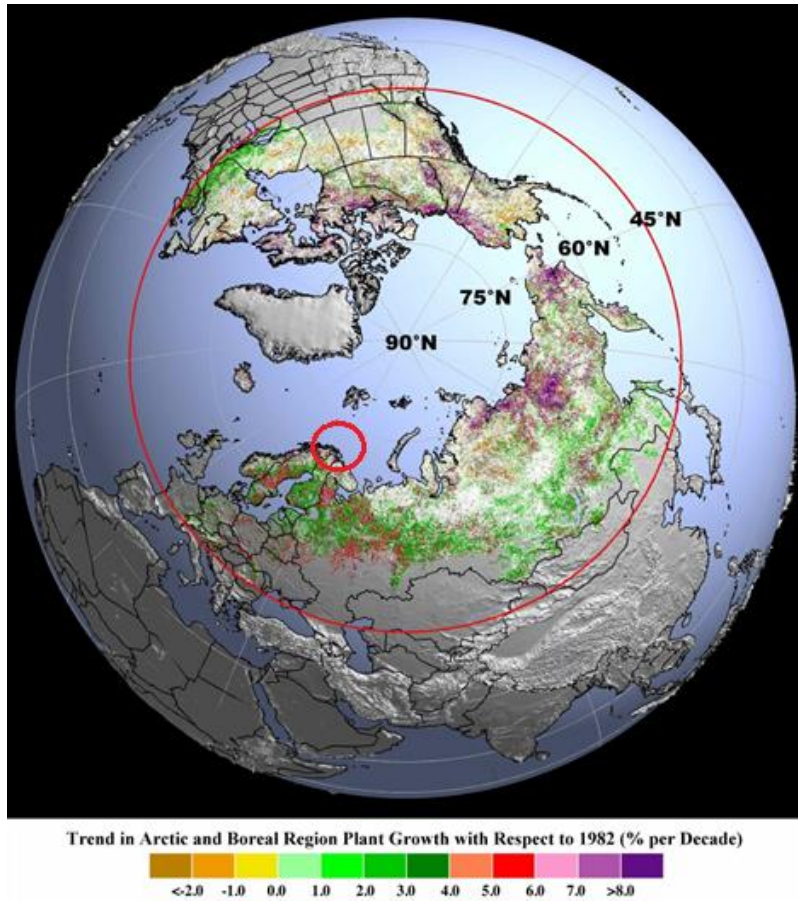




On Social aspects on reindeer disease problems – The contribution of traditional knowledge in counteracting climate sensitive infections

