

Rangifer management controls a climate-sensitive tundra state transition

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Study system Low Arctic tundra bordering to the boreal

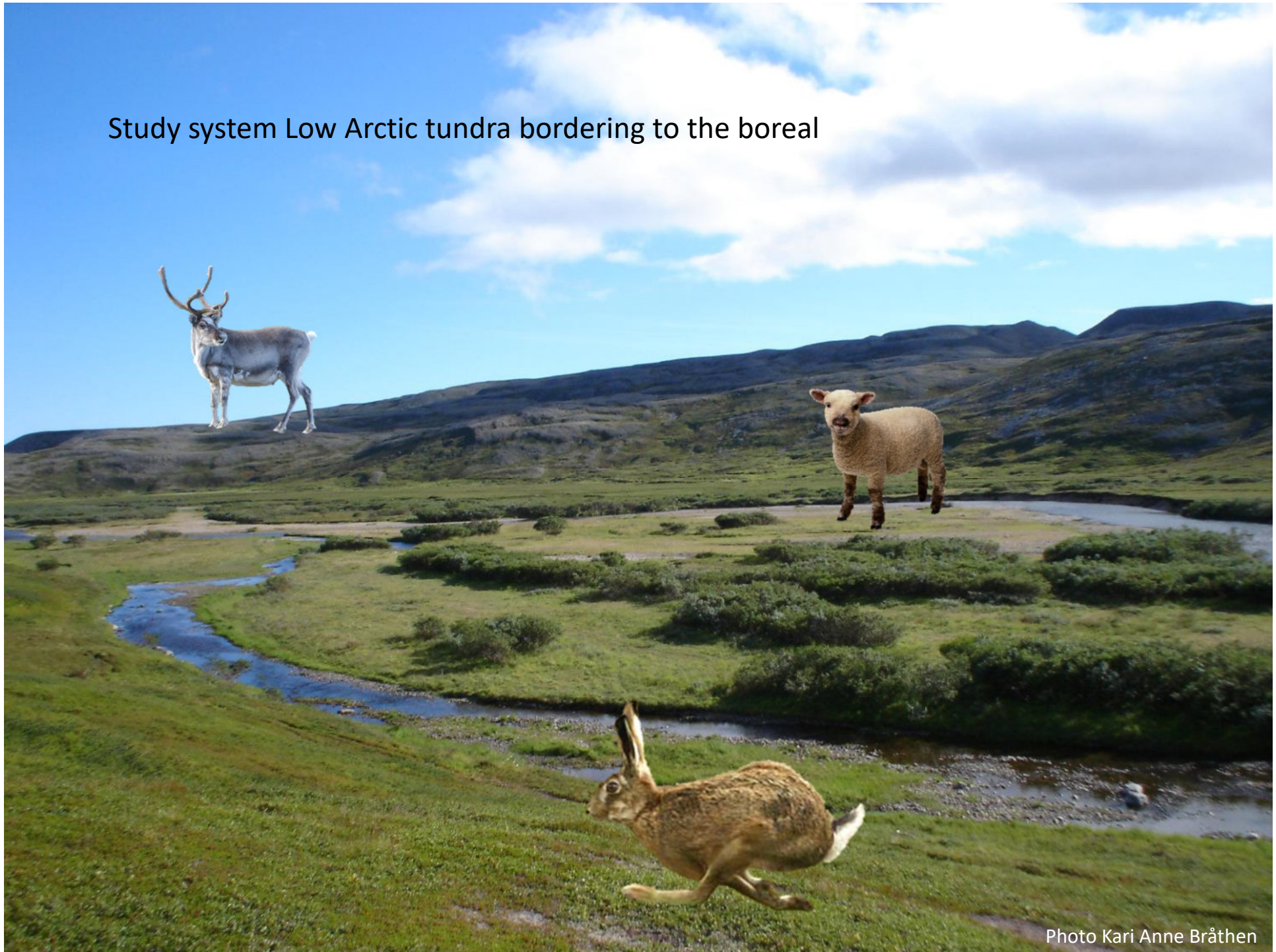


Photo Kari Anne Bråthen

Greening of the Arctic; the encroachment of shrubs or state shifts



Salix spp

Photo Geir Vie

Sturm et al 2001, 2005
Chapin et al 2005
Myers-Smith et al 2001, 2005
Etc.

