The Burning of Northern Peatlands: Are We Approaching a Tipping Point?

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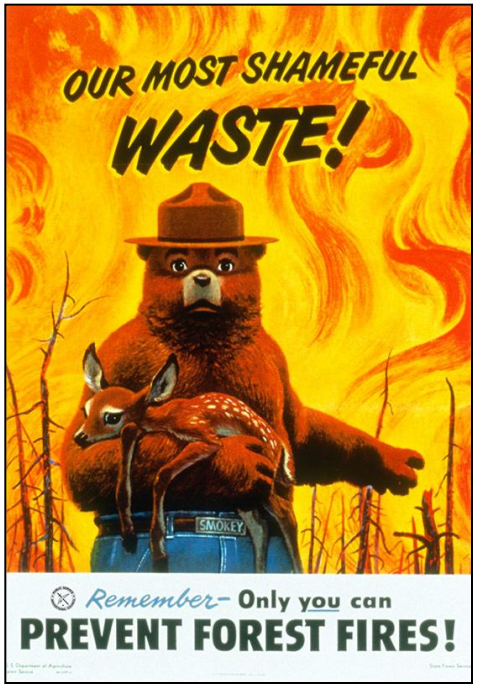
Resilience vs. Stability

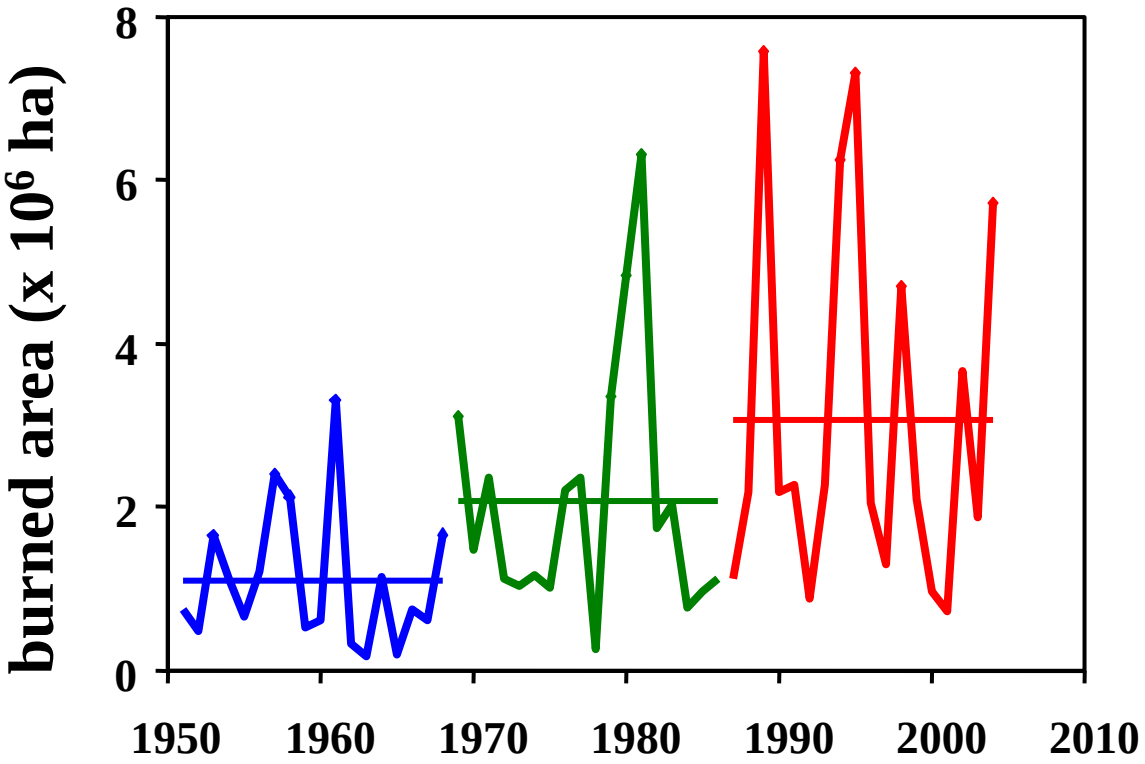


Example of a stabilizing factor

- *Sphagnum* hummock unburned "islands"
- Demonstrates importance of bulk density x soil moisture interactions on heat transfer
- Moderates overall carbon losses during fire