Hans Tømmervik, NINA and Jan Åge Riseth , Norut

Increase of plant growth per decade- 1982-2011



Greening/productivity
increased in 32-39% of the
Arctic

Browning: < 4%

Stable: 57-64%

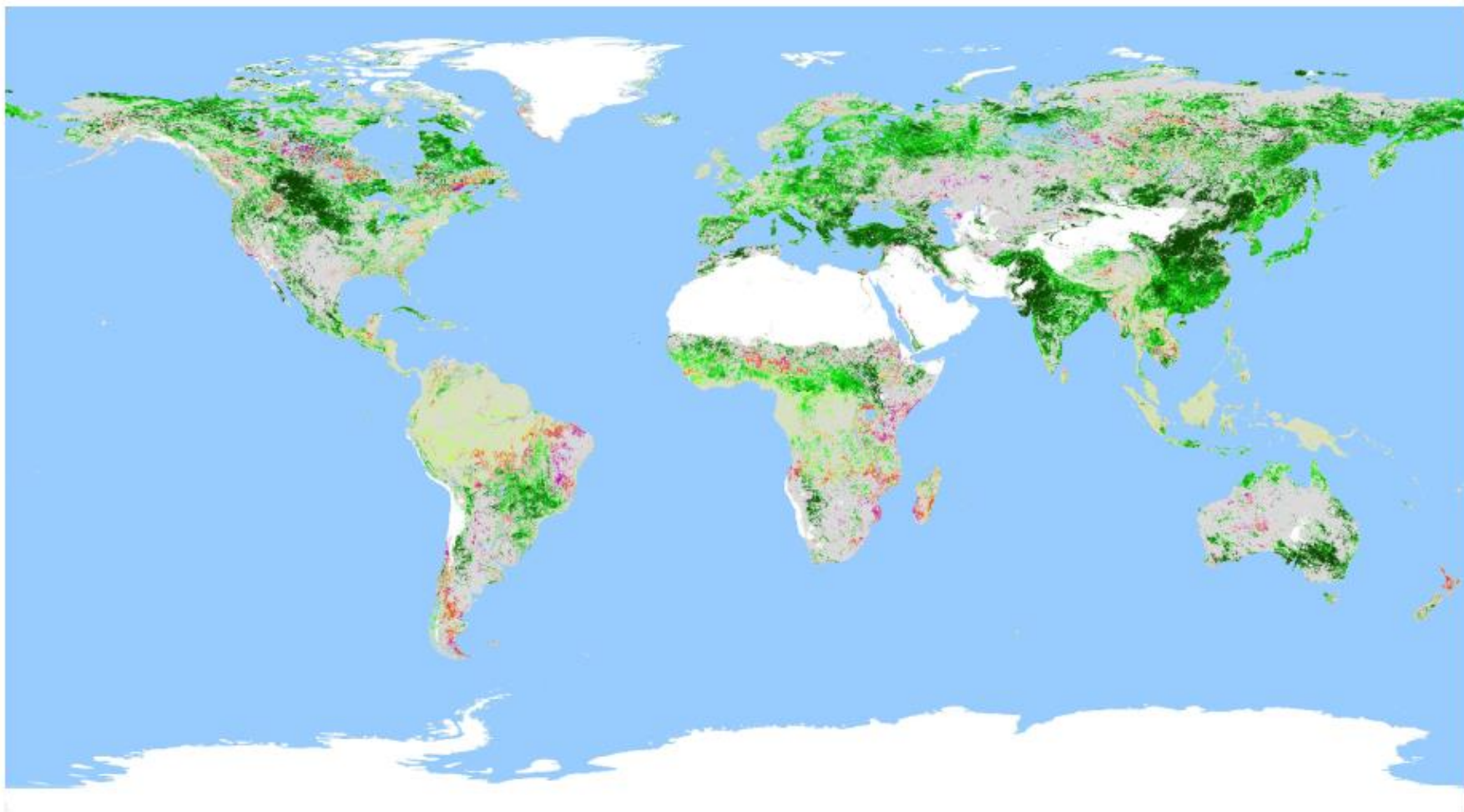
nature
climate change

LETTERS

PUBLISHED ONLINE: 10 MARCH 2013 | DOI:10.1038/NCLIMATE1836

Temperature and vegetation seasonality diminishment over northern lands

L. Xu^{1*}, R. B. Myneni^{1*}, F. S. Chapin III², T. V. Callaghan^{3,4}, J. E. Pinzon⁵, C. J. Tucker⁵, Z. Zhu¹, J. Bi¹, P. Ciais⁶, H. Tømmervik⁷, E. S. Euskirchen², B. C. Forbes⁸, S. L. Piao^{9,10}, B. T. Anderson¹, S. Ganguly¹¹, R. R. Nemani¹², S. J. Goetz¹³, P. S. A. Beck¹³, A. G. Bunn¹⁴, C. Cao^{15,16} and J. C. Stroeve¹⁷



<-14.0 -9.4 -6.7 -4.7 -2.9 0.0 3.8 5.3 6.6 7.8 9.1 10.6 12.5 15.4 >20.6

Trend in annual average LAI with respect to climatology ($\% \text{ decade}^{-1}$)

The rate and magnitude of climate change (CC) are greater in northern regions than elsewhere.

Sensitive ecosystems

- low biodiversity
- highly specialized species



«Shrubification»: From heath to shrubs and forests



[Abisko](#), Sweden (Photo: [Prof. Terry Callaghan - EU-Interact](#))

Reduction of open and free reindeer ranges may induce spread of blood sucking ticks and spread of diseases (CSIs) mainly along the coast



