



*An independent non-profit institute
pioneering environmental and climate
research*



*A coordination and support
action under Horizon 2020*

NERSC Technical Report no. 452

CAPARDUS – Capacity-building in Arctic standardization development



Photo of Longyearbyen taken on 6 June 2023
Credit: Stein Sandven, NERSC

Final report on the Svalbard case study 2020-2023

Authors: Stein Sandven, Lisbeth Iversen, Torill Hamre, Astrid Stallemo

<p>TITLE: CAPARDUS - Capacity-building in Arctic standardization development. Final report form the Svalbard case study 2020-2023</p>	<p>REPORT IDENTIFICATION NERSC Technical report No. 452</p>
<p>CLIENT Research Council of Norway</p>	<p>CONTRACT Project number: 333112</p>
<p>Coordination and Innovation Actions under EC Horizon 2020</p>	<p>Grant Agreement no. 869673</p>
<p>CLIENT REFERENCE CAPARDUS Extension project</p>	<p>AVAILABILITY Open</p>
<p>INVESTIGATORS Stein Sandven, Lisbeth Iversen, Torill Hamre, and Astrid Stallemo from NERSC</p> <p>Other contributors: More than 60 persons attending the three workshops have contributed with presentations and comments to the project. The names are listed in the Appendix.</p>	<p>Signed: 25 April 2024</p> 

Executive summary

This report describes the work performed in the Svalbard case study as part of the H2020 CAPARDUS project from 2020 to 2023. During the pandemic physical meetings and workshops could not be organised in Svalbard because of travel restrictions. The activities in this period were limited to online meetings with representatives from the local community in Svalbard, literature search and uploading of documents to the Arctic Practice repository under the Ocean Best Practice System. The first physical meeting took place during the Svalbard Science Conference in Oslo in November 2021. Here a side-meeting was organised with 30 participants from projects working in Svalbard. The side-meeting was a collaboration with the Svalbard Social Science Initiative and the objective was to build connections between Svalbard-related social science research and the local community in Longyearbyen in the context of climate change and its impact.

The first physical workshop in Longyearbyen was organised 6 – 9 August 2022 in collaboration with the Cultcoast project led by NIKU. The workshop title was "Community-based monitoring and Citizen science (CBM-CS) in the Svalbard area". The workshop included one day with focus on cultural heritage research activities and one day with an excursion to Hiorthamn to visit cultural heritage sites. During the workshop the status of CBM-CS systems in Svalbard and other Arctic areas was reviewed. The possibilities to develop CBM-CS systems to support cultural heritage research and tourist activities were discussed. Guidelines, practices, standards and regulations which are relevant for CBM-CS activities were reviewed. The workshop had a 1-day session discussing the concept and requirements for an Arctic Practice System (APS). An APS system is envisioned to be a sustained repository for practices related to environmental observations,

resource exploitation and other activities in the Arctic. ‘Practice’ means a documentation in digital form of how things are done for example in observation of a specific ocean phenomenon. What an APS should do will be identified in dialogue with people living or working in the Arctic with knowledge about practices in their daily work. The idea is to build on the existing Ocean Best Practice System, which is operated under IOC-UNESCO, but expand it to include a wider range of disciplines and topics that are important in the Arctic.

The second workshop was organised in Longyearbyen on 7-8 February 2023 where representatives from the local community in Longyearbyen met with cultural heritage scientists and tourist operators to discuss how practices, guidelines and standards are developing in Svalbard. The tourist sector through Visit Svalbard and Svalbard Museum develop their own information systems, which are addressing different aspects of tourist activities. The actors involved in cultural heritage researchers and management work under governmental regulations, implying that activities follow existing standards and guidelines. Cultural heritage has its own information systems (“Akseladden” and “Kulturminnesøk”) which are operated by the Directorate for Cultural Heritage (“Riksantikvaren”). An Arctic Practice System needs to be connected to these information systems which are partly top-down and partly bottom-up driven. The tourist operators have their official travel portal for Svalbard, operated by Visit Svalbard which is targeted towards the tourists.

The third workshop 8- 9 June 2023 was a direct follow-up of the February workshop, where another group of actors attended. They represented projects and organisations involved in Arctic safety, both in terrestrial and marine operations. Several aspects of shipping were presented and discussed from the Arctic Safety Centre and the multidisciplinary course on Arctic shipping at UNIS. Furthermore, presentations were given about the Joint Rescue and Coordination Centre – North Norway, the EU ARCSAR project, the Red Cross, Telenor, Visit Svalbard and the pilot services by the Coastal Administration.

The most important legal and regulatory documents are the Svalbard Treaty, the Svalbard Law and the Svalbard Environmental Act. These are dealing with nature conservation areas, cultural heritage management, pollution and waste, hunting, trapping and fishing, and land-use management. The recent recommendations by the Norwegian Environment Agency for stricter regulations of human traffic on Svalbard will have ramifications for the tourism industry, including new limits on marine-based activities and access to sites, increased safety and insurance regulations, and likely more requirements for certified guides. The overall purpose of regulatory strengthening is to limit and reduce impacts to the natural environment and the cultural heritage.

Standardization is often driven by regulations, legal framework, treaties, etc. An example is the [Polar Code](#) implemented by IMO after development by the member countries over many years. The regulations in the Polar Code are expected to spin-off standard development related to safety and responsibility of shipping in the Arctic (and Antarctic). The regulations in Svalbard are much more specific and play a key role in developing standards in the region. Development of standards, guidelines and practices in Svalbard and other Arctic areas is often a bottom-up process, building the experience on how to do things, which develop into practices by gaining support from a wider community. Standardization in the Arctic is complex because there are many knowledge systems, research disciplines, operational activities, cultural activities and new technologies that change peoples’ lives and work.

This report is a synthesis of the results reported in the deliverables D3.1, D3.2 and D7.1 submitted to EU in 2022 and 2023.

List of contents

1. INTRODUCTION	4
2. ABOUT PRACTICES AND STANDARDS	5
3. SVALBARD ACTIVITIES, MEETINGS AND OTHER EVENTS 2020-2022	7
3.1 ONLINE MEETINGS DURING THE PANDEMIC	7
3.2 ENGAGEMENT WITH SVALBARD SOCIAL SCIENCE INITIATIVE	7
3.3 COLLECTING DOCUMENTS ON STANDARDS, GUIDELINES AND PRACTICES	8
3.4 COLLABORATION WITH ARCTIC EXPEDITION CRUISE OPERATORS (AECO).....	8
3.5 COLLABORATION WITH CULTURAL HERITAGE RESEARCH IN SVALBARD.....	8
3.6 SIDE MEETING AT SVALBARD SCIENCE CONFERENCE IN OSLO IN NOVEMBER 2021	9
3.7 JOINT MEETING BETWEEN THREE CULTURAL HERITAGE PROJECTS IN SVALBARD, 13-15 SEPT 2022	10
3.8 MS NORDSTJERNEN EXPEDITION 8 – 12 SEPTEMBER 2022.....	10
3.9 PUBLIC SEMINAR IN LONGYEARBYEN: SVALBARD - NEW AND OLD POSSIBILITIES: 10 OCTOBER 2022.....	11
3.10 COMMUNITY WORKSHOP ORGANISED BY BALANCING ACT AND FACE-IT PROJECTS: 25 OCTOBER 2022	11
4. WORKSHOP ON CULTURAL HERITAGE RESEARCH IN SVALBARD: 6 – 9 AUGUST 2022	12
4.1 CULTURAL HERITAGE WORK IN SVALBARD – DAY 1	12
4.2 EXCURSION TO CULTURAL HERITAGE SITES IN HIORTHAMN – DAY 2	15
4.3: CITIZEN SCIENCE AND COMMUNITY-BASED OBSERVING SYSTEMS IN THE SVALBARD REGION – DAY 3	15
4.4 THE VALUE OF CULTURAL HERITAGE EXPERIENCES FOR VISITORS AND THE LOCAL COMMUNITY – DAY 3	17
4.5. DEVELOP GUIDELINES AND BEST PRACTICES RELATED TO CULTURAL HERITAGE AND TOURISM	19
4.6. ARCTIC PRACTICE SYSTEM – DAY 4.....	21
5. WORKSHOP ON PRACTICES, GUIDELINES AND STANDARDS FOR TOURIST OPERATORS 7 -8 FEBRUARY 2023 .	22
5.1 FOLLOW-UP THE DISCUSSION OF AN APS	22
5.2 TOURISM IN SVALBARD	23
5.3 SVALBARD MUSEUM	26
6. WORKSHOP ON PRACTICES, GUIDELINES AND STANDARDS IN ARCTIC SAFETY: 8-9 JUNE 2023	27
6.1 ARCTIC SAFETY PROJECTS AND ORGANISATIONS.	28
6.2 SHIP TRAFFIC IN THE SVALBARD REGION	30
7. A SYNTHESIS OF THE CAPARDUS CASE STUDY IN SVALBARD	31
8. SELECTED DOCUMENTS, REFERENCES AND LINKS	35
APPENDIX	36
LIST OF PARTICIPANTS IN THE WORKSHOP 6-8 AUGUST 2022	36
LIST OF PARTICIPANTS IN THE WORKSHOP 7-8 FEBRUARY 2023 AT POLHEIM	36
LIST OF PARTICIPANTS IN THE WORKSHOP 8-9 JUNE 2023 AT POLHEIM	37

1. Introduction

CAPARDUS is a coordination and support action under H2020 with focus on capacity-building to develop practice, guidelines and standards related to activities in the Arctic. The main objectives of the project have been to establish a framework for Arctic standards, document how standards develops within selected themes, and engage users and communities in documenting practices, guidelines and standards withing their fields. There is growing human presence and footprint in the Arctic, which requires rules, regulations and guidelines, adapted to local and regional conditions. People living and working in the Arctic operate according to ethics, norms, informal agreements, practices, conventions and guidelines which vary between the communities. There is no “standard Arctic”, only a variety of highly diverse regions and communities with own norms and practices. To develop national and international standards for different operators is an ongoing process, and the CAPARDUS project has documented how this process evolves in four regional case studies (Fig. 1). The four regions represent different cultural, social and economical environments, where climate change and new socio-economic situations have severe impacts on the communities.



