



POLARIN

POLAR
RESEARCH
INFRASTRUCTURE
NETWORK

Deliverable 9.6
Report on TA implemented to date

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SUMMARY

POLARIN is an EU-funded project that through its Transnational Access (TA) programme provides researchers with free, cross-border access to unique polar research infrastructures across Europe and internationally, including world-class equipment and facilities. Successful applicants are granted with free access costs, travel, accommodation, and subsistence costs, allowing them to conduct research at facilities located and operated by research institutions and organisations based in a different country from their home institution. This initiative promotes international collaboration and knowledge exchange by granting access to specialized research sites and technology that are not available in a researcher's own country or with their national research infrastructure.

The implementation of the 1st call for proposals started in spring 2025. We describe here the projects that have taken place until 31st of August 2025.

Transnational access implemented until 31st of August 2025

1. BIPOLAR

Call ID: 1st POLARIN TA CALL

Project identifier: 15

Project Title: Cryptogam biodiversity dynamics under climate change in the Arctic and Antarctic poles

User Group Leader: Mariana García Criado, Centre for Ecological Research and Forestry Applications (CREAF), Spain

Status: Ongoing

Implementation period: 16/07/2025 – 31/03/2026

Research infrastructure(s):

- **Kilpisjärvi Biological Station University of Helsinki, Finland;** Implemented, physical access.

Implemented from July 20, 2025 to July 27, 2025, total units 14,0 user days

Users: Mariana García Criado, Centre for Ecological Research and Forestry Applications (CREAF), Spain; 7,0 days

Jiří Šubrt, University of Edinburgh, United Kingdom; 7,0 day

- **Pallas-Sodankylä Atmosphere-Ecosystem Supersite, FMI, Finland;** Implemented , physical access.

Implemented from July 16, 2025 to July 20, 2025, total units : 8,0 days

Users: Mariana, García Criado, Centre for Ecological Research and Forestry Applications (CREAF), Spain; 4,0 days

Jiří Šubrt, University of Edinburgh, United Kingdom; 4,0 days

- **Professor Julio Escudero Station, INACH, Chile; in planning, physical access. February 02, 2026 to February 16, 2026**

Abstract: Earth's polar regions are warming at unprecedented rates. However, little is known about the trends of cryptogam species (lichens and bryophytes), which are essential for ecosystem function, despite expectations that these can be seriously affected by climate change. BIPOLAR aims to quantify the potential for adaptation to climate change of bipolar cryptogams found both in the Arctic and Antarctica. We will employ a holistic and multidisciplinary approach comprising three different work packages, each with a distinct taxonomic and geographic focus (from the specific-specific to the regional and biome scales) and scientific approach (ecological and physiological). Here, we will quantify bipolar cryptogams' climatic niches (WP1), provide a better understanding of physiological acclimation of cryptogams (WP2), and untangle the effects of climate change on cryptogams' relationship with ecosystem functioning (WP3). Overall, BIPOLAR will establish a baseline for bipolar cryptogam climatic niches in order to better predict their future changes and effects on ecosystems, provide a foundation for Antarctic conservation and management plans, and strengthen currently fragmented Arctic and Antarctic research links.

Achievements (pending report for access to Escudero)

For WP1, we collected the following information at each plot: survey date, surveyors, habitat description, region, site, plot, species name, cover per functional group, and any additional notes. Microclimate data were downloaded for the TOMST loggers already established and contain information at 15-min intervals on temperature (at air, surface and soil level) and moisture content on the soil. We collected ~50 samples of species that we could not identify in the field in order to identify them later on in the lab. We took 10 photos of crustose lichens on rocks for further species identification. For WP3, for every lichen sample we collected the following information: collection date, habitat description, region, site, GPS coordinates, and species name. Collection from Pallas (two different sites) has one site accompanied by microclimate data from TOMST loggers (see above). Collection from Kilpisjärvi (four different sites) has three sites directly connected to microclimate data, while microclimate data for the fourth site will be extrapolated from model derived data from Kilpisjärvi by Dr Pekka Niittynen and Dr Julia Kemppinen.

2. Pro-Carbon

Call ID: 1st POLARIN TA CALL

Project identifier: 19

Project Title: Optical Proxies for estimation Carbon Fluxes in the Fram Strait

User Group Leader: Piotr Kowalczyk, Institute of Oceanology Polish Academy of Sciences, Poland

Status: Implemented, physical access.

Implementation period: 11/08/2025 – 27/08/2025

Research infrastructure(s): RV Kronprins Haakon, NPI, Norway; **Implemented**, 38 user days

Users: Aleksandra Kaleta, Institute of Oceanology Polish Academy of Sciences, Poland; 19,0 days

Rafael Gonçalves-Araujo, Danish Technical University, National Institute of Aquatic Resources, Denmark; 19,0 days

Abstract: Rapid warming over the last decades had led to the reduction of Arctic Ocean sea ice area and thickness, which led to increased primary production and changes in phytoplankton community structure toward smaller organisms. The main goal of the project is to determine set of empirical relationships between selected essential biogeochemical variables such as the concentrations of chlorophyll-a, nitrates, particulate and dissolved organic carbon and inherent/apparent optical properties in the Fram Strait which is divided by Polar Front separating Atlantic Water (east side) from the Polar Water (west side). Collected data will be used for the estimation biogeochemical variables from apparent optical properties (AOPs) and measured IOPs and for the development of regionally optimized ocean color remote sensing algorithms. Algorithms could be used to extend spatial distribution of biogeochemical variables based on AOPs measured in situ and from satellites, as well as assess their dynamic on temporal and vertical scales using autonomous measurements platforms e.g. ARGO floats. Field work will be undertaken in summer months of 2025 and 2026 onboard of Norwegian research ships r/v Kronprins Haakon. We will conduct instrumental in situ measurements of physical and chemical characteristics of water column and IOPs. Simultaneously, spectral and hyperspectral radiometric measurements will be conducted with use of profiling and floating radiometer. Radiometric data will be analyzed together with in situ measured and water samples and IOPs to develop regionally validated algorithms for retrieval of concentrations of chlorophyll-a, IOPs and concentrations of optically significant seawater constituents and the phytoplankton community structure. Developed algorithms will be applied to satellite products from various satellite missions.

