

Template for project descriptions

Funding for coordination and networking/support activities in Svalbard (Svalbard Strategic Grant)

Name of project

The Terrestrial Ecosystem Flagship in Ny-Ålesund: From workshops to research projects

The project is:

A combined project (workshops and network)

Responsible institution in Norway

Norwegian Polar Institute, Framsenteret, Postboks 6606 Langness, 9296 Tromsø, Norway

Affiliation to Svalbard's permanent research localities: Longyearbyen and Ny-Ålesund.

Project management and project group

Jesper Mosbacher, Project leader at responsible organization. The Norwegian Polar Institute (Norway).

Angela Augusti, Chair of Ny-Ålesund Terrestrial Ecosystem Flagship group. National Research Council, CNR (Italy).

Eva Fuglei, Co-chair of Ny-Ålesund Terrestrial Ecosystem Flagship group. The Norwegian Polar Institute (Norway).

Maarten Loonen, University of Groningen (The Netherlands)

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Excellence (Originality/Novelty/Solidity)

National and/or international collaboration

The Ny-Ålesund Terrestrial Ecosystem Flagship program is embedded within a very strong international network with multidisciplinary expertise. Terrestrial ecological research has a long and strong history in Ny-Ålesund (Pedersen et al., *in review*; with several members of the flagship group as key contributors). The network of institutions participating in this proposal is truly international, and most institutions have long-term presence in Ny-Ålesund or Svalbard. Most of them have research sites established near Ny-Ålesund (NPI, UG, CNR, NERC, KOPRI, NIPR), and some have research sites in other locations in Svalbard such as near Longyearbyen (NPI and University of South Bohemia). The Ny-Ålesund Terrestrial Ecosystem Flagship currently hosts members from 17 nations, and more than 40 institutions, combining terrestrial ecosystem expertise across the Arctic, but with an emphasis on Ny-Ålesund. The combined terrestrial community have in the last 5 years published multiple papers linked with work at Ny-Ålesund (Pedersen et al., *in review*). Several members and nations active in the Terrestrial Ecosystem Flagship are responsible for key long-term time-series of data obtained and maintained in the area.

In recent years, the Terrestrial Ecosystem Flagship has been awarded around 595 kNOK. This was used to organize meetings with the goals of, amongst others, integrating existing and past studies; identifying strategic experimental sites with the aim to use for common studies; reviewing existing data; and identifying knowledge gaps to be considered as foci for future research. Having as an underlying principle the enhancement of cooperation and collaboration, the activities of the Flagship were widely advertised with the result that the meetings organized in this period brought together around 60 researchers in total and resulted in the organization of 6 working groups and the recent major review paper.

The Terrestrial Ecosystem Flagship group has, thus, demonstrated success in bringing together national and international researchers active on Svalbard with the wish for increased collaboration and coordination. The present project has a primary goal to further develop cooperation and collaboration among scientists working on Svalbard. In part this will be achieved through harmonization of experimental approaches used in the several existing experimental sites in different locations in Svalbard and in part through the creation of networks of new observations that will complement established data series. With the planned workshops we envision to further strengthen the network, expanding it by inviting international partners across the Arctic community, with the ultimate goal of developing a large external grant application based around sites across the Arctic. It is our goal that the flagship network after the workshops catalyze active collaboration in the field, developing and conducting research projects that further our knowledge of terrestrial ecosystems in the Arctic. A particular focus of the workshops and network meeting planned in this project will be discussion of the parameters that need to be considered in evaluating the impact of climate change, which is occurring particularly rapidly in western Svalbard making Ny-Ålesund a key study location, on High Arctic tundra. The newly developed Ny-Ålesund GIS system will be a valuable tool supporting this process, enabling a comprehensive overview of existing monitoring activities. The parameters identified can be proposed as SIOS core data candidates for use in future long-term monitoring of this exceptional terrestrial ecosystem.