Ecosystem state shifts caused by climate change

Greening of the Arctic; the encroachment of shrubs



Photo Dylan Karter



Photo Geir Vie

The state shift is a change in abundance

The encroachment of shrubs; consequences

Browsing

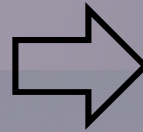


No change



The encroachment of shrubs; consequences

Encroachment evident

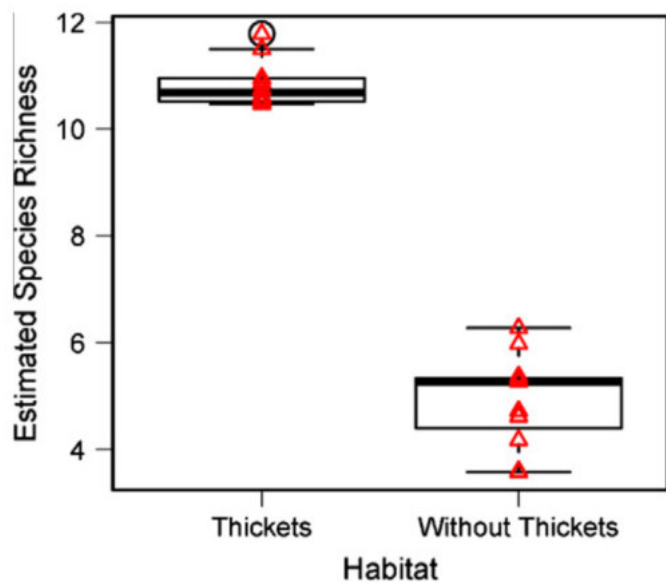


Climate feedback



Varangerhalvøya april 2008