Figure 1. Map showing the areas where the CAPARDUS case studies were conducted. The results from the Svalbard study is described in this report.

2. About practices and standards

The Arctic is a very heterogeneous region and development of standards and practices is often a bottom-up process. But sometimes it is a top-down decision providing regulations that sets framework for standard. It can therefore be useful to consider top-down and bottom-up process in parallel. Examples of top-down processes are when high-level bodies (e.g. UN, EU, international agreements) define official standards related to transport, food, construction, etc. Standards are often connected to regulations, legal framework, treaties, etc. An example is the [Polar Code](#) implemented by IMO after development by the member countries over many years¹. The regulations in the Polar Code are expected to spin-off standard development related to safety and responsibility of shipping in the Arctic (and Antarctic). There are also many bottom-up processes to establish best practices, recommendations and guidelines which evolve over time as they gain support from a wider community (Fig. 2).

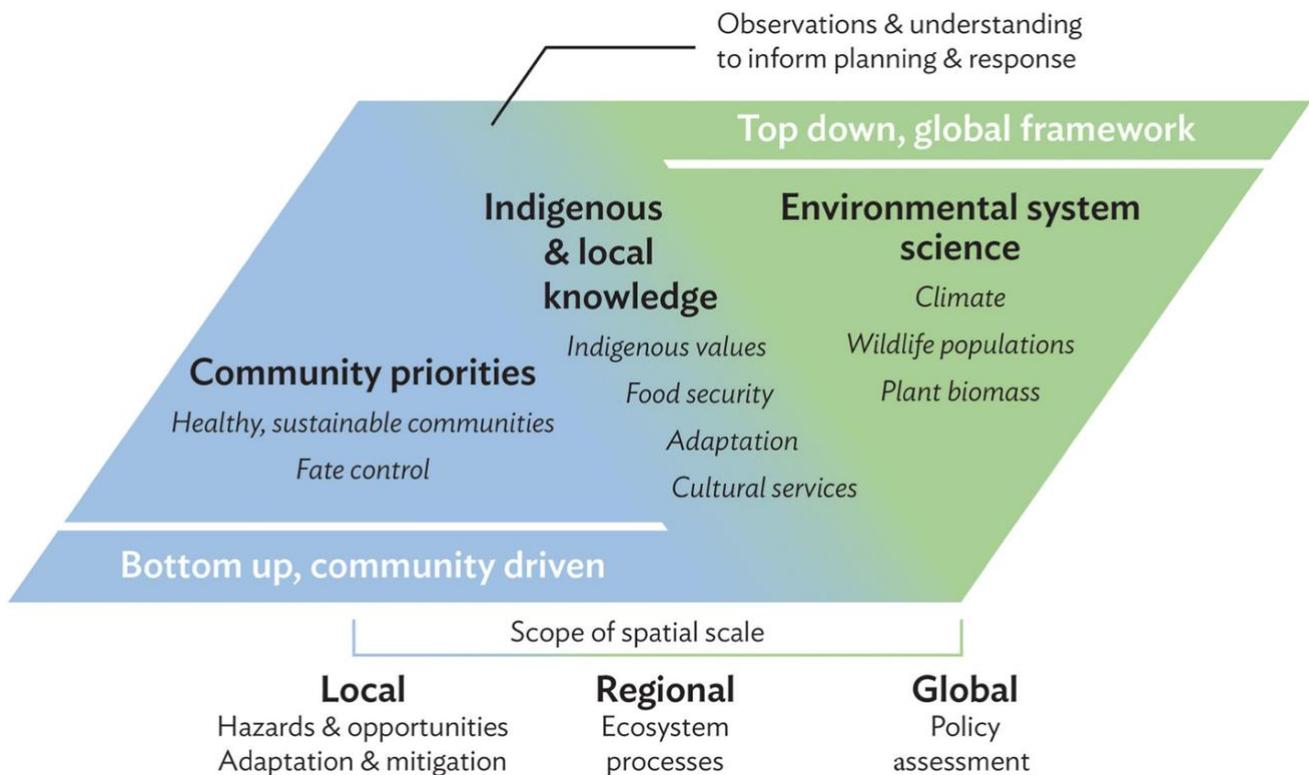


Figure 2. Illustration of how top-down and bottom-up processes are connected regarding environmental observations (from Eicken et al., 2021).

There is a range of practices and standards to consider, as shown in Table 1. The terms used depend on who the users are and what their needs and objectives are. In the most general sense, a standard is something established by custom, general consent, or authority as a model to be compared against, a rule for measuring the quantity, weight, extent, value or quality of something. When we speak of technical standards, we are speaking of published documents that establish specifications and procedures designed to maximize the reliability, interconnectivity, interoperability, and performance of materials, products, methods or services.

Table 1. The most common terms used to describe standardization development in the project.

Term	Provisional Definition
Method	a way of doing anything, esp. according to a defined and regular plan; a mode of procedure in any activity, business, etc.
Ethic	a system or set of moral principles; (in weaker sense) a set of social or personal values
Norm	a standard or pattern of social behaviour that is accepted in or expected of a group
Informal Agreement	an arrangement made between two or more parties and agreed by mutual consent
Convention	a rule or practice based upon general consent, or accepted and upheld by society at large
Guideline	a general rule, principle, or piece of advice
Standard Operating Procedure	a Standard Operating Procedure is a document which describes the regularly recurring operations to ensure that the operations are carried out correctly (quality) and always in the same manner (consistency)
Common Practice	something that is done frequently within a community of practice and is considered normal
Good Practice	a good practice is a successful experience that has been tested and replicated in different contexts and can therefore be recommended as a model.
Best Practice	commercial or professional procedures that are accepted or prescribed as being correct or most effective
Specification / technical standard	an established norm or requirement for a repeatable technical task. It is usually a formal document that establishes uniform engineering or technical criteria, methods, processes, and practice
International Standard	an internationally recognized exemplar of correctness, perfection, or some definite degree of any quality
(National) Policy	a principle or course of action adopted or proposed as desirable, advantageous, or expedient; esp. one formally advocated by a government, political party, etc.)
Formal Convention	an agreement between countries that is legally binding to the contracting States
Treaty	a contract between two or more states, relating to peace, truce, alliance, commerce, or other international relation
International Law	(legal instrument) (the body or branch of law concerned with dealings between nations; a law of this kind)
National Law	a binding rule or body of rules prescribed by the government of a sovereign state that holds force throughout the regions and territories within the government's dominion

Regarding standards, it is important to be aware of the distinction between *de jure* standards and *de facto* standards. When dealing with rapid technological, environmental and socio-economic changes, best practices can develop rather quickly and become *de facto* standards, and some may become *de jure* standards. *De jure* standards are distinguished mainly by the fact that they were created under processes managed by a standards development organization. The benefit of working under a [Standards Development Organization](#) (SDO), such as ISO or IEEE, is that it provides the rules and governance for standards creation that are needed to ensure fairness and transparency, as well as the mechanisms to assist in the distribution and maintenance of the standard. A community can modify a *de jure* standard to suit its particular interest by creating extensions, where new elements are added, or profiles which define specific ways certain elements of a base standard must be used. There are also *de facto* standards, which can be just as rigorous as *de jure* standards and have influence by virtue of their widespread adoption. An example of evolution from *de facto* to *de jure* status is the Portable Document Format (PDF). Created by Adobe in 1993, it became a widely-used *de facto* standard and in 2005 it became a *de jure* standard as ISO 19005-1:2005.

Development of standards involve processes on several levels, ranging from traditions and practices to standards and legislation, as illustrated in Fig. 3. The processes can evolve quickly, such as in digitalization and other technology development, while they domains can be slow in legal and regulatory Methodologies,

standard operating procedures, handbooks, or traditional community practices are different forms of Arctic practices, which have been explored in the CAPARDUS project.

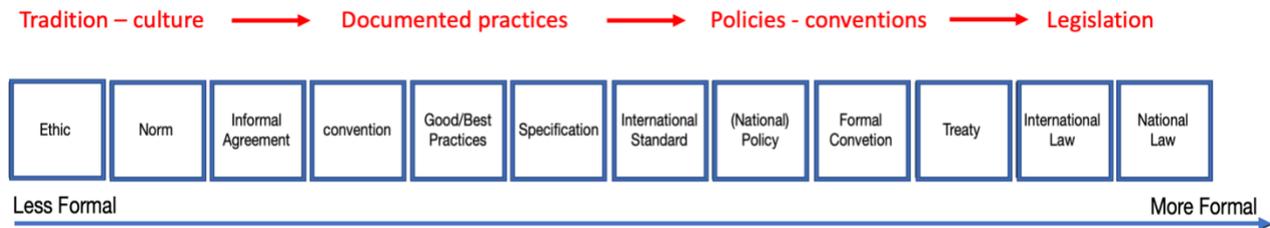


Figure 3. Illustration of the standardization continuum, ranging from the least formal to the most formal standards.

Standards can act as common language and practices among stakeholders when aiming to share and use observing systems, data, ensure safety, and many other activities in the Arctic. Equipment manufacturers, observing programs, data producers, citizens, and governments all benefit from the creation of open standards.

It is vital that the standards development process ensures that all interested parties work together in the context of openness and transparency. In particular, as data becomes the world's most valuable resource, it becomes ever more important that the digital ecosystem for data be designed and managed in a way that ensures sufficient user access, transparency, accountability, and quality assurance.

