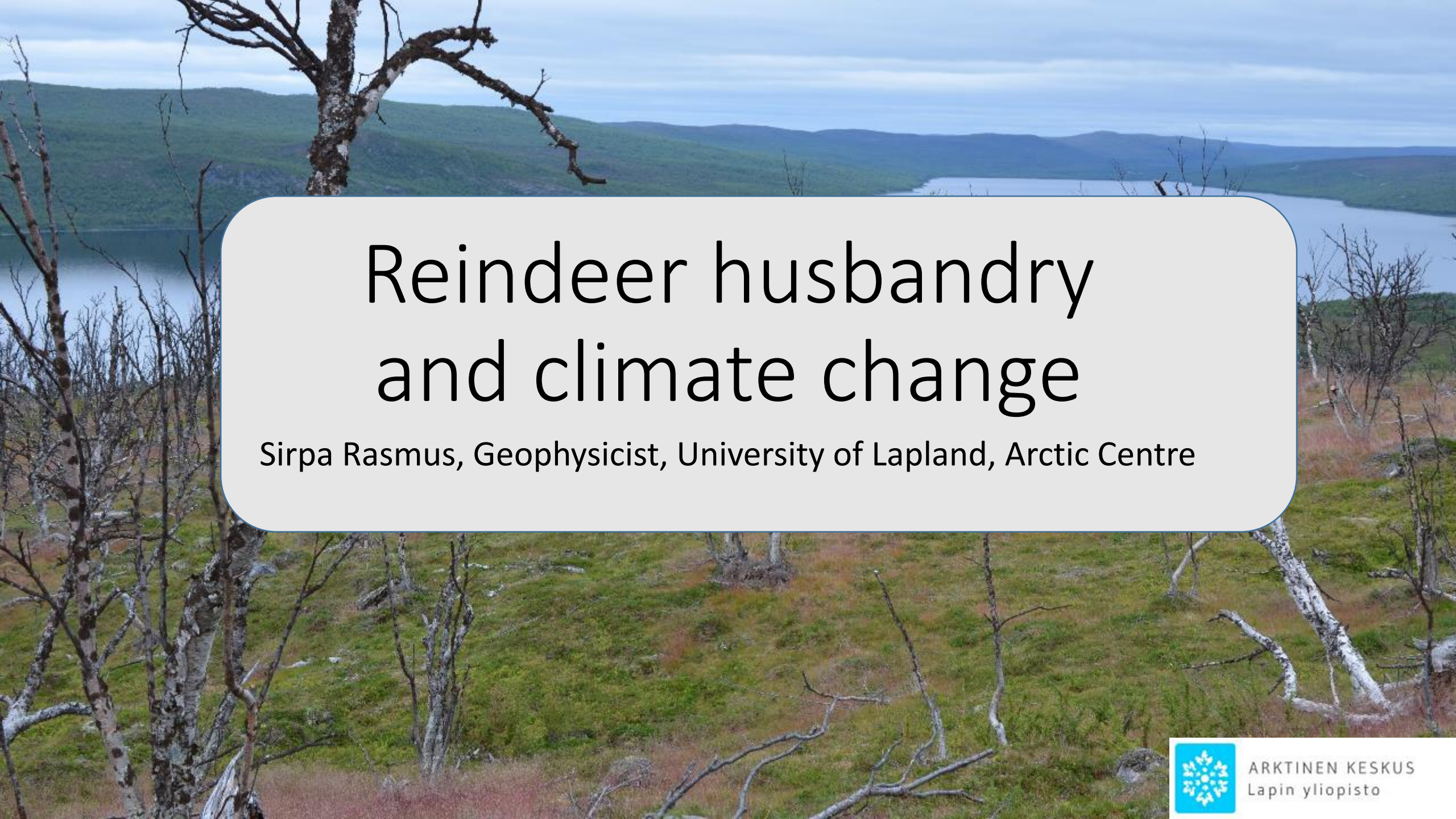

Reindeer husbandry and climate change

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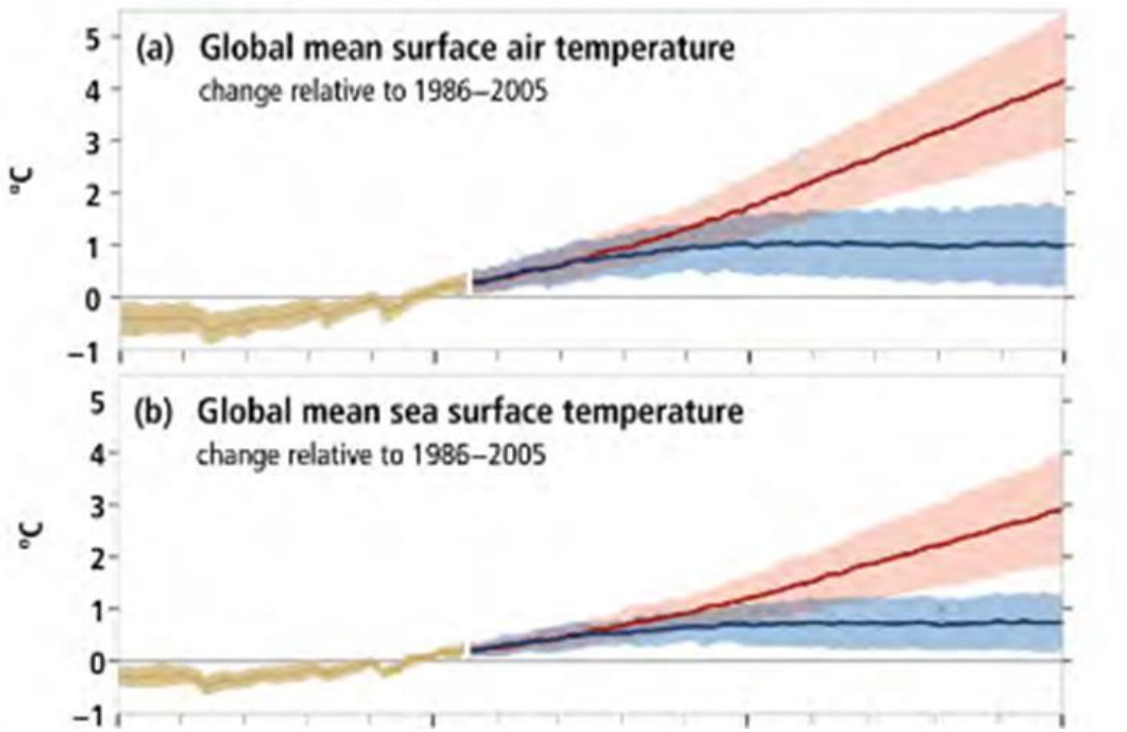
ARKTINEN KESKUS
Lapin yliopisto