Achievements

The field work was conducted during Fram Strait 2025 cruise on board of the Norwegian ice breaker r/v Kronprins Haakon and was organized in three main tasks – instrumental measurements of inherent and apparent optical properties of the upper layer (0–200 m of the Arctic Ocean), collection of water samples for laboratory determination of the particulate absorption, absorption by CDOM, concentration and composition phytoplankton pigments, phytoplankton and microbial community composition, and concentrations of the particulate carbon and inorganic nutrients. Additionally, laboratory experiments were set up to quantify uptake of nitrogen and inorganic carbon by microbial communities.

Collected samples and data acquired from measurements required analysis and post processing which require from 3 to 12 months after the cruise to complete. As soon as the data became available for statistical analysis and development of empirical relationships that will link values of optical variables with biogeochemical variables. Derived relationships will be used to develop an optical proxies for various fractions of organic carbon in the Arctic Ocean. Developed proxies will be used for further development of satellite algorithms and parametrisations used in biogeochemical models. Data and

relationships, algorithms and parametrisation will be published in the form of scientific paper within 24 months of completion of current project. All data will be published on open source data repository under CC-BY licence, with DOI.

3. SCOOP

Call ID: 1st POLARIN TA CALL

Project identifier: 50

Project Title: Sources and cycling of organic matter along glacial-proglacial-fjord flow paths

User Group Leader: Eva Doting, University of Pennsylvania, United States

Status: Implemented, physical access.

Implementation period: 05/08/2025 – 19/08/2025

Research infrastructure(s): UK Arctic Research Station, UKRI, United Kingdom; Implemented, physical access. 20,0 user days, 2 users

Users: Eva Doting, University of Pennsylvania, United States; 10,0 days

Anne Kellerman, Florida State University, United States; 10,0 days

Abstract: Glaciers are experiencing unprecedented, accelerating melting and retreat due to climate warming. This has led to an increase in glacier discharge, which supplies freshwater and bioavailable dissolved organic matter (DOM) and nitrogen (N) to vulnerable fjord ecosystems. However, the sources of bioavailable DOM in glacial runoff, and how these will be impacted by the up-glacier migration of snow lines, remain unknown. In addition, potential inputs of bioavailable DOM and N leached from proglacial soils that develop when new terrain is exposed as a result of glacier retreat have not been quantified, limiting our understanding of controls on the flux of bioavailable DOM and N from glacierized catchments. To address these knowledge gaps, we aim to constrain sources of bioavailable OM and N along glacial-proglacial-fjord flow paths and estimate changes in OM and N delivery to fjords as a result of glacier retreat. Specifically, we will determine the concentration and composition of DOM and N sourced from atmospheric deposition, supraglacial particulates, subglacial discharge and proglacial soils of two glaciers near Ny-Ålesund, Svalbard. We will employ bulk and molecular level analyses to quantify the concentration of dissolved and particulate total and organic carbon and N, the concentrations of nitrate and ammonium, and the composition of DOM. Furthermore, we will determine the bioavailability of DOM and N to the recipient downstream ecosystem by incubating water samples from supraglacial and proglacial ecosystems, and leachates sourced from aeolian or supraglacial particulates and proglacial soils with a fjord microbial inoculum. Our data will reveal the sources of bioavailable DOM and N in glacier runoff of land-terminating High Arctic glaciers. This will advance our understanding of how the supply of bioavailable DOM and N in glacier runoff will change in response to the up-glacier migration of snowlines and continued glacier retreat in a warming climate.

Achievements

To address the SCOOP objectives, we planned to collect small quantities of water, sediment and soil along the glacial-proglacial-fjord flow path of Midtre Lovenbreen and Austre Brøggerbreen, and to use collected samples in incubations to assess the biodegradability of OM and N along the sampled glacial-proglacial-fjord flow paths.

No preliminary results are available, as the generation of data from the collected samples is dependent on state of the art analytical instrumentation that requires laboratory-based sample processing and is subject to long wait times due to sample back-logs. We anticipate that generated data and results will contribute to the identified research priorities 'Terrestrial Carbon Cycle and Permafrost' and 'Polar Ecosystems and Biodiversity' and will answer the project objectives outlined in section 2.

4. USNA-PL

Call ID: 1st POLARIN TA CALL

Project identifier: 85

Project Title: Upscaling estimates of Arctic Soil nutrient Availability from Plot to Landscape

User Group Leader: Richard Streeter, University of St Andrews, United Kingdom

Status: Ongoing, physical and remote access.

Implementation period: 01/07/2025 – 06/09/2025

Research infrastructure(s): Kilpisjärvi Biological Station, University of Helsinki, Finland;

In person access from July 01, 2025 to July 08, 2025, **Implemented**, 21 days, 3 users

Users: Richard Streeter, University of St Andrews, United Kingdom; 7,0 days

Ian Lawson, University of St Andrews, United Kingdom; 7,0 days

Yajie Zhu, University of St Andrews, United Kingdom; 7,0 days

Remote access from September 5 to September 6, 2025, 2 days, **implemented**, **PR#2**

Abstract: Vegetation growth in tundra regions is limited by soil nutrient availability, and nutrient availability is affected by the soil physical environment. The soil physical environment is sensitive to climatic conditions and will be affected by a warming climate. To accurately model how vegetation cover in tundra regions will change it will be necessary to predict changes in nutrient availability. Currently, the main limitation to doing this is limited understanding of how nutrient availability in tundra regions varies spatially. Vegetation cover and microtopography affect the soil physical environment and are likely to be particularly important in determining nutrient availability. This project will address this challenge by quantifying soil nutrient availability across local and landscape scales using an innovative combination of plot-based measurements and landscape scale drone remote sensing. The aims of this project are to 1) understand how small-scale variations in soil and vegetation cover affect the availability of nutrients to plants and; 2) to scale-up small-scale observations so we can map nutrient availability in detail at a landscape (hectare-) scale. To achieve these aims the project

has two objectives. First, to make detailed measurements of soil temperature, soil moisture and available nutrients in different topographic/vegetation settings over the majority of a growing season. These measurements would take place in Kilpisjärvi in Finland. Second, we will use drones to map these same areas at high resolution and build digital models of the land surface. These models will be used to map vegetation cover and nutrient availability at a landscape scale. This project is an essential step to improve our estimates of the response of tundra ecosystems to future climate change by increasing our understanding of how nutrient availability varies in tundra soils at landscape scales. This will develop the basis for future land surface modelling exercises.

