

Changing Landscapes: Fire and Caribou Habitat

Jill Johnstone

Northern Plant Ecology Lab

Whitehorse, Yukon

jfj.npel@gmail.com



UNIVERSITY OF
SASKATCHEWAN

Fire in the Taiga

- Fire is common throughout the forested taiga, and in some tundra regions
- Fires vary in severity and size
 - Crown and surface fires
 - Degree of smoldering combustion
 - Large fires are rare - but account for most area burned
- Ecological recovery affected by
 - Fire characteristics
 - Pre-fire community



Fire principally affects caribou by changing habitat quality

- Creates more open terrain (increased vulnerability to predators?)
- Fallen dead trees may impede movement in some burned patches
- Consumes forage & resets ecosystems to early succession
 - Fewer forage lichens available



Lichens and succession



Recovery of forage lichens requires several decades

- Timeline may vary among regions

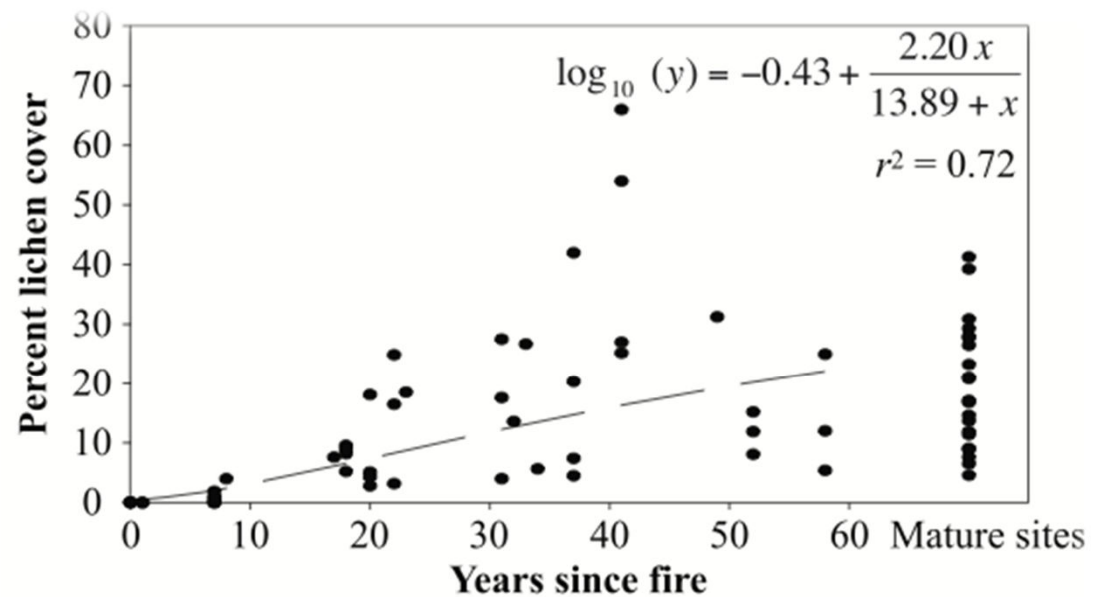


FIGURE 3. Relationship between time since fire and average percent lichen cover at 48 study sites in northern Alberta, Canada, as well as percent lichen cover at 25 mature stands.

Figure from Dunford, McLoughlin et al. 2006

Caribou in landscapes with fire

- Caribou adapt to fire by moving
 - Use different parts of the landscape according to habitat quality
 - Strategy has permitted coexistence for millennia
 - Variation among regions, and through time
- However, fire is sensitive to climate
 - Climate change has & will affect fire activity
 - Fire is part of the changing landscape for caribou