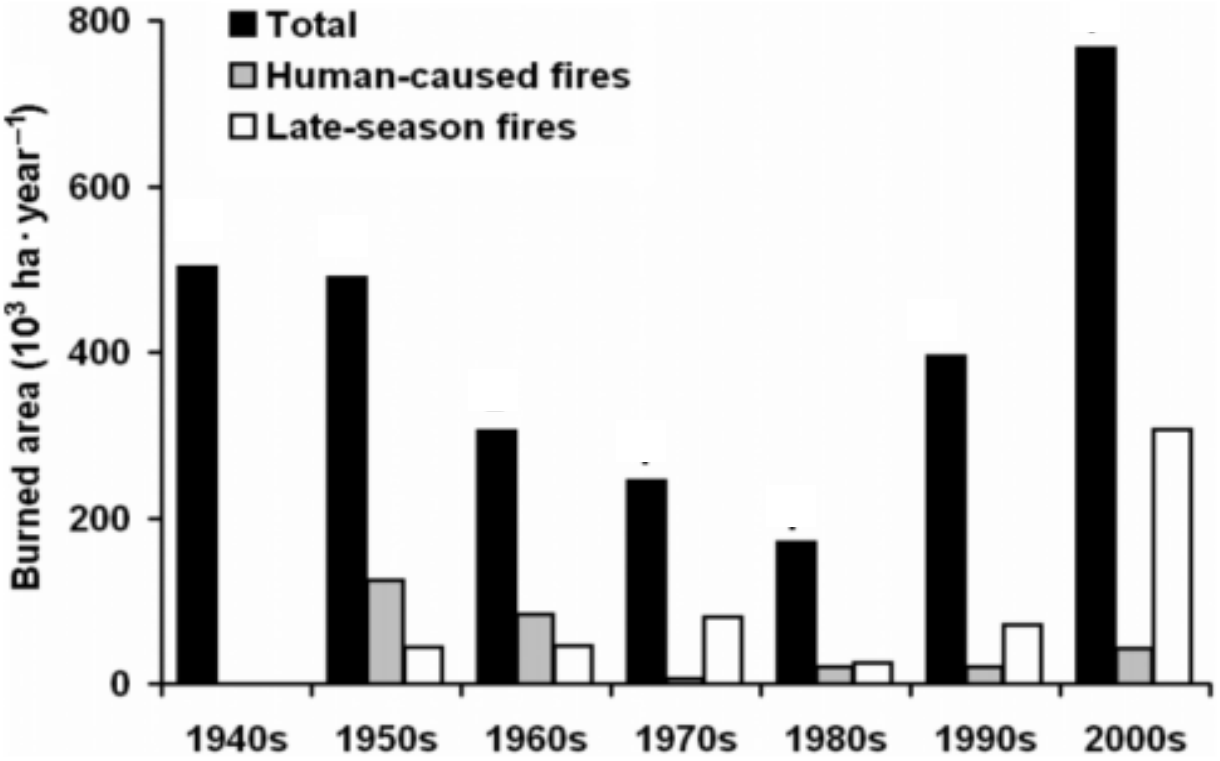
Benscoter et al. 2011 (Int J Wild. Fire)