Achievements

Our fieldwork was completed on 06 July 2025 and included the following components:

Sample sites: 16 transects were established within the planed area, oriented between SSW and SSE, with moderate elevation variation and vegetation cover >80% at both ends. Transects were assigned to 4 categories (shrub-ridge, shrub-hollow, lichen-ridge, lichen-hollow), each replicated 4 times. At both ends of each transect, a 1 × 1 m quadrat was placed, resulting in a total of 32 quadrats.

Dataloggers: Sensors were deployed in 16 quadrats across 8 adjacent transects. Each quadrat was equipped with 1 temperature probe, 1 soil moisture probe, and 4 pairs of PRS nutrient probes. In total, 6 Tinytag temperature probes, 6 TOMST temperature probes, and 17 Delta-T soil moisture probes (4 also recording temperature) and 128 pairs of PRS probes were deployed. Soil nutrient probes were inserted to ensure full contact with the organic layer covering the ion-exchange membrane. (All the nutrient probes (bar 3 out of a total of 256 – two broken and one pulled out of the ground) were successfully retrieved on 01 Sep and the data loggers also retrieved.)

Soil survey: Soil organic layer thickness was measured at 5 locations in each quadrat, and organic soil samples were collected for subsequent loss on ignition laboratory analysis in UK.

Vegetation survey: For all 32 quadrats, geospatial position (corner coordinates), slope aspect, and mean vegetation height were measured. Vegetation community composition to species level was assessed following the DOMIN scale.

UAV survey: UAV data were acquired across the entire study area (350 x 350 m, encompassing all quadrats) using a DJI Phantom 4 UAV equipped with a multispectral camera. Flights were conducted on 30 June 2025 at 10:30 local time under diffuse light conditions and wind speeds <5 m/s. The UAV was flown at a constant altitude of 80 m above ground level, producing a ground sample distance (GSD) of ~4.5 cm/pixel. A grid-based flight plan was implemented in DJI Pilot software to ensure sufficient image overlap for photogrammetric processing. 400 vegetation ground control points (GCPs) were surveyed with a differential GPS system to an accuracy of <0.05 m.

5. ROBIN

Call ID: 1st POLARIN TA CALL

Project identifier: 91

Project Title: The roles of biotic interactions in shaping the diversity, distribution, and functions of Arctic pollinators

User Group Leader: Diana Laura Rojas Guerrero, Jagiellonian University, Poland

Status: Implemented, physical access.

Implementation period: 29/06/2025 – 25/07/2025

Research infrastructure(s):

- Arctic Station, University of Copenhagen, Denmark; Implemented, from June 29, 2025 to July 13, 2025; 28,0 days, 2 users
Users: Diana Laura Rojas Guerrero, Jagiellonian University, Poland; 14,0 days
Zuzanna Płoszka, Jagiellonian University, Poland; 14,0 days
- The DMI Geophysical Observatory Qaanaaq, DMI, Denmark; Implemented, from July 22, 2025 to July 26, 2025; 12,0 days, 2 users
Users: Diana Laura Rojas Guerrero, Jagiellonian University, Poland; 6,0 days
Zuzanna Płoszka, Jagiellonian University, Poland; 6,0 days
- Zackenberg Research Station, Aarhus University, Denmark; Implemented, from July 08, 2025 to July 22, 2025; 7,0 days, 1 user

User: Michal Kolasa, The National Research Institute of Animal Production, Poland

Abstract: Biodiversity, a critical determinant of ecosystem stability and function, is shaped by the interactions among species. How these biological interactions affect species' distributions, genetic structure, and functions is poorly known. Here, we propose to dissect the diversity and biotic interactions of insect pollinators in different areas of Greenland. Specifically, we aim to reconstruct pollinator taxonomic and genetic diversity and distribution, as well as the diversity and distribution of their microbial symbionts, parasites, and pathogens, across three areas of Greenland. Further, we aim to evaluate the roles of microbial symbionts in insect local adaptation and their interactions with other organisms. We will do this by systematically sampling insect pollinator communities, emphasizing hoverflies, from flowering plants in three areas of Greenland. Insects will subsequently be used for laboratory analyses through host and microbial marker gene and metagenomic sequencing-based techniques. This work will substantially contribute to the understanding of pollinator and their microbiota diversity and distribution in Greenland, at different spatial scales. It will also improve knowledge of the drivers of these distributions and their significance for ecosystems facing climate change.

Achievements

Samples collected in June - July 2025, across four localities, encompass 376 multispecies and individual specimen samples (Qeqertarsuaq, n = 99; Ilulissat, n = 54; Qaanaaq, n = 44; and Zackenberg, n = 179). Records of such datasets include information such as: • Collection date, collector detail, and locality

name • Geographic coordinates (latitude, longitude) • Method of collection (i.e. sweep net, malaise trap, sticky trap, by hand) • Biotic interactions (i.e. apparent infections, signals of disease, plant visits) • Putative morphology-based identification or classification A compilation of such records is stored in digital format in our research group's archive and is available for immediate use. Pollinator collections will be processed for multitarget amplicon sequencing in October 2025. Individual samples will be selected for metagenomic sequencing in early 2026. Upon results publication, metadata files will include key information obtained after sequencing-based specimen processing and based on gene markers: • Sequencing-based species identity (barcode sequence) • Accession numbers for all sequencing data • Status of biotic interactions (i.e. infections by pathogens, parasitoids or symbionts)

6. MOSQUITO

Call ID: 1st POLARIN TA CALL

Project identifier: 93

Project Title: Mosquito-borne viruses of the Arctic: an ecosystem perspective

User Group Leader: Essi Korhonen, University of Helsinki, Finland

Status: Implemented, physical access.