Caribou
vulnerability

Adaptive
capacity

Potential
Impact

Types of
changing
landscapes

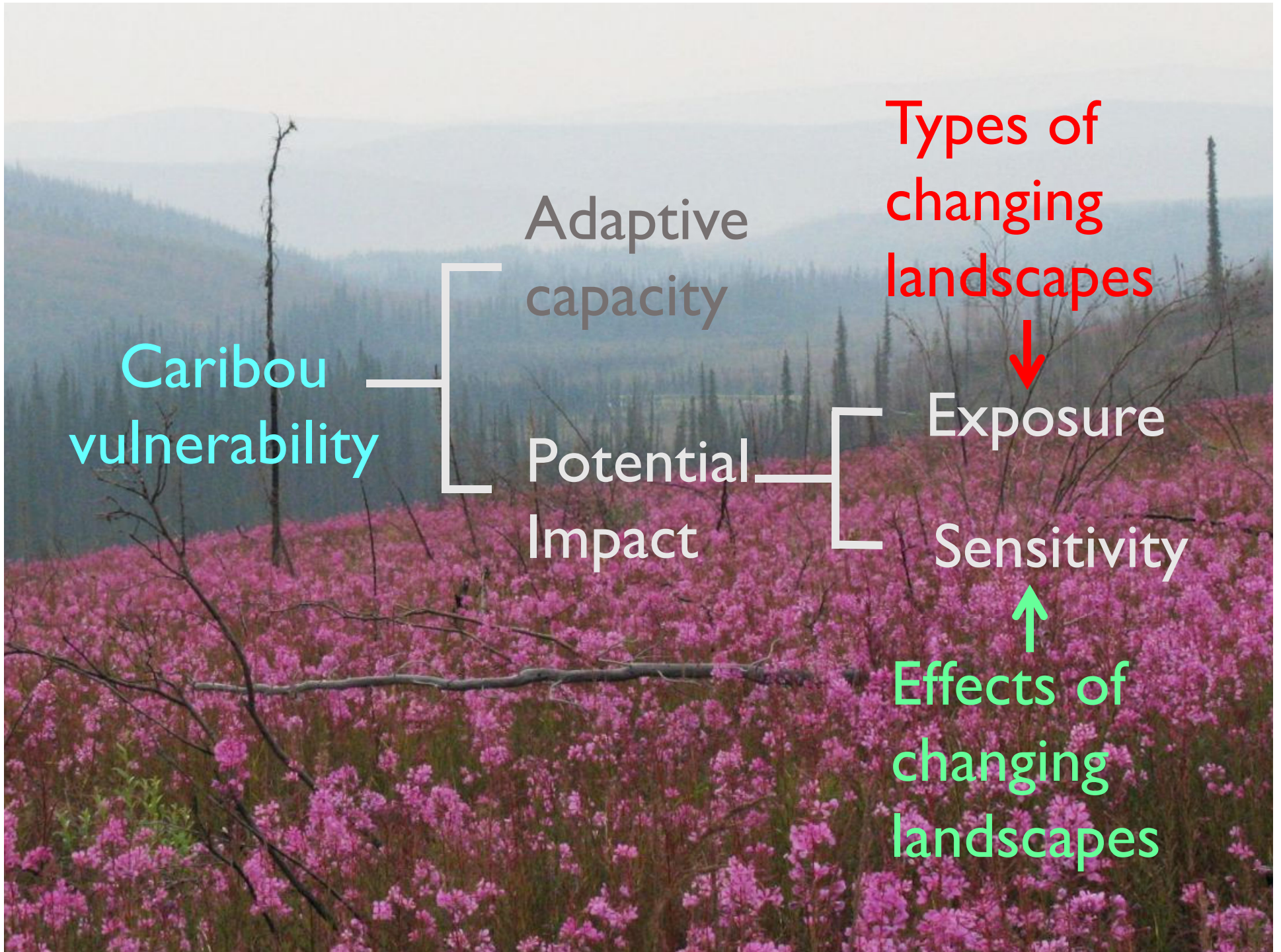


Exposure

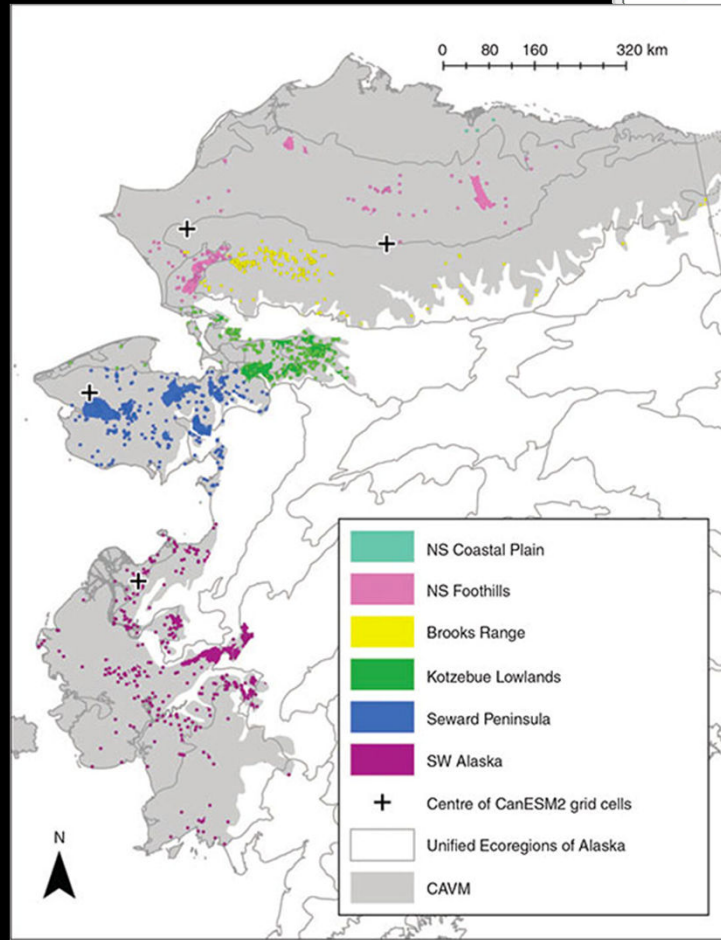
