NordBorN meeting in Denmark

Aarhus 25-27 March 2025

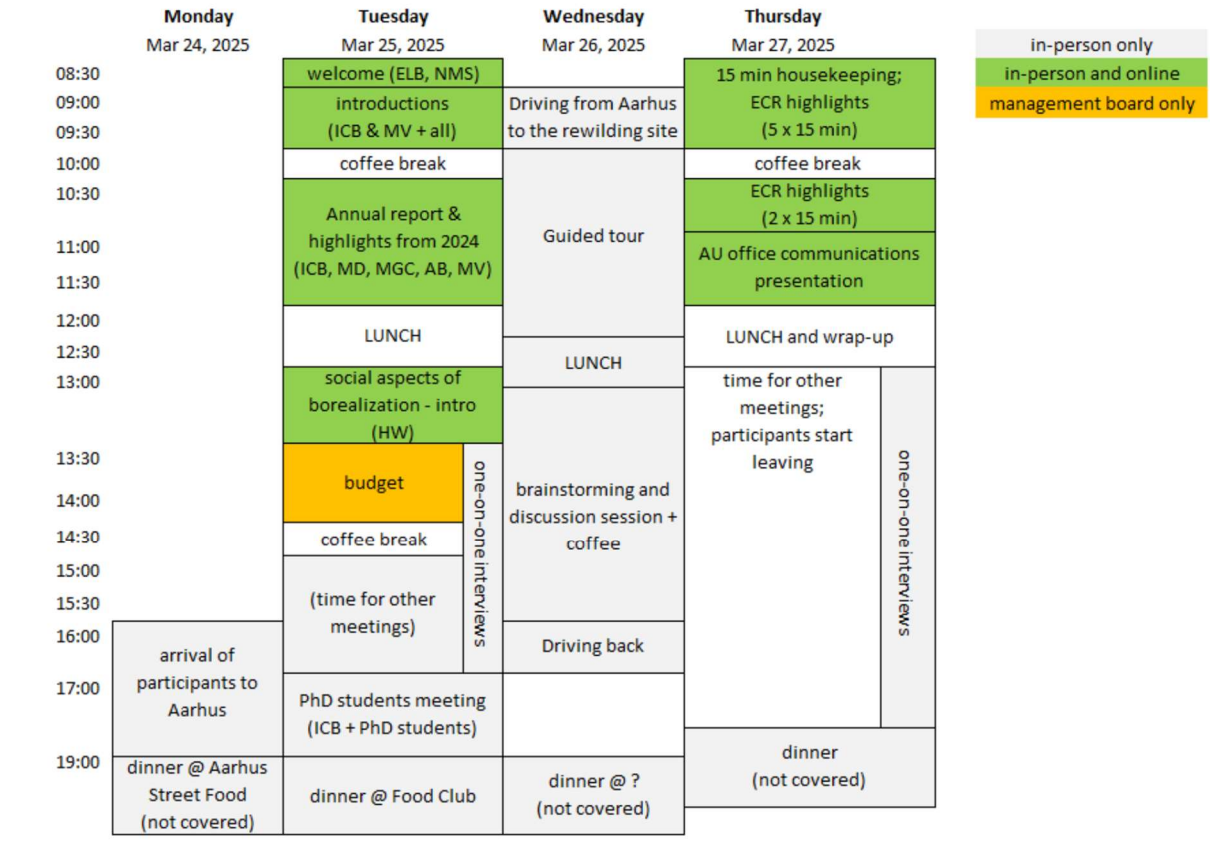
Attendants

In person: Timo Kumpula (TK), Maria Pavolotskaia (MP), Miguel Villoslada (MVi), Dave Williamson (DW), Helen Wheeler (HW), Sarah Evans (SE), Elias Koivisto (EK), Jón Guðmundsson (JG), James Speed (JDMS), Mariana García Criado (MGC), Isabel C Barrio (ICB),Niels Martin Schmidt (NMS), Tanguy Bernard (TB); Anne Bjorkman (AB), Beatrice Trascau (BT), Alexandra Barry (ABa), Mathilde Defourneaux (MD), Mariana Verdonen (MV), Laura Barbero-Palacios (LBP), Efrén López-Blanco (ELB), Jane Jepsen (JUJ), Gala Kozlenko (GK) [from left to right in the image, top and bottom row]

Online: Katrín Björnsdóttir (KB), Jarad Mellard (JM)