Implementation period: 01/07/2025 – 08/07/2025

Research infrastructure(s): Greenland Institute of Natural Resources, GINR, Greenland; Implemented, in person, from July 08, 2025 to July 14, 2025; 22,0 days, 3 users , physical access.

Users: Lorna Culverwell, University of Helsinki, Finland; 6,0 days

Teemu Smura, University of Helsinki, Finland; 8,0 days

Hanna Vauhkonen, University of Helsinki, Finland; 8,0 days

Abstract: Global change is rapidly transforming the interplay between wild animals, pathogens and humans. This causes new transmission routes, altered epidemiology and the risk of new disease. The Arctic epitomises such changes. To understand these changes, studying viruses alone is not enough. The interplay between mosquito hosts, their viromes, and the hosts and predators of mosquitoes constitutes an intricate ecological network. It is only by studying this network that we can predict how global change will affect the transmission routes of diseases in the future. Given generally low human population densities in this region, the main source of blood meals for bloodsucking insect vectors are mammals other than humans and birds. Insect vector dynamics are then dependent on a system extending way beyond human-vector interactions, effectively illustrating the topical OneHealth concept. Despite the importance of understanding this network, the links between insect vectors and other parts of the ecosystem are poorly known. In this project, we will use Greenland as a model system to i) examine the full virome of mosquitoes, ii) resolve the spatial and temporal dynamics of mosquito populations and their viromes, iii) relate such dynamics to their biotic and abiotic drivers, and iv) apply the resulting knowledge to assess and predict changes in virus transmission pathways in a changing Arctic.

Achievements

The research team travelled to Greenland to investigate mosquito populations and their associated viral diversity. Work was conducted primarily at Kobbefjord Research Station using a mobile sequencing laboratory transported from Helsinki. Equipment included a Bento Lab, MinION sequencer, Qubit, laptop, and other essential laboratory tools. Despite logistical challenges caused by flight delays and the lack of freezer and internet facilities at the station, the team successfully adapted their workflow to complete the planned research. Mosquitoes at different life stages (larvae, pupae, and adults) were collected from established field sites near Nuuk and at Kobbefjord Research Station.

7. ARCTICOLLAB

Call ID: 1st POLARIN TA CALL

Project identifier: 106

Project Title: A view from nowhere? Situating research collaborations in the Swedish Arctic

User Group Leader: Hanna Oosterveen, University of Manchester, United Kingdom

Status: Implemented, physical access.

Implementation period: from May 07, 2025 to May 30, 2025, physical access.

Research infrastructure(s): Abisko Scientific Research Station, SPRS, Sweden; Implemented, 23 days

Users: Hanna Oosterveen, University of Manchester, United Kingdom; 23,0 days

Abstract: At Arctic science conferences, there are few terms Arctic researchers use more than ‘collaboration’. The challenges of conducting research in the Arctic, an unforgiving, strategic, and rapidly warming region that is home to many and also far from large centres, require diverse collaborations. Despite the centrality of collaboration in Arctic research, meanings and practices of collaboration lack critical engagement. In this project, I will follow the collaborations fostered to carry out scientific research at the Abisko Scientific Research Station, whether that be between multi-disciplinary researchers, reindeer herders, local communities, politicians, tourists, artists, and national institutions. Following these collaborations will make it possible to look at how collaborations condition scientific practices, what influences the nature of collaborations, the hegemony of some perspectives on the environment over others, how collaborations are perceived by those involved, and how collaborations and all the complexities they come with transform into research outputs. Moreover, this project examines how the changing Arctic environment influences collaborations.

Achievements

Conducted 47 interviews of around an hour long. Collected field notes from participant observation carried out while scientists were in the field, showing me their methods while I lent a hand.

The interviews are still in the process of being transcribed. After they are transcribed, the transcription is stored in a separate place (UoM P-drive) from the original voice recording so that the voice cannot be matched to the transcript. In the process, once transcribed, I assign each interview

participant a pseudonym. I sort the interview transcripts thematically and also remove any identifiable features from the excerpts.

The fieldnotes have all been typed up and are in the process of being sorted thematically. All names are pseudonymised and identifiable features are either removed or changed.

8. TEMPNET

Call ID: 1st POLARIN TA CALL

Project identifier: 127

Project Title: The temperature-dependence of arctic interaction networks

User Group Leader: Patricia Kaye Dumandan, Swedish University of Agricultural Sciences, Sweden

Research infrastructure(s): Greenland Institute of Natural Resources, GINR, Greenland; Zackenberg Research Station, Aarhus University, Denmark

Status: Implemented, physical access.

Implementation period: 16/06/2025 – 07/08/2025

Greenland Institute of Natural Resources, GINR, Greenland; Implemented, from June 16, 2025 to June 23, 2025, 21,0 days, physical access.

Users: Patricia Kaye Dumandan, Swedish University of Agricultural Sciences, Sweden; 7,0 days

Tomas Roslin, Swedish University of Agricultural Sciences, Sweden; 7,0 days

Henrika Bosua, University of Greifswald, Germany; 7,0 days

Zackenberg Research Station, Aarhus University, Denmark; Implemented, from June 22, 2025 to July 4, 2025; 7,0 days, physical access.

User: Tomas Roslin, Swedish University of Agricultural Sciences, Sweden; 7,0 days

Abstract: Natural communities can be conceptualized as webs of interactions, with species as nodes and interactions as links. Little attention has been given to the fact that most elements within such networks are temperature-dependent, and that with ongoing climate warming, they are subject to change. Our team is dedicated to developing the conceptual framework required to address such change. In brief, we are formalizing the temperature-dependence of ecological interaction networks into mathematical models. With the POLARIN application, we aim to apply and parameterize the theoretical framework to an empirical model system: arctic networks subject to severe temperature limitations. In other words, we characterize the occurrence of node and links in arctic networks by their temperature response functions. This is implemented as i) observations of species interaction frequencies under ambient conditions, ii) ecophysiological experiments aimed at quantifying species

performance under controlled temperature conditions, and iii) mesocosm experiments targeting species interactions under experimentally elevated vs. ambient conditions. Ultimately, the project will yield a conceptual framework for the benefit of both society and a large scientific community, essential for producing informed estimates of future changes in the arctic realm.