3. Svalbard activities, meetings and other events 2020-2022

The objectives of the case studies in Svalbard were: 1) develop dialogue and collaboration with actors in Svalbard related to development of guidelines and standards, 2) establish collaboration with Arctic shipping tourist operators related to Community-Base Monitoring and Citizen Science (CBM/CS) development, and 3) organise workshops with other projects to discuss the community needs for research-based knowledge in Svalbard. The main challenge in Svalbard is to adapt the community to the effects of climate change and the transition from a mining town to new activities, especially tourism and research. The case study was therefore focused on guidelines and standards related to collecting data and building knowledge to support planning and decision making in Svalbard.

3.1 Online meetings during the pandemic

NERSC has organized and participated in several online meetings and workshops with the [Local Council](#) in Longyearbyen, tourist operators in Svalbard, other research projects and members of the Svalbard Social Science Initiative. The meetings with the Local Council discussed the needs for data collection, and environmental monitoring to support the areal planning in the region, in particular areas for building houses and infrastructure versus areas to be protected. The objective of the meetings was to strengthen collaboration across sectors and institutions, build trust and identify topics of concern, needs for data and coordination of data for decision making, and future proposals to take actions.

3.2 Engagement with Svalbard Social Science Initiative

The [Svalbard Social Science Initiative](#) is an association of social science, humanities and arts-based researchers working with a wide range of issues in Svalbard. Since it was established in 2019 the SSSI has organised a number of events in collaboration with NERSC and with support from the Svalbard Strategic Grant, and the H2020 INTAROS and CAPARDUS projects. The SSSI informed about research activities and communication with the local community through its website and seminars in Longyearbyen. The members of the SSSI have

broad expertise in social science disciplines and are involved in several activities organized under the CAPARDUS project.

3.3 Collecting documents on standards, guidelines and practices

A number of documents have been identified as part of the systematic review of standards for the Svalbard area. A selection of these documents have been registered in the [Arctic Practice repository](#) under the [Ocean Best Practice System](#). The document types range from traditional scientific/technical publications to assessment reports from the Arctic Council and national agencies, reports on status and plans for management of natural hazards, guidelines on data management, tourist guidelines, ethical guidelines, business plans, policy documents as well as legal and regulatory documents. All these documents can contribute to the standardisation continuum in the Arctic.

3.4 Collaboration with Arctic expedition cruise operators (AECO)

Collaboration with expedition cruise operators, including their organization [AECO](#), has been established to strengthen the Arctic observing systems through development of community-based monitoring (CBM) pilots and citizen science (CS) programs (Fig. 4). This collaboration was initiated by NORDECO under the [INTAROS project](#) (2016-2022) and followed up under CAPARDUS. Several such programs have been initiated where tourists travelling on expeditions are data collectors regarding marine mammals, birds and other environmental data. Further discussion about cruise operators is given in chapter 5.



Figure 4. Map of data collection sites as part of citizen science program during voyages with AECO expeditions in the Svalbard area. Courtesy: G. Gudmundsdottir, AECO.

3.5 Collaboration with cultural heritage research in Svalbard

In March 2021 an online workshop was organised in collaboration with the [CULTCOAST project](#) where one of the objectives is to monitor, manage and protect sites and landscapes in Svalbard under climate change (Fig. 5). The [workshop](#) had 10-12 participants with presentations how to strengthen Arctic observing systems through development of community-based monitoring (CBM) and citizen science (CS) programs. The workshop included cruise operators, local guides, representatives from the Governor. A result of the online workshop was a plan for a physical workshop in August 2022, with discussion of further development of CBM and CS projects (see chapter 4).

Cultural Heritage Sites in Coastal Areas. Monitor, Manage and Preserve Sites and Landscapes under Climate Change and Development Pressure

April 2019-March 2023 . Researcher project NFR MILJØFORSK/ RCN environmental research, Project Number: 294314

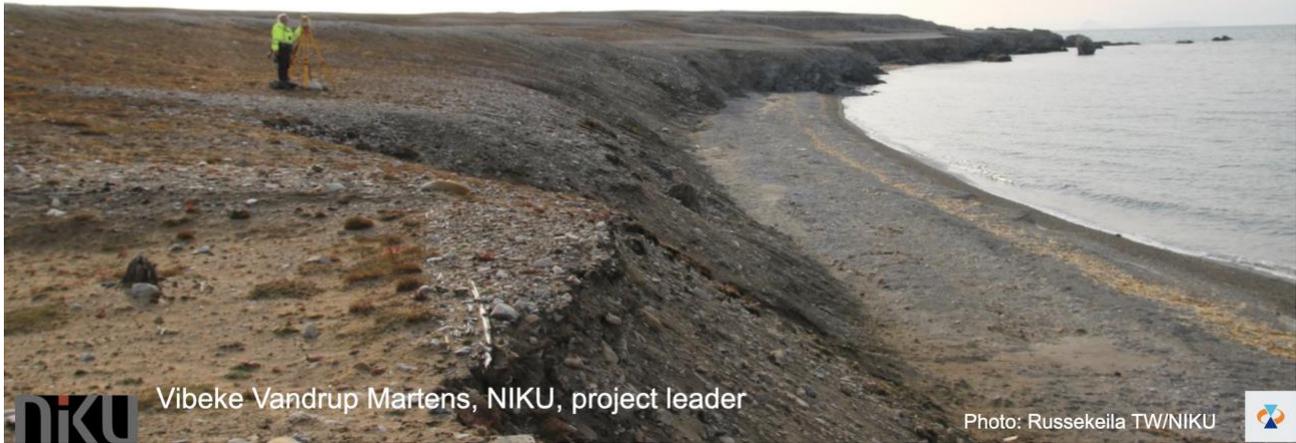


Figure 5. Illustration of the CULTCOAST project.

3.6 Side meeting at Svalbard Science Conference in Oslo in November 2021

A networking project funded by the Svalbard Strategic Grants supported NERSC and SSSI to organize a side-meeting to the [Svalbard Science Conference](#) on 4 November 2021 (Fig. 6). The side-meeting had more than 30 participants giving presentation of their projects and discussed future collaboration. One the next day SSSI gave a presentation of its activities and plans in plenary at the Svalbard Science Conference.



Figure 6. Photo from the side-meeting on November 4, which was attended by more than 30 participants, including SSSI members, and other guests from various institutions and disciplines.

These events were supported by CAPARDUS and used for networking to build national and international collaboration between natural sciences (cryosphere, biosphere) and social sciences (health, economy, community planning, etc.). Data collection in the Svalbard region is growing as a result of more research projects in the Arctic. Most of the data are collected in natural sciences (climate and ecosystem research) and organised under the [SIOS Knowledge Centre](#), located in Svalbard Science Park in Longyearbyen. Recently,

social science data have started to become more important because the research need to serve the societal needs and improve the living conditions for people living and working in the Arctic.

3.7 Joint meeting between three cultural heritage projects in Svalbard, 13-15 Sept 2022

The projects [ArcticAlpineDecay](#), [CULTCOAST](#), and [PCCH-Arctic](#) organised a joint workshop at UNIS to inform each other about their activities, where CAPARDUS attended the public seminar on 14 September. In the ArcticAlpineDecay project (Deterioration and decay of wooden cultural heritage in Arctic and Alpine environments) *researchers study how tourists and climate affect our vulnerable cultural heritage on Svalbard and Hardangervidda in Norway*. In CULTCOAST the aim is to find methods to monitor, manage and preserve these environmental goods that are exposed to threats from climate change and development pressure. The PCCH-Arctic (Polar Climate and Cultural Heritage – Preservation and Restoration Management) aims to create a knowledge base for sustainable safeguarding and future use of cultural heritage in the Arctic under changing demographic and climatic conditions (Fig. 7). The coordinator of the PCCH-Arctic, Anatoly Sinitsyn, have authored the report [“Development of coastal infrastructure in cold climate. Summary Guideline”](#)



Figure 7. Cable way timber trestles in Longyearbyen which was a research topic in the [PCCH-Arctic](#) project.. Photo: Anatoly Sinitsyn, NTNU

3.8 MS Nordstjernen expedition 8 – 12 September 2022

MS Nordstjernen was part of the Coastal Voyage fleet in 1956 and is now a protected vessel which was refurbished in 2000 for exclusive arctic sailing (Fig. 8). Today, the vessel is used for explorer voyages the waters around Spitsbergen. A representative from CAPARDUS took part in the Arctic Immersion Expedition in the South Spitsbergen National Park, organized by [Hearts in the Ice](#). This 4-day trip had participants from many institutions in Svalbard including politicians, business people, the postal service, Store Norske, Hurtigruten Expedition, Visit Svalbard, Svalbard Energy and Svalbard Folkehøgskole. In addition, master students, international researchers, artists/ photographers and designers among others participated. The passengers participated in Citizen Science activities (e.g. beach cleaning and flying drones for research projects).



Figure 8. Photo of MS Nordstjernen. Copyright Hurtigruten Expeditions.

Important parts of the voyage were conversations about climate change, adaptation to climate change, citizen science and co-creation pilots to provide for a sustainable future as well as panel discussions. Questions raised were: *What is the value of citizen science? What can observation, indigenous wisdom and immersion into nature teach us about resilience, compassion and care, as we all work to solve the «big problems».* During the expedition dialogues and a panel discussions took place with local actors in Longyearbyen, discussing issues such as the green shift and co-creation of knowledge through collaborative research projects, including citizen science and community-based monitoring programs.