Objectives

The Ny-Ålesund Terrestrial Ecosystem Flagship program is one of four NySMAC initiated Ny-Ålesund flagship programs that aim to coordinate and integrate national and international research and monitoring. The Terrestrial Ecosystem Flagship focuses on ecosystem-based research on tundra, fresh water, and soil in and around Ny-Ålesund, Svalbard including microbial, plant, invertebrate and vertebrate communities (e.g., Coulsen et al. 2010; Pedersen et al. 2016; Toshitake et al. 2018; Layton-Matthews et al. 2019; Hansen et al. 2019; Pedersen et al. *in review*). The Terrestrial Ecosystem Flagship group has recently successfully organized several workshops aimed at bringing researchers together to increase active collaboration and to develop a joint review manuscript about the terrestrial research activities in Ny-Ålesund (Pedersen et al. *in review*). A key element of the review was to highlight important knowledge gaps currently existing in terrestrial ecosystem research in-and-around Ny-Ålesund.

This proposal aims at further developing the network and collaboration established within the Terrestrial Ecosystem Flagship group in Ny-Ålesund and will build upon the lessons learned from 50 years of terrestrial research at Ny-Ålesund (Pedersen et al. *in review*). With a combined network and workshop project, our primary objective is to bring together the international scientific community to develop existing and initiate new collaborations to reinforce the cooperation and collaboration within the Terrestrial Ecosystem Flagship programme in Ny-Ålesund. It is our primary goal that this will lead to new, exciting, collaborative research proposals and projects. To reach this goal we will organize two workshops and one network meeting for the Terrestrial Ecosystem Flagship community, as well as develop and carry out a collaborative pilot study, using these as a basis to develop a major international grant proposal.

The first workshop is planned to be held back-to-back to the Svalbard Science Conference in Oslo in November 2021. This will create and consolidate collaboration and coordination among the project partners and those that will participate in the subsequent networking activities. Representatives from all

relevant research locations and organisations active in Svalbard will be invited. The workshop will include keynote talks highlighting existing knowledge as well as knowledge gaps and missing expertise. It will also be used to define the objectives of the pilot project. By taking advantage of the SSC meeting arena, we intend to attract and include new terrestrial researchers in the network, as well as minimizing our overall carbon footprint.

The second meeting will take place in Ny-Ålesund during the summer of 2022. Here we aim for a network meeting, and discussions and plans will be finalized with the objectives, and participation in a small pilot project encouraged. Experimental approaches and field protocols will be tested and evaluated. The network meeting will be organised in Ny-Ålesund, taking advantage of established herbivore exclosures and other established terrestrial ecosystem monitoring and manipulation sites to enable achievement of the planned pilot study. By arranging a network-meeting in Ny-Ålesund we will take advantage of the fact that some of the participants already will be in Ny-Ålesund for their existing planned activities.

The final workshop will focus on developing a large-scale international collaborative research proposal based on the data obtained and ideas generated from the pilot study. This is planned to take place in the Czech Republic in March 2023. The proposal will be centred in Ny-Ålesund and incorporate multiple field sites in Svalbard, initially, over time expanding this to include multiple pan-Arctic locations, thereby giving very broad context and relevance. This final workshop will include several invited keynote speakers and collaborators from other international sites (e.g., from Greenland, Russia, and Canada) as well as representatives from all relevant research locations in Svalbard.