The forest/treeline study

A. Hofgaard et al.

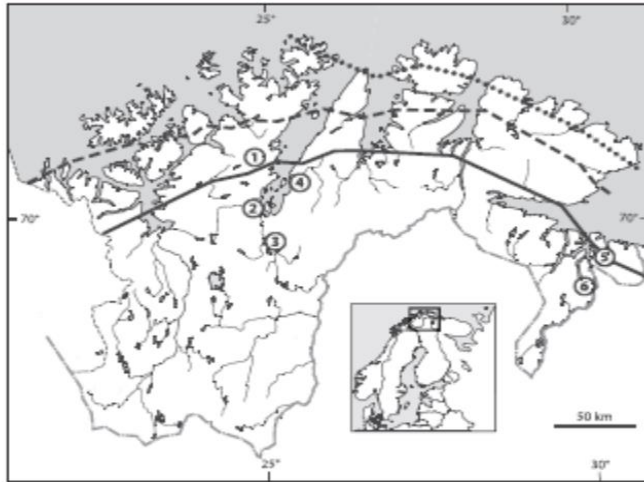


Figure 1 The study region of Finnmark county in northern Norway with commonly cited and used latitudinal delineations for birch forest (---) and pine forest (—) according to Hustich (1983; no. 4 in Table 1), and southern limit of arctic tundra (....) according to the Circumpolar Arctic Vegetation Map (CAVM Team, 2003; no. 15 in Table 1). Encircled numbers indicate test sites used for land cover type classification (1, Smørfjordeidet; 2, Stabbursnes; 3, Porsangmoen; 4, Børselv; 5, Jarfjord; 6, Pasvik). The inset map show location of the study region in north-western Europe.



Journal of Biogeography (*J. Biogeogr.*) (2013) **40**, 938–949

**ORIGINAL
ARTICLE**

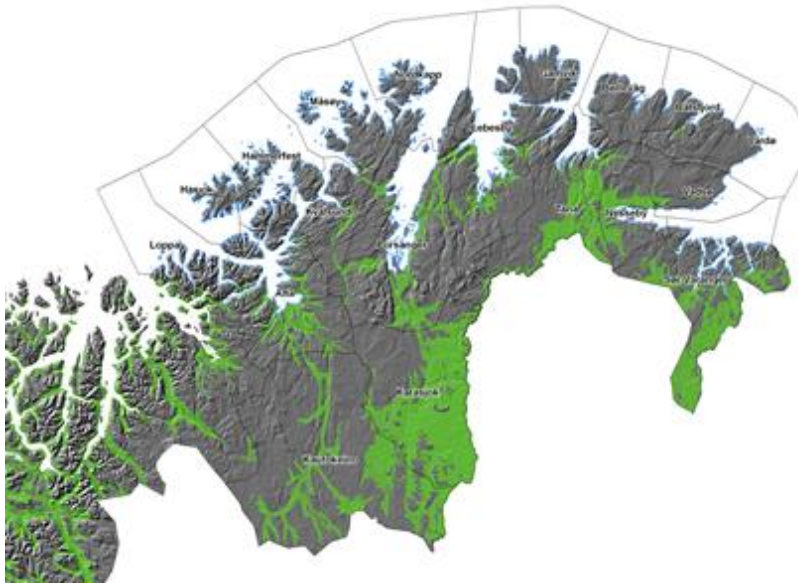


**Latitudinal forest advance in
northernmost Norway since the early
20th century**

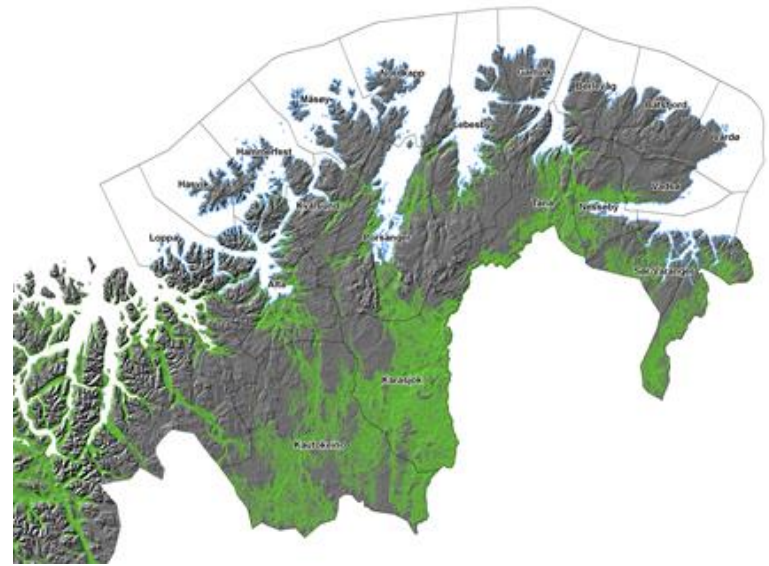
Annika Hofgaard^{1*}, Hans Tømmervik², Gareth Rees³ and Frank Hansen¹