Obseved and expected global changes

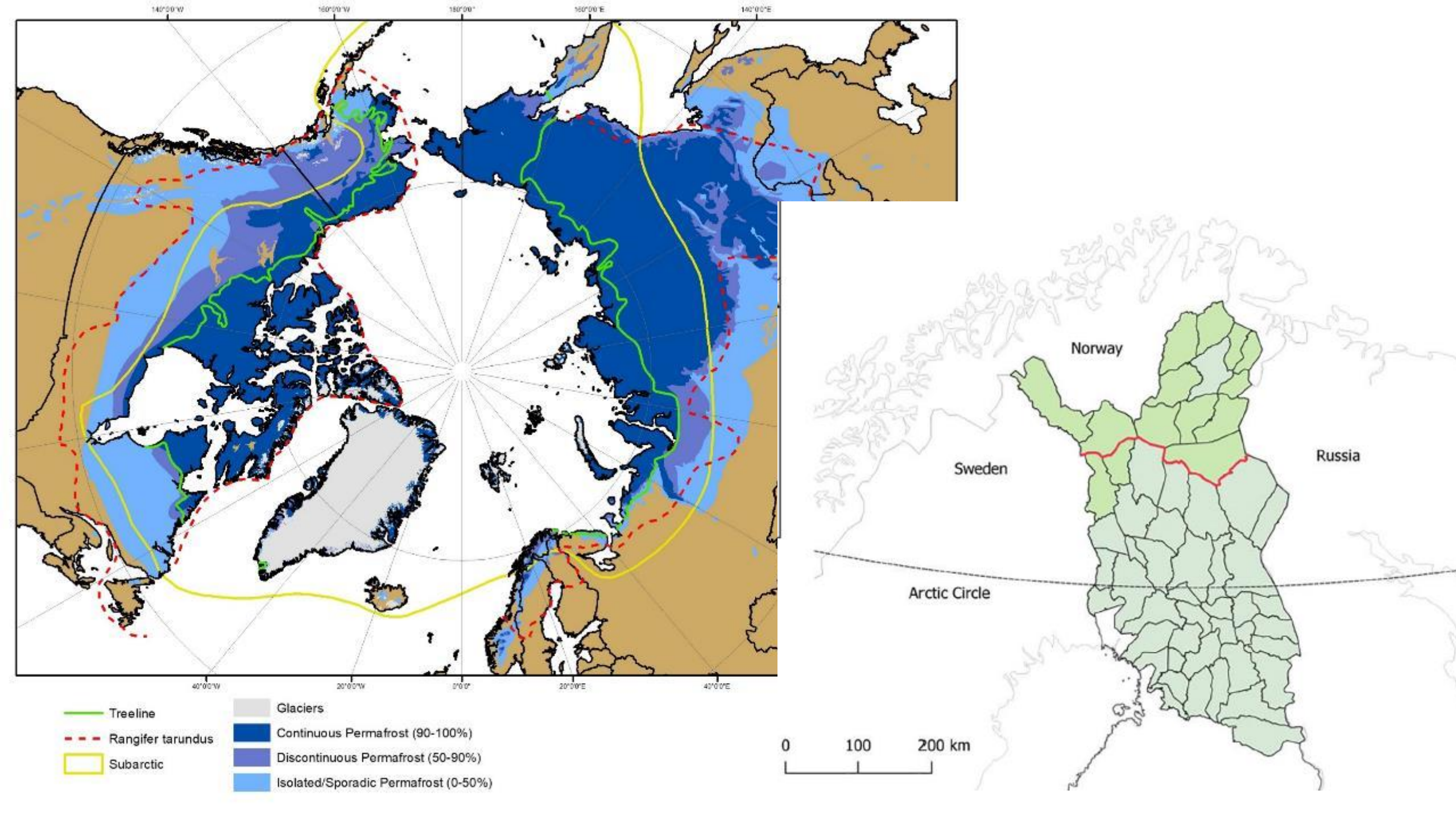
- Rise in global mean air temperature
- Rise in global mean sea temperature
- Sea level rise
- Decreases in snow and ice covers