Meeting venue: Conference Center Building 1420-1423, Fredrik Nielsens Vej 2-4, Aarhus. Main meeting room: M 1.1 1421-118

NordBorN meeting in Denmark -- plan overview



Tuesday March 25

8:30-9:00 Welcome

NMS, ELB and GK welcomed meeting participants to Aarhus University. They provided an overview of the meeting agenda and covered the main points regarding logistics for the meeting. The main venue for the meeting on Tuesday and Thursday was the Conference Center of Aarhus University, where we had a main meeting room and several smaller rooms for conducting one-on-one interviews. On Wednesday there was a visit planned to the Mols Laboratory rewilding center, a research centre owned by the Natural History Museum of the University of Aarhus located about an hour drive from Aarhus.

9:00-10:00 Introductions

ICB gave a short presentation of the NordBorN project. NordBorN is a University Cooperation project funded by NordForsk for 5 years (2024-2028) that involves 9 institutions, and a growing number of participants. Since the first project meeting in Iceland last March 2024, ABa and MP have joined the team at GU as PhD students, EK joined the UEF team as PhD student and DW joined the NTNU team as a postdoctoral researcher. In addition, SE is the youngest and most

recent addition to the team at AUI, where she will be developing her MSc project on social perceptions of borealization. Welcome all!

A total of 20 NordBorN researchers attended the meeting in person and 2 others attended online for parts of the meeting. All institutions were represented at the meeting. In addition, this year we had three guests from Anglia Ruskin University: Helen Wheeler (HW), Holly Clover (HC) and Amy Wright (AW), who are investigating the linkages between ecological and societal implications of borealization in the Arctic.

All participants, in person or online, were asked to send a fun picture of themselves and introduce themselves.

Finally, MV reminded NordBorN researchers of the resources available in the shared folders, including the database of funding opportunities, upcoming conferences and PhD courses.

10:30-12:00 Annual report and highlights from 2024

ICB gave an overview of the first year of NordBorN activities. By the end of March 2025, we will have to submit our first annual report to NordForsk. The reporting involves two platforms, the reporting of outcomes through the ResearchFish portal, and the report itself, to be submitted through the NordForsk online system.

Since most NordBorN researchers do not have a ResearchFish account, a form was set up by MV so that NordBorN researchers can submit information about NordBorN-related outcomes, that are then manually entered into ResearchFish. The form is open for submission any time, but a question is whether we should request input regularly (e.g., quarterly). It was suggested that rather than requesting input through the form, it might be more effective to allocate a specific time during the annual meeting to focus on this reporting part, when we can gather all the relevant information from participants and enter it into ResearchFish directly. Another question was what counts as a NordBorN-relevant output, as some of the items to be reported in ResearchFish include things like being part of an Editorial Board or being invited as a keynote speaker, that could be related to our “borealization” work but is not necessarily a result of the collaboration. A suggestion was to understand NordBorN-relevant outputs broadly, as those outputs also highlight parts of the work carried out by NordBorN researchers and the broader impact of the project. In this sense, we revisited the definition that was agreed on at the last NordBorN meeting of a NordBorN-related project or activity as that where at least two NordBorN partners were involved. This definition might be too stringent, for example to include activities led by NordBorN researchers, related to borealization, that do not involve other partners, or that only involve partners outside the network. We agreed that, as long as the researcher considers the activity relevant to NordBorN, it should be considered a NordBorN activity.

- ➔ Thus, at the meeting it was decided that a **NordBorN project or activity** should be any project or activity conducted by a NordBorN researcher related to the topic of borealization.

The report to be submitted through the NordForsk online system includes two main sections, the financial report and a scientific report including subsections on deviations from the project plan, gender balance, highlights and main findings, and Nordic added value.

One question came up regarding the gender balance section. Currently in this subsection we report on diversity, rather than gender alone because we believe gender is just one aspect of diversity, which is a more interesting aspect that we want to encourage in our team. Reporting on diversity issues is challenging because we have not asked this information directly from participants and it relies on assumptions we are making. If we were to ask for this information, it could not be collected in a completely anonymized way (we need to know who has answered the survey) and the information should be treated confidentially; we would need to ensure that only certain people have access to that information, and that only anonymized summaries of that information are shared for reporting purposes. In any case, all questions relating to this potentially sensitive information should include the option "prefer not to say".