Foto Rolf Anker Ims

The encroachment of shrubs; consequences

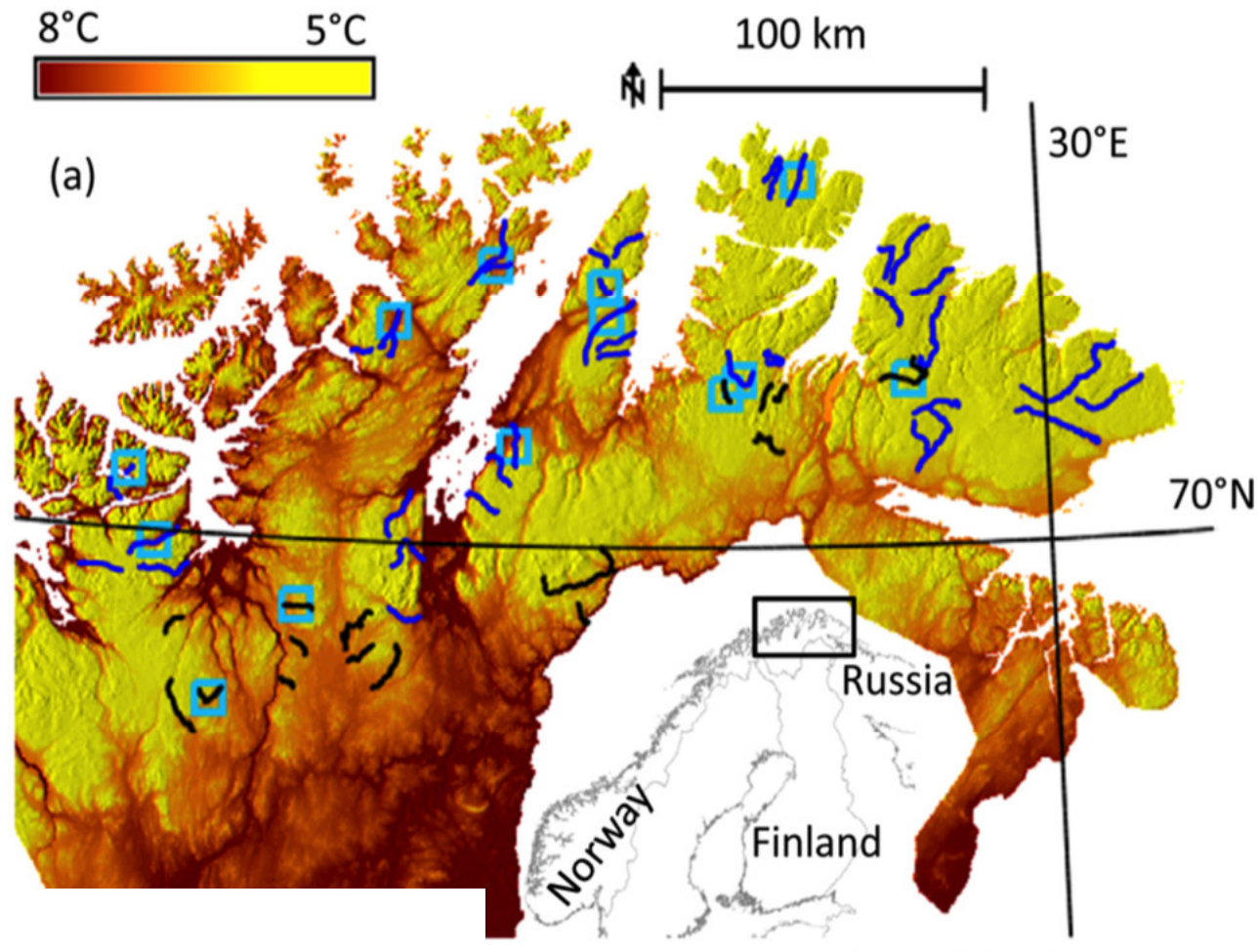


Ims and Henden 2012



Photo Francisco Murguzur

A regional scale survey to disentangle temperature and browsing effect



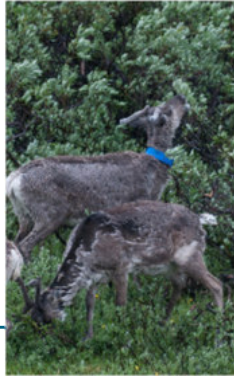
Focus: tall shrub patches and small recruits of shrubs in the grasslands



Photo Geir Vie

What happens to small shrubs (before they grow big) determines shrub encroachment

