A horizon scan of the management of Eurasian reindeer


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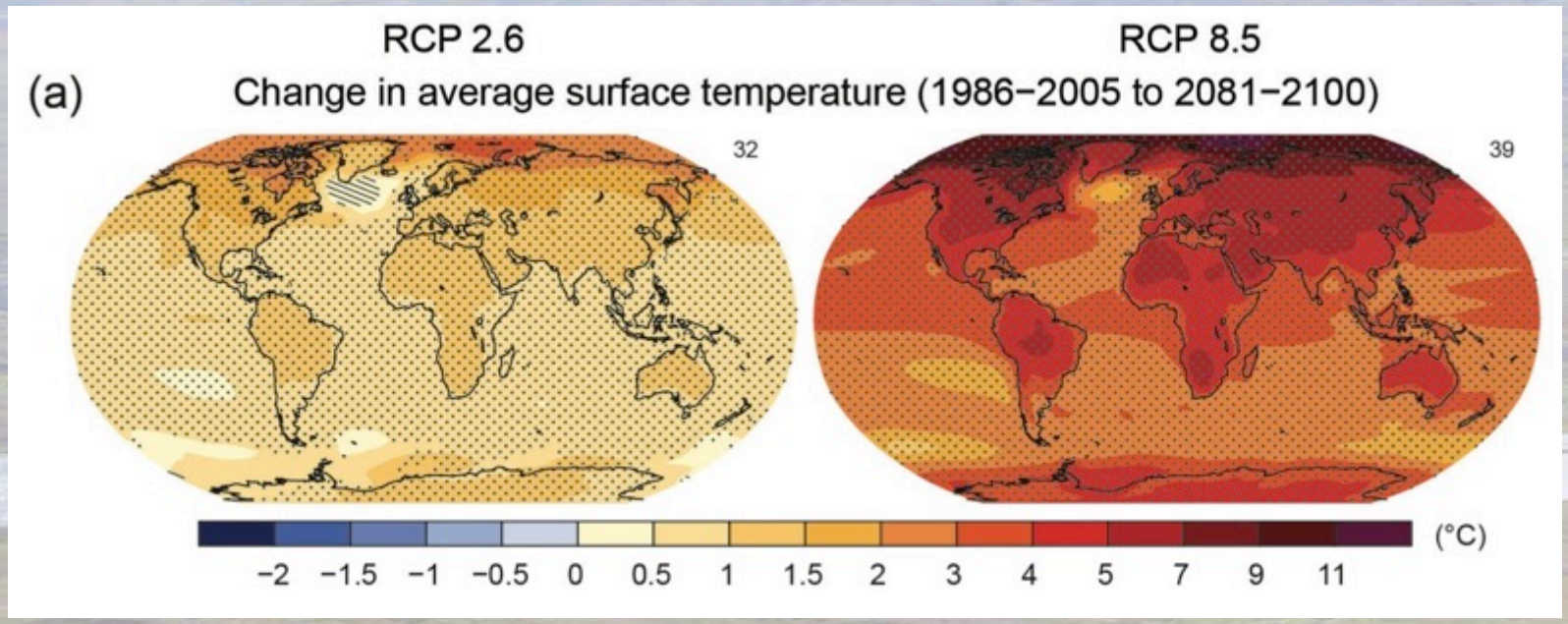
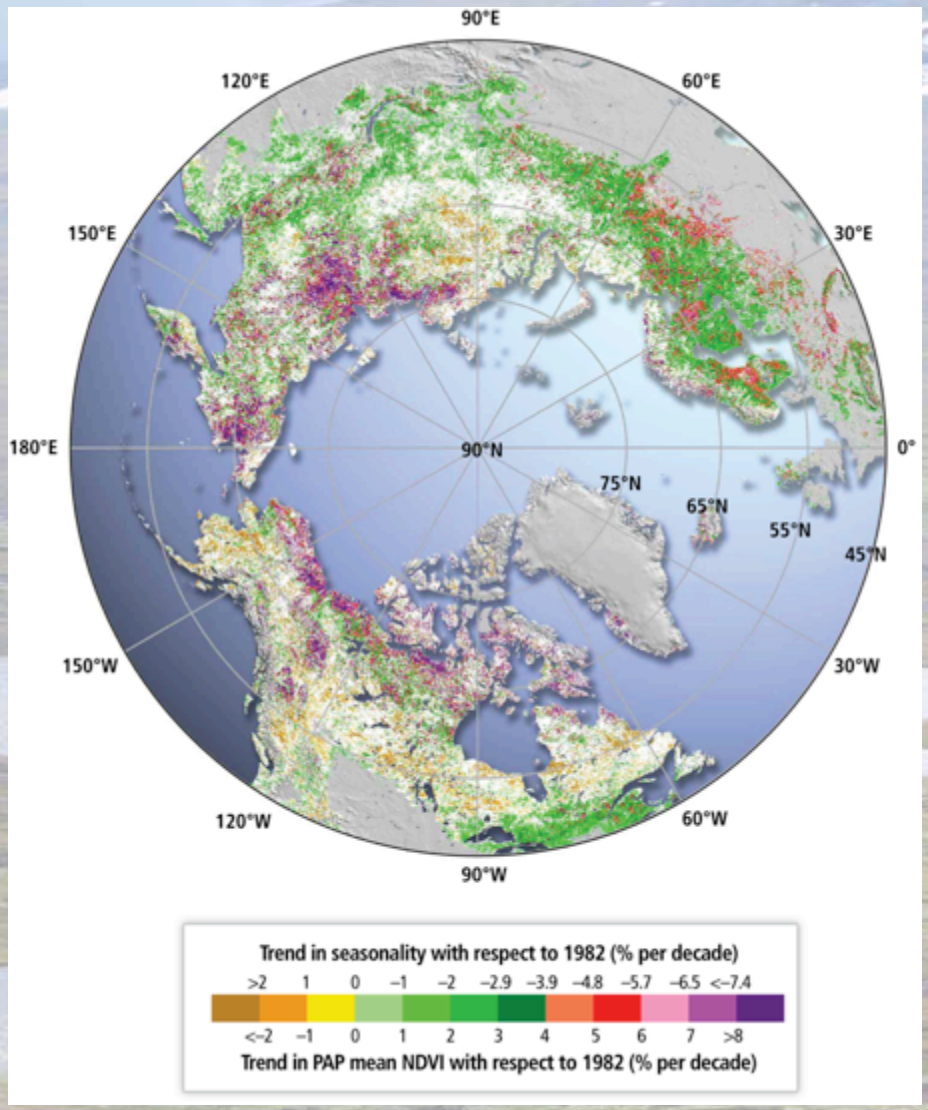
A changing Arctic