3.9 Public seminar in Longyearbyen: Svalbard - New and old possibilities: 10 October 2022.

A [public seminar](#) was arranged by [Fridtjof Nansen Institute](#) at the Cultural House in Longyearbyen for tourist operators, researchers, local decision-makers and other inhabitants. In Svalbard most of the jobs are connected to governmental activities (public services, research) except tourism and satellite services provided by SvalSat. It is a priority to establish more non-governmental jobs, where tourism is the most promising. However, there are a number of problems with the growing tourism, so more regulations have been implemented to limit the tourist traffic. Fishery was discussed, but it is not expected to become a significant business in the foreseeable future. Questions were raised about what challenges and opportunities Svalbard faces in light of the new geopolitical reality and a changing climate. Around 100 people attended and CAPARDUS was represented by Hilde Fålnun Strøm.

3.10 Community workshop organised by Balancing Act and Face-it projects: 25 October 2022

The half-day workshop was organised by Nordland Research Institute as part of the research projects [BalancingAct](#) and [FACE-IT](#). The workshop took place at Funken Lodge. The question raised was: *How will climate and environmental change affect tourism and the use of natural resources on Svalbard?* The projects study how the tourism industry on Svalbard can create new and sustainable development opportunities in the face of the new reality with more restrictions for the tourist operators, and adaptation to climate change. This means solutions that ensure that viable local communities are maintained and nature is protected. Prof. Janne Søreide from UNIS was one of the facilitators of the workshop and gave an overview of the main climate and environmental changes in the Svalbard region (Fig. 9). The aim of the workshop was to contribute knowledge to the discussion about the future development of Svalbard policy and the national discussion about trade-offs between environmental and climate considerations and local tourism-based value creation. It is of core importance for the projects that knowledge is developed together with the tourism industry and the local community.



Figure 9. Janne Søreide from UNIS presented the main climate and environmental changes in the Svalbard region

4. Workshop on cultural heritage research in Svalbard: 6 – 9 August 2022

The collaboration between CAPARDUS and CULTCOAST was further developed by organising a joint workshop in Svalbard over four days. The workshop was entitled “Community-based monitoring and Citizen Science in the Svalbard area. The venue was UNIS, where about 30 people were invited to attend. 20 attended in-person, while about 10 participated online.

4.1 Cultural heritage work in Svalbard – day 1

The CULTCOAST project has focus on studies of cultural heritage and cultural environments at high latitudes. Cultural heritage values are under serious threat from multiple sources, including inadequate safeguarding, climate change and pressure on land areas. The CULTCOAST project aims to assess the possibilities for the long-term preservation of legally protected archaeological and built cultural heritage sites in the context of geo-hazards caused by changing climate conditions, and to suggest innovative tools for risk assessment, mapping, evaluating, prioritising, mitigation and sustainable management of heritage sites. The project focuses on (1) first, sustainable use and protection of coastal cultural heritage, cultural environments, and cultural landscapes; (2) secondly, on climate change induced geo-hazards; and (3) thirdly, how public management can safeguard cultural history values.

There are more than 2000 sites of cultural heritage on Svalbard. All traces from human activity dating from before 1946 automatically protected by the Svalbard environmental protection act. Svalbard was first discovered in 1596. Longyearbyen was an American-Norwegian mining town from 1906 until 1916. Ny-Ålesund, a coal mining town from 1916, has developed into an international research station today.

There are also sites and cultural heritage from the Second World War, but not much of this is registered in a good way. Climate change is affecting Svalbard to a very large degree. Svalbard used to be an arctic desert but this is now no longer the case. More rain and snow is challenging the cultural heritage as well as the built environment. There are no signposts for cultural heritage on Svalbard today, thus the guides are very important for the protection and information about the cultural heritage sites and objects.



Figure 10. Photo of Hiorthhamn in Svalbard, an abandoned mining town from 1917. Photo by A. C. Flyen, NIKU.

The industrial remains, whaling and hunting infrastructure and remains of the early scientific expeditions are key elements of Svalbard's environment. The early mining industry provided accommodation and easier access to the archipelago, paving the way for tourism, which dates to the 1800's and focuses on both natural and cultural environments. An example of an abandoned mining town is Hiorthhamn (Fig. 10) which was in operation for a few years from 1917. The climate change, which is now accelerating in the Arctic, is impacting the cultural remains very quickly. The main degradation parameters are geohazards and biological decays, which are enhanced by the climate change, and human wear and tear caused by increased tourist traffic. The natural and human induced degradation reinforces each other, leading to rapid changes which can be observed from year to year.

Many cultural heritage sources of information about "everyday" people's lives are not recorded in the history books, like many things connected to the mining activity. With the changes in the permafrost layers, information about former activities and sites will be lost. A central question is how long it helps to preserve the fields/ sites and the objects on the sites. We need to excavate and document the sites and objects, but also to see how we can act in these areas, and how we can be present, without further damaging the cultural heritage.

Tourism is one of the key economic pillars of developing a sustainable society of the archipelago (Hovelsrud et al., 2021). The recent recommendations by the [Norwegian Environment Agency](#) for stricter regulations of human traffic on Svalbard will have major ramifications for the tourism industry, including new limits on marine-based activities and access to sites, increased safety and insurance regulations, and likely more requirements for certified guides. The overall purpose of regulatory strengthening is to limit and reduce impacts to the natural environment and cultural heritage.

The [Norwegian Cultural Heritage Act](#) (1978) and the [Svalbard Environmental Protection Act](#) (2001) make it a national responsibility to safeguard cultural heritage as a scientific source material and as an enduring basis for understanding and linking present and future generations to history. Due to the rapid manner by which climate change impacts on fragile Arctic nature and cultural heritage environments (Fig. 10), and the increasing pressure from tourists visiting the remote and exotic archipelago, there is an urgent need for knowledge-based inputs to inform decision-making and help develop strategies for natural and cultural heritage management at different levels. One recommendation is to establish citizen science methods where tourists and others can use mobile phone with apps to monitor cultural heritage sites around Svalbard. By involving the public, new data can be collected from a wider area, results shared more effectively through society, and environmental issues

better understood. The result will be a greater awareness of challenges which can prompt changes in people's behavior.

Anders Olson from Directorate for Cultural Heritage ([Riksantikvaren](#)) presented the role of the directorate and some digital services which are available for Norway in general and for Svalbard in particular. Riksantikvaren develops and operates [Askeladden](#), a nationwide database system for managing cultural heritage monuments and sites. The systems use both database and GIS functionality. An example of screendump from the system is shown in Fig. 11.

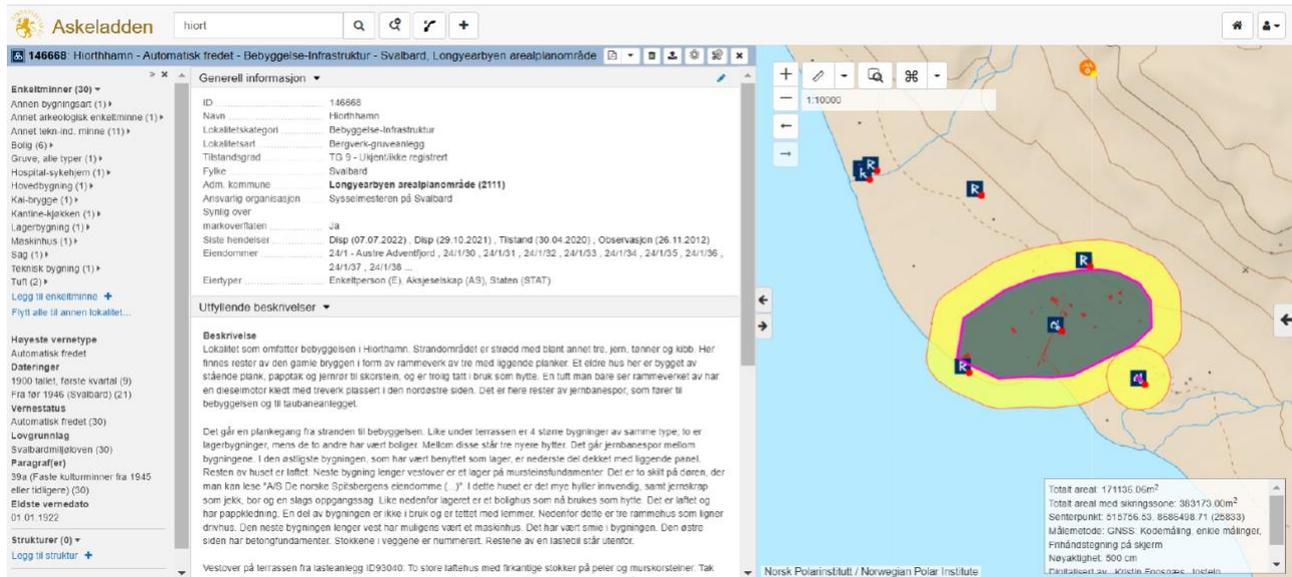


Figure 11. Screenshot from Askeladden, showing a map and text describing the Hiorthhamn area, a protected heritage site in Svalbard with many objects from the coal mining period.

The aim is to integrate all data relating to immovable sites and monuments that are protected by the Cultural Heritage Act (except shipwrecks and other marine heritage monuments). Askeladden has about 5000 registered users and about 1000 of these can create content and edit the database. Others have only reading access. Data from Askeladden are available according to Norwegian License for Open Governmental Data, which means that data are shared through GeoNorge cooperation and through own API's. The data can also be used to build new services based on open standards (e.g. Web Feature Service and Web Map Service).