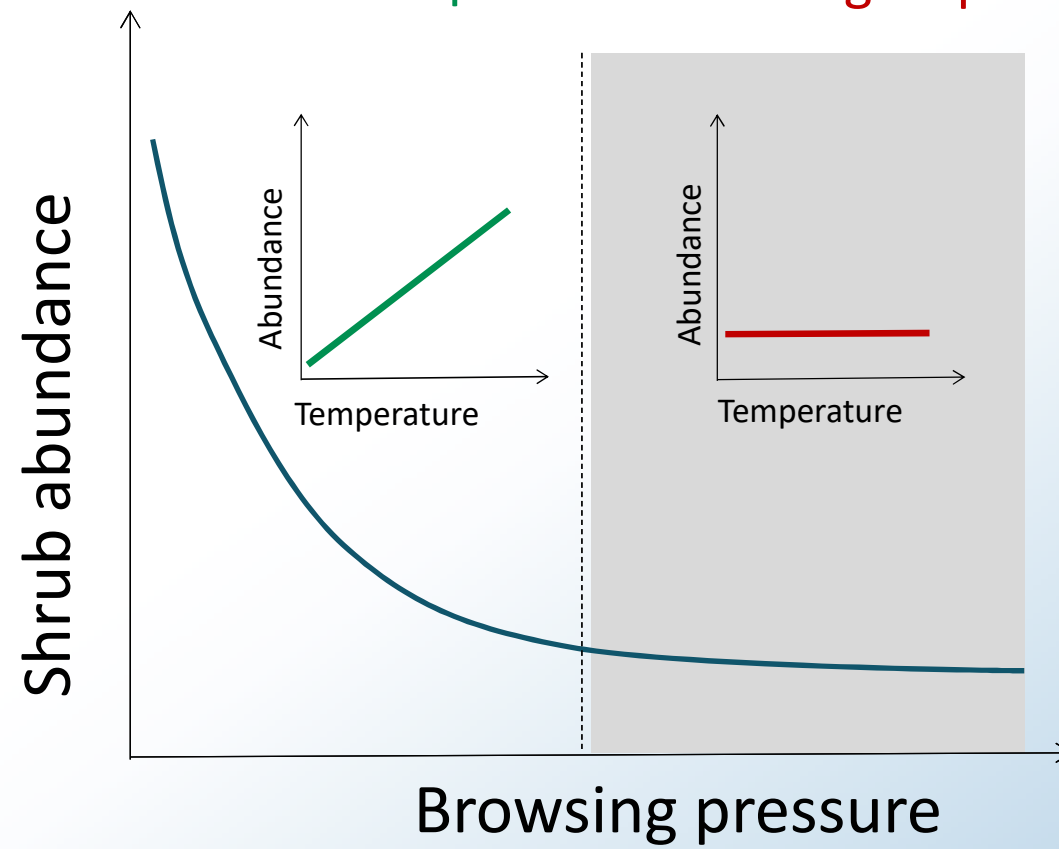




Escape



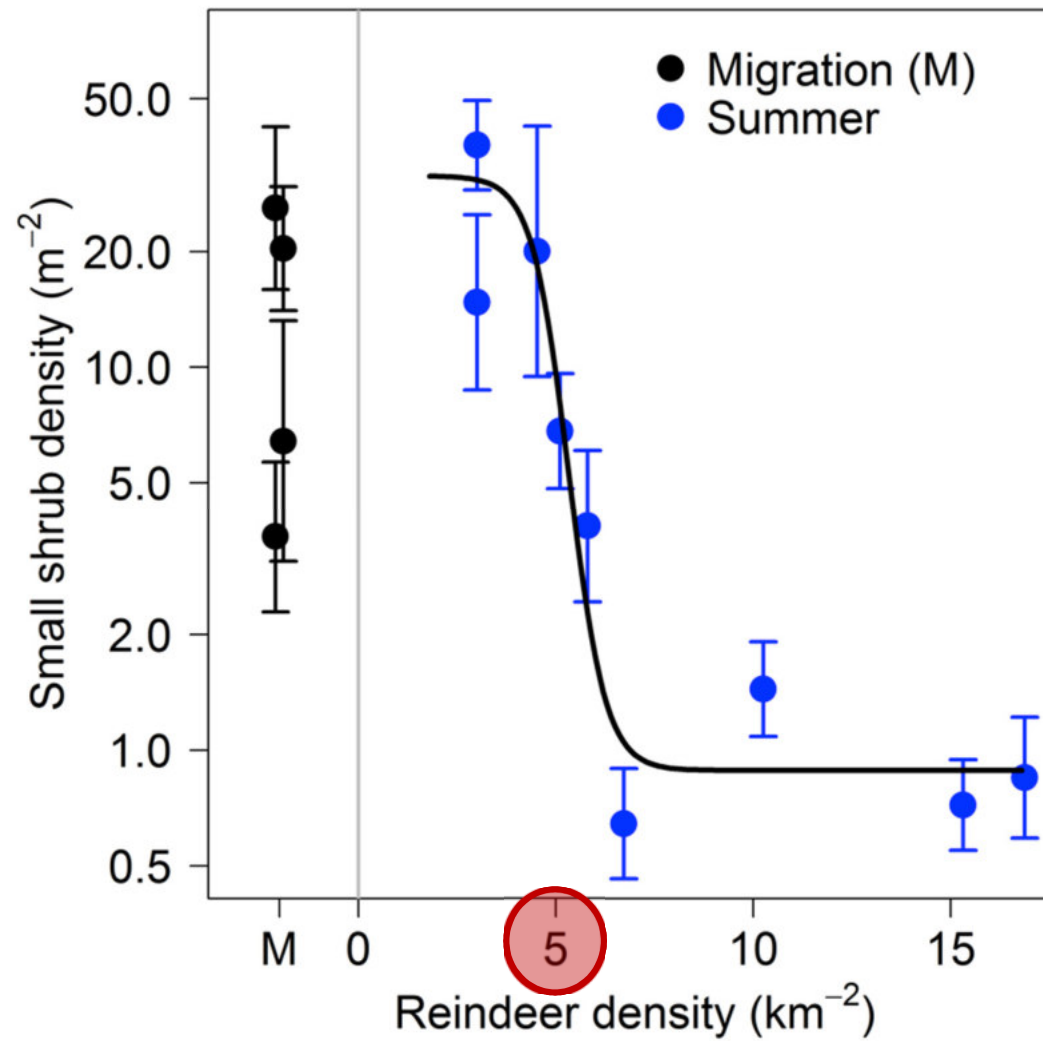
Browsing trap



Small shrubs
(before they grow big)



(a)