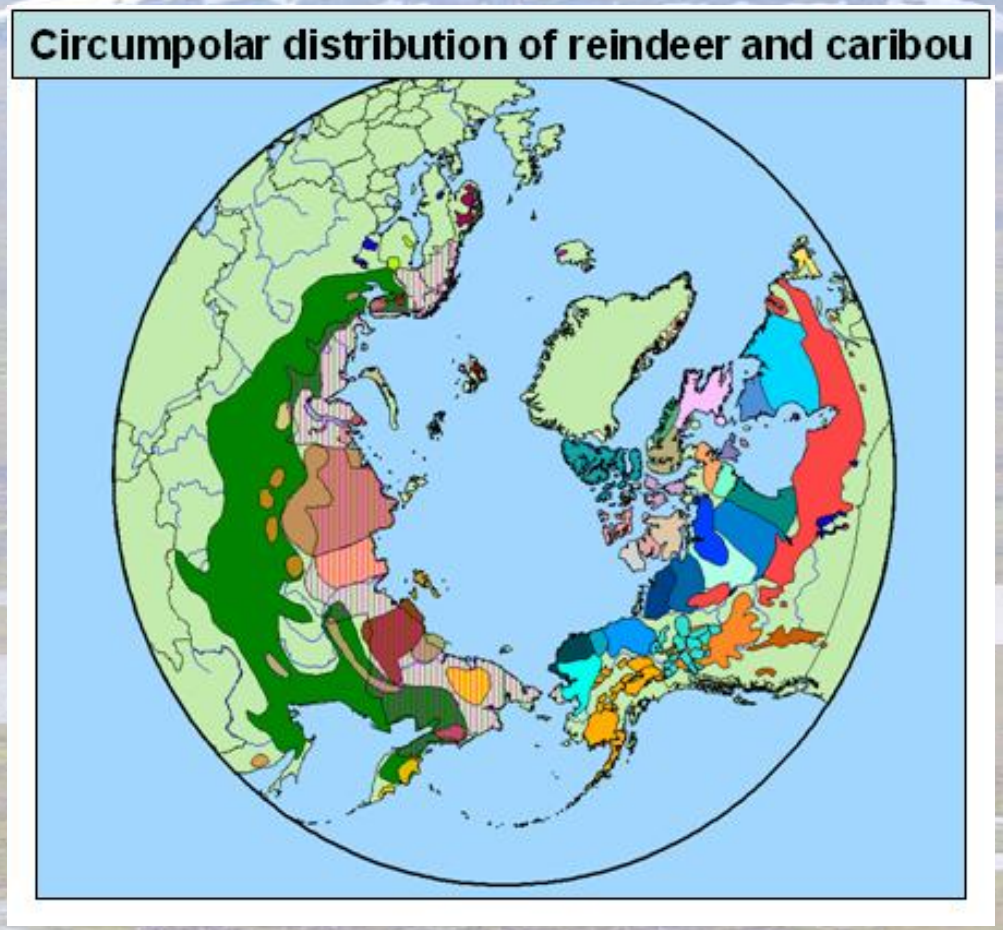


A changing Arctic



A changing Arctic

Reindeer – a keystone species



Reindeer – a keystone species

Questions and aims

- Questions:
  - What are the effects of the changing pressures on reindeer and reindeer husbandry?
  - What are the critical gaps in our current knowledge?
- Aim:
  - To guide research
  - To have arguments towards financers
  - To contribute to a more sustainable future in the Arctic

What is an Horizon scan?

"The systematic search for, and examination of, potentially significant medium- to long-term threats and opportunities that are not well recognized within a particular field"

-Sutherland et al. 2014

Scoping
Gathering information
Spotting signals
Watching trends
Making sense of the future

Methods

- Pre-conference scoping:
  - Searches in WoS + own networks
  - 119 persons contacted, 30 answered (25%)
  - 61 suggestions for important research areas
  - Aggregated into 18 research topics
- This session:
  - Scoring for scientific importance, level of knowledge, and importance for management
- Post-conference:
  - Write a paper – co-authorship
  - Become rich and famous

What is going to happen today?