Pilot study

Herbivory is a main driver of the tundra ecosystem with strong effects on the vegetation, but with significant cascades to other parts of the ecosystem (Van der Wal et al. 2006; Bernes et al. 2015). While all the various components are highly interconnected and integrated in the ecosystem, the components have so far mostly been studied by the members of the Terrestrial Ecosystem flagship group individually. Utilizing existing exclosures, monitoring and manipulation sites not only allows us to investigate the effect of the larger vertebrate herbivores in the Svalbard terrestrial ecosystem, e.g., the Svalbard reindeer (*Rangifer tarandus platyrhynchus*) and pink-footed goose (*Anser brachyrhynchus*), but enables integration of all elements of the terrestrial food web, including primary producers, invertebrates, and the microbial (including decomposer) communities. This pilot project will provide a key opportunity to connect, integrate and utilize the multidisciplinary expertise present in the Terrestrial Ecosystem Flagship. Such studies can provide the setting to study the effects of herbivory, and the cascading effects on the entire ecosystem in an experimental setting. They provide the opportunity to connect above- and below-ground processes, and may involve animals, plants, water, gases and soil microbial community components and can range from biodiversity to biogeochemical processes (e.g., Falk et al. 2015; Mosbacher et al. 2016). Potential areas for collaboration could, for instance, include identifying the effects of exclusion of herbivores on tundra plant communities (e.g. Mosbacher et al. 2016), and whether these changes are reflected in other trophic levels (e.g., arthropods, Schmidt et al. 2018)), carbon balance (Falk et al. 2015) and phenology of the ecosystem (Mosbacher et al. 2016), to below-ground soil processes and microbiota, as well as nutrient pools (e.g. Stark and Grellmann 2002; Mosbacher et al. 2016; Stephan et al. 2017). Studies at other locally established environmental manipulation sites also allow the integration of the impacts of major climate/environmental drivers on all components of the ecosystem, taking advantage of Ny-Ålesund's location in one of the most rapidly changing parts of western Svalbard. Such studies also have the potential in future to alter key physical components of the ecosystem such as snow depth and cover, soil temperatures, active layer depth and water tables (e.g., Falk et al. 2015; Mosbacher et al. 2016), again highlighting the potential for truly inter- and multidisciplinary collaboration. Utilizing exclosures and long-term environmental manipulations such as open top chambers are approaches applied widely across the Arctic and provide an attractive foundation for larger future collaboration across multiple sites and nations.

Ultimately, this proposal will reinforce the Terrestrial Ecosystem Flagship network in Ny-Ålesund by continuing to engage, facilitate, enhance, and expand the already strong network and collaboration and allow us to develop from workshops into joint research projects together.

Impact

Added value of the network project or workshop

This project builds on the previous Terrestrial Ecosystem Flagship SSG project “Proposal to the Svalbard Strategic Grant for realization of activities in 2018-19 to further develop and reinforce the Terrestrial Ecology Flagship in Ny-Ålesund”. The combined workshop and network project will be a continuation of a long record of terrestrial research in Ny-Ålesund. Specifically, the planned research proposal related to the established grazing exclosures and environmental manipulation sites in the Ny-Ålesund area will stand out as a platform to connect similar ongoing projects in other field sites within Svalbard, e.g., in the Longyearbyen area and in Hornsund. There are currently at least 13 active projects utilizing exclosures or environmental manipulations across Svalbard (RIS database). The planned pilot study will also connect research in Svalbard by exploiting synergies with complementary research projects at other circumpolar field sites, e.g., Zackenberg, Greenland and the Antarctic Peninsula. This will contribute to further developing and strengthening the Ny-Ålesund Terrestrial Ecosystem Flagship programme. Furthermore, the activities planned in the present proposal are closely linked to the activities of other flagship programs and, in particular, with the ongoing joint-flagship project “Nutrient cycle - linking the Atmosphere, Terrestrial, Marine and Glaciological flagship programmes in Ny-Ålesund”.

