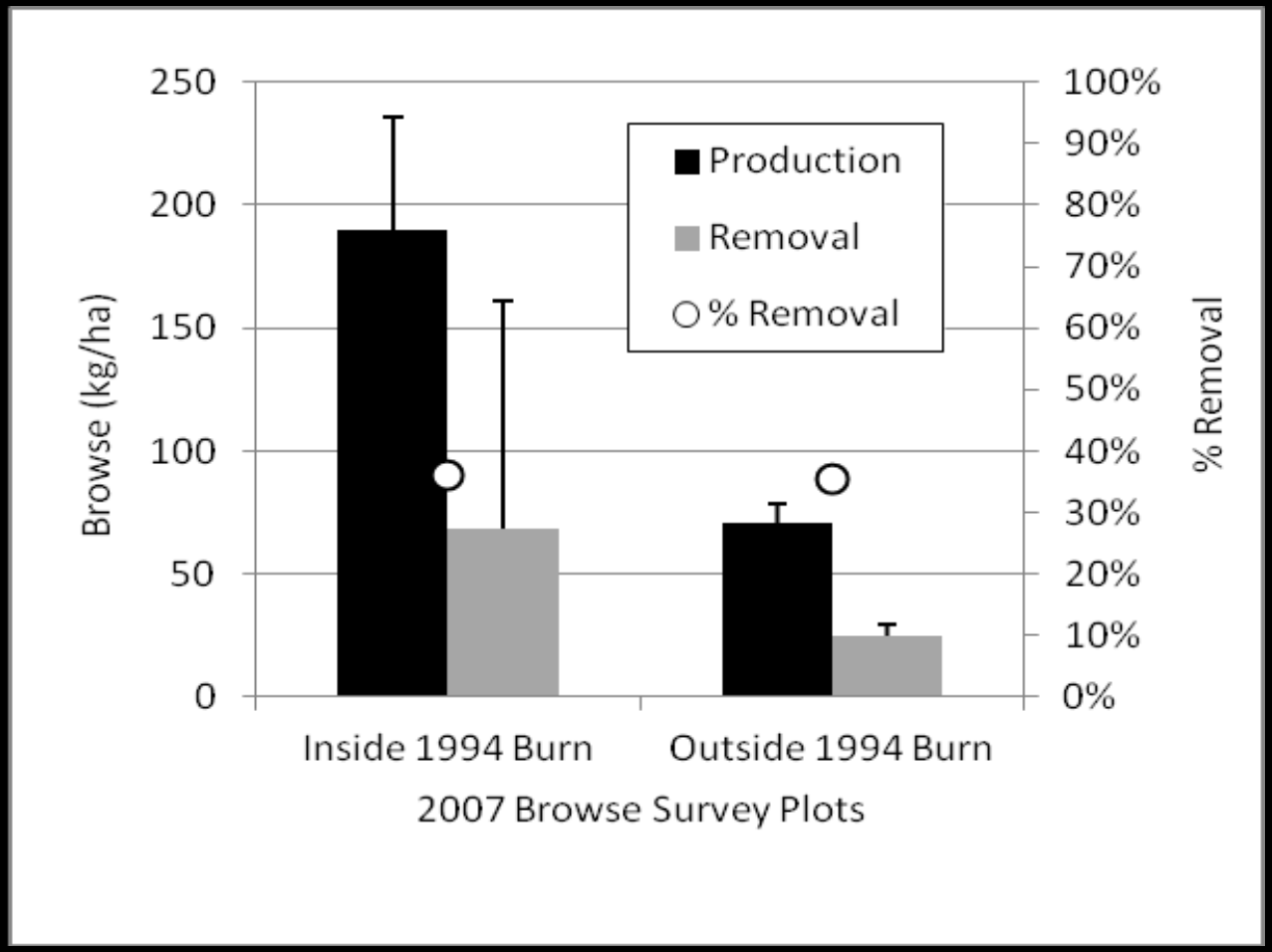
↑ Browse production

↑ Browse removal per ha (x6)