Forest cover in Finnmark county

1914



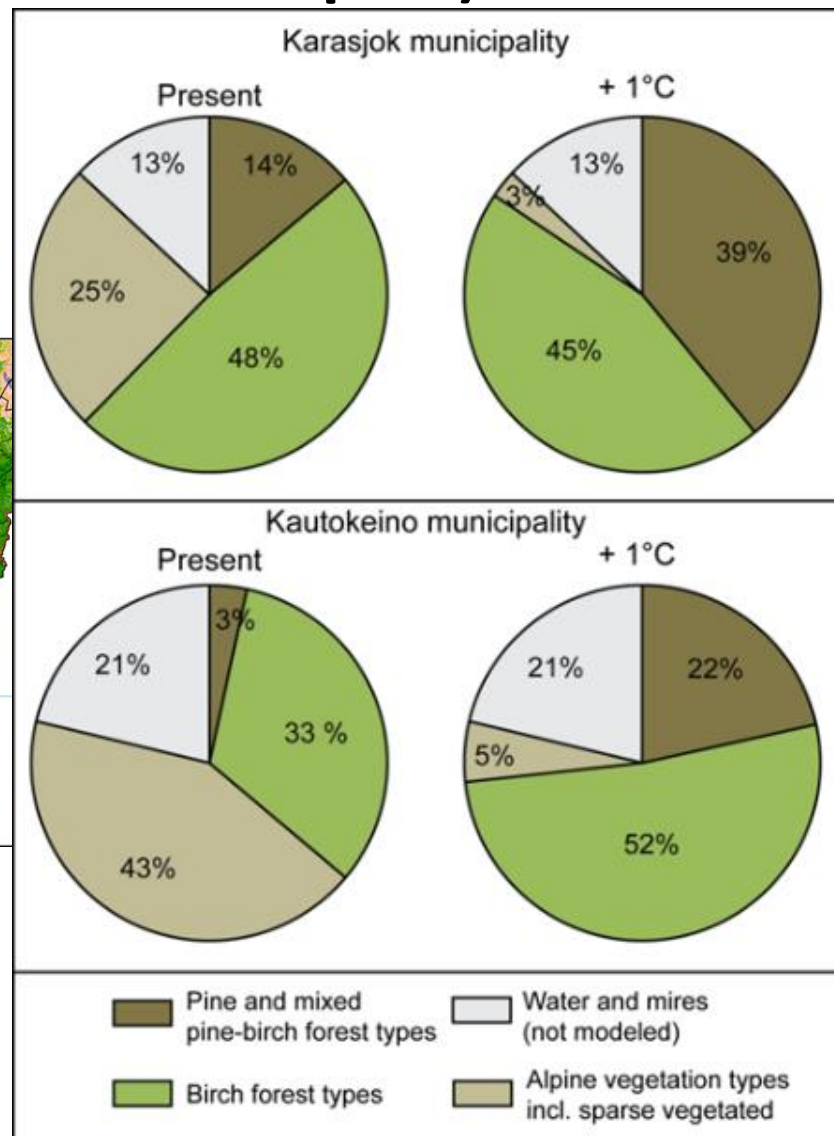
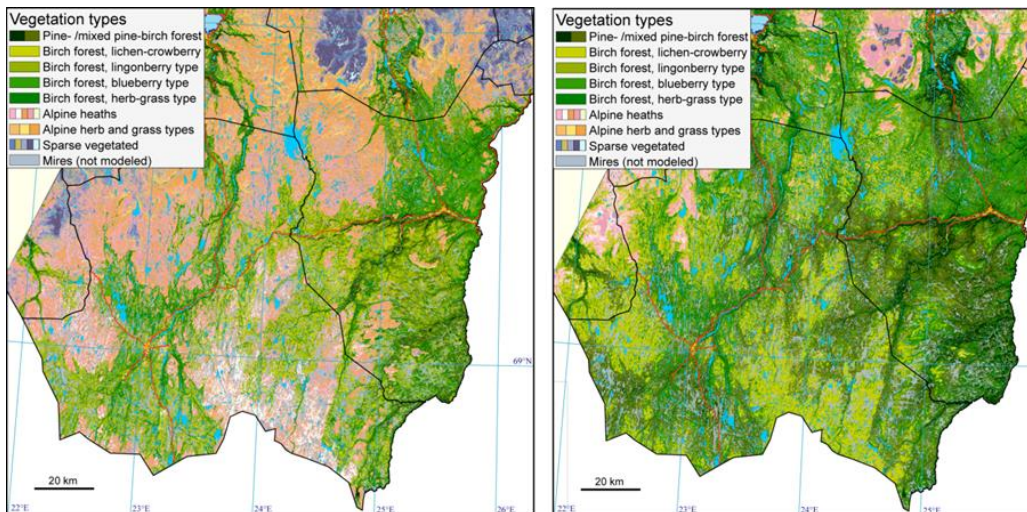
2012