During its first year of activity, the NordBorN consortium has expanded from 27 to 35 members, and early career scientists now make up 33% of the consortium (11 participants). There have been no major deviations from the original plan, although some adjustments were needed to accommodate delayed recruitments, and we have also been able to make the most of some emerging opportunities. In its first year NordBorN has met, and even exceeded, the planned deliverables. For example, during 2024 NordBorN researchers submitted 5 funding applications (out of the 2-3 planned) and published 2 papers (out of the 6 planned at the end of the funding period).

Some of the main highlights of the year were presented by the leading authors:

Mathilde's PhD

MD successfully defended her PhD at the Agricultural University of Iceland last December 2024. Her project, titled "The impacts of spatio-temporal shifts in vertebrate herbivore communities on the functioning of the Icelandic tundra" was co-supervised by ICB (AUI), JDMS (NTNU) and Noémie Boulanger-Lapointe (University of Victoria, Canada). MD's PhD project thus represents an excellent example of PhD co-supervision between Nordic partners (AUI, NTNU), involving also other international collaborators. MD's PhD project was initiated in 2021 within the framework of TUNDRAsalad, a research project funded by the Icelandic Research Fund, which addressed the role of herbivore diversity in changing tundra ecosystems. MD's research focused on Iceland, where she documented large changes in herbivore communities over the last decades associated with climate and land-use changes. Overall, the number of domestic herbivores declined and wild herbivores increased in Iceland, but there was no overall increase in grazing pressure. These changes have the potential to exacerbate human-wildlife conflicts where wild migratory geese are perceived as competing with sheep in the grazing areas. As well, these changes have important implications for the functioning of tundra ecosystems, for example in the redistribution of nutrients across the landscape.

MD is the first NordBorN PhD student to graduate. Congratulations Mathilde!

Plant borealization across the Arctic

MGC presented the results of a study to assess patterns of borealization of plant communities across the Arctic. The study used existing plot-level vegetation datasets from the International Tundra Experiment (ITEX) network, including 32 study areas, spanning 1,137 plots, resurveyed between 1981 and 2023 and encompassing 287 vascular plant species. The study reveals that borealization occurred in around half of the studied plots, and it was more prominent at sites in Eurasia, closer to the treeline, in warmer and wetter regions, and where the magnitude of climate

change was lower. The results also indicate that borealization will be mainly driven by the spread of already established species in the tundra, rather than the widespread replacement of tundra by boreal specialists. A preprint of the study is openly accessible on *EcoEvoRxiv*, and the manuscript has been submitted for publication. The project received funding from the United Kingdom - Iceland Arctic Science Partnership Scheme, funded by the UK Department of Science Innovation and Technology and NERC, to MGC (UEdin) and ICB (AUI).

Submission of MSCA DN application

AB presented an overview of the grant application that was submitted last November 2024 to the Marie Sklodowska-Curie Actions (MSCA) Doctoral Networks call of the European Commission. The proposal involved most NordBorN partners and expanded the consortium to include non-academic partners and relevant stakeholders. Funding in this application would fund 14 doctoral candidates to develop their projects related to borealization of tundra ecosystems. Results of the call will be announced in April 2025.

Borealization perspective manuscript

MV presented an overview of the status of the manuscript. The term borealization has been applied to describe northward shifts in the distribution of boreal species, mainly in marine environments. Similar changes are described for terrestrial ecosystems, but a common terminology is lacking. In the paper, we define the term tundra borealization as shifts in species composition with climate change and land use change from the boreal forest into the tundra biome. Land use changes interact with climate change to lead to species and community reorganization in northern biomes, and borealization can have important consequences to food webs and ecosystem functions. There is growing evidence of borealization of plant and animal communities in tundra ecosystems and there are different methods that can be used to quantify borealization. Yet, metrics to assess borealization need to be standardized. Bringing together different definitions and lines of evidence for tundra borealization, we aim to emphasize this important ecological process and rapidly evolving area of research. The manuscript will be submitted for publication soon.

13:00-13:30 Social aspects of borealization: introduction to the project

HW introduced the project *Understanding the interlinkages between ecological and societal implications of borealisation in the Arctic* funded by the UK Department for Science, Innovation and Technology and Foreign and Commonwealth Development Office, as part of the United Kingdom - Arctic Council Working Groups – Research and Engagement Scheme 2024/25. As part of this project, HW and her team conducted interviews using a cognitive mapping technique on researchers' perceptions of the societal implications of the processes of borealization. The aim of the research is to support Arctic Council Working Group synthesis reports, such as the Arctic Monitoring and Assessment Program (AMAP) "Societal Implications of Climate Change in the Arctic" report. The results of this study will be written up into a research manuscript for peer-reviewed publication.

