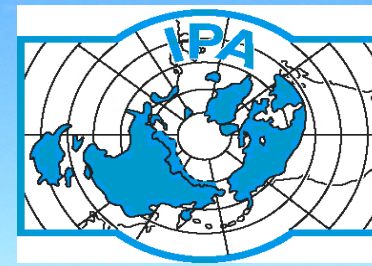




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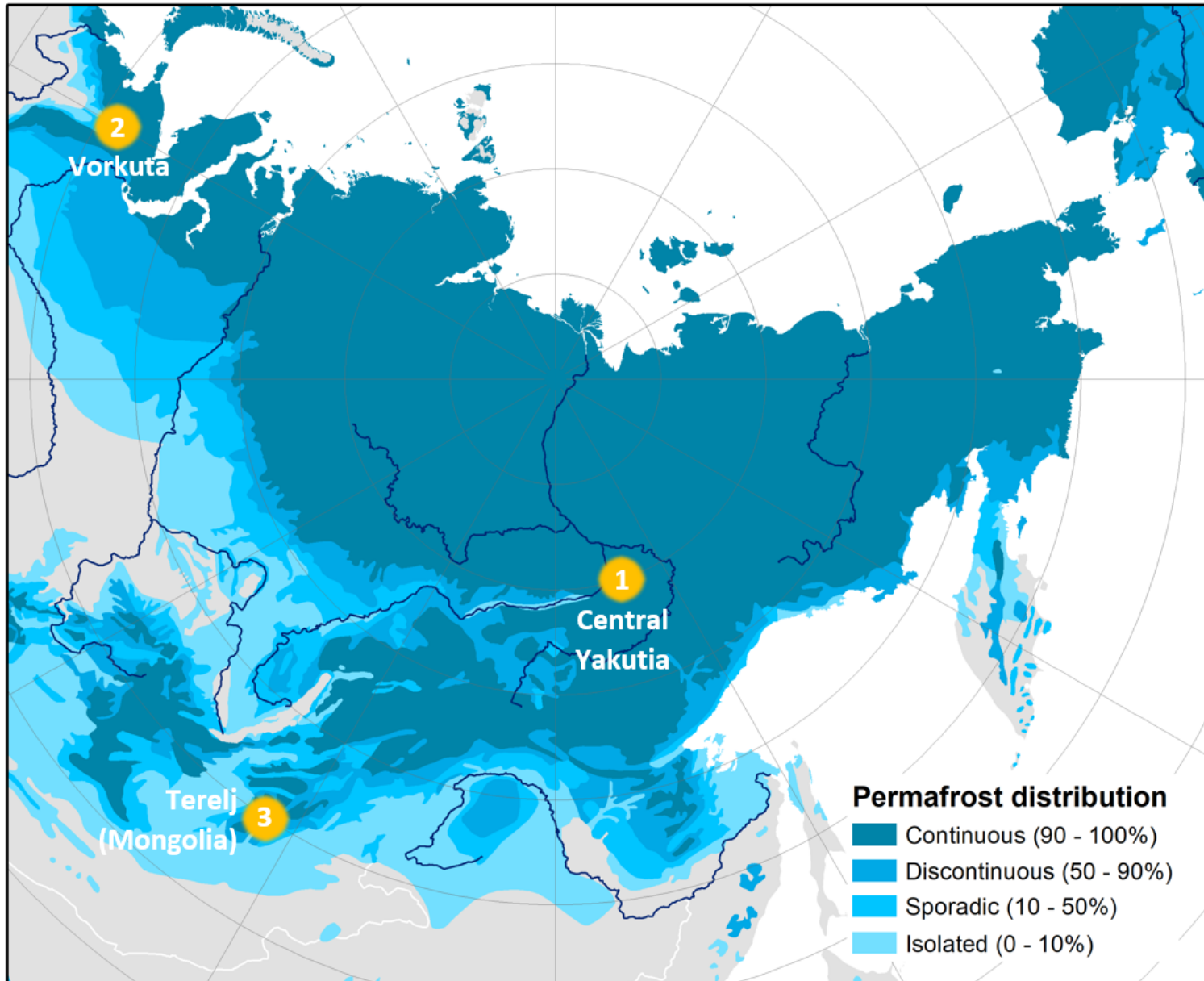
Mathias Ulrich, Leipzig
Otto Habeck, Hamburg