Achievements

During the field season, we conducted laboratory and natural experiments, and field surveys in Kobbefjord and Zackenberg. This included: (i) thermal performance assays (using movement activity and development rate as responses), ii) conducting a pilot experiment, based on deploying a camera-based monitoring system to record arthropod activity in temperature-monitored field enclosures, and iii) observing arthropod activity during different weather conditions in situ. Beyond implementing our original plans, we also conducted some additional, complementary experiments. One of which was focused on establishing the development rate of mosquitoes as a function of temperature. Another was part of the pilot experiment conducted in a mesocosm setting, where we attempted to score pollen transfer in the mesocosms by measuring UV spread to supplement our imagery data.

9. NICE

Call ID: 1st POLARIN TA CALL

Project identifier: 92

Project Title: Unravelling the role of ice cover on bacteria diversity and nitrogen cycling in warming arctic lakes

User Group Leader: Anna Carratala Ripolles, EPFL, Switzerland

Status: Implemented, physical access.

Implementation period: 02/06/2025 – 23/06/2025

Research infrastructure(s): Arctic Station, University of Copenhagen, Denmark, 31 days, 3 users

Users: Anna Carratalà, Laboratory of Environmental Virology (LEV), École Polytechnique Fédérale de Lausanne (EPFL), Switzerland, 13 days.

Htet Kyi Wynn, Laboratory of Environmental Virology (LEV), École Polytechnique Fédérale de Lausanne (EPFL), Switzerland, 13 days.

Prof. Tamar Kohn, Laboratory of Environmental Virology (LEV), École Polytechnique Fédérale de Lausanne (EPFL), Switzerland, 5 days.

Abstract: Arctic lakes are some of the most extreme and pristine freshwater environments on Earth, with their seasonal ice cover hosting unexpectedly abundant microbial communities that may play key roles in nitrogen cycling and other biogeochemical processes. As climate change accelerates the reduction of ice cover duration and thickness, understanding how these microbial communities adapt to changing conditions is crucial for predicting the broader ecological impacts of global warming. This project aims to characterize the distinct environment created by the ice cover in Arctic lakes, focusing

on its role on the development of a specific microbiome and uncovering the adaptive strategies of ice-associated bacteria. Our research will involve environmental monitoring, physiological assays, and metagenomic sequencing to track fine-scale patterns of microbial growth and metabolic activity within the ice-water interface. We will sample different sections of the ice cover, water column, and bioaerosols to capture spatial and temporal dynamics in microbial community composition and function. Additionally, we will focus on nitrogen cycling processes, investigating how microbial activity drives key transformations such as nitrogen fixation, nitrification, and denitrification. By comparing results from two lakes in West Greenland and resolving lake-specific differences, we will gain valuable insights into how local environmental conditions influence microbial-driven biogeochemical processes. The project will be conducted over a three-week field campaign in the month of June at the Arctic Station (Qeqertarsuaq, Greenland), with its proximity to the study lakes enabling efficient sample collection and monitoring. Ultimately, this research will contribute to a more comprehensive understanding of the interactions between ice cover, microbial communities, and ecosystem functioning, helping to refine predictions of Arctic lake responses to climate change.

Achievements

During the field campaign, a comprehensive dataset was built to characterize the physico-chemical environment, microbial communities, and nitrogen cycling in the two Arctic lakes. Key measured variables included water temperature, pH, conductivity, dissolved oxygen, and concentrations of nitrogen, ammonia, and carbon, as mentioned above. Meteorological data—air temperature, wind direction and wind speed—were recorded at the research station to provide further contextual environmental information.

Collected samples:

- **Ice cover samples** from multiple sites in each lake, sectioned vertically to capture depth-dependent variation in microbial communities and chemical composition.
- **Water samples** from the surface in the water column using a telescopic pole, aligned with ice core locations.
- **Bioaerosols** collected 70 cm above the ice surface using a cascade Niosh sampler to investigate potential microbial transport between ice and water.

Microbial analyses including DNA extraction, 16S rRNA gene sequencing using Oxford Nanopore long-read technology, qPCR quantification of functional genes related to nitrogen cycling (*nifH*, *amoA*, *nirS*, *nosZ*), and metabolic activity assays (Ecolog plates) to assess substrate utilization and functional potential, are currently being developed in the lab in Switzerland. All samples are associated with metadata including date, location, ice thickness, and the rest of the environmental parameters at the time of collection.

10. GLASS

Call ID: 1st POLARIN TA CALL

Project identifier: 139

Project Title: GLacier Algal Sampling Strategies

User Group Leader: Christopher Williamson, University of Bristol, United Kingdom

Status: Implemented, physical access.

Implementation period: 07/07/2025 – 17/07/2025

Research infrastructure(s): Tarfala Research Station, Stockholm University, Sweden; Implemented, 40 user days in PR1, 20 user days in PR2

Access 1: July 7-July 17, 2025

Users: Christopher Williamson, University of Bristol, United Kingdom; 10,0 days

Benjamin Johnson, University of Bristol, United Kingdom; 10,0 days

Access 2: August 7-August 17, 2025

Users: Christopher Williamson, University of Bristol, United Kingdom; 10,0 days

Benjamin Johnson, University of Bristol, United Kingdom; 10,0 days

Access 3: September 7-September 17, 2025

Users: Christopher Williamson, University of Bristol, United Kingdom; 10,0 days

Benjamin Johnson, University of Bristol, United Kingdom; 10,0 days

Abstract: The GLacier Algal Sampling Strategies (GLASS) project is a pioneering initiative designed to address fundamental gaps in understanding glacier algal bloom dynamics and their implications for Earth system processes. Conducted at Storglaciären, Sweden, during the 2025 ablation season, GLASS will produce the first spatially resolved datasets on glacier algal abundance across bloom states, using fine-scale sampling grids and advanced geostatistical approaches to quantify spatial heterogeneity. These efforts will inform best-practice methodologies for glacier algal bloom monitoring and enable the production of critical ground-truth datasets needed to calibrate and validate remote sensing products. By tackling a key barrier to upscaling cryospheric algal studies, GLASS will facilitate a global understanding of the role of glacier algae in carbon cycling, nutrient fluxes, and albedo-driven melt feedbacks, while contributing to the European Biodiversity Strategy 2030 and the European Green Deal through the advancement of cryo-biodiversity knowledge and monitoring practices.