Sensitivity



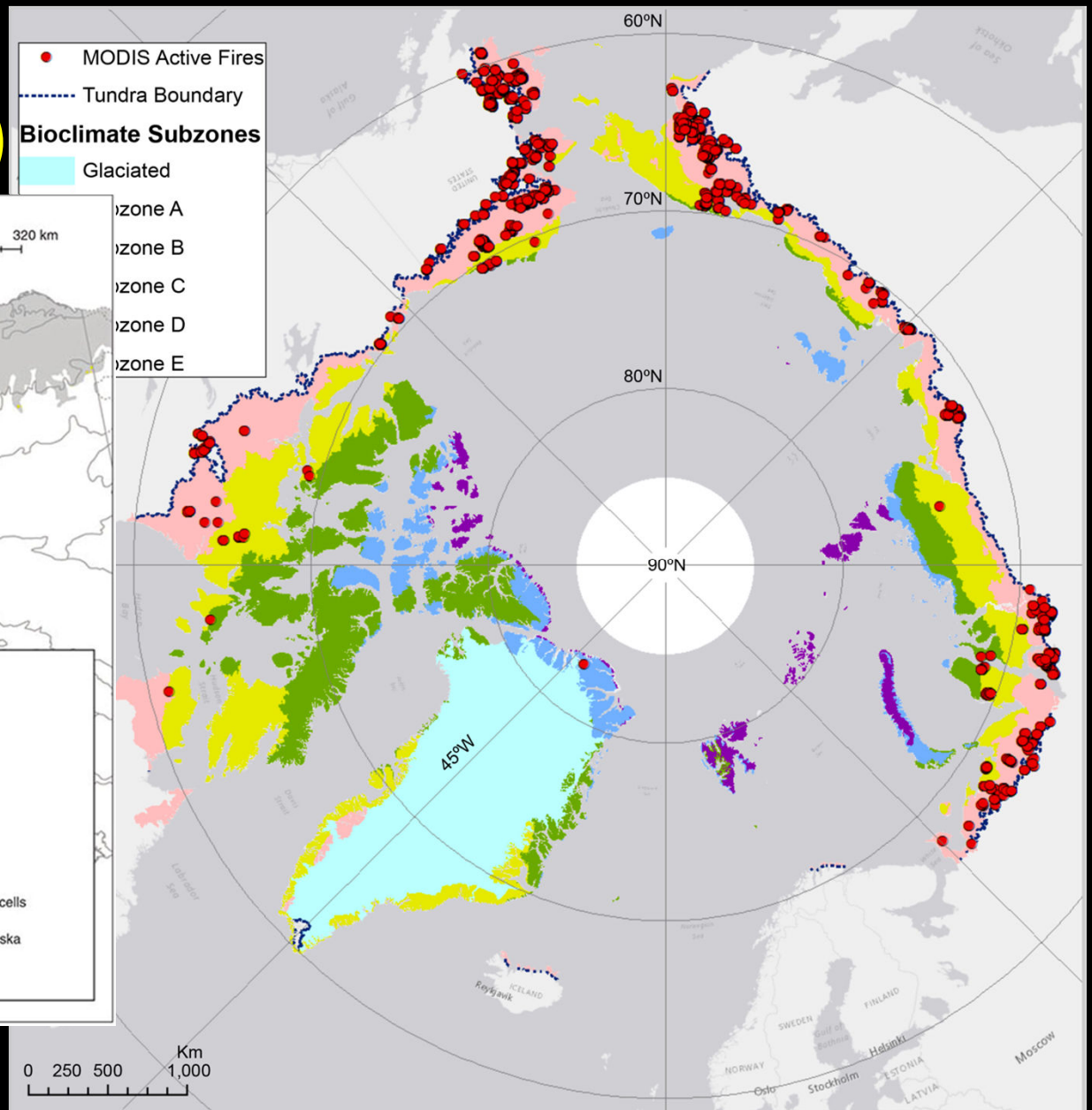
Effects of
changing
landscapes



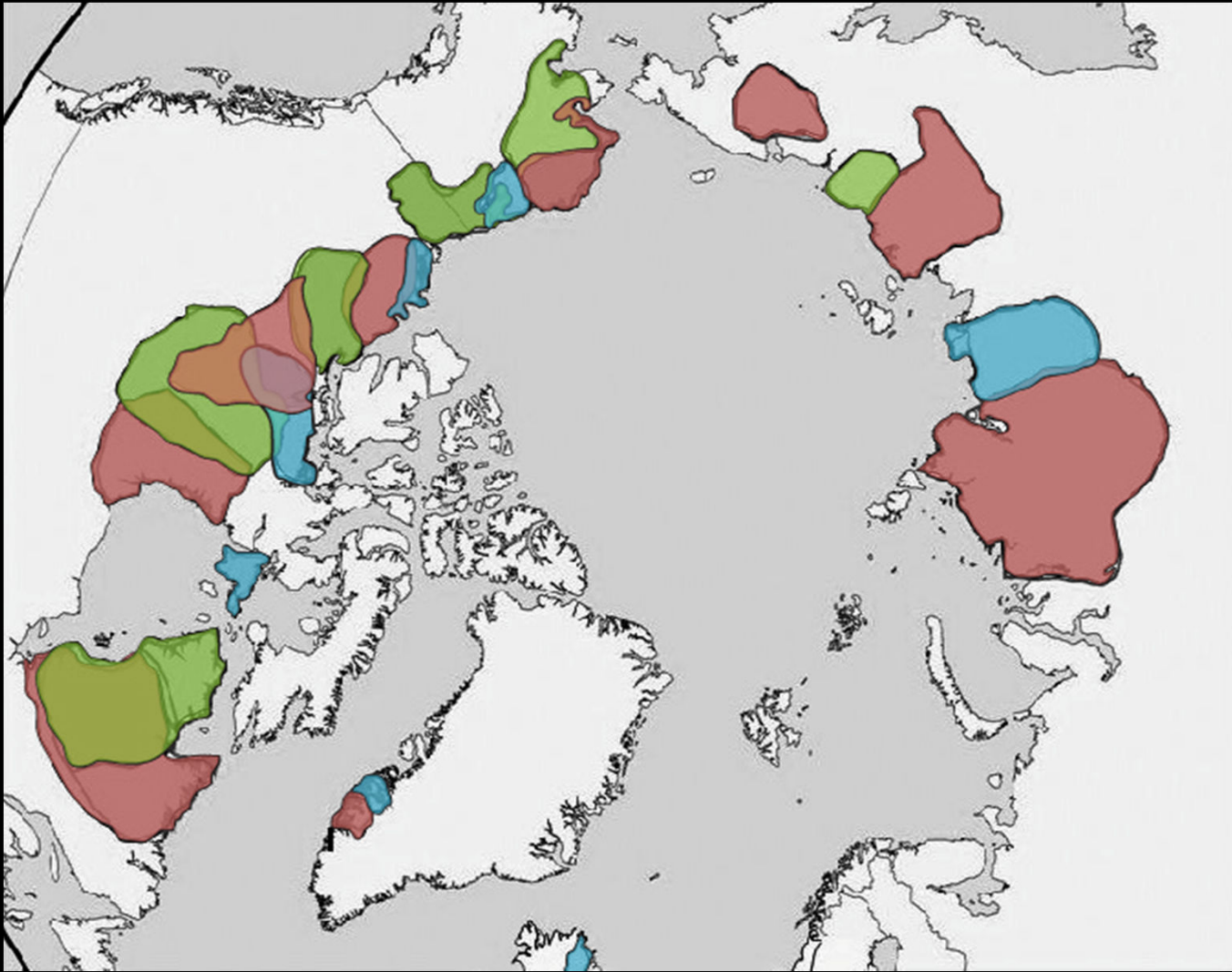
Tundra fires (summer range)