(IPA Action Group “Permafrost and Culture”)

Permafrost Dynamics and Indigenous Land Use: Tracing Past and Current Landscape Conditions and Effects of Environmental Change in Sakha/Yakutia, Russia

Photo: M. Ulrich

Broader framework: Permafrost and land use, Eurasian comparisons



Broader framework: Eurasian comparisons

Region #1: Central Yakutia/Sakha Republic

Cattle and horse husbandry in the central part of Yakutia (Sakha Republic) occurs in areas that came into existence because of thermokarst (permafrost degradation) in earlier millennia.

- **Workshop** with excursion in July 2015
- **Report:** Ulrich, Habeck 2015. Frozen Ground, 39, 3-4.
- **Publication:** Crate, Ulrich, Habeck et al. (2017), *Anthropocene* 18, 89-104

→ **Key Message:** Permafrost degradation *enabled* certain forms of land use – and land use practices *affect(ed)* landscape and permafrost dynamics.



Broader framework: Eurasian comparisons

Region #2: Komi/Nenets

Focus on tundra landscape dynamics on the western side of the Northern Urals and mobile pastoralism by Nenets and Komi **reindeer herders**.

- **Workshop** with excursion in September 2017 in Vorkuta
- **Report:** Habeck, Ulrich, 2017. Frozen Ground, 41, 4-6.
- **Publication:** Istomin & Habeck (2016), *Polar Science* 10(3), 278-287.

→ **Key Message:** Animal husbandry (reindeer herding) interacts with permafrost dynamics mainly indirectly – through changes in vegetation.



Photo: J.O. Habeck

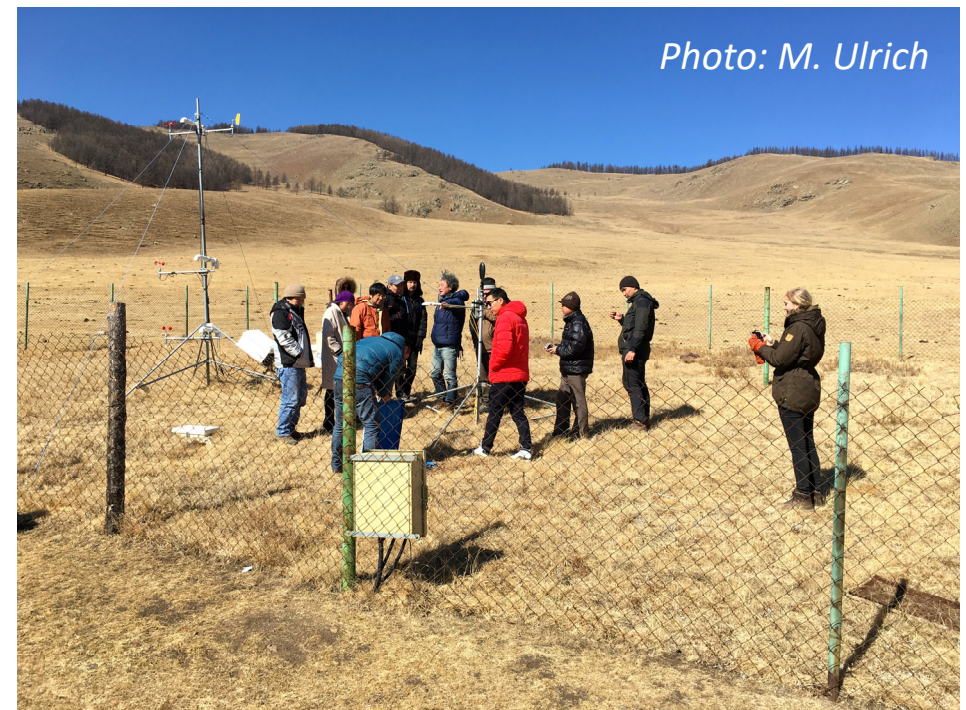
Broader framework: Eurasian comparisons

Region #3: Northern Mongolia

Sheep, goat, cattle husbandry, partly very intensive grazing regimes, affected by world-market shifts and changing hydrological conditions