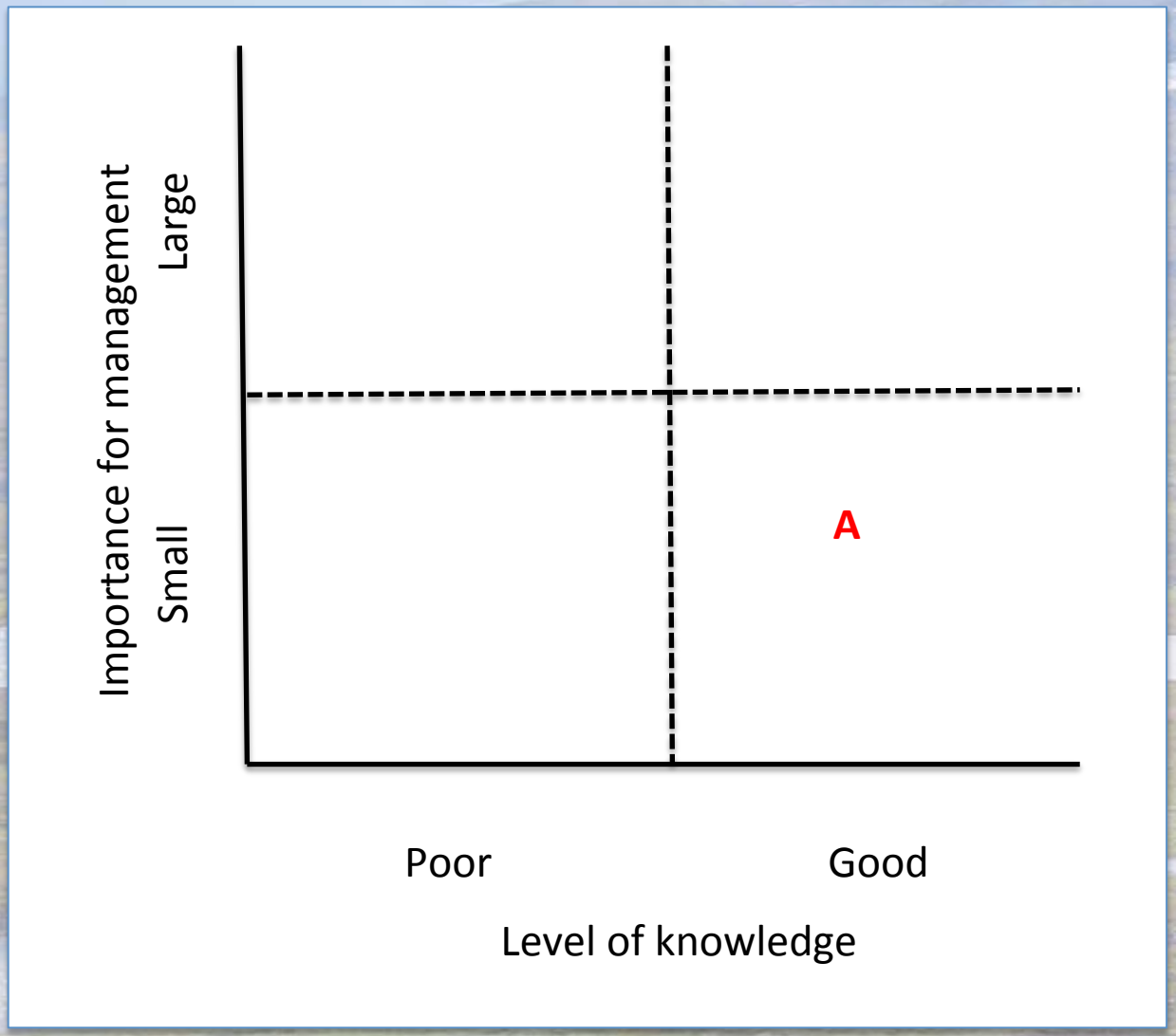
- Divide into groups
- List of 18 topics (and the possibility to add missing topics)
- Score each topic on scientific importance, from 1=Very important to 5=Least important
- Score each topic on level of knowledge and importance for management in a graph
- Note your names on the list
- Hand it in
- Prepare to say a FEW words on the topic(s) that you have scored as most important
- Preliminary results will be shown
- Sign up if you want to be a co-author

Scoring sheet

Names:

Score	Research topic	Description and examples of questions
	A. Reindeer phylogeography	Today, different genetic lineages exist among different reindeer populations (e.g. Scandinavian domestic reindeer, Svalbard reindeer, and Finnish forest reindeer). What are the functional differences among these genetic lineages, and are these adaptations to different environments?
	B. Cumulative effects of other land uses on reindeer pastures and herd productivity	Several types of land use (such as wind power parks, forestry, and tourism) can negatively (or positively) affect reindeer pastures. How does the cumulative impact of past and present land uses and their interaction influence reindeer husbandry? How do the effect of other land uses on reindeer husbandry vary across scales?
	C. Effects of reindeer density on predators	There are indications that abundant reindeer populations may function as subsidies for expanding southern predator/scavengers, by providing excess of food, especially during the resource-limited winter season. What role does abundant reindeer play as a potential subsidy for the ability of southern predators to expand into the tundra?
	D. Mechanisms driving population dynamics (in the long term)	Several mechanisms can drive reindeer population dynamics, e.g. climate, human activities (hunting and slaughtering), diseases and predation. Which mechanisms drive the long-term (wide) fluctuations in

Scoring graph



Get started!

- Critical gaps in understanding the effects of a changing arctic on reindeer (husbandry)
  - Groups
  - Score scientific importance on the sheets
  - Score level of current knowledge and importance for management on the graph using the letters

1 = Very important
2 = Important
3 = Moderately important
4 = Less important
5 = Least important