Achievements

Three field trips were conducted as planned during July, August and September 2025. Given the presence of snow overlying Storglaciären in July, surface ice sampling could not proceed and thus sampling and mapping of snow algal blooms that were present around TRS was performed, providing an additional dataset to the GLASS project and significant added value in the ability to contrast the spatial structure of snow algal blooms in the region with those of glacier algal blooms.

Sampling in August and September proceeded as planned, with both fine-scale and coarser-scale ground sampling performed across three heights (lower, middle, upper) on Storglaciären repeatedly in both months. These datasets were complimented in August by paired high-resolution sampling to

determine the aqueous geochemistry of the supraglacial environment hosting glacier algal cells. In both months, high-resolution drone surveys were also possible to allow upscaling of our ground point measurements to the whole glacier scale, and to provide a high-resolution DEM of the glacier surface for subsequent relation to glacier algal abundance and bloom development.

Overall, our three sampling trips produced the following datasets:

July – high resolution (2 cm) drone imagery of n = 5 snowpacks proximal to Tarfala Research Station through time (imaged repeatedly over 3 – 5 days each), paired with associated ground sampling of snow-algal assemblages that dominated snow packs.

Aug – high resolution (2cm) drone imagery of lower, middle and upper Storglaciaren areas paired with associated ground sampling of glacier algal assemblages that dominated the surface ice, including i) high-resolution sampling over 10 x 10 m areas to determine the spatial structure of the blooms and ii) coarser-scale sampling over 300 x 150 m areas to assess the larger-scale distribution of glacier algae across Storglaciaren.

11. BeNTHEC

Call ID: 1st POLARIN TA CALL

Project identifier: 62

Project Title: Benthic Nutrient dynamics and the Temporal and spatial controls on High latitude fjord Elemental Cycling

User Group Leader: Ricarda Runte, UiT - The Arctic University of Norway, Department of Geoscience, Norway

Implementation period: 20/07/2025 – 29/09/2025

Status: Ongoing, physical and remote access.

Research infrastructure(s): Polish Polar Station Hornsund, IG-PAS, Poland, 27 user days, reporting in progress

Physical access: 20.07.2025 – 26.07.2025 , 12 user days, 2 users

Ricarda Runte, UiT - The Arctic University of Norway, Department of Geoscience, Norway

Aurelie Labarre, Norwegian Polar Institute – Tromsø, Norway

Remote access: 02.05.2025 – 29.09.2025 , 15 user days, 1 user

User: Ricarda Runte, UiT - The Arctic University of Norway, Department of Geoscience, Norway

Abstract: The project investigates sediments as parts of nutrient cycling within fjords, specifically how the degree of glaciation of the fjord influences this cycling. While the dynamics within elemental cycling are increasingly studied within the marine water column, the interaction with and dynamics within sediments remain largely unknown. To increase the understanding of the ongoing dynamics, terrestrial endmembers of different degree of glaciation will be sampled, as well as the downstream terrestrial meltwater system. During transit to the station marine sampling will be carried out in addition to this. The aim of this sampling is to investigate the degree of glaciation as an environmental control factor on marine benthic nutrient cycling and with that see how climate change might impact benthic C, N and P dynamics. In order to gain insight into such spatial variations, water samples, glacial abrasion sediments, sediment cores and extracted pore waters will be analyzed for parameters providing information on nutrient sources, ability to transport from ice-to ocean, ability to transfer between sediments and waters, and availability to be taken up by organism.

Achievements

Access report pending submission

12. ARC-LINK

Call ID: 1st POLARIN TA CALL

Project identifier: 88

Project Title: Arctic Carbon Cycling: Linking terrestrial and aquatic systems

User Group Leader: Cheristy Jones, University of New Hampshire, United States

Status: Implemented, physical access.

Implementation period: 28/07/2025 – 11/08/2025

Research infrastructure(s): Zackenberg Research Station, Aarhus University, Denmark; Implemented, 30 days

Users: Cheristy Jones, University of New Hampshire, United States; 15,0 days

Ruth Varner, University of New Hampshire, United States; 15,0 days

Abstract: Arctic carbon (C) cycling is undergoing rapid transformation as the region warms four times faster than the global average. Glacial retreat and permafrost thaw expose landscapes to new vegetation, hydrology, and erosion processes, altering C fluxes across terrestrial and aquatic systems. However, the proportions of different C species transported to streams is poorly quantified and they are rarely linked to vertical CO₂ and CH₄ fluxes across the landscape. We propose to couple terrestrial and aquatic C fluxes at high spatial resolution in the Zackenberg Catchment, Greenland. This information will be crucial to informing climate models and understanding how these fragile ecosystems may change in the future.

Achievements

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11/11/2025

We completed the original work plan during our field operations and were able to conduct a more spatially expansion campaign (Fig. 1). In addition to the main Zackenberg river, we also sampled the Granseelv stream so compare different C emissions from different landcover types. In order to get a full aquatic carbon balance, we sampled six ponds in addition to river samples for the same constituents. Sediment samples for microbial analysis will also help us gain a mechanistic understanding of aquatic carbon cycling in this catchment. Due to the challenging terrain and short stay, we were not able to collect samples as high in the catchment as originally planned, but were able to obtain the necessary samples for our objectives.

13. PROMETHEUS

Call ID: 1st POLARIN TA CALL

Project identifier: 120

Project Title: Proglacial Development, Methane and Subglacial Legacies in Ice Marginal Lakes in Eastern Greenland

User Group Leader: Joost Martijn van Genuchten, The Arctic University of Norway (UiT), Norway

Status: Ongoing, physical access.