Birch forest change 1914-2012:

«Greening»: Shrubification and latitudinal/altitudinal change of tree and forest line (birch and pine)

Scenario: Forest cover in 2100 versus 2000



Advance View
<https://doi.org/10.3354/c091459>
 CLIMATE RESEARCH
 Clim Res
 Available online:
 May 18, 2017

Contribution to CR Special 34 SENSFOR: Resilience in SENSitive mountain FORest ecosystems under environmental change

OPEN ACCESS

Future forest distribution on Finnmarksvidda, North Norway

Stein Rune Karlsen^{1,*}, Hans Tømmervik², Bernt Johansen¹, Jan Åge Riseth¹

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Ticks are sensitive to ecosystem effects

- Temp., humidity, vegetation, snow cover, animals to feed on...
- Ticks - changed distribution to higher latitudes (Lindgren et al., 2000, Jore et al., 2014)
- Borreliosis/Lyme diseases,
 - Rodents are a reservoir species
 - Deer, humans and other species are mostly "dead end host"



CC is likely to **push the geographic boundaries of climate sensitive infections (CSIs) northward**, thereby increasing the potential for inhabitant humans and animals to be exposed to new and/or existing CSIs.



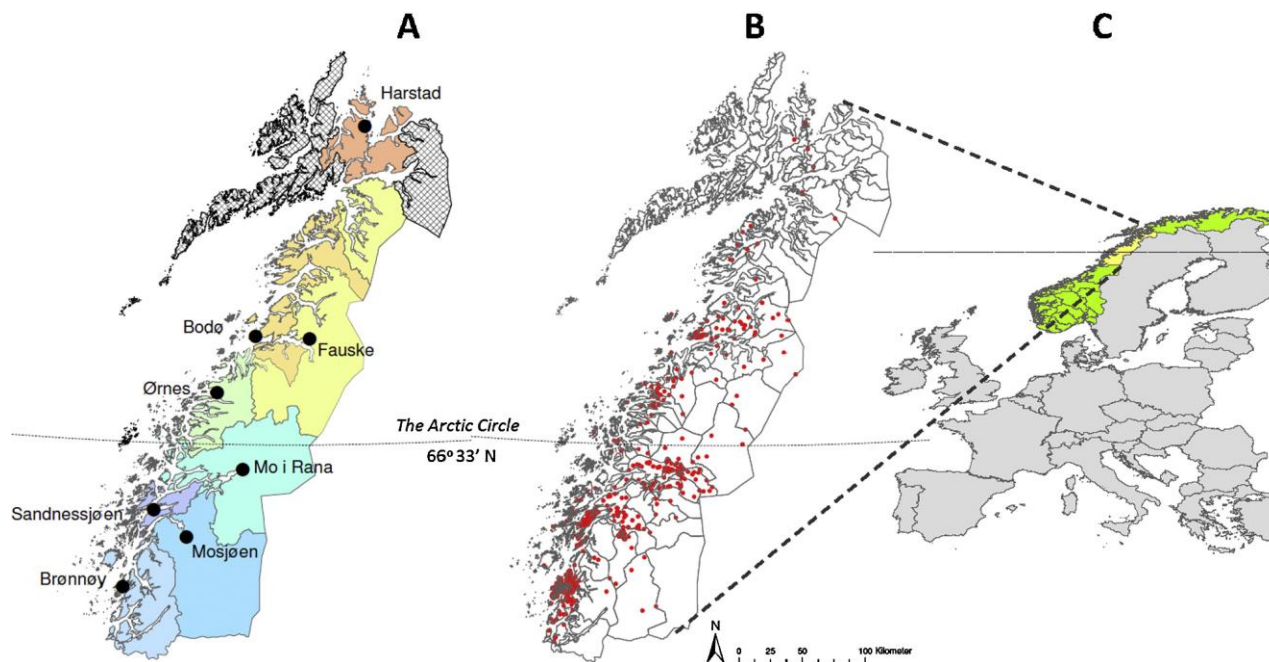
Original article

Ixodes ricinus and *Borrelia* prevalence at the Arctic Circle in NorwayDag Hvidsten^{a,*}, Snorre Stuen^b, Andrew Jenkins^c, Olaf Dienus^d, Renate S. Olsen^e, Bjørn-Erik Kristiansen^f, Reidar Mehl^g, Andreas Matussek^d^a Department of Microbiology and Infection Control, University Hospital of North Norway, Tromsø, Norway^b Department of Production Animal Clinical Sciences, Norwegian School of Veterinary Science, Sandnes, Norway^c Department of Environmental and Health Studies, Telemark University College, Bø, Norway^d Department of Laboratory Services, Division of Medical Services, County Hospital Ryhov, Jönköping, Sweden^e Host-Microbe Interactions, Institute of Medical Biology, UiT The Arctic University of Norway, Tromsø, Norway^f Institute of Medical Biology, UiT The Arctic University of Norway, Tromsø, Norway^g Institute of Microbiology, Armed Forces Medical Services, Oslo, Norway

A B S T R A C T

The distribution limit of *Ixodes ricinus* ticks in northwestern Europe (Brønnøy, Norway, 1° south of the Arctic Circle), has been known since the 1930s. To reconfirm this finding and extend studies in the areas adjacent to the Arctic Circle (66°33' N), ticks were collected from dogs and cats in 8 districts in northern Norway from 64°56' N to 68°48' N. We detected 549 *I. ricinus*, 244 (44%) of them in Brønnøy district, and 305 (range 6–87 ticks) in 7 districts in the northern part of the study area. The prevalence of *Borrelia* in these ticks was determined by real-time PCR. In the Brønnøy district (65°28' N, 12°12' E), 29% of the *I. ricinus* were *Borrelia* spp.