As an example of a research project bridging across the ecological and social implications of borealization, HW also introduced the BARIN – socio-ecological resilience project funded by the Canada – Inuit Nunangat – United Kingdom Arctic Research Programme (CINUK). BARIN

addresses how the northward expansion of beavers into the Arctic is impacting hydrology, ecosystems, fish and people and their livelihoods. Within BARIN, university and government scientists work with Inuvialuit organizations and people to coproduce research and develop tools to support ongoing research and monitoring.

Helen Wheeler presenting the study on social implications of borealization

13:30-17:00 Social aspects of borealization: one-on-one interviews with NordBorN researchers

HW, HC and AW scheduled one-on-one interviews with NordBorN researchers to better understand the perceptions of natural scientists on the ecological and social implications of borealization. During the ~45 min interviews, researchers were asked about the linkages between the ecological change associated with borealization and the impacts on people and communities. During the discussion, interviewers drew a cognitive map displaying those connections. Interviews took place on Tuesday afternoon and continued on Thursday afternoon.

13:30-14:30 Budget meeting (management board only)

ICB presented the financial report for the first year. Contact persons of all main partners were present at the meeting (AUI: ICB & MV; NTNU: JDMS; AU: ELB & NMS; GU: AB; UEF: TK; UiT: JM online). There have been some deviations from the original budget, leading to underspending by 25% of the requested amount to NordForsk. We are requesting to transfer the unused funds to the next year (keeping in mind that by the end of the project we should not have more than 10,000 NOK unused). NordForsk has been very understanding with the required adjustments to the budget, as long as these changes align with the original goals of the project. After the meeting ICB will send a more detailed explanation of these changes and questions regarding future use of funds raised during this meeting to NordForsk.

The difference in use of funding has been mainly due to delays in recruiting early career scientists to the project and different salary rates than originally budgeted for. The postdoc position at AUI started as a part time position at a lower salary rate. At UEF, the PhD position was recruited later and was able to secure external funding for part of the period (so this position only used one instead of 12 months of NordForsk funding originally budgeted for 2024). At UiT the salaries of the PhD student were higher than originally calculated, resulting in slight overspending. Regarding the own contribution of partners in terms of salaries of PhD students and postdocs, there was some delay in recruiting a PhD student at GU, but that is largely compensated by the recruitment of another PhD student to the project with own funding. At NTNU the recruitment of the postdoc position (own contribution) was delayed, and there were some issues with the recruitment of a PhD student (own contribution); this position is currently being readvertised. AUI's own contribution is also increased by an extension of the PhD position of MD until Dec 2024 (extended by 8 months).

In the future, to prevent recruitment delays as much as possible, we will ensure that enough lead time is allocated for the administrative processes at each university, and make sure that NordBorN positions are advertised as widely as possible so that we receive enough applications from suitable candidates. One issue that is already foreseen for the recruitment of a PhD student at AU in 2025 is the lack of suitable candidates and difficulties in finding matching funds for PhD students, so that funding for at least 3 years is ensured. A question was raised about the possibility of transforming this 12-month PhD position into a shorter postdoctoral position for which additional funding might be easier to secure.

The costs of organizing the first NordBorN meeting in Iceland were higher than originally planned, but the difference will be covered by the unused mobility funding to AUI in 2024 and part of its mobility allocation in 2025. In general, partners have not used the full amount of funding allocated to mobility and networking activities, because the first annual meeting was attended by fewer participants than budgeted for. This did not compromise the success of the meeting, which was also open to remote participants through a hybrid format for most sessions. The unused funds will be prioritised for mobility and networking activities of early career scientists within the network, thus further supporting the goals of the project.

Another challenge in budgeting has been the variable currency conversion rate between Nordic countries (NOK to ISK, DKK and EUR).

In 2025 the NordBorN consortium will continue its activities as planned, emphasizing continued support for research and training cooperation within and beyond the network.