- **Workshop** in March 2019 in Ulaanbataar with special session for students of geography and field excursion to Terelj study site
- **Report:** Habeck, Ulrich, 2019. Frozen Ground, 43, 5-6
- **Publication** in preparation (Dashtseren et al.)

→ **Key message:** Solar radiation and landscape aspect (north-facing slopes vs south-facing slopes) show a strong influence on local hydrology, vegetation and pasture conditions. Logging and heavy grazing have the potential to exert major changes on permafrost – and thus on local land-use conditions.



Main categories of comparison

- ✧ Assess on meso and micro level how different aspects of global climate change will impact the current speed and magnitude of landscape development and current forms of regional (indigenous) land use.
 - ✧ Assess on meso and micro level how socio-economic changes in different land-use activities will feed back into landscape development.
 - ✧ Assess to which extent regional (indigenous) land-use changes correspond with, aggravate, or neutralize the likely impact of climate-change effects on permafrost landscape development.
- **Connections between human behaviour and emerging land use patterns under different processes of permafrost landscape change require adequate representation of human decision-making.**

Now... back to Region #1: Yakutia/Sakha

Next step: Tundra/Taiga comparison

Having assessed major differences of permafrost and land use interrelation in diverse regions of Eurasia, we plan to conduct detailed research, **comparing the history and mid-term prospects of pastoral land use and landscape evolution** in two parts of Yakutia:

Central Yakutia

vs

Lower Kolyma Destrict

Boreal zone

vs

Tundra zone

Cattle & Horse breeding

vs

Reindeer herding

≥ 500 years of sedentary pastoralism

vs

≤ 200 years of mobile pastoralism

Locally intensive farming

vs

No significant farming



Tundra/Taiga comparison - Hypotheses

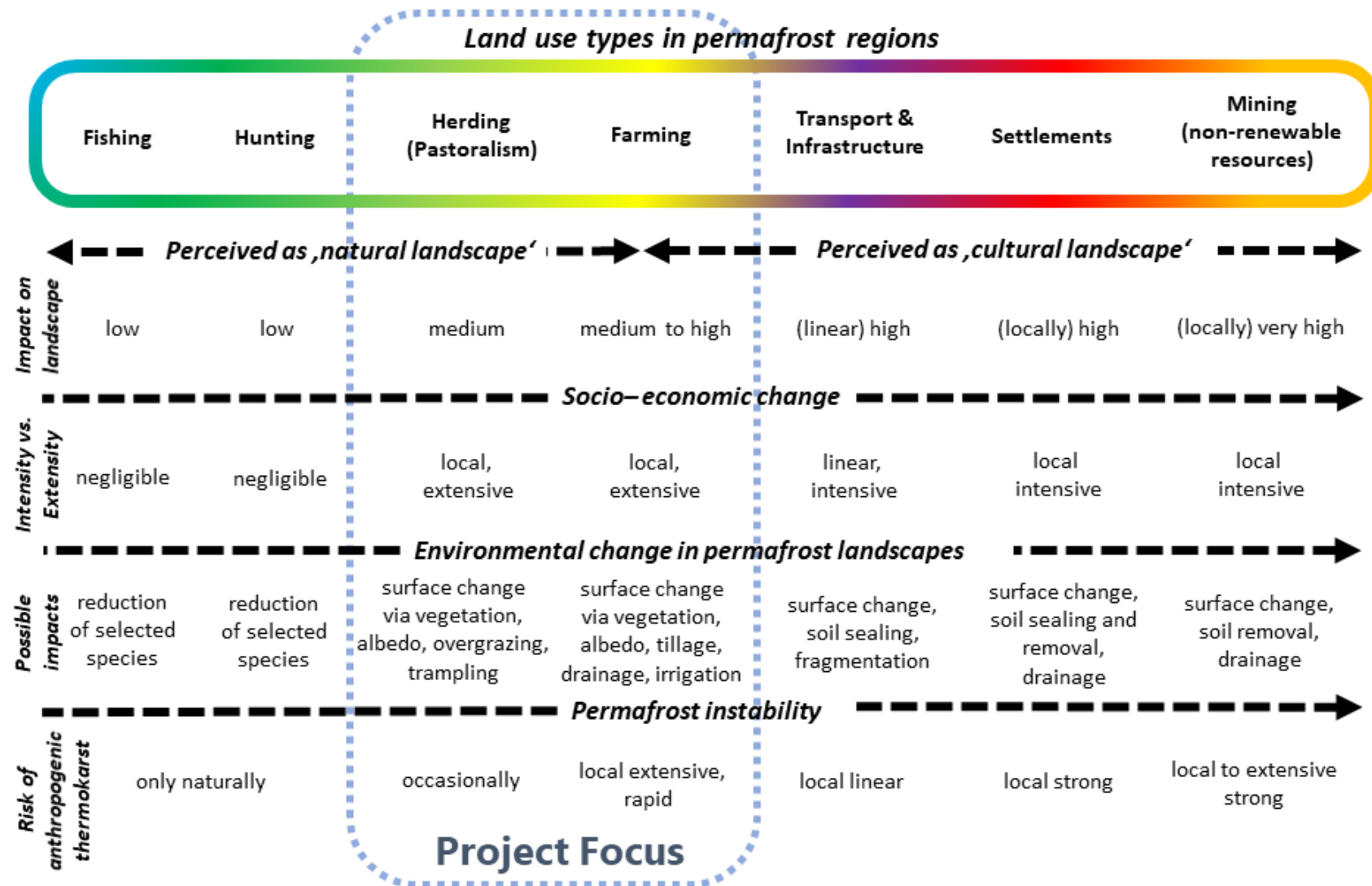
In the analysis of landscape development and land use, we distinguish between two periods: before and after the start of pastoralism and farming. We test the hypothesis that **landscape and land-use changes occurred at different scales and speeds** in the two zonal settings.

We postulate that existing forms of land use influence landscape development in different ways: they (i) correlate with, (ii) exacerbate or (iii) neutralize the effects of climate change (owing to different feedback mechanisms).