Past and future changes in the ocean and cryosphere

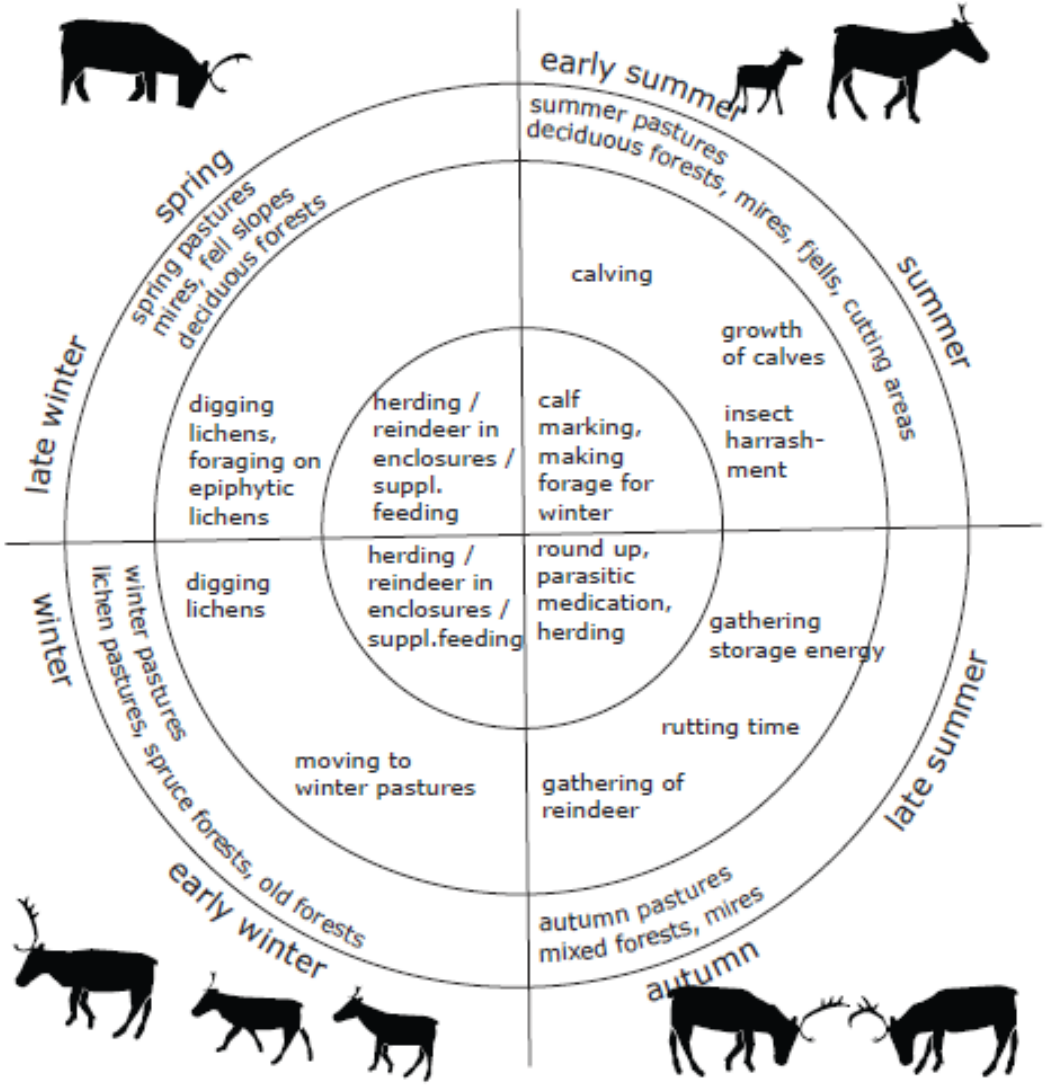
Historical changes (observed and modelled) and projections under RCP2.6 and RCP8.5 for key indicators