Boreal burned area



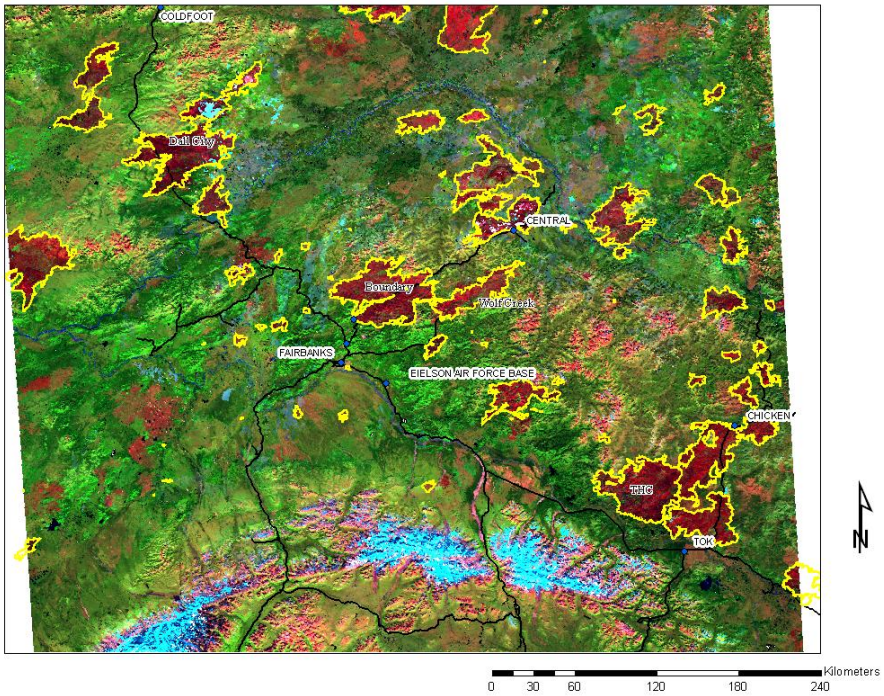
Kasischke and Turetsky 2006 GRL

Alaska burned area



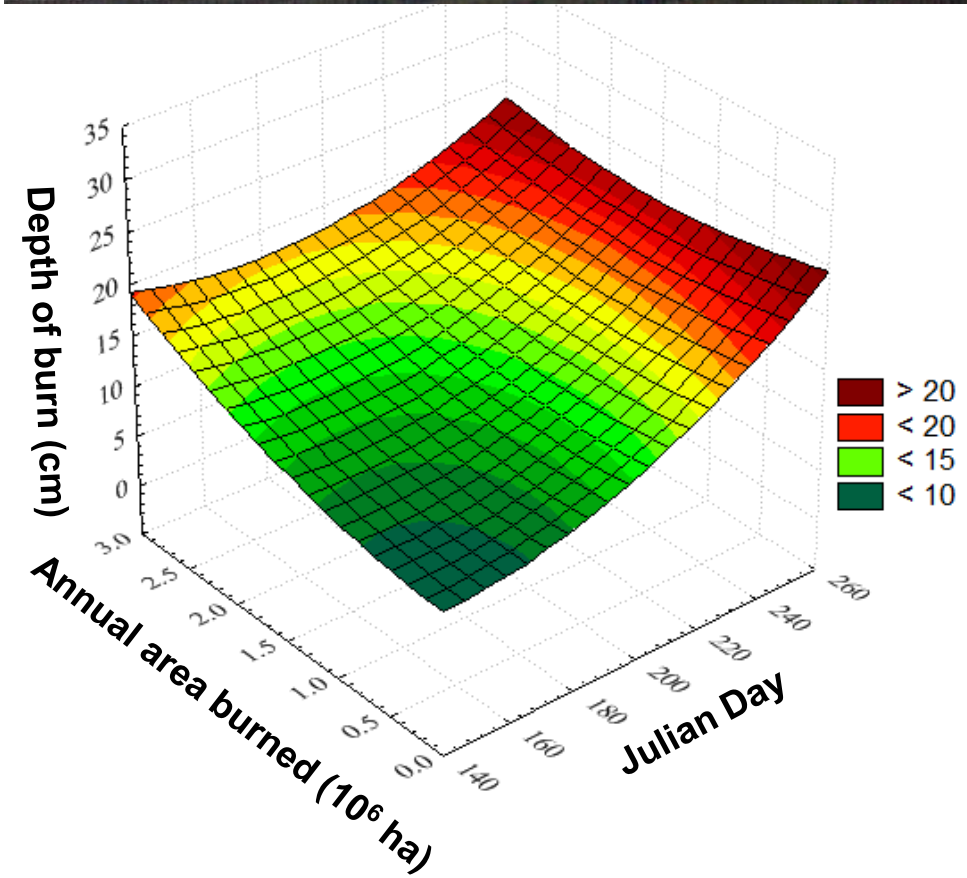
Kasischke et al. 2010 CJFR

Controls on depth of burn



- **Surveyed post-fire carbon pools in 178 black spruce sites in Alaska**
- **Measurements in 31 unique fires that burned from 1983-2005**
- **Reconstructed C loss due to burning of ground fuels**