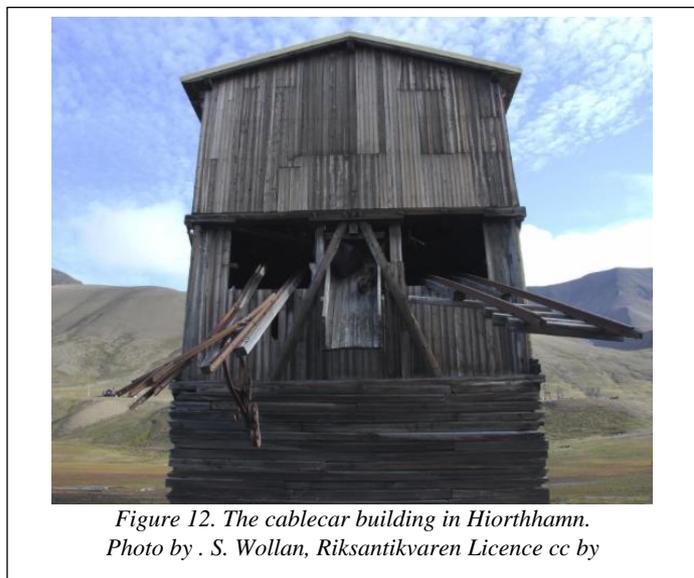


Figure 12. The cablecar building in Hiorthhamn.
Photo by . S. Wollan, Riksantikvaren Licence cc by

In addition to the official database, Askeladden, the directorate operates a public national website for dissemination of cultural heritage information ([Kulturminnesøk](#)). The website is designed for both computers and mobile phones, and it allows the public to contribute with their heritage objects, images, comments and links. At present there are about 20000 visitors to the website per month. The directorate continues to improve the interaction with users as contributor to the website. One of the main challenges is the unknown norms and standards for registration of cultural heritage as there are many regional differences in how this is done.

4.2 Excursion to cultural heritage sites in Hiorthhamn – day 2

On day 2 an excursion to Hiorthhamn was organised in order to show the cultural heritage objects from the coal mining period. The excursion had about 18 participants (Fig. 13) and was led by scientists Vibeke Vandrup Martens and Anne Cathrine Flyen from NIKU.

Hiorthhamn mining town was established in 1917 and operated regularly until 1921, after that only periodically, with the second largest number of listed buildings at a heritage site in Svalbard until 1940. Today, the area is protected, but many of the buildings are maintained by private persons and used as leisure houses. This helps to rescue the buildings and preserve them for the future. The main challenge is to protect the buildings close to the shore from coastal erosion, in particular the iconic cablecar building (Fig. 12).



Figure 13. Group photo from the excursion to Hiorthhamn

4.3: Citizen Science and Community-based observing systems in the Svalbard region – day 3

Community-based observations (CBM) and Citizen Science (CS) projects plays an increasingly important role in environmental and climate data collection. While CBM initiatives are mainly bottom-up initiatives in local communities the CS projects are often driven by scientists and can range from large global-scale projects (e.g. bird watching) to local initiatives on topics of importance in specific areas (e.g. snow avalanche observations). Common for all CBM-CS projects is that they need to be highly relevant and appealing for the public to be successful. In the Svalbard region several global citizen science projects are active because tourists and other visitors collect data and upload it to central repositories. A summary of the Citizen Science projects that are most developed and active in Arctic data collection was presented by Michael Kjøie Poulsen. Some statistics of these programs is shown in Table 3.

Table 3. Statistics from the major citizen science program in Svalbard (provided by M. K: Poulsen 22.08.2022)

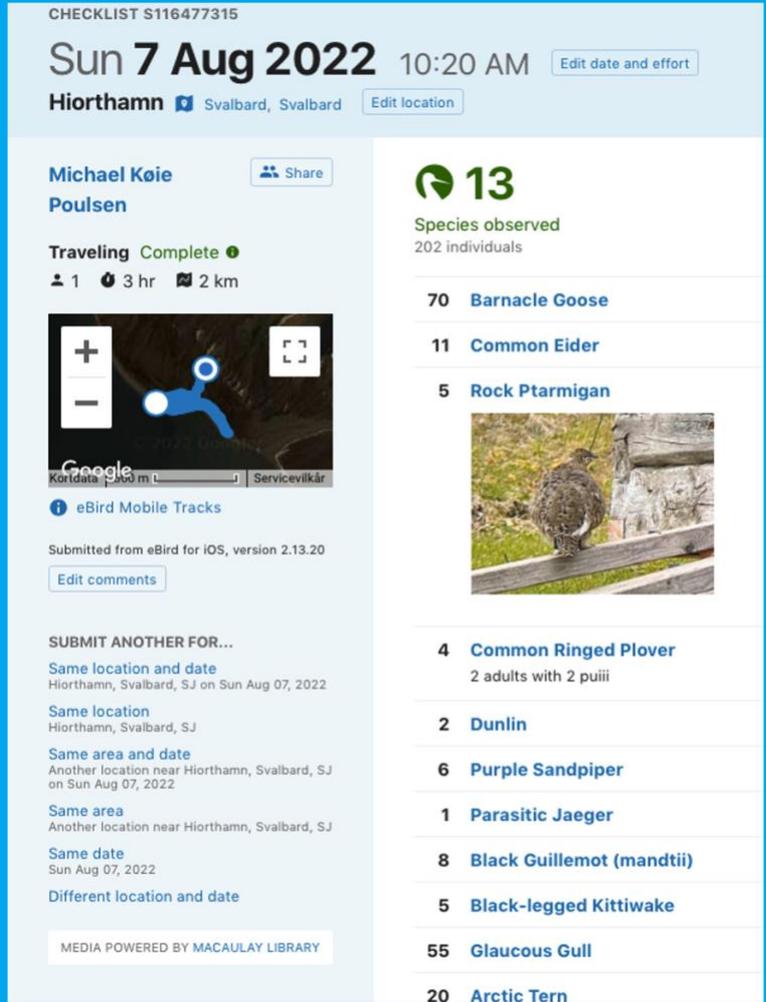
Citizen science program	No of observations	No. of species	No. of observers
iNaturalist Worldwide	109,899,401	388,842	2,304,763
iNaturalist Svalbard	4,056	268	236
eBird Worldwide	*69,604,719	10,623	797,448
eBird Svalbard	*4,145	103	475
Artsobservasjoner Svalbard	102,544	1,220	656
Happywhale Worldwide	222,056	**111	12,667
Happywhale Svalbard	334	16	

* for eBird is no. of observations = no. of checklists (with multiple species)

** Mostly Humpback Whale (with 207,222 records). 48 species with less than 10 records

A group of polar scientists and expedition cruise operators have set up an organisation called the [Polar Citizen Science Collective](#) which facilitates ship-based citizen science projects on AECO and other vessels.

During the excursion to Hiorthhamn Michael Kjøie Poulsen from NORDECO demonstrated how the *eBird* app works when you are in the field and can register observations of birds with a mobile phone camera (Fig. 14). *eBird* is a global observing system for birds, established and operated by Cornell Lab of Ornithology for the last 20 years (<https://ebird.org>). The goal is to gather information from birdwatchers, archive it, and freely share it to power new data-driven approaches to science, conservation and education. *eBird* is among the world's largest biodiversity-related science projects, with more than 100 million bird sightings contributed annually by birdwatchers around the world and an average participation growth rate of approximately 20% year over year. During the excursion it was discussed how to build a citizen science project for cultural heritage sites in Svalbard and elsewhere, building on the experience from the [SCAPE programme](#) in Scotland.



CHECKLIST S116477315

Sun 7 Aug 2022 10:20 AM [Edit date and effort](#)

Hiorthamn [Svalbard, Svalbard](#) [Edit location](#)

Michael Kjøie Poulsen [Share](#)

Traveling Complete ●

1 3 hr 2 km

[+ eBird Mobile Tracks](#)

Submitted from eBird for iOS, version 2.13.20

[Edit comments](#)

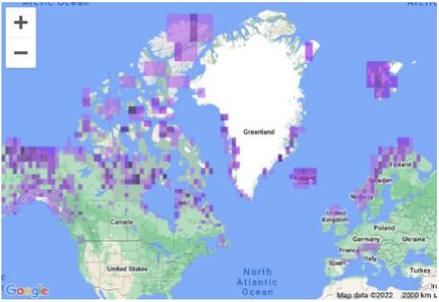
SUBMIT ANOTHER FOR...

- [Same location and date](#)
Hiorthamn, Svalbard, SJ on Sun Aug 07, 2022
- [Same location](#)
Hiorthamn, Svalbard, SJ
- [Same area and date](#)
Another location near Hiorthamn, Svalbard, SJ on Sun Aug 07, 2022
- [Same area](#)
Another location near Hiorthamn, Svalbard, SJ
- [Same date](#)
Sun Aug 07, 2022
- [Different location and date](#)

MEDIA POWERED BY MACAULAY LIBRARY



Michael Kjøie Poulsen observing birds in Hiorthamn and registered observations and photos in eBird (left)



[Map of observations of Rock Ptarmigan registered in eBird.](#)

Screenshot of the information eBird about Rock Ptarmigan and other species submitted by Michael Kjøie Poulsen during the Hiorthamn excursion.

Figure 14, Example of observation and registration of birds using the eBird app during the excursion to Hiorthamn .

Prof. Janne E. Sørreide at UNIS presented citizen science projects in the Svalbard area related to marine ecosystem research in collaboration with other scientists, tourists and expedition operators. Citizen science activities at UNIS are contributing to data collection in science disciplines such as sea ice, glaciology,

25 April 2024

permafrost, precipitation/runoff, ecosystems and coastal erosion. In all of these disciplines, climate change has severe impact and the observations are needed for research as well as for natural hazard preparedness and prevention. UNIS started cooperation with the tourist company Hurtigruten some years ago to collect oceanographic and marine biological data as part of the tourist cruises around Svalbard.

Hilde Fålund Strøm has long background in Arctic tourism as expedition leader and is presently leader of [Hearts in the Ice](#) (HITI) together with Sunniva Sorby. HITI is promoting engagement in climate change and conducts citizen science work for different projects.