-positive, and the species *B. afzelii* was nearly twice as prevalent as *B. garinii* and/or *B. valaisiana*. In the study area north of Brønnøy district, only 12 (4%) of the collected ticks contained *Borrelia* spp. In conclusion, tick occurrence and *Borrelia* prevalence are high in the Brønnøy district. In contrast, *I. ricinus* occurrence and *Borrelia* prevalence are low further north across the Arctic Circle in Norway.

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Geese-borne ticks?

Arctic geese: Pink-footed goose and Barnacle goose, Greylag goose



Vesterålen er siste stopp før Svalbard for kortnebbgås og hvitkinngås på vårtrekk.



Map and Photos: Ingunn Tombre, NINA

Arctic Geese?

Veterinary Parasitology 194 (2013) 9–15



Contents lists available at SciVerse ScienceDirect

Veterinary Parasitology

journal homepage: www.elsevier.com/locate/vetpar



Latitudinal variability in the seroprevalence of antibodies against *Toxoplasma gondii* in non-migrant and Arctic migratory geese

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Subject Editor: Hamish McCallum. Accepted 13 September 2010

Reconstructing an annual cycle of interaction: natural infection and antibody dynamics to avian influenza along a migratory flyway

Bethany J. Hoye, Vincent J. Munster, Hiroshi Nishiura, Ron A. M. Fouchier, Jesper Madsen and Marcel Klaassen

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Study objectives & methods

- how reindeer herders' traditional knowledge (TK) may provide a reservoir of precaution and adaptation possibilities to counteract the threats by CSI.
- Methods & preliminary results
 - Classical Sámi authors herder narratives & ethnography
 - Each source does not write much about reindeer diseases, prevention and treatment, but our findings seem consistent .
 - interviews of TK-holders.

Traditional knowledge (TK)

- One definition: *“a cumulative body of knowledge and beliefs, handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment” (Berkes et al. 1993)*

TK is *culture- and experience-based, transferred across generations, and includes empirical facts, social institutions and management, as well as inherited world views; it is often focused on practical application and provides a basis for cultural and community continuity.*

Foot rot *Necrobacillosis*

(*Slubbo/Glubbie*)

- Milking of reindeer, usual over wide parts of Sápmi up to early 1900s; in some areas practised up to 1950s-1960s
- Female reindeer gathered in small corrals, from early summer on
- If wet and muddy soil, excellent conditions for a bacteria (*Fuscobacterium necrophorum*),
 - attacks via small wounds/cracks in hoofs
 - Contagious via mud and shit
- Inflammation, necrosis, subcutan, (Tryland 2014)



Photo: Helgeland Museum (1936)