Implementation period: 01/08/2025 – 24/08/2026

Research infrastructure(s):

- Sermilik Station, University of Copenhagen, Denmark; **Implemented, from August 18, 2025 to August 30, 2025;** 36,0 user days , 3 users
 Users: Joost Martijn van Genuchten, The Arctic University of Norway (UiT), Norway; 12,0 days
 Guillaume Lamarche-Gagnon, The Arctic University of Norway (UiT), Norway; 12,0 days
 Gabrielle Emma Kleber, The Arctic University of Norway (UiT), Norway; 12,0 days
- Zackenberg Research Station, Aarhus University, Denmark **In planning, from August 13, 2026 to August 24, 2026, estimated 23 user days.**

Abstract: Atmospheric methane (CH₄) is a strong absorber of thermal infrared radiation. Up to about half of total emissions (572-896 Tg yr⁻¹) can be attributed to natural sources, yet estimates of natural methane emissions remain bounded by large uncertainties (194-489 Tg yr⁻¹), with growing concerns about projected increased emissions from high latitudes. Recent studies have also identified glaciers and ice-sheets across the Arctic as significant methane sources, with the methane being either biogenic or thermogenic in origin. However, these glacial systems are not included in global methane budgets due to limitation of the data. Currently, most methane is attributed to wetlands and freshwater systems, whereof newly deglaciated environments and proglacial lakes are seen as low contributors of methane emissions. Small lakes (< 10 km²) cover half of the total area of surface water in pan-Arctic environments with a higher methane signature compared to larger lakes. However, recent findings

from Southwest Greenland indicate that glacier-fed lakes there have high methane ebullition fluxes. This could possibly be induced by influence of subglacial environments. The PROMETHEUS project aims to explore these dynamic proglacial environments and their impact on the carbon cycle, focusing on how glacial meltwater and sediments affect methane signatures in lakes. This research could address significant gaps in current methane databases and extend our understanding of methane contributions from glacial-fed lakes and possibly subglacial systems globally. Current data is predominantly from Southwestern Greenland, creating a geographical bias. The project plans to expand research to Northeastern and Eastern Greenland, utilizing the Zackenberg and Sermilik research stations. These areas will help provide insights into the effects of various factors that control proglacial development and lake biogeochemistry with the aim to investigate how these emerging environments evolve over time.

Achievements (pending access to Zackenberg)

Lakes with a hydrological connection to the glacier meltwater (n=4) and the non-glacier connected lakes (n=2) have been investigated (Figure 3). Apart from the lakes, other successful field operations have been conducted, including a multitude of groundwater sources (n=5), which were originally only planned for the Zackenberg access. Also, a glacier portal has been sampled, which can potentially act as a clear subglacial comparison, to evaluate other proglacial systems with. All six lakes that have been sampled (Figure 3) following the conceptual workplan (Figure 2), which resulted in the sample inventory listed in Table 1. The workflow of samples was successful for all lakes, resulting in hundreds of samples including gas, sediment and water samples that will be further investigated in the laboratory for their molecular compositions and concentrations. In short, the original workplan is successfully conducted as initially anticipated for, which has led to a comprehensive archive of samples that will feed into the questions we set and act as a strong fundament to build further in reaching our goals with this POLARIN call.

14. TWILIGHT

Call ID: 1st POLARIN TA CALL

Project identifier: 117

Project Title: Life in the twilight: diversity and ecology of fungi and protists in anoxic freshwater environments in the Arctic

User Group Leader: Anne D. Jungblut, Natural History Museum, United Kingdom

Status: Implemented, physical access.

Implementation period: 01/08/2025 – 14/08/2024

Research infrastructure(s): Barrow Arctic Research Center, UICS, United States; Implemented, 2 users, in person, 18 user days (in actual costs)

Users: Anne D. Jungblut, Natural History Museum, London, UK; 9 days

Archie Clarkson, Natural History Museum, London, UK; 9 days

Abstract: The TWILIGHT project explores the diversity and ecology of fungi and protists in oxygen-depleted and anoxic freshwater environments in the Arctic. Complex eukaryotic life depends on oxygen. However, some protists and fungi have evolved metabolisms that allow them to grow under oxygen-depleted and to anoxic conditions in sediments and water. These microbial eukaryotes use fermentation metabolism and some have parasitic life-styles or grow in close symbiosis with bacteria and archaea. These microbial eukaryotes, play likely also critical roles in polar ecosystems by driving nutrient cycling, organic matter decomposition, and interactions with prokaryotic communities. Thermokarst ponds and lakes, formed by permafrost thaw, are hotspots of methane emissions. This project addresses critical gaps in understanding microbial eukaryotes' contributions to Arctic and global biogeochemical cycles. TWILIGHT will go beyond taxonomic assessments to investigate metabolic capacity and evolutionary relationships from uncultured protists and fungi directly from environmental samples. Innovative techniques such as deep short and long read sequencing and metagenome-assembled genomes will enable detailed analyses of metabolic pathways and genes linked to adaptation. Fieldwork at the Barrow Arctic Research Center will involve collecting and preserving water, sediment, and DNA/RNA samples to ensure robust molecular data. Environmental parameters such as oxygen, pH, temperature, and nutrient and ion concentrations will also be measured. By generating the first comprehensive genomic insights into microbial eukaryotes in oxygen-depleted and anoxic Arctic freshwater, this research will advance knowledge of their roles in carbon and nitrogen cycling linked to green house gas production and adaptation to anoxic conditions. The findings will inform climate models, biodiversity conservation, and public awareness of Arctic ecosystems under climate change.

Achievements

Access report pending submission

15. HoBoPolar

Call ID: 1st POLARIN TA CALL

Project identifier: 71

Project Title: The role of microbiota of plant holobiont in adaptive radiation of plants in polar regions

User Group Leader: Kari Saikkonen, University of Turku, Finland

Status: Implemented, physical access.