During the overwintering at Bamsebu, Hilde and Sunniva collected data for NASA, UNIS, Norwegian Polar Institute and other research institutions. Fig. 15 shows the collection of water samples under the ice in wintertime. This data collection was done in collaboration with Janne Søreide at UNIS. Such overwinter expeditions provide a unique possibility to collect in situ data in areas and seasons when such data are difficult to obtain.



Figure 15. Collecting water samples under sea ice

Gyda Gudmundsdottir from AECO (Association of Arctic Expedition Cruise Operators) gave an interesting presentation of the activities and plans to develop community-based and citizen science activities as part of AECO's expedition programme. The goal is to develop environmentally friendly, responsible and safe cruise tourism in the Arctic. AECO has therefore produced a number of guidelines to be used by the tourist guides and the cruise passengers during the expeditions. Citizen science has become a central part of the expedition cruises, because it has become a demand from the customers. The involvement of tourists in research and data collection gives them direct access to observation of the climate change and thereby a deeper understanding of the environment they are visiting. For the scientists, the expedition cruises offer a way to collect more environmental data from larger areas, compared to what the scientists can do alone. The collaboration between tourists and scientists is of mutual benefit, where the educated tourists become ambassadors for the environment.

AECO members are obligated to operate in accordance with national and international laws and regulations and have, in addition, agreed to follow an extensive set of guidelines to ensure operations are in accordance with our objectives, including a number of [site-specific guidelines and guidelines for visitors](#) to the Arctic. Onboard the ships education is seen as an integrated part off of the expedition, and all AECO members have lectures in different subjects like biology and other climate environmental issues. They have a lot of requests from different research projects and institutions to take part in programmes and projects, but this needs to be valuable and clear when it comes to roles of the participants. AECO has a lot of lesson learned reports to build on, as presented in <https://www.aeco.no/resources-and-tools/>.

4.4 The value of cultural heritage experiences for visitors and the local community – day 3

Per-Gunnar Hettervik is senior advisor in Norges Vel (The Royal Norwegian society for development), which is a non-profit, independent organisation working with promoting and supporting new industries,

entrepreneurship and creating strong local communities. He presented the main trends in the tourist industry and the particular motivations for adventure tourism (Fig. 16).



Figure 16. The motivating factors for adventure travels, from ATTA, 2021 (Adventure Tour Operator Snapshot Survey), Courtesy Per-Gunnar Hettervik, Norges Vel.

Furthermore, he explained the concept of regenerative tourism, which will be the next step in developing sustainable tourism. Regenerative tourism seeks to leave a place in a better condition than before the tourists arrived. It creates robust local communities that care for the visitors and respect biodiversity. It also provides local economic sustainability and supports local ownership. For Svalbard, as well as other tourist destinations, regenerative tourism is becoming the new paradigm, which will reframe the scope and role of cultural tourism in the arctic. It can reinvigorate and rebuild relevance for local communities, and the development of proper guidelines and best practice standards can enhance research and resource management.

In his presentation he debated overconsumption and the shift in paradigm in the travel industry, and current trends in tourism as well as research on motivations for travel. The presentation also demonstrated how cultural experiences are valued more than experiences of nature in many cases, and how we need to create bookable experience-packages, including cultural heritage and activities in nature, that strengthen the awareness of, and the tolerance limits, of the environment and respects the local population and its culture (Fig. 17).

Both nature- and cultural perspectives are parts of tourism, and the experience is that the tourists generally want to do good when they visit places. The motivation of the tourist could be about learning to know new areas and get an expanded world view. One way of making sure tourism can be part of the solution is to work with what is called adventure tech or beacons sensor technology, where you can use an app on your cellular phones even if you are in areas without internet connection.

Cultural heritage is seen as very important for connection between people and the place and is closely connected to sense of belonging. Many are interested in history and what has happened before in places they

live in or visit, and it helps to understand other people, the context of their lives, and often relates to family connections and memories.

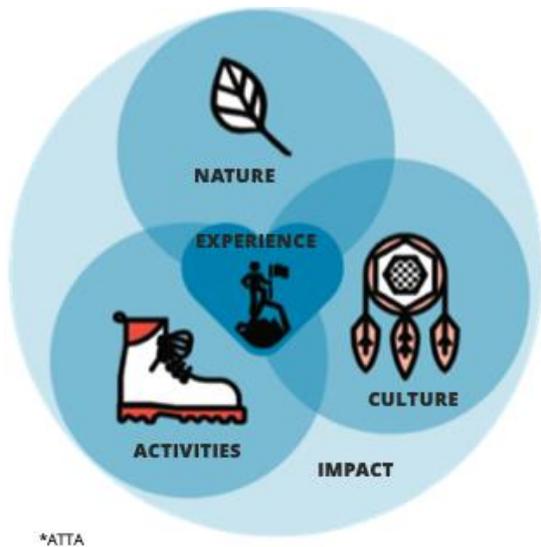


Figure 17. Tourists are interested in valuable life experience when they travel. The experience consists of elements from nature, culture and activities. From ATTA, 2021 (Adventure Tour Operator Snapshot Survey), Courtesy Per-Gunnar Hettervik, Norges Vel (left). In Longyearbyen Taubanesentralen (cablecar station) is one of the major cultural heritage sites. Photo by Dina Brode-Roger (right).

An understanding of the cultural heritage of a place/community may influence behaviour, e.g. visitors are more respectful, more engaged, more likely to follow guidance, more likely to choose activities and experiences that relate to cultural heritage and are sustainable. There is an important pre-condition that cultural heritage information is communicated effectively, both before travel and through the intermediaries/ guides who visitors encounter during their visits. Cultural heritage communicated and integrated in a good way in sustainable tourism development is preparing the ground for tourism with low or no impact, but vulnerabilities and threats must be sorted out. Present value seems to be low in at the beginning of a visit, but increases during the stay and experience people have. Tourists seem to be interested and prepared, as they google, read guidelines and talk to guides during field trips and guided tours. Cultural heritage first get a person value when you understand the meaning. Added value has to do with the experience, to see the site or object, that it is local or near. Proximity adds a value, like the culture house, the museum and storytelling in various ways (Fig. 16).

Dina Brode-Rogers, PhD candidate at University of Leuven, works with the societal changes in Svalbard in her PhD thesis. She has been living in Svalbard and presented some of her work where she conducts interviews with people different background to study the importance of cultural heritage, tourism, research activities and how the Svalbard community should be developed in the future. In her PhD work she is looking at Svalbard in a broader perspective including history, heritage, art, culture, tourism and the community today. A part of the PhD work is the FOSSIL project, which is connected to the reuse of the old power plant in Longyearbyen which was shut down in 1984. In 1992 the Svalbard law/ protection law, decided that all buildings and remains from before 1946 was automatically protected. Dina engaged in focus group interviews with people who had visited the power plant, and the feedback was that FOSSIL needs to be a living part of the town.

4.5. Develop guidelines and best practices related to cultural heritage and tourism

Shared knowledge and co-development with archeologists, social scientists, natural scientists, heritage experts etc. is essential for developing good practices and eventually context specific guidelines. Good communication

skills combined with respect for local knowledge are important assets to bring into the field of regenerative tourism. In this context citizen science projects can be very useful where repetitive observations and photos are collected to document changes over time. Citizen science projects combined with other monitoring methods can be helpful contributions towards a more sustainable cultural heritage management and thereby supporting a regenerative tourism.

Regenerative cultural heritage experiences for visitors/local community could be obtained by use of beacon technologies, offering tailored information to the visitors via mobile phones (Fig. 18). Tourism with a societal and nature- or cultural driven purpose, have the potential to be regenerative. This could be further developed through the use of mobile phone technologies. Audio tools like podcasts and storytelling in a form of edutainment and adventure, would also be important elements, but must be created from the “raw data”, and based on scientific knowledge. Training of guides in Cultural Heritage is very important and should be more in focus, as “nothing beats a good guide!”

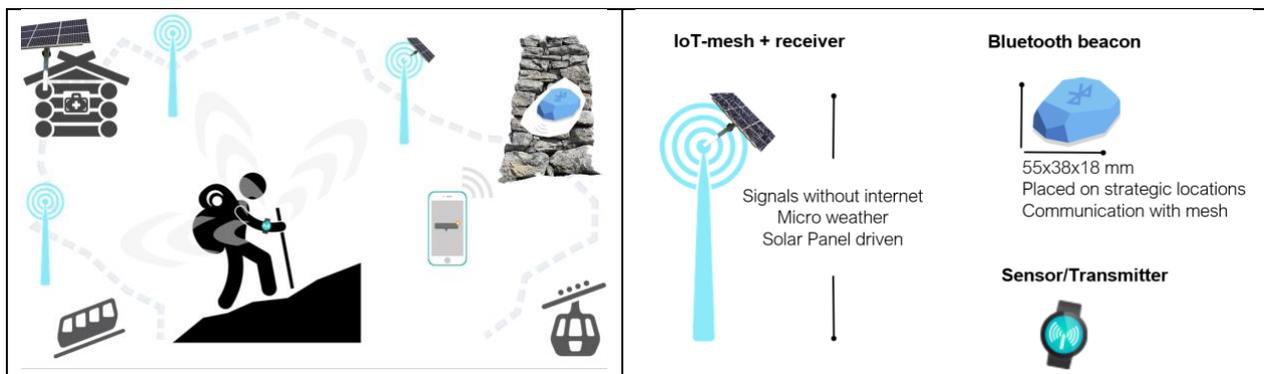


Figure 18. Use of beacon technology and mobile phones to inform tourists about cultural heritage, nature experience and other information that tourists need. The beacons contain information that is transmitted to mobile phones in the area. Courtesy: Per-Gunnar Hettervik, Norges Vel.