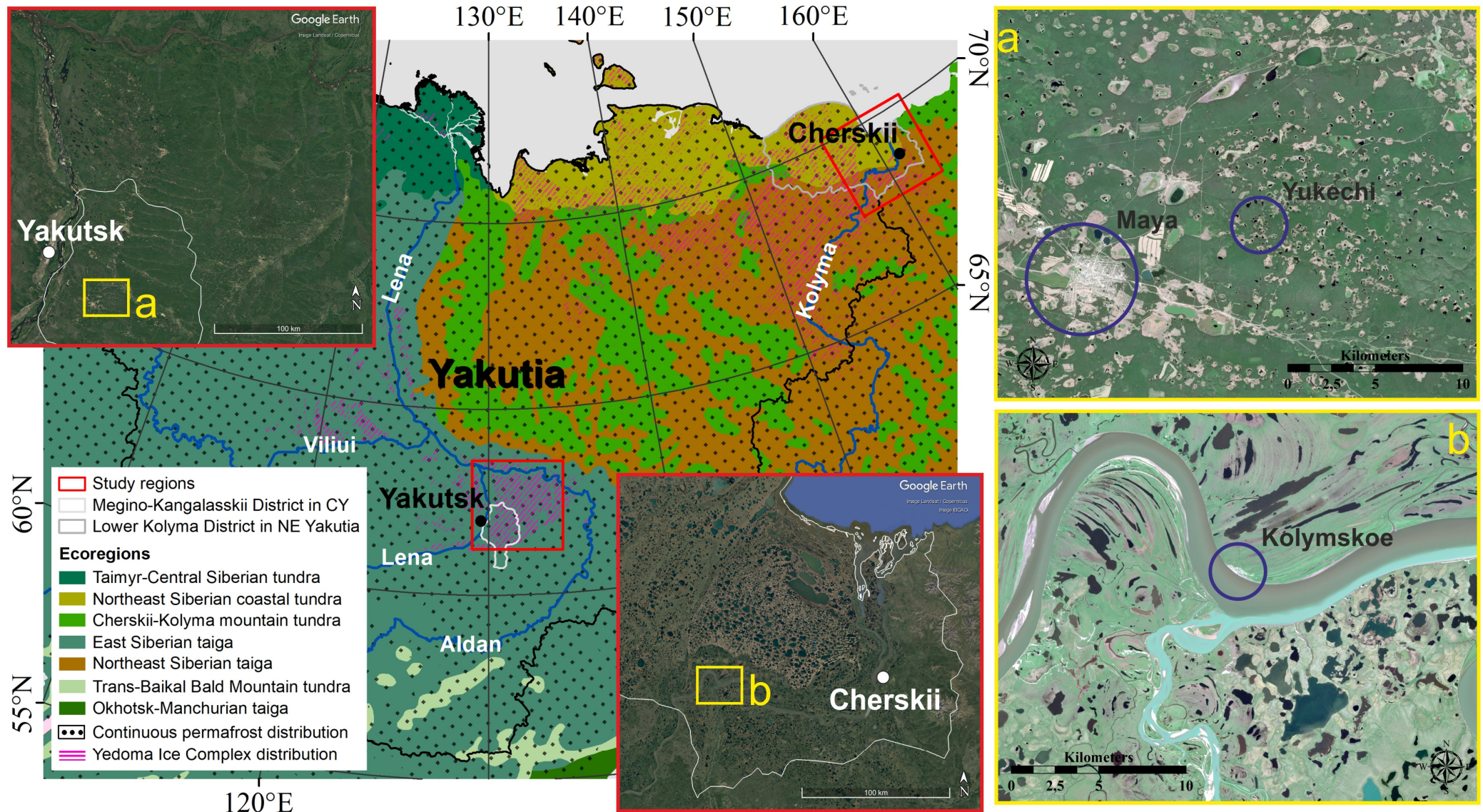
Pastoralism as *one* among other forms of land use in permafrost regions

Permafrost Dynamics and Indigenous Land Use: Tracing Past and Current Landscape Conditions and Effects of Environmental Change in Yakutia, Russia (submitted 07/19 to DFG)