Historical (observed) Historical (modelled) Projected (RCP2.6) Projected (RCP8.5)


Treeline
Rangifer tarundus
Subarctic
Glaciers
Continuous Permafrost (90-100%)
Discontinuous Permafrost (50-90%)
Isolated/Sporadic Permafrost (0-50%)
Norway
Sweden
Russia
Arctic Circle
0
100
200 km

Why are we interested?

- Seasonal weather events and the quality of the herding environment determine the welfare of reindeer and the success of the reindeer husbandry as a livelihood
- High climate vulnerability and several weather/climate risks involved



Impacts of changing climate on reindeer husbandry

- Primary effects – changing weather conditions etc.
  - ➢Secondary effects – changes on pastures, new parasites etc.
    - ➢Tertiary effects – adaptation actions, effects on culture and language etc.

- Changes affect reindeer as animals, on working environment and pastures, on herding practices...
- Some parts of the “value chain of reindeer husbandry” more climate sensitive than others

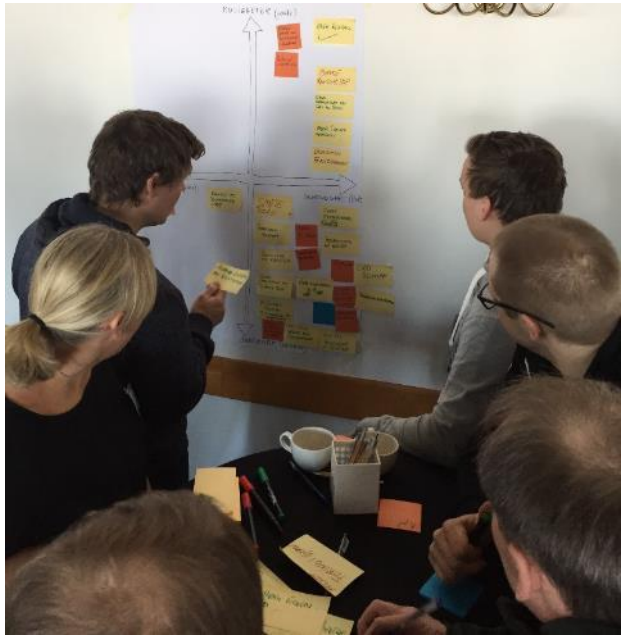
Figures:
Yle, Minna Turunen, Hannu Heikkinen

Knowledge for better adaptation

- Climate change has been studied a lot, but studies on adaptation of reindeer husbandry are few
- Herders have developed coping strategies against harmful weather events but it is not common to plan for long-term climate change adaptation
- Governance, guidance and education of reindeer husbandry supports coping, but adaptation plans are often missing
  - ➢Need to exploit the knowledge we have
  - ➢What we are doing, when we collect / use local observations? And why?
  - ➢Validating/comparing vs bridging or two-eyed seeing (Abu et al. 2019; doi: 10.1080/07900627.2018.15580 50)

Figures:
Yle, Minna Turunen, Hannu Heikkinen

- IPCC (2019): “Learning is needed to relate different knowledge sets, as through this process new and relevant understanding for improved decisions and solutions can be created.”