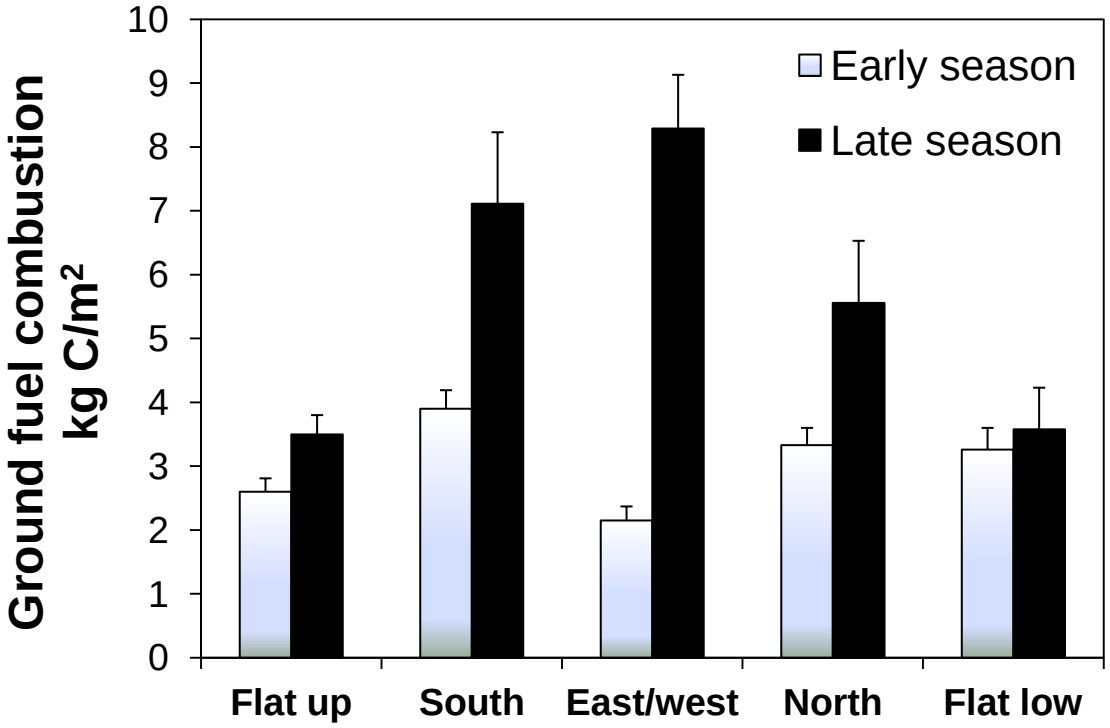
Controls on depth of burn



- **In most years, depth of burn increases through the fire season**
- **During large fire years, depth of burning is severe all season**

Turetsky et al. 2011 (Nature Geoscience)

Controls on depth of burn

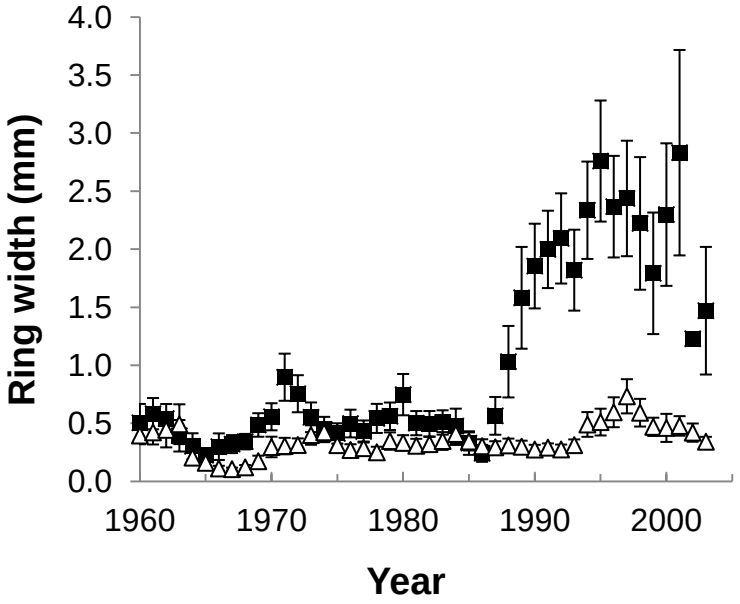


Turetsky et al. 2011 (Nature Geoscience)