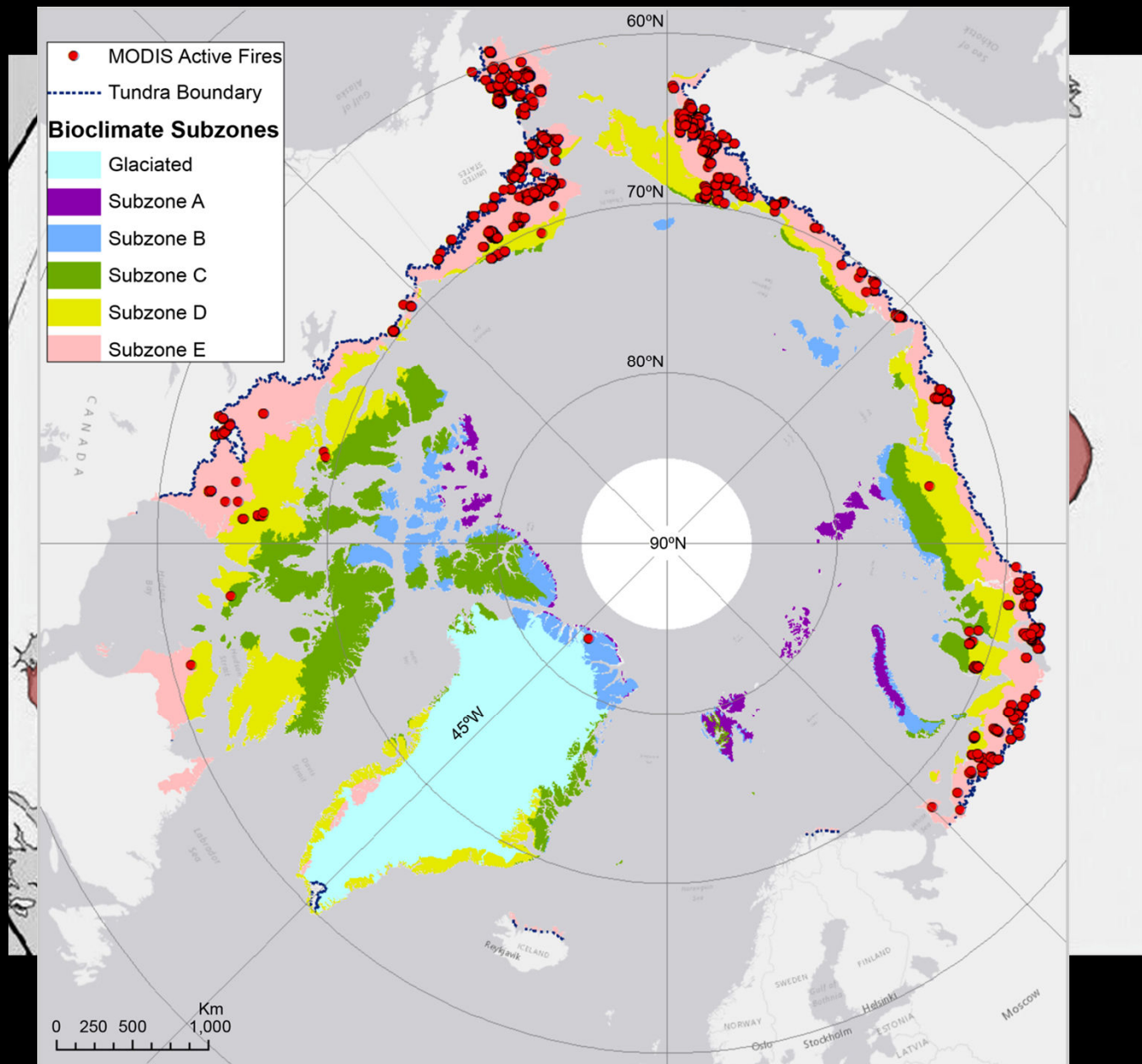
Past tundra fires in Alaska
(French et al. 2018 Int. J. Wildl. Fire.)



Fire events during 2001-2015, overlaid on Arctic bioclimatic zones
(Masrur et al. 2018 Env. Res. Lett.)