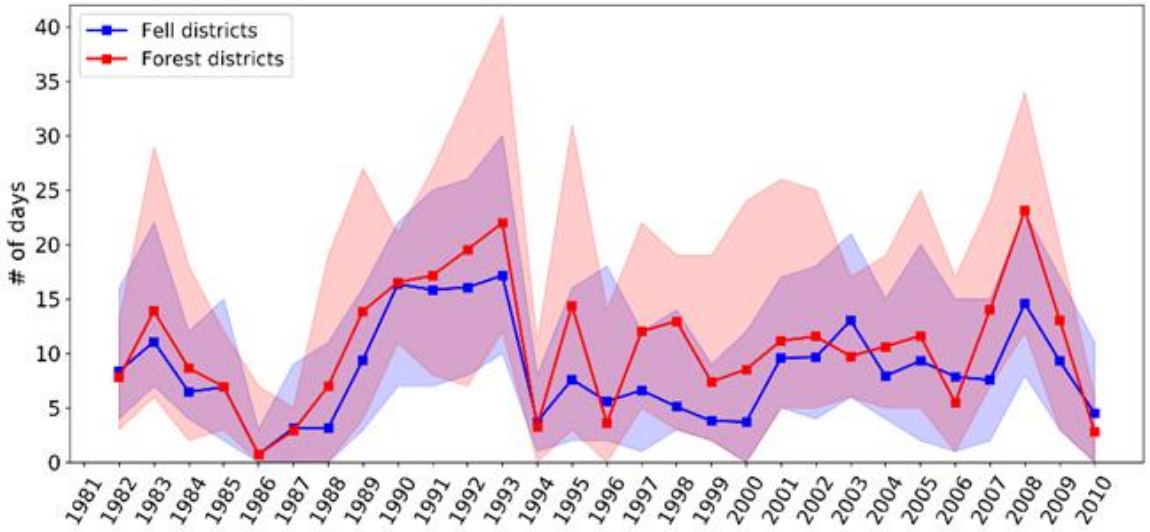
Photos: Hannu Heikkinen

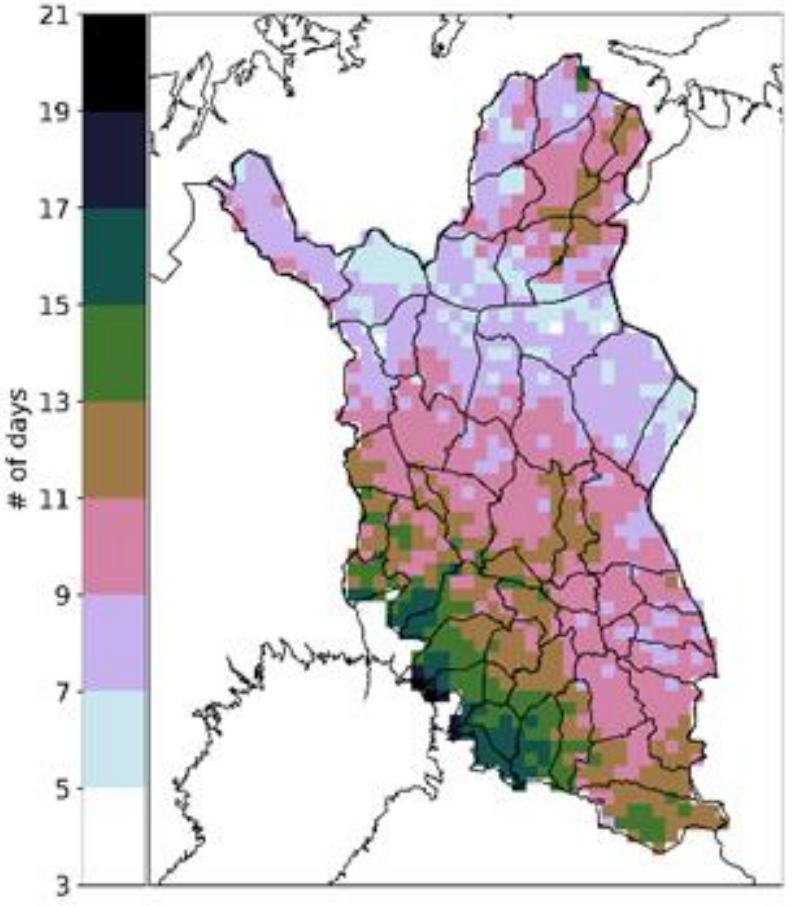
Example 1: Gridded climate data + survey

- Herders' observations on seasonal changes during past 30 years, gathered via a survey questionnaire
- Distributed systematically to all herding districts through the information services of the Reindeer Herders' Association and the professional journal Poromies in Finland
- A set of temperature-, precipitation- and snow-related indices relevant for herding, derived from spatially interpolated daily meteorological data (1981-2010) with high spatial resolution.