Another method is to use Wikipedia more actively in a community for sharing knowledge. Wikipedia is one of the top 10 websites in the world and is open for all with possibilities to link to other resources that is relevant to a specific article. Several useful tools are provided by Wikipedia (e.g. <https://en.wikipedia.org/wiki/Edit-a-thon>, https://en.wikipedia.org/wiki/Wikipedian_in_residence).

For example the museums, Riksantikvaren and Arts Council Norway are using Wikipedia services to disseminate cultural information and experience. The same could maybe be done or attempted regarding culture in Svalbard. The basic idea is to develop formal or informal collaboration between residents who share an interest in a site or monument and have a role in its management, interpretation, and protection. If CBM systems are properly set up and the data used, this could help in assessing conservation priorities and act as an early warning system for protection or conservation action to be taken.

Engaging with communities could also be done by launching a Cultural Heritage year or festival, or events like wooden path to a protected building or site, inviting people to participate in protection of built elements, and management of sites. Topics for such events could be to arrange a railway week, brick week or make a walking trail or « game » with information, markers etc. During the dark season one could make sound- and light shows for both locals and tourists.

Development of guidelines and standards for tourist activities should be done as a collaboration between the governor, experts and locals with knowledge about the practical aspects of tourism. This will help to decide which sites can be visited, how many visitors, how often and which sites should not be visited. To offer employment in cultural heritage tourism like museums, visitor centres, guides etc, would be positive for the Svalbard community. There needs to be to be a process for how to consult and properly involve communities in decision-making around cultural heritage tourism. In a recently inscribed World Heritage Sites (WHS) in Greenland, UNESCO employed a top-down approach in their community communication where meetings

were held to give information rather than asking for input. This has undermined local support for the inscription and the WHS has restricted economic activity of fishermen in the area. Elected politicians should be responsive to the needs and interests of their constituents in the planning and implementation of cultural heritage tourism in the Arctic. Standards and guidelines should reflect your decisions, and the science and engineering sector should provide best practices for preservation etc.

The understanding of what's happening, and the ability to technically act on this and to have resources to make decisions and fulfill them are important aspects. To find the balance of measures or methods to obtain what is needed in relevance to the object or objective is very important. This will require engage form the community in the discussion, both in planning and implementation. One way of doing it is to involve the community in citizen science and science-based monitoring of cultural heritage from past to present.

4.6. Arctic Practice System – day 4

The programme on day 4 was organised by Jay Pearlman, Francoise Pearlman, Pauline Simpson and Siri Johda Khalsa, representing the [IEEE France Section](#), one of the partners in CAPARDUS.

Jay Pearlman, introduced the Arctic Practice activities in the CAPARDUS project, where one of the goals is to design an Arctic Practices System (APS). It is a challenge that we use the terms “practices”, “repository”, “value chain”, “metadata” and many others. These words can have different meanings depending on context, cultures and scientific discipline. Practices are adopted to culture, where use cases can illustrate the meaning of the terms in practical examples. Jay presented the [Ocean Best Practice system](#), which is permanent repository for documents related to ocean observing systems, technologies, procedures. During the presentation the question of the issue of legal constraints and localities were raised. Jay explained that to create common licenses could be a solution to better secure how for example an article can be used. The Ocean Best Practice System (OBPS) was formally adopted as an IOC project in June 2019 and is hosted at the Project Office of IODE of IOC-UNESCO in Oostende, Belgium.

The APS system is envisioned to be a sustained repository for practices related to environmental observations, resource exploitation and other activities in the Arctic. ‘Practice’ means a documentation in digital form of how things are done for example in observation of a specific ocean phenomenon. What an APS should do will be identified in dialogue with people living or working in the Arctic with knowledge about practices in their daily work. The APS is envisioned to cover the whole “value chain” from societal requirements to data acquisition, products, services and societal benefits. The APS will build on the UNESCO/IOC Ocean Best Practices System (OBPS, Fig. 19), which was implemented to address similar challenges in the marine domain, hosting forward-facing best practice management system in tune with standards in global ocean observing.

A first survey on requirements for an APS was conducted in January-February 2022, addressing Arctic user groups in general, not only the Svalbard community. Major outcome of this survey was the importance of (1) including indigenous methodologies and practices; (2) accessibility of the contents through several platforms, in particular mobile phone, (3) focus on practices linked to training, and (4) language issues. The latter implies that the APS should have a user-friendly language and facilitate for multilanguage services. A particular challenge is indigenous languages, which is important for inclusion of indigenous knowledge. During the subsequent CAPARDUS workshops in 2023, the question of developing an APS was discussed with several user groups, showing that the needs are very heterogenous and many used groups have their own information system they want to develop further.

An APS should therefore not replace existing systems, but rather be connected to them in a federated way. This means that the APS will have a number of subsystems. Based on broad user requirements, the components and modules of the system are determined, with focus on a core set of modules identified in the case studies and user profiles. In brief, tailored user interfaces (UIs) and user experiences (UXs) will draw content from a secure database storing stakeholders either submitted directly to the APS or harvested from existing systems and filtered through a set of processing modules to identify, structure, and translate content to increase its value to users. User feedback modules will support iterative refinement and improvement, ensuring that the APS can

meet the needs of its intended users as they change in a rapidly changing Arctic. From the case studies, a number of user profiles were identified, where requirements for an APS were discussed.

However, the idea of a federated information system such as an APS has been welcomed as shown in the first survey and follow-up dialogues with different user groups. A design document for an APS was prepared, describing how an APS can be implemented. The realization of an APS would be a goal for a follow-up project.

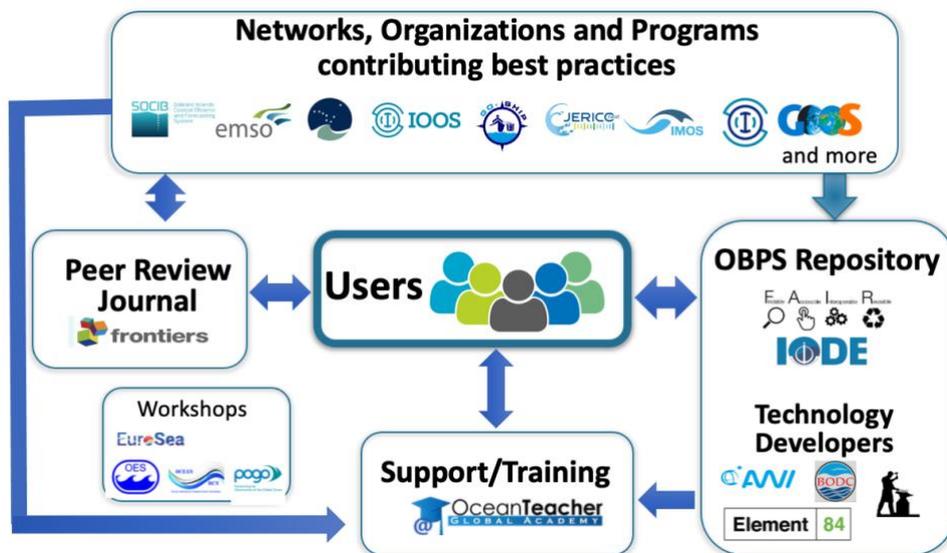


Figure 19. Diagram of the components of the Ocean Best Practice System. The Arctic Practice System will involve a wider group networks, organizations and programmes covering the marine, terrestrial and other Arctic specific disciplines as well as CBM systems.

5. Workshop on practices, guidelines and standards for tourist operators 7 -8 February 2023

The climate change and its consequences in Svalbard and other Arctic regions lead to new requirements for planning and decision-making based on new knowledge building on scientific and economic data. The workshop on 7-8 February was a follow-up of the previous workshop described in chapter 4, with the goal to identify practices, guidelines and standards in topics of importance for people living and working in the region. The topics addressed in the workshops included protection of nature and culture, shipping, tourism, resource exploitation, research activities, data sharing and safety of operations. Development of standards involve processes on several levels, ranging from traditions and practices to standards and legislation. In this workshop representatives from the tourist operators were invited together with researchers from NIKU and local community members from Longyearbyen.

5.1 Follow-up the discussion of an APS

The objective of the workshop was to explore and discuss how practices, guidelines and standards are developing among the tourist operators in Svalbard. The outcome of the discussion would help to identify the need for an Arctic Practice System (APS), which is planned to be a digital system where practices, guidelines, standards as well as regulations can be uploaded, stored and retrieved (Pearlman et al., 2020). Both providers and users of practices contribute to building up the system over time by including more and more information. The APS concept can be illustrated as shown in Fig. 20, where we attempt to describe a concrete example of how an APS could be designed for the Svalbard community.

An important element of the APS is that is defined in a societal context where the purpose of the system is to develop and document knowledge among actors who work on a specific topic, for example snow avalanche monitoring (Fig. 20). Snow avalanche monitoring is important for the safety of the inhabitants and the tourists travelling around in Svalbard. The APS should contribute to improve knowledge sharing between scientists, the public sector, businesses and governmental bodies. Improvement in knowledge sharing between the involved actors is a key factor for sustainable development in the Arctic.