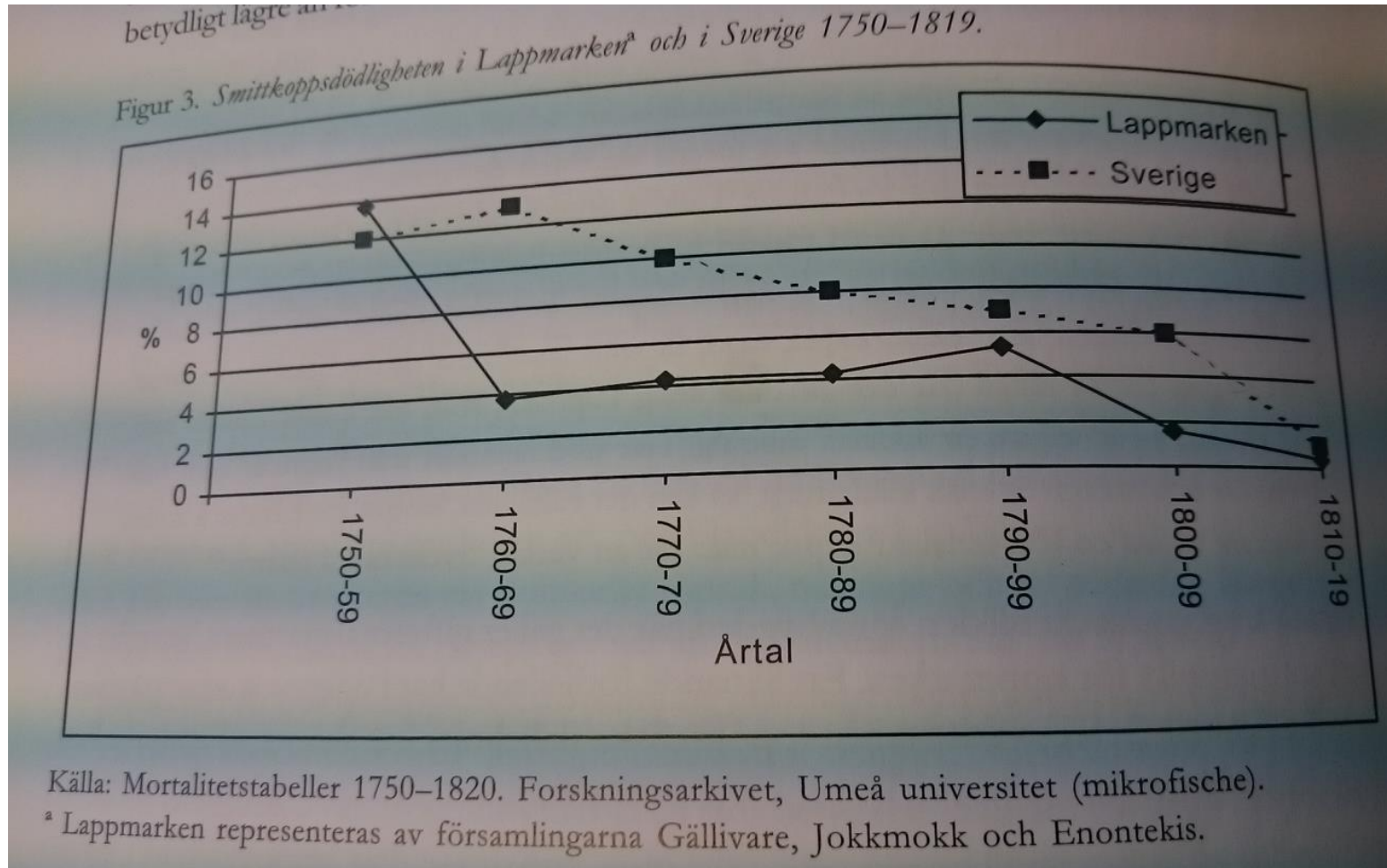


Prevention praxis (I)