Meteorological data example

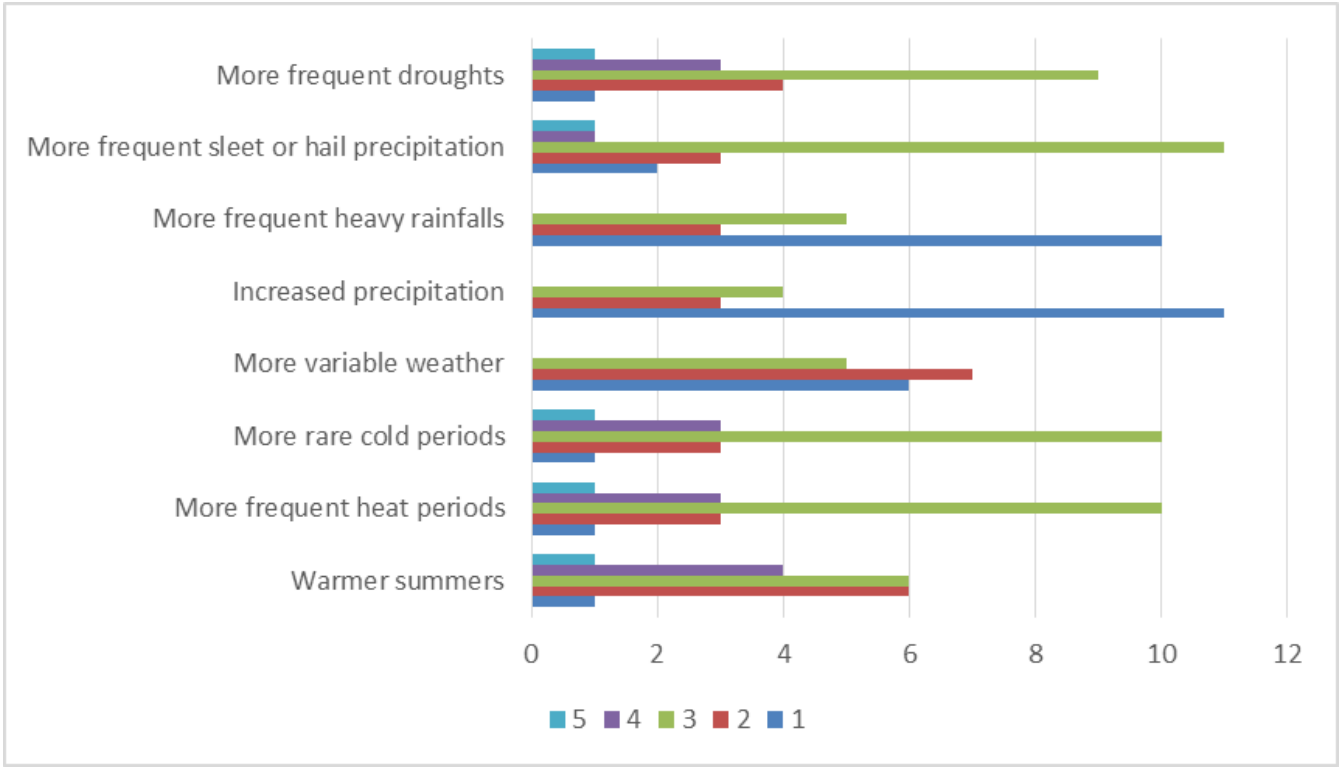
- Number of zero-crossing days in the winter
- Mean values (1981-2010) on the map with 10x10km resolution
- Annual time series in fell and forest districts. The dots depict spatial averages and the shaded areas show the ranges across the grid boxes of the regions.