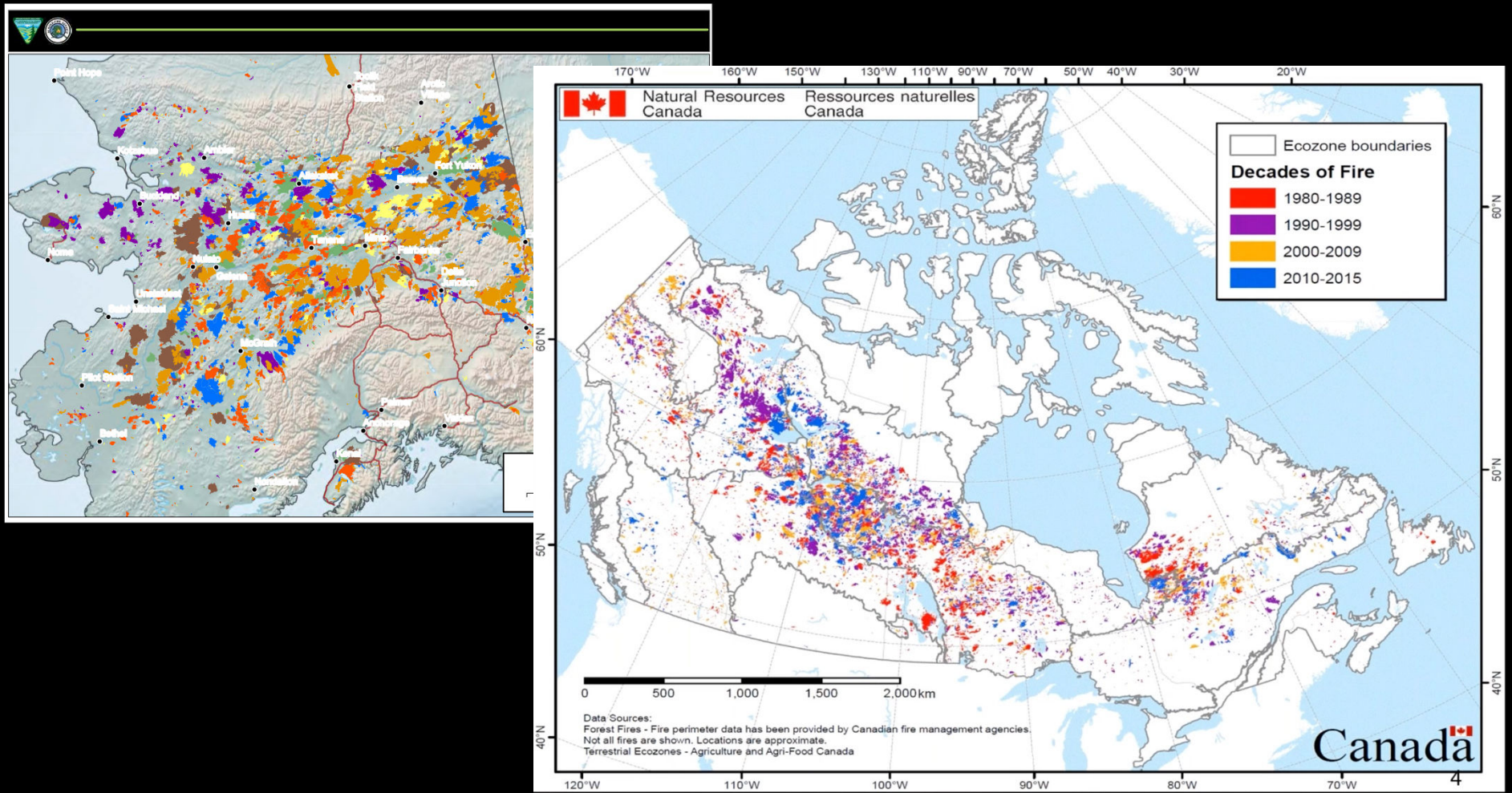


the CARMA caribou range map



Fire events during 2001-2015, overlaid with the CARMA caribou range map

Caribou exposure to wildfire – primarily an issue in wintering grounds



The changing fire landscape: what, why, how fast?



- Ignition and spread of fire requires suitable fuels
 - Weather (climate)
 - Vegetation (fuels)
- Changing climate means changing weather patterns