Project focus in line with and complementary to existing research

Research sites: the view from above



 Regional context, key study sites, and rural communities of the research project

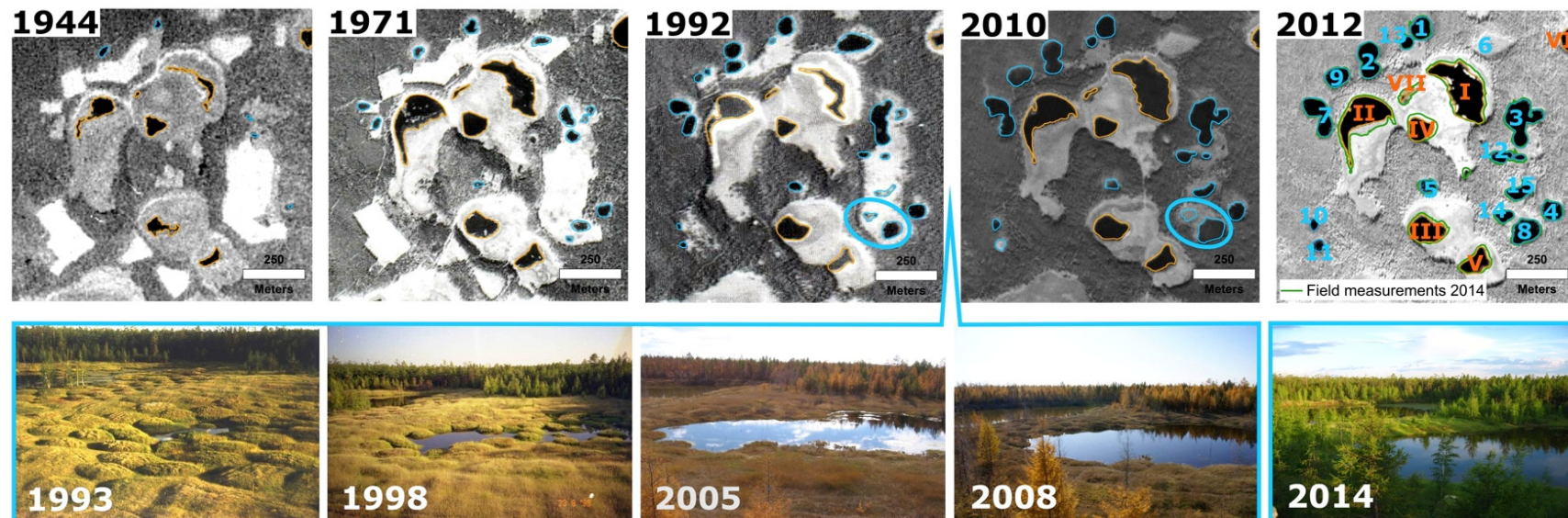
Scientific aims and work packages (1/3): Outline of landscape changes, 1.000 years

A Understanding permafrost landscape changes over the last 1000 years, notably in periods when resource use was limited to hunting and gathering, whereas pastoral forms of land use were not existent yet – *The natural (pre-pastoral) landscape aspect.*

A1 *Reconstructing environmental conditions and landscape dynamics during the last 1000 years based on thermokarst lake and basin sediment archives and ecological analyses and detection of potential human activities (pastoralism) in the uppermost sequences at key sites.*

A2 *Quantifying morphological changes due to permafrost degradation by high-resolution remote sensing analysis, and geomorphological field survey for reconstruction of permafrost degradation and aggradation cycles at key sites.*

A3 *Quantifying the regional distribution and dynamics of thermokarst landforms.*



Scientific aims and work packages (2/3): Human-environment interaction, 100 years

B Determination of anthropogenic and natural parameters of landscape dynamics over the last century, considering changing modes and intensity of pastoralism and other forms of land use – *The cultural landscape aspect.*

B1 *Determining ecological and climatic gradients, their seasonal and annual changes within the study sites and their influence on land cover, hydrology, biomass productivity, and permafrost stability.*

B2 *Evaluating the historical and present conditions of indigenous land use in the study regions to assess its influence on landscape evolution, using published material, archive sources, and inhabitants' memories.*