17:00-18:00 Meeting with PhD students

As part of a small pedagogical research project, ICB met with NordBorN PhD students for a group interview to discuss their experiences in different doctoral study programmes in the Nordic region. Seven PhD students in different stages of their programme, from recently starting to recently graduated, participated in the group interview and shared their views on the doctoral programmes at their home universities. Although there are some similarities between universities, there are differences depending on the disciplines and among the individual research groups where the projects are developed. In general, PhD students felt that they are trained in some skills, but were lacking others, especially when thinking of careers outside

academia. The results of the study will be prepared as a report and will be summarized and shared with the students.

Wednesday, March 26

9:00-13:00 Visit to the Mols Laboratory rewilding center

The Mols Laboratory is a research facility of the Natural History Museum Aarhus located in the Mols Bjerge National Park. Mols Laboratory consists of a farm, Nedre Strandkær, and ~150 hectares of land, donated to the Natural History Museum Aarhus in 1941.

At Mols Laboratory we were welcomed by Bo Skaarup, Museum Director, who gave us a guided tour through the property and explained the ongoing research projects. For the last 10 years, with the support of the Danish Nature Fund, a rewilding project has aimed to restore biodiversity in the area. They have removed all small fences and maintain populations of Galloway cattle and Exmoor ponies that now roam freely year-round in the area and behave as wild animals.

13:00-17:00 Brainstorming and discussion session

The Mols Laboratory facilities provided an excellent venue to enjoy the sun and discuss some ideas. One of the topics discussed was the next NordBorN postdoc position, to be hosted at NTNU for 36 months, starting in January 2026. The new postdoc will be taking over from the tasks that MV has been developing so efficiently over the last year. This role in managing and coordinating is essential for the well functioning of the network. There will be several months of overlap between MV and the new postdoc in early 2026, so that they can work together, and the transition is smooth. Originally, the idea was that the NordBorN postdocs would also have time for their own research, but so far that has unfortunately not really been the case for MV. In the advertisement for the postdoc position for the first NordBorN postdoc it was difficult to clearly specify the time that should be allocated to the different tasks (coordinating role vs research), and this may still prove challenging for the next position, as needs vary over the year (e.g. grant application deadlines, reporting, etc.). A question was raised as to whether the next NordBorN postdoc should focus on a specific network-wide project, perhaps some synthesis or conceptual work, similar to the task of defining “tundra borealization” that MV is leading (see borealization perspective manuscript above).

This point led to discussing ideas for projects that could be developed across the network, and research questions we could address together. One of the strengths of the network is that we work across taxa and the ability we have as a group to do meaningful syntheses across fields of expertise. For example, following the work that HW and her team have been doing on the systematic map on the socio-ecological impacts of borealization, we could build on those efforts to identify impacts of borealization (e.g. focusing on a subset of documents identified by HW’s systematic map). One of the issues that still needs more attention relates to methodology and how to quantify borealization. Ideally, we should be able to identify process indicators that characterize boreal vs. tundra ecosystems, to be able to answer the question of when “the Arctic is no longer the Arctic”, by understanding functional changes associated with the biome shift. It was proposed that we could use carbon as an indicator, although there are many uncertainties

associated with C dynamics. Another aspect to focus on could be above-belowground processes. As well, it was suggested that we could use the framework of the essential biodiversity variables (EBVs). In any case, it would be great to define such metrics to be able to set baselines for future reference and assessment of change. Essentially the task would be to set up a framework for future work, or as it was nicely put "not actually doing it, but talking about it" ;)

The next step would be to actually measure these indicators. This could be envisioned as having one pilot "supersite", or alternatively a network of sites (multi-site approach). Of course, having a single site helps concentrate efforts but is risky in terms of representativeness. Another question would be where sites should be located. For example, one of the conclusions from MGC's work on plant borealization using the ITEX database was that more sites at the tundra-forest ecotone would be needed to understand borealization processes. Ultimately, the aim would be to strengthen our ability to make projections into the future, of what environmental changes will look like and what will be the main consequences.