Long-term drainage of a boreal treed fen

Turetsky et al. 2011. Nature Communications

Drainage increased tree productivity



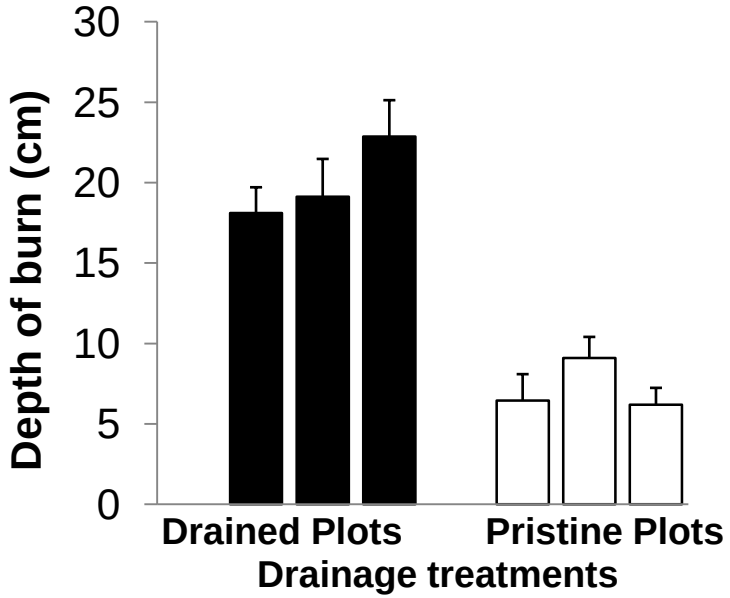
Soil C Storage (g C/m^2/yr)

Reference plots: 33.9 ± 10.8

Drained plots: 68.7 ± 15.1

Turetsky et al. 2011. Nature Communications

Drainage increased depth of burn



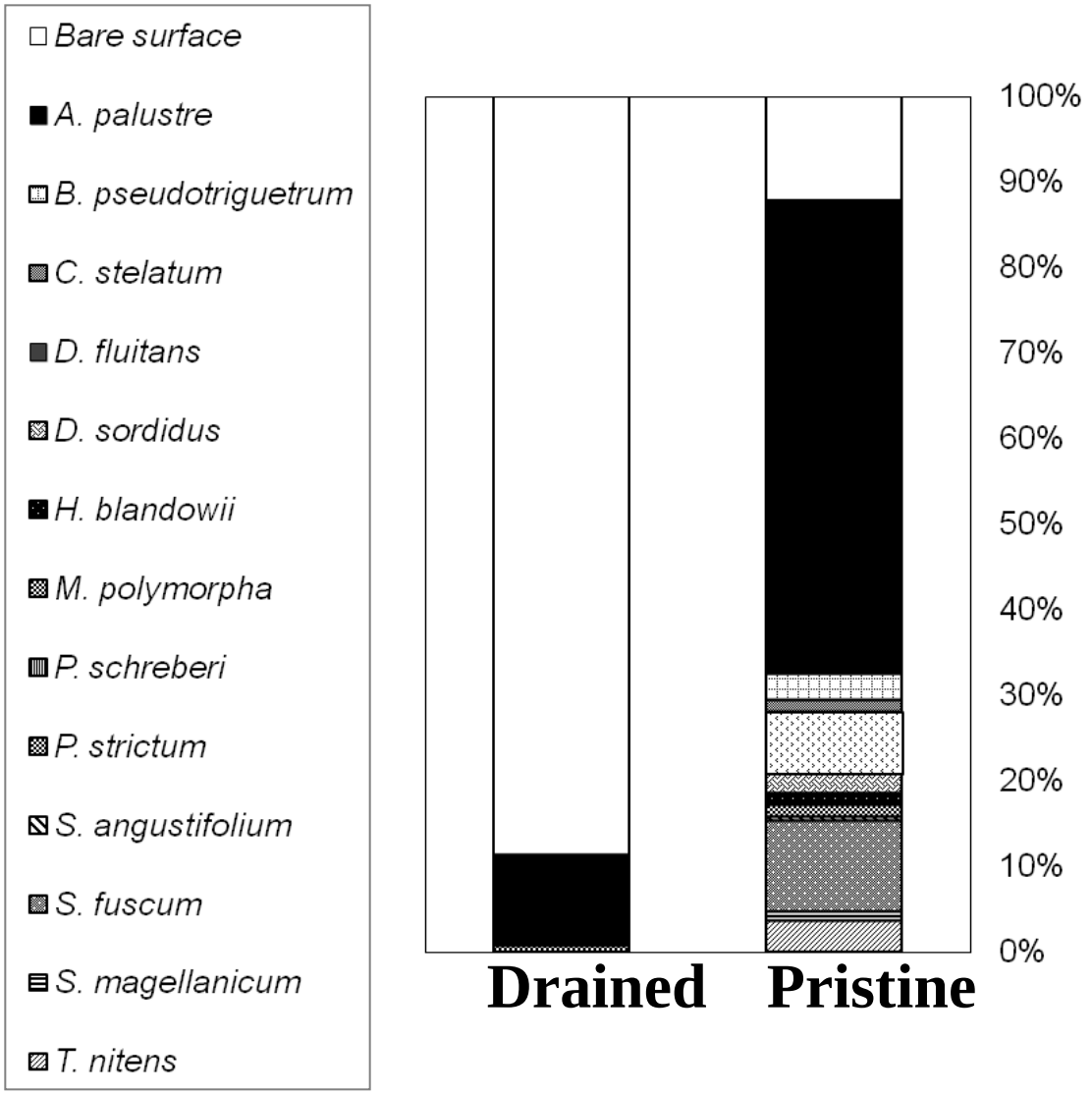
Combustion losses (kg C/m^2/yr)