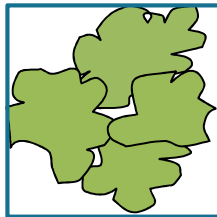


STATE SHIFT

Tall
life stage

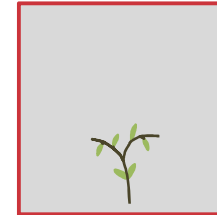


High infilling
↓
Shrubland

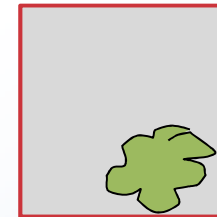


NO STATE SHIFT

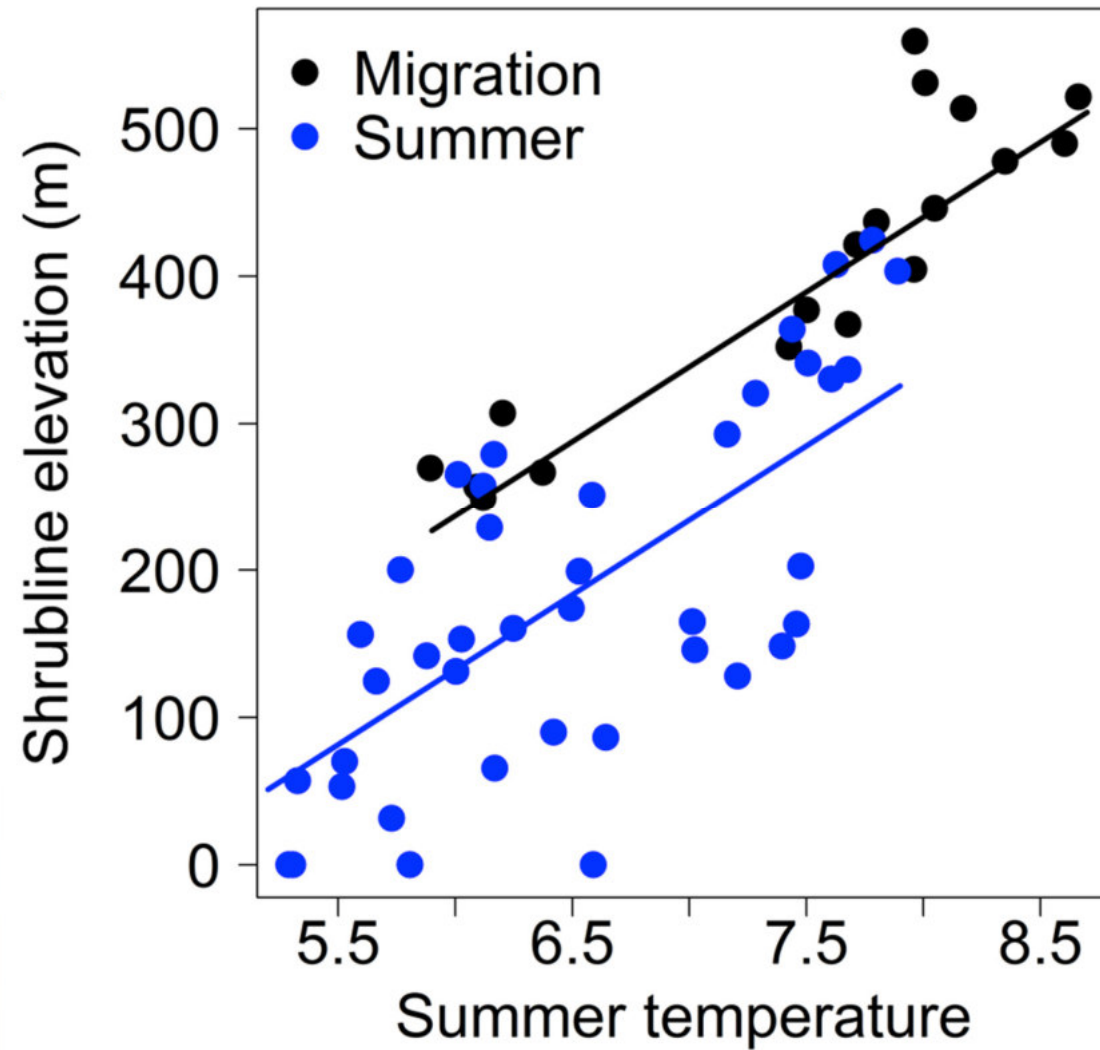
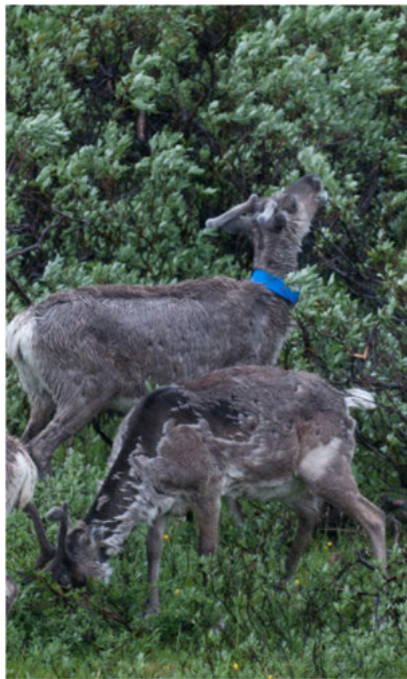
Small
life stage



Low infilling
↓
Grassland



Presence of reindeer in summer causes larger scale patterns



SHRUBLAND STATE



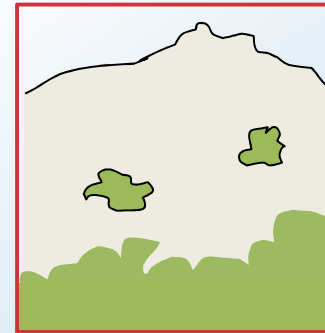
Advancing
shrub-line



GRASSLAND STATE



Arrested
shrub-line



See Climate-ecological Observatory for Arctic Tundra – www.coat.no for monitoring

Acknowledgments

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