Browsing pressure was high throughout HC94 burn

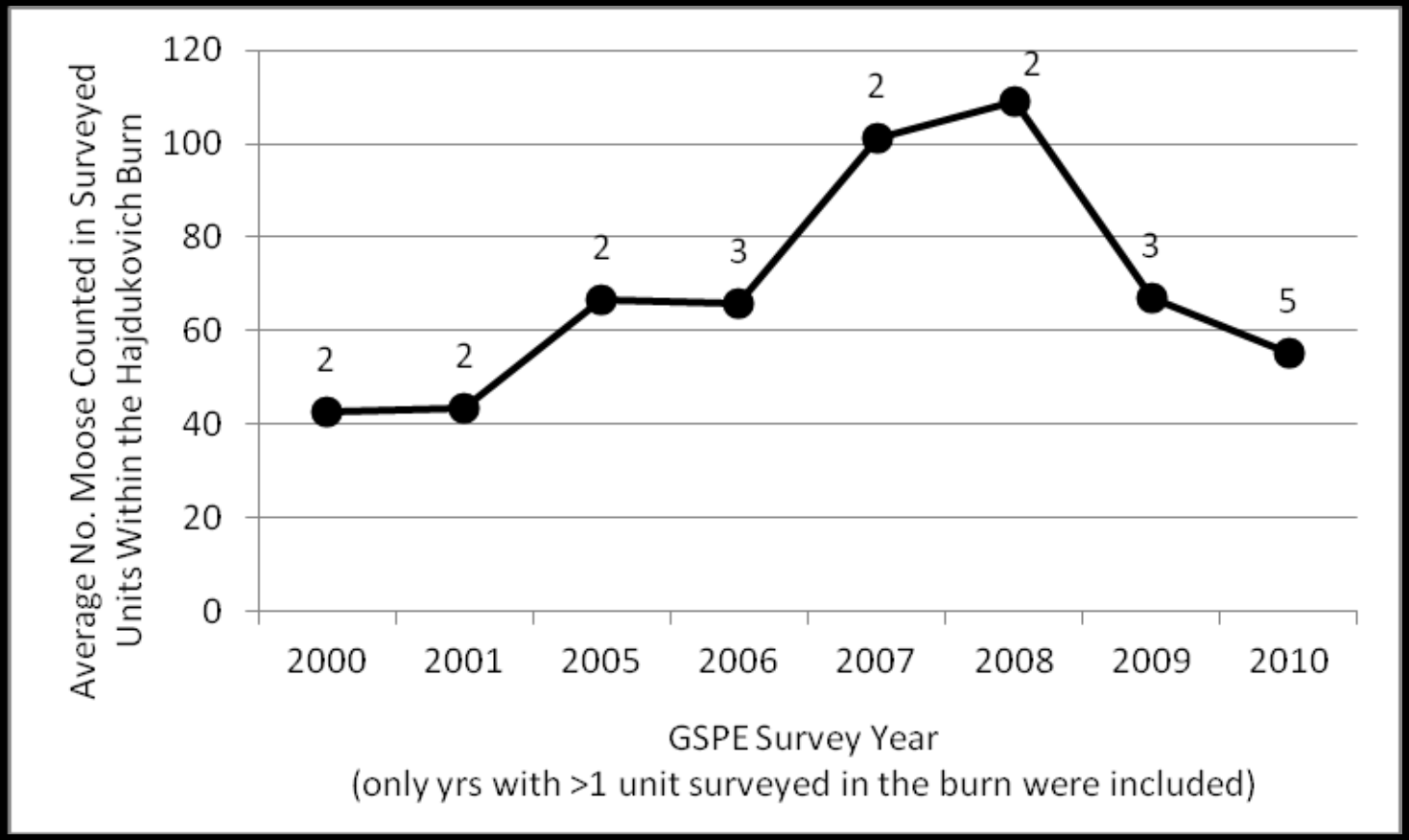
Rachel Lord thesis 2008

Browse production and removal in HC94 burn



Adapted from Paragi and Kellie 2008 ADFG

High moose densities in the HC94 burn

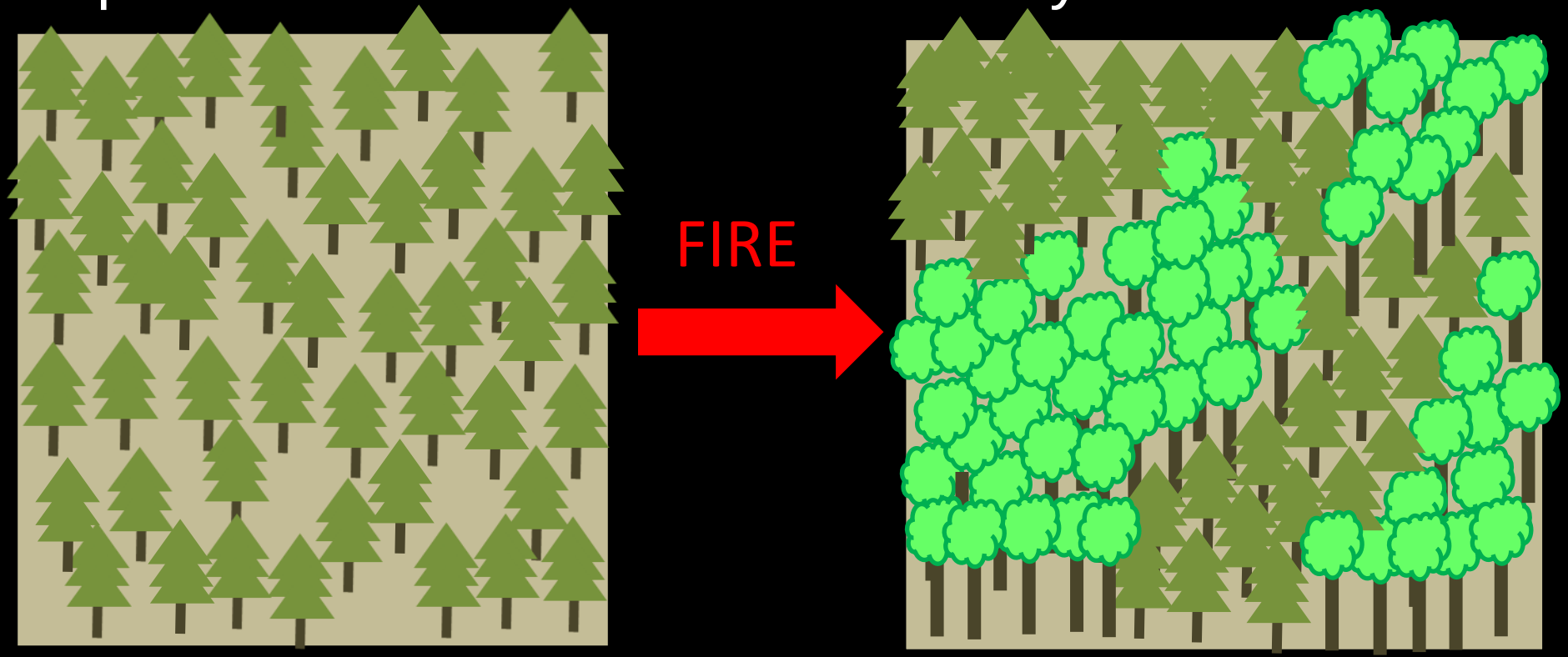


Kalin Kellie (ADFG) *personal communication*

Densest moose populations (within GMU 20D) in areas that burned 11-30 years ago

Maier et al. 2005, CJFR Vol.35 pp2233-2243

Implications of variation in fire severity for herbivores



Fire severity → Deciduous: coniferous biomass → Forage availability → Nutrition → Moose population density

Fire severity → Growth rates of aspen and spruce → Site architecture → Forage accessibility → Forage availability

Site architecture → Hunter success → Moose population density

Thank you!

Knut Kielland
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Eric Kasischke
Roger Ruess

Field work:
Kirsten Barrett
Matt Borr
Cameron Carroll
Ben Cook
Cassidy Phillips
Adrian Rocha