Implementation period: 04/08/2025 – 15/08/2025

Research infrastructure(s): Ny-Ålesund Research Station – Sverdrup, NPI, Norway; Implemented, 21,0 user days

Users: Kari Saikkonen, University of Turku, Finland; 7,0 days

Marjo Helander, University of Turku, Finland; 7,0 days

Riitta Nissinen, University of Turku, Finland; 7,0 days

Abstract: HoBoPolar is testing recently introduced hypothesis that light-sensitive microbes assist hybridization, and thus, plant adaptations in the extreme polar light environments. Our research builds on extensive collections of plants and their microbes from both Antarctica and the Arctic. The model plant (*Deschampsia alpina*) and plant associated microbe samples from Ny-Ålesund Research Station - Sverdrup (Svalbard/Norway) area will expand the geographic coverage of the microbiota and plant collections across the latitudes in the Arctic. The Station is ideally located, because compared to other parts of the Arctic, corresponding climatic zones are present at higher latitudes in Western Europe owing to Gulf Stream effects. Furthermore, *D. alpina* populations in vicinity of Ny-Ålesund have been extensively mapped, which quarantine the success of the field collections. Our research aims to 1) advance understanding of plant-microbe interactions and the role of microbes and hybridization in plant invasions, 2) uncover new microbial functions related to plants while expanding the focus from temperature to light, and 3) generate new testable hypotheses and tools to improve research strategies aiming to understand global biodiversity and its responses to environmental changes.

Achievements

Our objective for the August 2025 field season at the Ny-Ålesund Research Station (Sverdrup) was to collect *Deschampsia alpina* and *Festuca rubra* plants (10-15 individuals from 5 populations / species), along with the plant associated microbial samples (20-30 DNA and dilution plating isolation/population).

We were able to exceed the goals of our original work plan by establishing a collaboration with Dr. Virve Ravolainen (Norwegian Polar Institute), who kindly collected plants for us from two additional sites in addition to our own sites.

Overview of collected data and samples:

- *Deschampsia alpina*; 10-15 individuals from 7 populations
- *Festuca rubra* plants; 10 individuals from 3 populations
- the plant associated microbial samples from 10 plants/population

The plants are growing in University of Turku greenhouses and prepared for ecological experiments (September 2025). Bacterial isolates are counted and transferred to pure cultures for identification, genome sequencing and further use in mesocosm experiments with the plants. DNA samples are prepared for DNA isolation and community characterization.

16. DROP

Call ID: 1st POLARIN TA CALL

Project identifier: 49

Project Title: Deep Roots in Thawing Permafrost

User Group Leader: Gesche Blume-Werry, Umeå University, Sweden

Status: Implemented, physical access.

Implementation period: 01/07/2025 – 31/08/2025

Research infrastructure(s): Toolik Field Station, University of Alaska Fairbanks, United States, 30 user days, in person.

Users: Vanessa Götz, Umeå University, SE, 15 days

Emma Andersson, Umeå University, SE, 15 days

Abstract: The Arctic is warming three times faster than the global average, causing large-scale ecological changes, such as altered plant communities, increased productivity, and permafrost thaw. These shifts impact ecosystem carbon dynamics and, as most plant biomass and production in arctic tundra is belowground, roots play a crucial role. However, roots are challenging to observe and thus understudied, despite their distinct and significant responses to climate change. More research on root dynamics is essential to understand carbon-climate feedbacks from thawing permafrost.

Achievements

Soil temperature and moisture collection started but is ongoing, so this is an evolving dataset. Active layer thickness is collected, and we plan to include this in upcoming publications from the experiment. Root biomass collection from this TA is incomplete, so we plan to sample again next year with hopefully better outcomes.

As outlined in the TA DMP we plan to keep collected data private until publication, thereafter public on a data repository (eg. Datadryad). We are, however, very open to collaborations and happy to provide data to people working in the experiment or interested in meta-analyses for which these data could be of help.

17. NYRSTERT

Call ID: 1st POLARIN TA CALL

Project identifier: 94

Project Title: Deep Roots in Thawing Permafrost

User Group Leader: Martin Hoelzle, University of Fribourg, Switzerland

Status: Implemented, physical access.

Implementation period: 27 August 2025 – 9 September 2025

Research infrastructure(s): Ny-Ålesund Research Station – Sverdrup, NPI, Norway; 4 users, 16 user days in RP#1, and 21 user days in RP#2

Users:

Isabella Brining, University of Fribourg, Switzerland, 4 user days in PR#1

Mirjam Eberli, University of Fribourg, Switzerland, 4 user days in PR#1

Jeanne Choquet, University of Fribourg, Switzerland, 4 user days in PR#1

Julie Wee, University of Fribourg, Switzerland, 4 user days in PR#1

Abstract: The Arctic is warming three times faster than the global average, causing large-scale ecological changes, such as altered plant communities, increased productivity, and permafrost thaw. These shifts impact ecosystem carbon dynamics and, as most plant biomass and production in arctic tundra is belowground, roots play a crucial role. However, roots are challenging to observe and thus understudied, despite their distinct and significant responses to climate change. More research on root dynamics is essential to understand carbon-climate feedbacks from thawing permafrost.

Achievements

Fieldwork took place between 30 August and 6 September 2025, involving four participants over 8 days, with measurements coordinated from the Norwegian Polar Institute Sverdrup Station. The surveys included Electrical Resistivity Tomography (ERT), Refraction Seismic Tomography (RST), and Vertical Electrical Sounding (VES) to produce directly comparable datasets spanning more than three decades.

A total of 43 profiles were identified as potential measurement targets in the Ny-Ålesund area, including 17 Refraction Seismic Tomography (RST), 18 Electrical Resistivity Tomography (ERT), and 8 Vertical Electrical Sounding (VES) profiles, across four study sites: Brøggerbreen, Stuphallet, Kvadehukken, and Mørebreen (Figure 1). Given the limited duration of the field campaign (nine days), completing all of them was not feasible. The fieldwork therefore focused on a selection of 6 RST, 7 ERT, and 4 VES profiles as primary objectives.

In a first step, a comparative analysis between the historical (1990s) and recent (2025) datasets will allow the identification of long-term changes in subsurface conditions (Wee and Delaloye, 2022). It is also planned that the data will be analysed using a Petrophysical Joint Inversion (PJI) framework (Mollaret et al., 2020) to obtain quantitative estimates of ground ice and active layer properties. Two MSc students from the University of Fribourg will lead the processing and interpretation within their theses. By generating unique, long-term, and high-quality permafrost datasets, NYRSTERT strengthens Arctic–Alpine collaborations and contributes to POLARIN’s key research challenges on Permafrost and Cryosphere Change and Long-Term Environmental Monitoring.