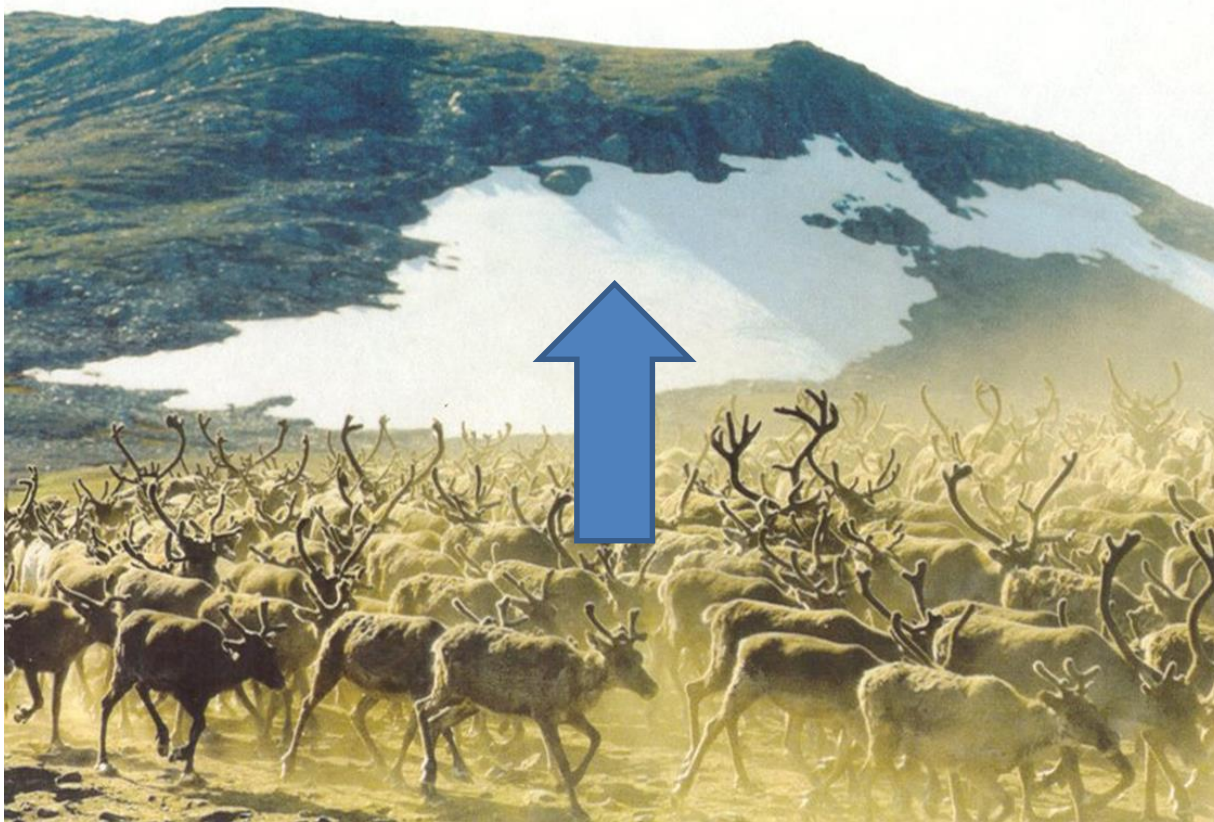
- In early summer; move reindeer to unused grazing land, avoid staying too long in trampled and dirty grazing land (N.N.Skum 1955)
- «The Elders knew that the animals should not be kept too close» (embodied knowledge). Interviewee (born 1944):
- No observation of **foot rot** (Interviewee born 1947)
 - *Relatively small herds*
 - *dry hills as milking sites*
 - *milking site rotation: 3 weeks*
 - *Next year: new milking sites*
 - Old ones , well fertilized used for growing of potatoes

Prevention praxis (II)

- The Sámi moved away from Small-pox epidemics in the late 18th century (and had significant lower mortality than Swedes): Source: P.Sköld, 2004



Prevention praxis III



Moving the reindeer uphill in the high mountains or to snow patches. Use of small glaciers or snow patches for milking and ear marking purposes (Thomas Renberg to HT in 1978). Also mentioned by Interw. born 1944. Photo: Vilhelmina-Norra Sameby

Climate change

- Uncertainty in winter due to freeze-thaw cycles
 - Possible actions
 - Transportation of reindeer
 - Supplementary feeding
 - More gathering/handling of reindeer=>
 - Risk of contamination/spread of diseases
 - Supplementary feeding should take place on open land, not in corrals

Example: Tourists meet reindeer

Inga Sami Siida (Vesterålen, coastal North Norway) presents reindeer for tourists in a corral, serves tourists a meal, tell some narratives, for the visitors : **an encounter with unique animals and a unique culture**



- **Disease reduction strategy:**
- change of animals taken into corral
- moving animals to a new corral for observation before reentering the herd,
- Also circulate the few tamed individuals
- Alternative to being super restrictive, which is difficult in many respects
- Tourism reduces the need for land
- Prevention based on *intuition* (experience)-**How much strain can an animal take?**

Arctic Frontiers Tromsø

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