Dissemination, communication of results and target groups

The dissemination and the communication of the results obtained in the project will be the object of discussion during the meetings. Being the main objective of the project, the definition of the partnership of a large research proposal, and the draft of the proposal itself, the goal of the dissemination and communication partly will be to reach as many national and international scientists as possible that can contribute to the larger proposal. To reach the scientists that already work in Ny-Ålesund and in Svalbard, in general, considered the main target group of this project, the invitation to participate in the three meetings will be through the Terrestrial Ecosystem Flagship mailing list. Moreover, with the aim to invite and to inform about the activities of the project to as many as possible Arctic scientists, the meetings will be advertised on the Ny-Ålesund research station website (<https://nyalesundresearch.no/research-and-monitoring>) and at NySMAC meetings twice per year, at the Svalbard Science Conference (SSC) 2021, at the Polar Night Weeks (PNW) organized by SIOS, in January 2022 and 2023 and at the annual Arctic Science Summit Week (ASSW) organized by IASC. In addition, the results obtained in the pilot study planned for the network meeting (second meeting in Ny-Ålesund) will be proposed as a State of Environmental Science in Svalbard (SESS) report within SIOS for the year 2023, as it directly addresses some of the pillars of the SESS report.

Relevance and benefit to society

The outcomes of this project will be of help in planning and designing management of the Arctic region, primarily Svalbard. The project intends to form the basis for a larger research proposal. Discussion during the two workshops and the pilot study during the network meeting will partly address issues around about how major environmental drivers such as climate change and patterns and intensity of grazing, both alone and in synergy, affect tundra ecosystems, in particular their botanical, invertebrate and microbial biodiversity, and nutrient flows and cycling. This will provide a timely and much needed boost to knowledge of tundra ecosystems, their biodiversity, functions, and services and enable greater understanding of the resilience of these crucial but, at the same time vulnerable, ecosystems.

Environmental impact, ethical perspectives, recruitment of women/gender balance

We have planned the three meetings with the aim to minimize the environmental footprint of the participants. For this reason, the first workshop will be in Oslo linked with the Science Svalbard Conference in November 2021. The second meeting will be in Ny-Ålesund, Svalbard during summer 2022. This is required as we need to examine, test, and evaluate the field protocols, which is critical to be done on site. By organizing the meeting in summer, when most of the scientists working in Ny-Ålesund are already on site, we will minimize the environmental footprint since a proportion of the participants will be already in place. The exact timing of the meeting will be decided based on the presence of participants in Ny-Ålesund. The location of the third meeting in the Czech Republic was selected due to its accessible central European location. The chair and co-chair of the Ny-Ålesund Terrestrial Flagship are both women, and the project team has a balanced gender composition (5 female and 6 male scientists).

Implementation

Resources, expertise, distribution of roles and cooperation

A major strength of the Terrestrial Ecosystem Flagship is the multi-diverse skill set and expertise already present among the members. This proposal, in essence, aims to bring together these areas of expertise in joint research proposals and projects, both now and for the future. In addition, we aim to bring in new prospective members and participants for the joint research. All the project members will be responsible for participating in the planned activities, activating their networks, and bringing in participants for the workshops and meetings.

Each meeting will be organized by the project manager (Jesper Mosbacher), as well as the chair (Angela Augusti) and co-chair (Eva Fuglei) of the Terrestrial Ecosystem Flagship. Eva Fuglei (Co-chair) and Jesper Mosbacher (project manager), both from the Norwegian Polar Institute will be closely involved in organizing the first workshop meeting in Oslo. Angela Augusti (chair) will be closely involved in organizing the network meeting in Ny-Ålesund, while Josef Elster of the University of South Bohemia (Czech Republic) will lead organization of the second workshop meeting taking place in Czech Republic.

All the project members will be responsible for developing and writing the larger joint-research proposal formed during the second workshop.

Budget

The funding will go towards bringing people together for two workshops and one network meeting over the next 2.5 years. The funding will specifically be used to cover costs of travel, accommodation, lunch, and dinners for participants. Both workshops will be budgeted with approximately 150,000 NOK, while the network meeting in Ny-Ålesund will be budgeted with 200,000 NOK to cover the increased expenses of this remote site. We apply for a total funding of 500,000 NOK.

For more details, please see the online grant application form.

Risks

Due to the uncertainties related to the Covid-19 pandemic, there is a potential risk that we will not be able to meet in person as planned for the back-to-back workshop at the Svalbard Science Conference in Oslo 2-3 November 2021. We will mitigate this risk by co-arranging the first workshop with a web-based solution.