Brainstorming under the sun

Thursday, March 27

8:30-8:45 Housekeeping

External Advisory Group. NordBorN needs to appoint an External Advisory Group (EAG) that can provide advice and strategic inputs to the steering committee. As described in the grant application, this board would consist of selected external experts with knowledge in biodiversity and ecosystem shifts with climate change in northern regions, that could discuss the interests of

different stakeholder groups. Ultimately, this board would also act as a bridge between NordBorN and the wider society, thus enhancing the dialogue with policy-makers. This issue is outstanding since last year, because the aim was to first conduct a stakeholder analysis to gain a better overview of the stakeholders involved in borealization issues, before identifying potential candidates for the EAG. Because the stakeholder mapping was not as advanced as we expected, members of the EAG have not been appointed yet, and it is a high priority this year to establish NordBorN's EAG. During the meeting we discussed who should be appointed to such an EAG. Focusing on NordBorN's key areas of activity (education and training of early career researchers, international collaborations, scientific excellence and societal impacts), we could contact relevant organizations, for them to suggest potential candidates. Suggested organizations were: APECS for education and training of early career researchers, IASC for international collaborations and CAFF for societal impacts; for scientific excellence we could suggest names of relevant experts. One thing to keep in mind is that we do not have dedicated funding for supporting the activities of the EAG, so we should keep their requirements to a minimum. ICB will contact the relevant organizations after the meeting and ask for their advice.

Next NordBorN annual meeting. The next annual meeting will be organized by the team at the University of Gothenburg. The idea is to have the annual NordBorN meetings as ca. 2-day meeting and 2 days of travel to/from. Annual meetings could be attached to other meetings or conferences or be the occasion for organizing such activities. AB and the GU team will propose some potential dates for the meeting in 2026.

The annual meetings provide space for general NordBorN updates and formal meetings of the steering group and the management board, but also for updates on the research being conducted by the growing number of early career scientists in the network. As well, these meetings provide opportunities to discuss future joint initiatives and brainstorming. At the meeting it was discussed that it would be good to reserve some time during the annual meetings for reporting activities, especially if the meetings are organized in early Spring, before the deadline for the annual reporting to NordForsk.

Regular meetings online. To keep information flowing across the network it would be nice to have regular meetings for updates. These could be organized with some regularity (e.g. every 2-3 months) or around specific times (e.g. upcoming deadlines, etc.), but it would be good to set the dates well in advance so that people can put them in their calendars.

NordBorN Early Career Researchers. The NordBorN early career team is growing, with now 11 ECRs! It was suggested that to organize ECR-related activities a first step could be to create a Teams channel. MV will take care of that.

8:45-11:00 ECR highlights

Elias Koivisto, UEF: *Understanding Arctic Greening Trends: A Multispectral Approach to Shrubification and Ecological Shifts.* Elias presented an overview of his PhD and his first paper. He started at UEF in autumn of 2024. Elias' focus is to study how phenology and different plant functional traits are shifting with the warming climate. He is using various remote sensing data and machine learning with different spatial scales to determine these changes. In the first two papers of his PhD he is taking a historical perspective and in the last paper he is forecasting these changes in different IPCC climate scenarios.

David Williamson, NTNU: ***Machine vision for plant phenology.*** Dave presented the results of a paper recently published in New Phytologist where a group from NTNU's University Museum used a machine learning model to assess trends in global flowering phenology over hundreds of years. They used 8 million herbarium specimens to investigate global temporal trends over two centuries in mean flowering date and flowering season duration within ecoregions. They found that temporal trends in flowering phenology were more variable at lower than at higher latitudes, likely due shifts in temperature and precipitation seasonality and lower constraints from photoperiod.

Maria Pavolotskaia, GU: ***Warming-driven shifts in pollinator communities and flowering phenology alter reproductive success in tundra plants.*** Maria will start her PhD at the University of Gothenburg in April 2025, where she will assess how pollinator communities in have changed in northernmost Sweden over the past decades following warming and how these changes relate to the pollination services they provide to plants. Maria's research will explore shifts in bumblebee community composition, the plants they rely on for pollen collection, and how these changes influence patterns of plant reproduction.

Alexandra Barry, GU: ***Tundra plant community productivity in a changing climate.*** Ally is studying how warming and other environmental changes in the Arctic tundra drive changes in plant community productivity through shifts in functional traits and community assemblages. In her PhD she will use a combination of growth chamber experiments and field observations to tackle this question.