Score	Research topic	Description and examples of questions
	A. Reindeer phylogeography	Today, different genetic lineages exist among different reindeer populations (e.g. Scandinavian domestic reindeer, Svalbard reindeer, and Finnish forest reindeer). What are the functional differences among these genetic lineages, and are these adaptations to different environments?
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	D. Mechanisms driving population dynamics (in the long term)	Several mechanisms can drive reindeer population dynamics, e.g. climate, human activities (hunting and slaughtering), diseases and predation. Which mechanisms drive the long-term (wide) fluctuations in reindeer population dynamics (i.e. population abundances or growth rates)? Do they differ among populations? What is the relative importance of each mechanism?
	E. Effects of the interaction between other land uses and climate change on reindeer pastures	Both other land uses and climate change may have negative impacts on reindeer and reindeer husbandry (e.g. by reducing the amount of available forage or creating a temporal mismatch between reindeer migrations and plant greening). How do climate change and other land uses interact to influence reindeer pastures?
	F. Effects of climate change, including global warming, on reindeer pastures and reindeer productivity and abundance	Climate change and global warming result for example in changes both in winter and summer conditions, growing season length, plant productivity and composition, and insect densities; changes that thus can have both positive and negative effects on reindeer husbandry. What are the net consequences of these changes on reindeer pastures and reindeer productivity and abundance across Eurasia?
	G. Development of better censuses (wild reindeer)	Today, censuses of wild reindeer are mainly conducted from airplanes. This technique is expensive and not optimal for censuses of populations that live in the forest. Can we develop easier and more reliable methods for counting wild reindeer (i.e. estimating population size)?
	H. Indigenous rights and reindeer husbandry	Legislation, policy and authority actions (which effect access to land and other conditions for reindeer husbandry) differ amongst countries such as Norway, Sweden and Finland. How do these differences influence reindeer management and production?
	I. Optimal harvesting strategies	In reindeer husbandry, harvesting is a selective strategy usually based on the age and sex of the animals. What are the optimal harvesting strategies under varying top-down and bottom-up forces?

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	J. Decision processes, strategies and communication with other actors	Governance at different hierarchical levels, decision making processes, policy, and communication between reindeer herders and other actors (e.g., decision makers and other land users) all influence reindeer husbandry. How do these processes and pathways differ amongst regions and countries? What are the consequences of these differences for reindeer husbandry?
	K. Effects of predation on reindeer husbandry and productivity	Several predators threaten reindeer herds, especially (but not exclusively) through predation on calves. Since calves are slaughtered for meat and are the most important source of income in reindeer husbandry, predation can cause remarkable damages to the industry. What are the impacts of predation on reindeer husbandry? Does the interaction between different habitat characteristics and predator, reindeer, and alternative prey densities cause variable effects on reindeer husbandry productivity?
	L. Health issues (wild reindeer)	Climate change may contribute to alter the effects of contagious agents (parasites, viruses, and bacteria) on reindeer or introduce new agents to areas that did not experience them before. How will the effects of contagious agents on threatened wild reindeer populations vary with future climate change?
	M. Ecosystem services provided by reindeer (husbandry)	Reindeer influence a number of ecosystem properties and processes, for instance biodiversity, community composition and productivity. What is the net effect of reindeer husbandry on ecosystem services both locally and regionally? What factors govern these effects?
	N. Restoration of pastures	A large amount of reindeer pastures has been lost in many areas of the Arctic and subarctic due to overgrazing, other land uses, and climate. Can historic, deteriorated pastures be restored, and if so how?
	O. Adaptations to changes for a sustainable reindeer husbandry	Reindeer husbandry is a flexible social-ecological system that has survived in changing environments for a long time. Are there adaptation mechanisms that can be adopted to maintain an ecologically, economically and socially sustainable reindeer husbandry in relation to the rapid environmental changes it is facing today?
	P. Cumulative effects of other land uses on reindeer behavior	Several types of land use (such as wind power parks, forestry, and tourism) can disturb reindeer on their ranges. What are the cumulative effects of other land uses on reindeer behavior (i.e. movement, migration, and range use) in the short term and in the long term? Do short- and long-term effects differ?
	Q. Effects of reindeer on pastures	In some circumstances, reindeer densities may be so high, or pasture availability so low, that pastures become overgrazed. This can occur for example when other land uses force reindeer into smaller, new ranges. How do overabundant populations or herds using new migration routes affect vegetation and ecosystems?
	R. Evolutionary responses (adaptations) to climate change	In the past thousands of years, the Artic and subarctic have experienced extreme climatic fluctuations. How has reindeer genetic diversity helped the species to overcome past changes in climate? What is the role of phenotypic plasticity *vs* micro-evolutionary responses?