Survey results (n=90)

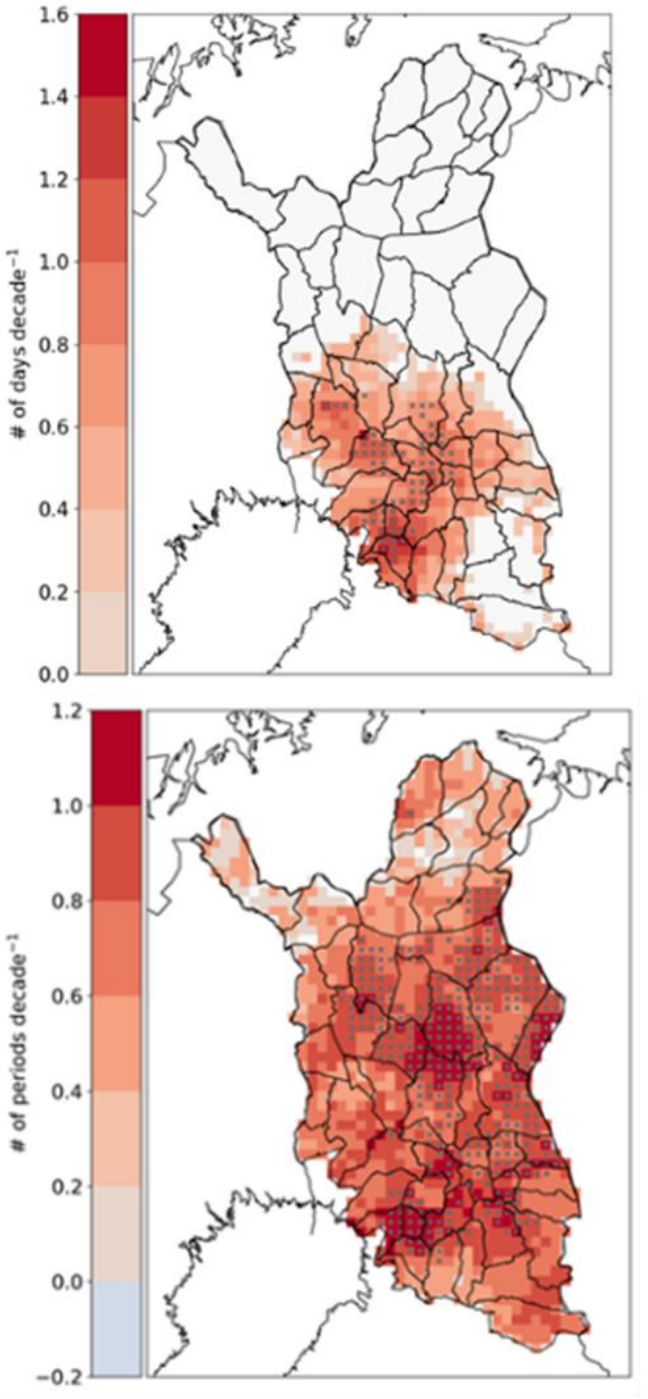
- Herder observations generally comparable to meteorological observations
- Some regional differences
- Distribution of answers – agreements and disagreements
- Problems because a bit different time slot was considered for the knowledge sets (e.g recent rainy summers not seen in the meteorological data but affected the herder views)



- ”The soil freezes a bit…wet snow falls…ice is formed…again wet snow… the reindeer wander south against the wind.”
- ”Rain around Christmas and the New Year is almost an annual phenomenon nowadays. It puts an end to digging almost every winter.”
- ”Advanced arrival of spring is good for reindeer, and growth on the pastures starts earlier, since there is food available already during the calving time.”

Changes experienced/expected

- Warmer springs, summers, autumns, winters
- Later snow formation and earlier snow melt
- Longer and warmer growing season, more intensive heavy rains?
- Winter rain more common, crossing of zero degrees more common