 - This affects fire patterns
 - Paleoecology
 - Models

Fire in the Past

- Paleoecology shows fire activity has varied through time
- Reconstructed changes from upper Yukon River, Alaska:
 - Fire extent
 - Fire frequency
 - Fire severity
 - Forest composition
- Recent increases in fire activity

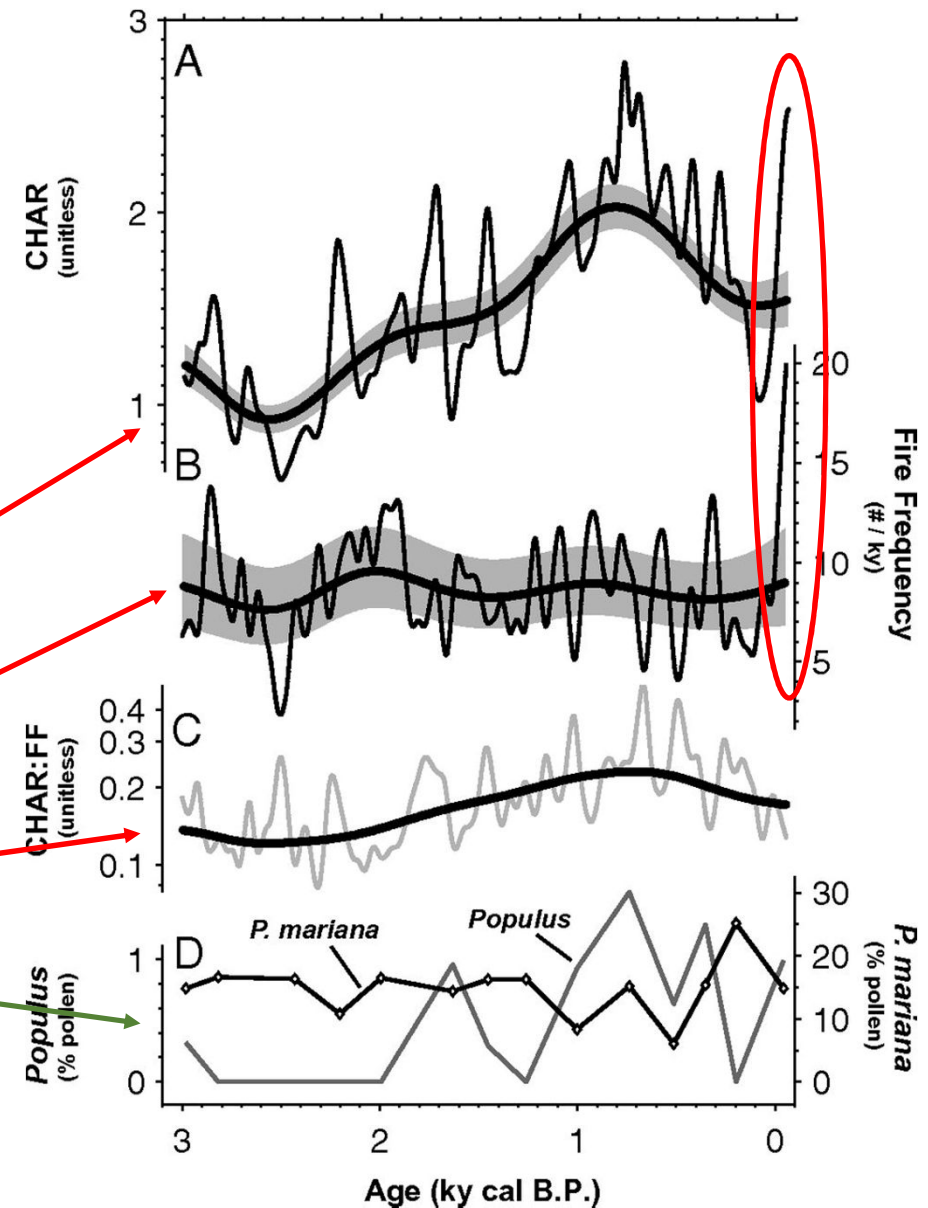
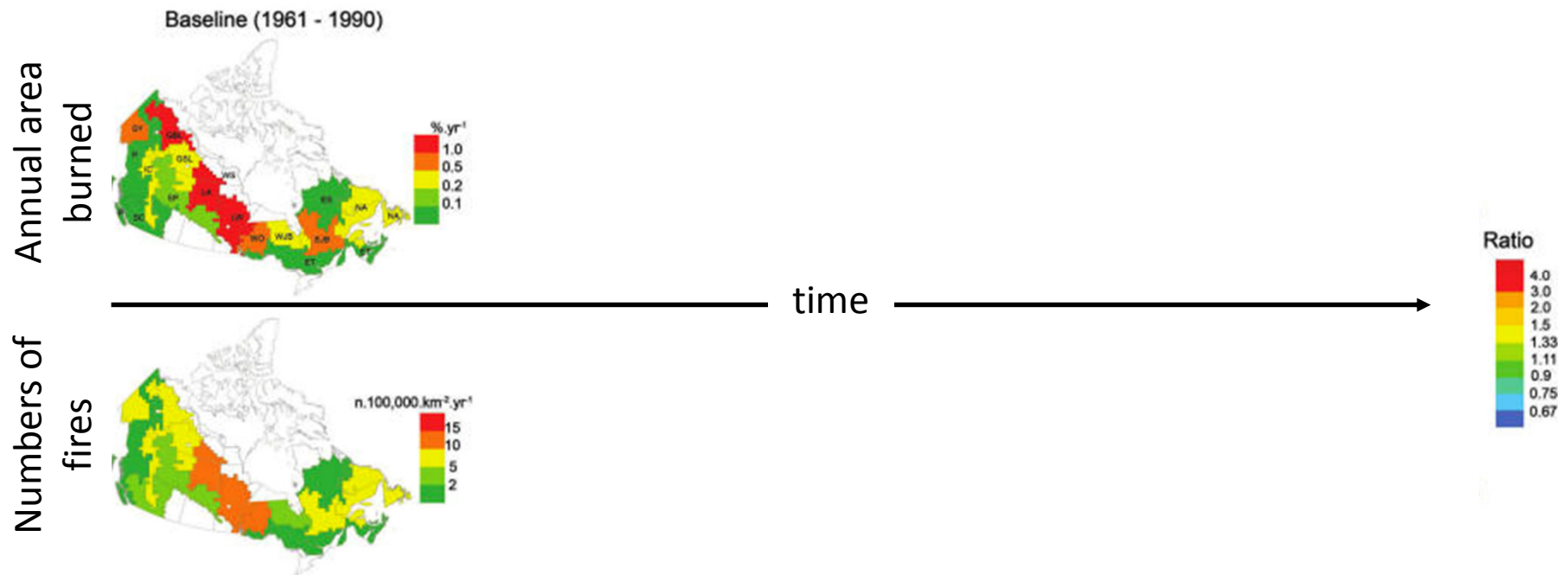