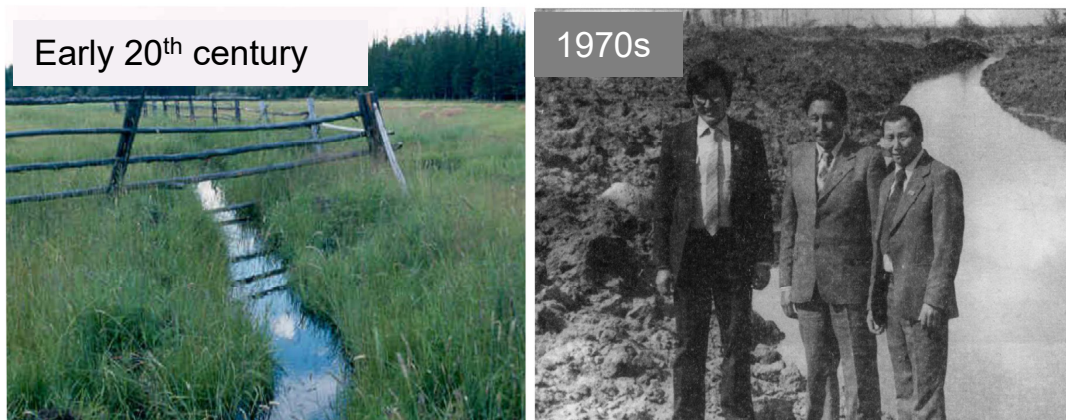
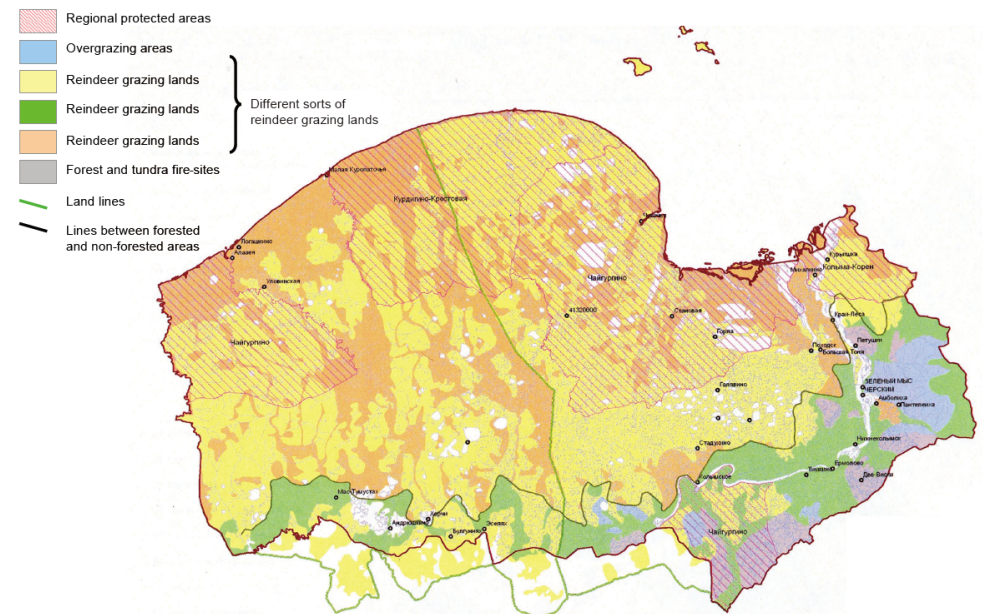


Photo left: S. Crate; right: Akimov 2006, p. 216



Kurvits et al., 2009, pp.14, CAFF Techn. Rep. 19

Scientific aims and work packages (3/3): Assessing (near-) future landscape change

C Evaluating on regional and local scale how socio-economic changes in different land-use activities will feed back into landscape development and vice versa –

The synthesis and future aspect.

C1 Identifying main demographic, economic and socio-cultural drivers of different forms of land use (including different forms of pastoralism).

C2 Assessing to which extent land-use changes in the study regions correlate with, aggravate, or neutralize the likely impact of climate-change effects on permafrost landscape development and modelling the future susceptibility of the key study sites to permafrost degradation.



We express our sincere gratitude to IASC and IPA, without whose support the activities of the “Permafrost and Culture” Action Group would not have been possible. Sincere thanks also to our research partners and colleagues.

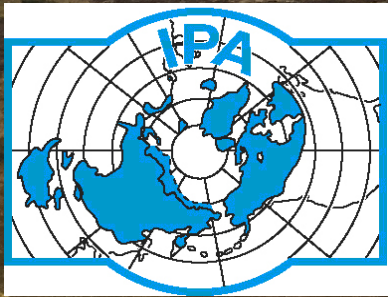


Photo: M. Ulrich



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