Above: trend in the number of hot summer days, 1981-2010

Below: trend in the number of warmer-than-average weeks in the winter, 1981-2010

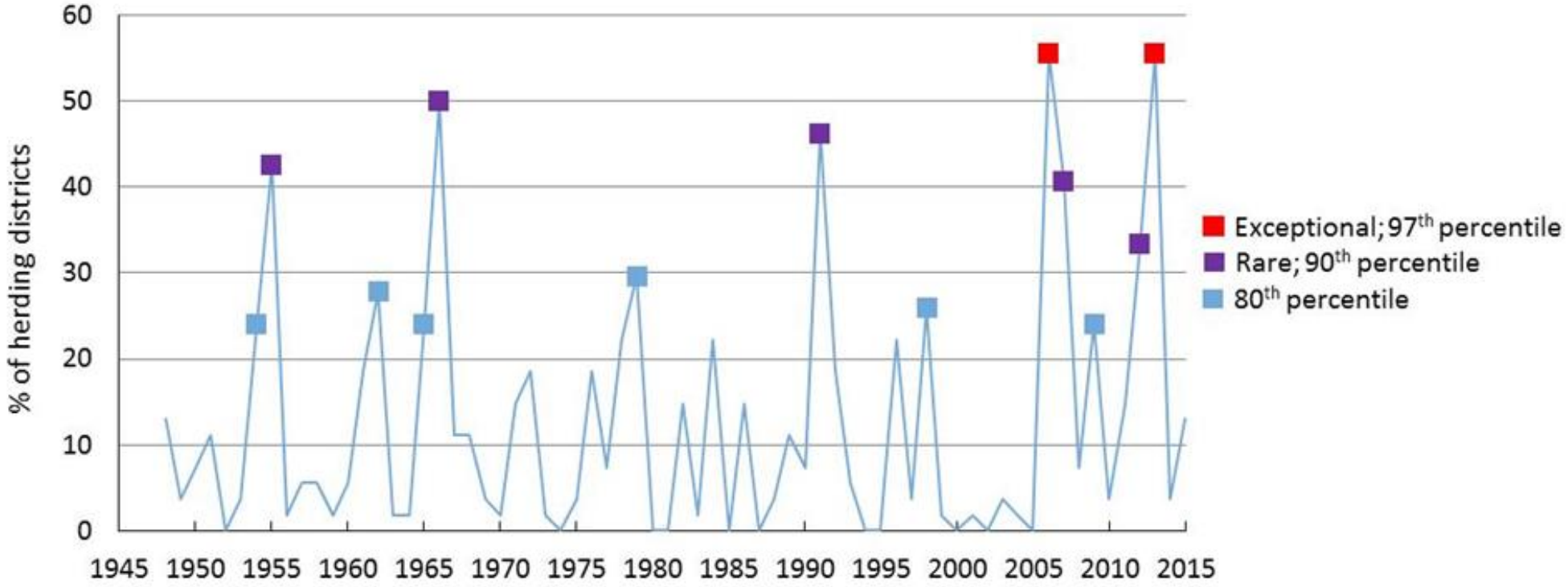
Interesting knowledge gaps

- Formation of ice layers in the snow cover
- Formation of mold below the snow cover
- Wild mushroom yield
- Insect harrassment

- ➢Weather-related phenomena
- ➢Very important for reindeer and for herders
- ➢Changes expected in a changing climate
- ➢Observations few, forecasting/simulation skills poor

Example 2: From the archives - icing of the pastures

- Dataset on the annual extent of ice formation events in northern Finland between 1948 and 2016
- Based on reindeer herders' descriptions of the cold season in their management reports



- Time series for the percentage of reindeer herding districts reporting basal ice formation events
- Five out of seven of the most extensive basal ice formation events (90th percentile) occurred between 1991 and 2016.
- The most commonly reported processes related to ice formation were thaw or rain-on-snow events followed by freezing of the snow cover.

- “Winter grazing was bad, because wet snow fell in the autumn and froze together with lichen during the following freezing weather.” (Vätsäri district, 1955-1956)
- “A strong heat wave in November that turned snow to watery slush, which then froze and prevented reindeer from foraging.” (Alakylä district, 1971-1972)
- “Rain at the end of November hardened the snow. Pastures like skating rinks.” (Pyhä-Kallio district, 2007-2008)

Some lessons learned

- Multi/Inter/Transdisciplinary work is useful; co-creation of knowledge; working with herders, other land users, policy makers, educational institutes
- Using practitioners' knowledge from the archive sources, interviews and surveys, and participatory methods (e.g. workshops)
- No validation, comparison, or integration – relating, parallel examination or bridging
- Presenting scientific observations using "human scale"
- Emphasis on seasonal weather, not on climate
- Emphasis on coping strategies, not on adaptation

- Adaptation of reindeer management to climate change CLIMINI; https://www.arcticcentre.org/FI/climini
- Reindeer husbandry in a Globalizing North ReiGN; http://www.reign.no/
- Drivers and Feedbacks of Changes in the Arctic Terrestrial Biodiversity CHARTER; http://www.charter-arctic.org/
- Arctic Rain-on-Snow Study AROSS; https://nsidc.org/rain-on-snow
- (SAAMI –project; https://www.oulu.fi/cerh-fi/saami)

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Thank you!

Herding year 2019/2020

- Illustrative example: rare weather and snow conditions since autumn until spring caused problems and reindeer losses
  - These kind of conditions are probably more common in the future (high temperature and precipitation during the winter)
  - Clear needs were noticed for developing the adaptation measures of herders, and support from governance, guidance and education