Figure from Kelly et al. 2013 PNAS

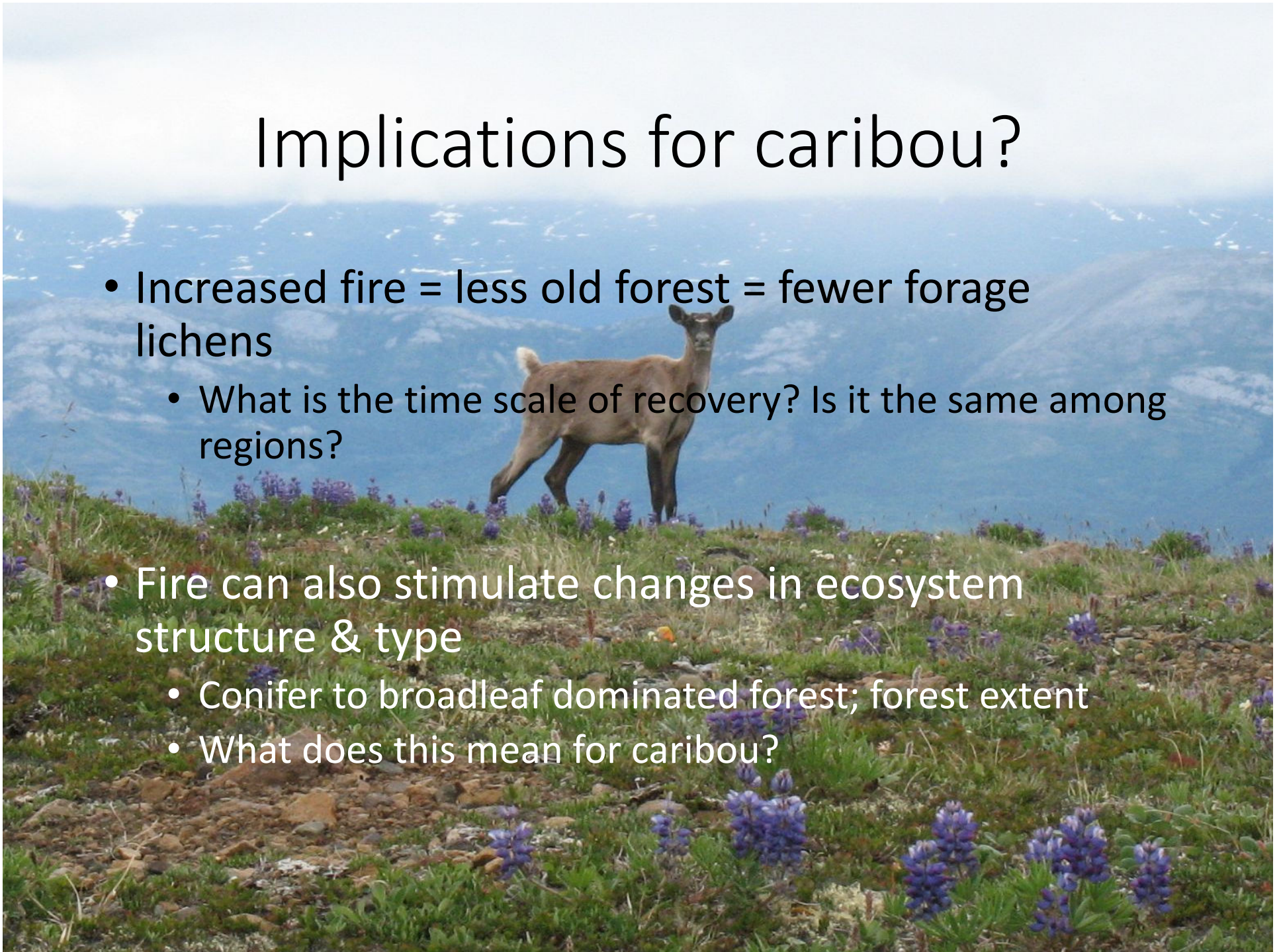
Expectations of Future Fire



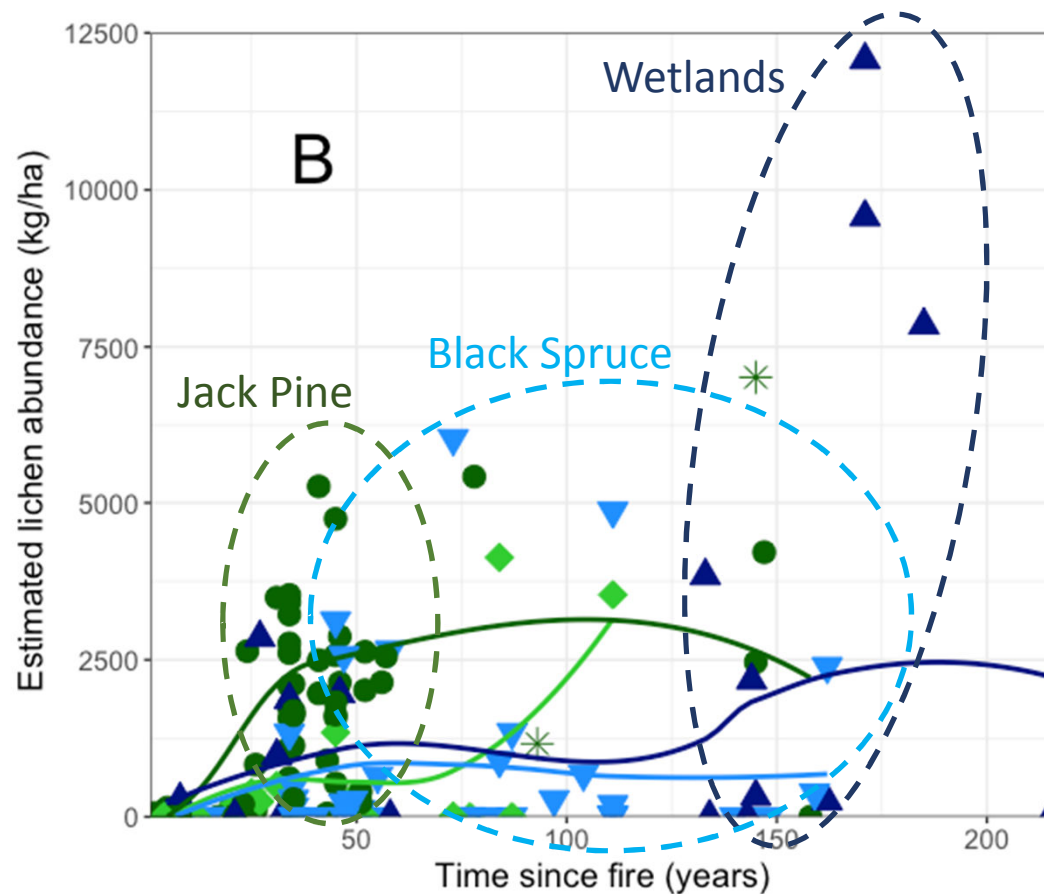
Projected changes in fire activity across Canada in coming decades
(Boulanger et al. 2014 Can. J. For. Res.)

Implications for caribou?

- Increased fire = less old forest = fewer forage lichens
 - What is the time scale of recovery? Is it the same among regions?
- Fire can also stimulate changes in ecosystem structure & type
 - Conifer to broadleaf dominated forest; forest extent
 - What does this mean for caribou?