Reference plots: 2.0 ± 0.5 kg C m^{-2}

Drained plots: 16.8 ± 0.2 kg C m^{-2}

Turetsky et al. 2011. Nature Communications

Drainage and successional pathways



- **No moss recovery**
- **No persistence of microtopography**
- **Loss of stabilizing factors = regime shift?**

Sherwood MSc 2012

Post-fire understory succession in drained areas

Conclusions

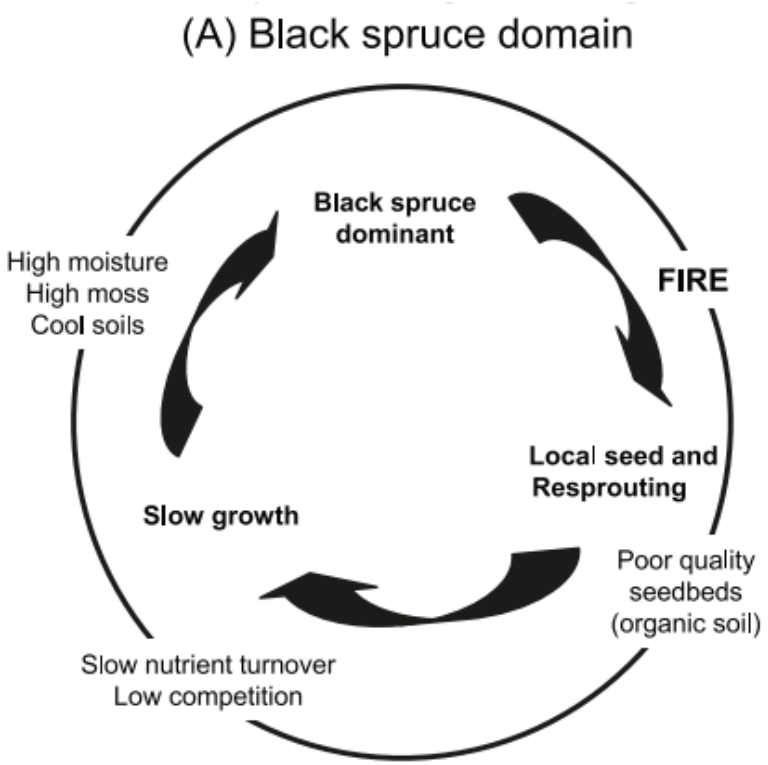
Are we at a tipping point?