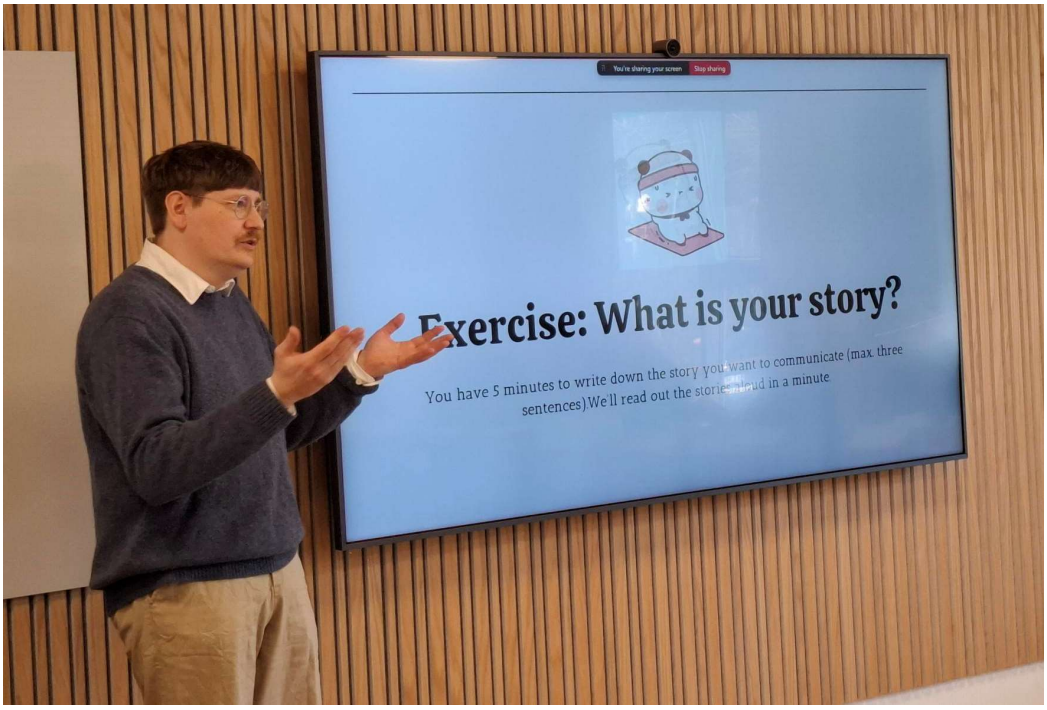
Beatrice Trascau, NTNU: ***Disentangling biodiversity responses to land-use and climate changes across Norway.*** Beatrice's PhD is focused on assessing the relationships between diversity patterns in space and time and land-use and climate changes. Beatrice is integrating large-scale land cover data as well as species occurrences to assess how past land-use changes have shaped the biodiversity across Norway. Beatrice presented the first paper derived from her PhD work, assessing the evidence base to assess biodiversity changes due to land use. The paper quantified changes in land cover across Norway over the past 20 years and found that certain land cover transitions correlated with a decline in biodiversity monitoring efforts.

Laura Barbero-Palacios, GINR: ***Caribou, muskox, and the Arctic balance: Understanding herbivore-landscape feedbacks.*** Laura presented an overview of her PhD project (started at GINR and NTNU in Spring 2024). She will model how caribou and muskox modify the landscape in West Greenland and how these changes affect their spatial behaviour; climate and land use change will be added as possible future scenarios. Laura also explained that two sets of size-selective exclosures will be built in west Greenland to study the effect of different herbivores on the ecosystem.

Tanguy Bernard, UiT*: Modelling Golden Eagle breeding success in Western Finnmark*. Tanguy presented the work he has been developing for the first chapter of his PhD. He adjusted a multispecies functional response model that allows to study the impact of several prey species population dynamics on the proportion of Golden Eagle breeding pairs attempting to breed. The most important prey species in explaining the temporal patterns seems to be the Willow Ptarmigan. The next step is to look at the role of reindeer carrion availability in explaining spatial patterns.

11:00-12:00 AU office communications presentation

Jeppe Kyhne Knudsen worked as a science journalist at DR, the Danish Broadcasting Corporation and is now a journalist working at the Dean's office at Aarhus University. Jeppe works together with researchers at AU to help them communicate their findings to broader audiences. During his presentation, Jeppe presented some background about communication models and proposed some exercises for us to think about the messages we want to convey and why.



Science communication starts by asking what is your story

12:00-13:30 Wrap-up

Next steps. Shortly after the meeting the first annual report will be submitted to NordForsk. Once the report is approved AUI will receive the payment for the second year (early May) and will transfer the corresponding funds to the main partners (mid May). As well, the manuscript on tundra borealization will be submitted for publication soon, and the network will be presented at the EGU conference in Vienna in late April.