Fire and lichen recovery

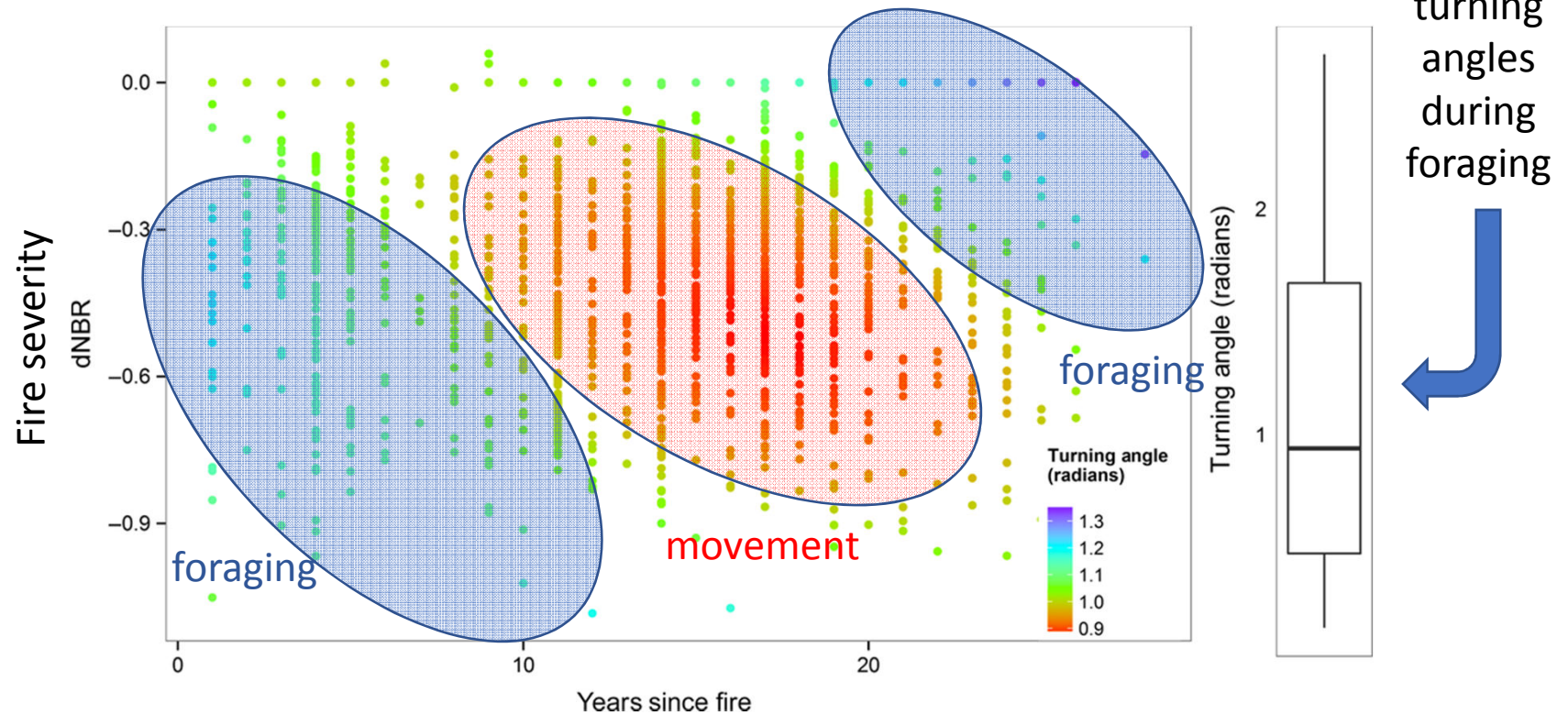


Forage lichen abundance in relation to forest age & type
in northern Saskatchewan

(Ruth Greuel, U. Saskatchewan MSc thesis 2018)



Caribou may respond to fire in complex ways



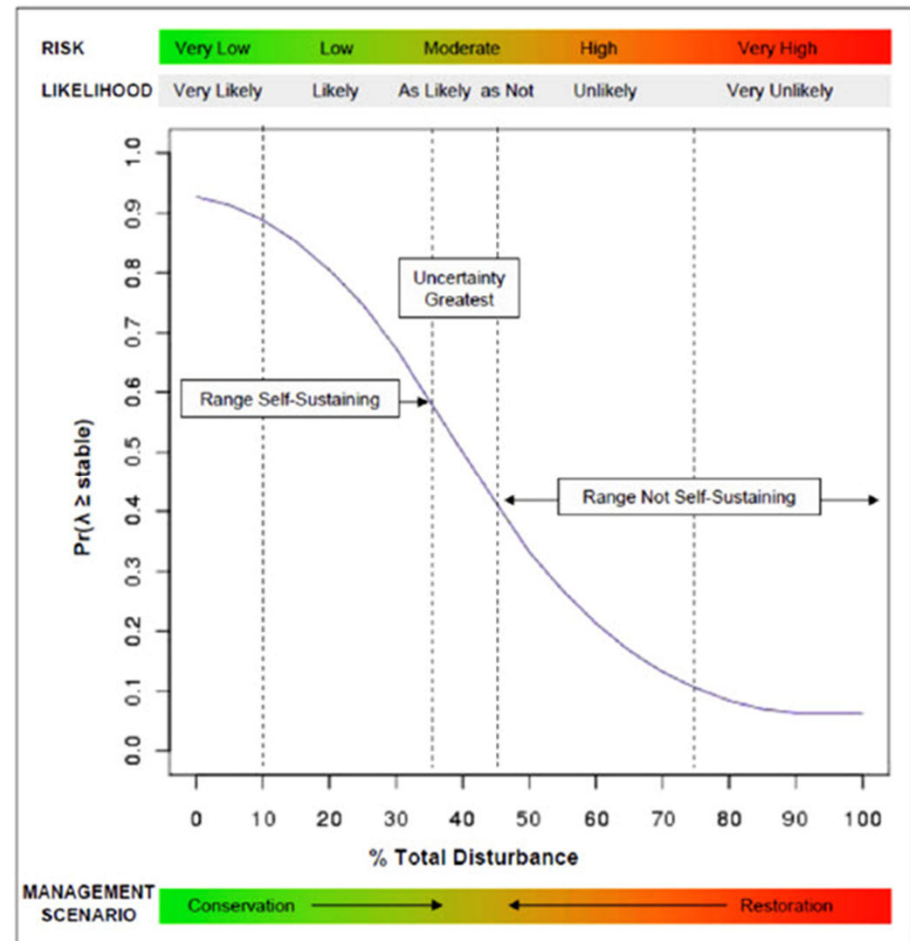
Caribou turning angles in relation to fire severity and time since fire

Telemetry data for NWT barren-ground caribou, 2006-2011.

(Rickbeil et al. 2017 Glob. Change Biol.)

Can we identify ecological thresholds?

- How much fire is too much for caribou?
 - Is fire disturbance functionally the same as human disturbance?
 - Does fire affect different caribou populations in the same way?
 - Does the nature of fire change that relationship?



Environment Canada's 2012 disturbance model for boreal caribou



Landscape approaches to support caribou resilience

- Protect fire-protected habitats
 - Wetlands, islands – often support very dense lichens
- Maintain movement flexibility
 - Access to large range area allows avoidance of burned areas
- Options for accelerated recovery?
 - Lichen seeding
- Consider synergies between disturbance and predation
 - Natural predators may increase in early successional habitats

Questions & Debate