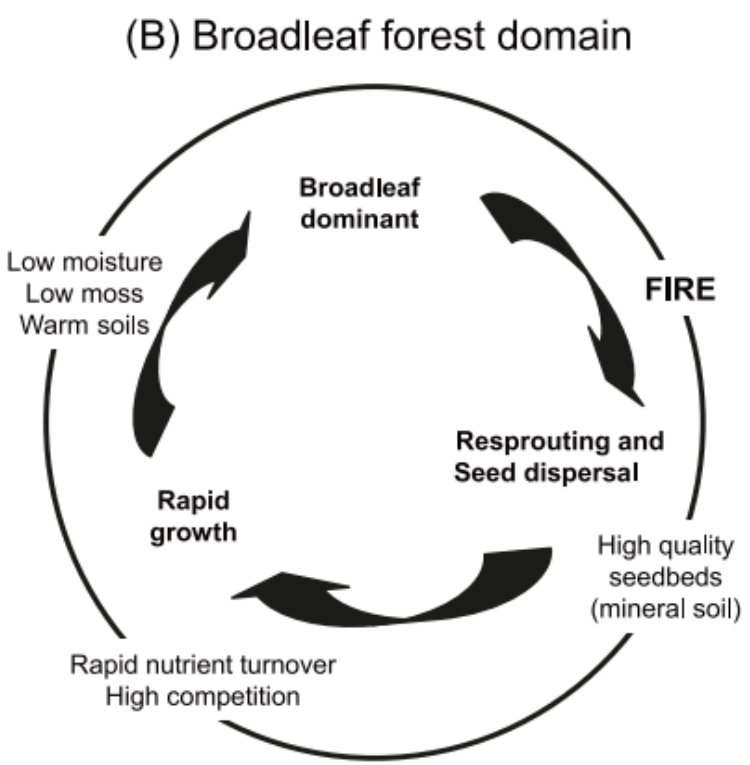
• In Alaska, flat lowlands have been resistant to deeper burning during late season fires, whereas drier landscape classes have experienced severe late season burning.

• However, drainage of a Canadian peatland increased combustion severity and caused the loss of old carbon.

• Drainage also impacted post-fire succession, leading to loss of the moss layer.

Key Issues:
Potential for Regime Shifts





Favoured after low severity fires

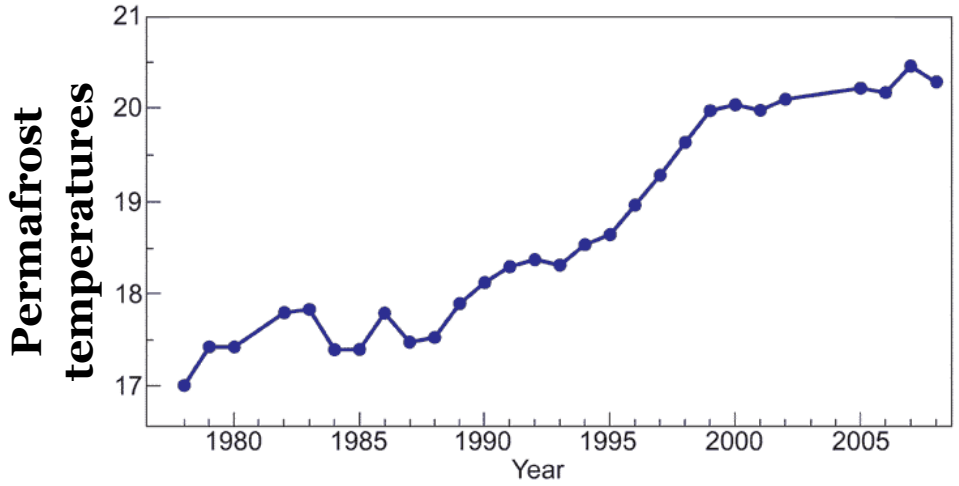
Favoured after high severity fires

Johnstone et al. 2010. Canadian J Forest Research

Key Issues:
Increases in Novel Burning Conditions

Anaktuvuk River Fire, Alaska

Key Issues:
Interactions between Permafrost & Fire



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