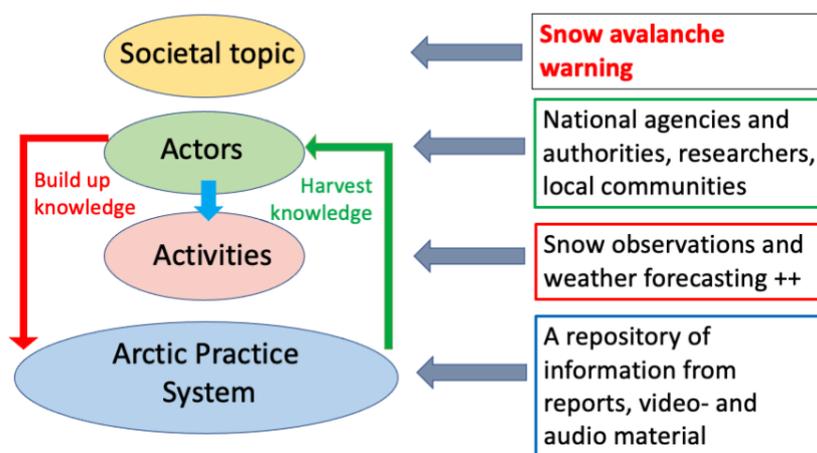


Figure 20. For a given societal topic, such as snow avalanche warning, there are different actors involved such as national agencies with responsibility for monitoring and forecasting services (e.g. Norwegian Water and Energy Directorate and Norwegian Meteorological Institute), local authorities (the Governor), researchers and the local community (Longyearbyen Community Council). The activities represent the documentation of what is done and should be stored in a repository and be available for building up new knowledge. An APS needs to be constantly developed by ingesting new documentation so the users can search for information to harvest evolving knowledge.

5.2 Tourism in Svalbard

Tourism in Svalbard is increasing year by year and is identified as a key economic pillar for future development in Svalbard. Although tourism provides new economic opportunities, it can often result in pressure on infrastructures and contribute to problems for the local inhabitants. For instance, port facilities and services for the cruise vessels can be congested and overloaded in the high season when many vessels and tourists arrive at the same time.

Ronny Brunvoll from Visit Svalbard (Fig. 21) presented status and perspectives on tourist development in Svalbard. He presented the statistics of the tourist traffic by comparing data from the peak year 2019, which was before the pandemic, and 2022, when the tourist traffic was fully opened after the pandemic. Visit Svalbard is the official tourism board for Svalbard and Longyearbyen. Visit Svalbard is a member-based organisation and a neutral development and coordinating body of the local tourism industry. They are also responsible for the official [travel portal for Svalbard](#) with tourist information, where the Svalbard guidelines are communicated to all visitors (see insert on next page).

In 2022 Longyearbyen had ca. 68000 guest accommodation compared to 77000 in 2019. Conventional cruises had ca. 20000 passengers in 2022 compared to 40000 in 2019. Explorer cruises had up to 28000 passengers in 2022 compared 22000 in 2019 (note the increase in this category). Another characteristic of the tourist traffic is the longer season, where only November, December and January have low traffic. The policy for further growth in the tourist traffic is to have more visitors in the dark months and not increase the traffic in the peak season. It is also decided to stop further building of new hotels. This will allow better to use of existing hotel capacity and provide more year-round employment of the tourist operators.



Figure 21. Ronny Brunvoll presenting tourist statistics for Svalbard

[Hurtigruten Svalbard](#) is the largest tourist operator in Svalbard and a major operator in other Arctic and Antarctic areas. The company provides full tourist packages including cruises with expedition vessels, hotels, restaurants, shops, activities. In 2019 their new ice-strengthened cruise ship [MS Roald Amundsen](#) was launched with hybrid propulsion that will reduce fuel consumption and CO2 emissions (Fig. 22). The company hires scientists to be responsible for organizing citizen science activities onboard their vessels in collaboration with science projects. The scientist onboard are involved in many of the major citizen science projects in the Arctic and Antarctic. Several guides are employed to educate the guests about the climate and environmental changes in the polar regions, and to disseminate this information to the outside world.

The effect of the corona pandemic had dramatic impact on the tourist traffic in 2020-2021. The number of passengers on conventional cruise ships (more than 500 passengers) was about 20000 in 2022 compared to 40000 in 2019. However, the number of passengers on the explorer vessels (less than 500 passengers) grew from 22000 in 2019 to 28000 in 2022, showing that the tourist traffic in this category is growing.

The policy for further growth in the tourist traffic is to have more visitors in the dark months and not increase the traffic in the peak season. The Local Council has also decided to stop further building of new hotels. This will allow better to use of existing hotel capacity and provide more year-round employment of the tourist operators. The policy for further growth in the tourist traffic is to have more visitors in the dark months and not increase the traffic in the peak season.

THE SVALBARD GUIDELINES

1. Don't be an Arctic litterbug! Leave no lasting signs of your visit.
 2. Birds and other animals are not to be disturbed. Remember, you are the guest.
 3. Help take care of the biodiversity. Do not pick flowers.
 4. Leave old cultural remains alone. Law protects all traces of humans from before 1946.
 5. It is prohibited to lure, pursue or otherwise seek out polar bears in such a way as to disturb them or expose either bears or humans to danger.
 6. Don't leave settlements without a suitable gun, and experience in using it.
 7. Be considerate to others.
 8. Contact the Governor's office (Sysselmannen) if planning a longer field excursion. A mandatory registration applies for travel to large parts of Svalbard.
 9. Acquaint yourself with the rules and regulations pertaining to travel and other tourist activities in Svalbard.
 10. For the sake of both the environment and yourself, we recommend organised tour arrangements.
- It is impossible being an invisible tourist, but we do appreciate your trying.



Figure 22. The ice-strengthened cruise vessel MS Roald Amundsen

For the tourist operators, managers, and government it is important to build up knowledge about the impact of tourism on the environment and how the tourism should be developed in a responsible way (Hovelsrud et al. 2020). The impacts from tourism can be diverse encompassing effects on the natural as well as the socio-cultural environment. The high Arctic environment is in general considerably more vulnerable than regions further south. Of particular concern is disturbance to feeding, nesting and denning areas for birds and mammals in both terrestrial and marine environments, not least because exotic wildlife is a prime attraction for tourism (Øian and Kaltenborn 2020). Human traffic on the tundra can also cause soil erosion, trampling of vegetation, scars from campfires, contamination from human waste and littering. Cultural heritage sites are also often in a 'delicate' situation due to some of the same factors. In addition, there have been instances where tourists have disturbed graves, littered sites and taken wood from old buildings and historical constructions for use as firewood. Human traffic can therefore change the appearance of attractive tourist sites, and thus alter the social experience and socio-cultural meaning of these markers of salient history (Holmgaard et al. 2019).

Visit Svalbard has strong focus on developing sustainable tourism, which means that the quality in all parts of the industry should be improved and that the value creation for the society should increase. This means that training of guides become more professional is a very important task (Fig. 23). The principles for sustainable tourism should include:

- Be responsible and safe
- Operate the whole year and provide activities for the dark season such as cultural history, and northern light experience
- Length of each visit should be longer, avoiding the short visits
- Reduce climate emission and leave no traces



Figure 23. Visit Svalbard has provided [training of guides](#) since 1998, which is important for the safe and responsible tourist activities (Photo: Visit Svalbard).

Education and training of tourist guides is a key factor in developing the tourist industry in a sustainable way, which means that the operator must have focus on quality, safety and minimal human footprint of their activities. Visit Svalbard and the major operators such as Hurtigruten offer internal training for their guides, but the need for more formal education becomes more important as the industry is growing. University of Tromsø, the Arctic University of Norway, in collaboration with UNIS offers a 1-year educational program, called [Arctic Nature Guide](#), which is a practical course and can take about 30 students each year. The Arctic Safety Centre at UNIS plays a key role to develop competence and provide course in safety (section 6).

In 2023 the Norwegian Environment Agency proposed more [regulations](#) of human traffic on Svalbard to protect the environment in response to the growth in tourism in the region. These regulations will have major ramifications for the tourism industry, including new limits on marine-based activities and access to sites, increased safety and insurance regulations, and likely more requirements for certified guides.

5.3 Svalbard Museum

Hege Anita Eilertsen presented the role of [Svalbard Museum](#) as the main institution to inform the public about the natural and cultural history of Svalbard, which goes back 400 years. The museum prepares and disseminates knowledge about Svalbard through objects, photos and texts displayed in modern premises co-located with the Svalbard Science Park (Fig. 24). In 2024 the main exhibition at the museum is under reconstruction and have entirely new design and a revised content with interactive learning stations.

The museum disseminates knowledge about the industrial remains, whaling and hunting infrastructure and remains of the early scientific expeditions are key elements of Svalbard's environment. The early mining industry provided accommodation and easier access to the archipelago, paving the way for tourism, which dates to the 1800's and focuses on both natural and cultural environments. Tourism is one of the key economic pillars of developing a sustainable society of the archipelago (Hovelsrud et al., 2021).

The museum has permanent exhibits covering all central topics of importance to understand the past and the present of Svalbard:

- Basis for life in the Arctic
- The discovery of Svalbard
- Exploration of the archipelago
- Hunting/whaling
- Trapper's life
- Geology and mining
- Modern life and research
- Life in the ocean and on the tundra
- The Svalbard Global Seed Vault



Figure 24. Exhibits in Svalbard Museum

The museum works to adapt new digital technologies to produce and disseminate information about Svalbard. For the tourist industry it is important that the museum becomes attractive for the visitors, allowing them to stay longer and obtain more knowledge about Svalbard, especially the cultural history. By producing digital information through videos, story-telling, animations, and virtual reality/artificial reality tools the museum can contribute to sustainable tourism.

The museum plans to become a more important tourist destination, especially in the dark season. An interesting example of cultural heritage documentation is the restoration of the Svea and Lunckefjell coalmine area, where the mines and the area have been 3-D scanned and made available in digital form. The whole mining community has been removed, but the community will be available as a virtual reality (<https://www.niku.no/prosjekter/digital-dokumentasjon-av-gruvemiljoet-i-svea/>).

The concept of an Arctic Practice System can be very relevant for the museum if it can be designed according to the specific requirements of the museum. A system where digital object can be uploaded to a repository by knowledge providers can be useful for the museum, which can prepare the uploaded information into useful products for tourists and other users. In Longyearbyen, there is also the [North Pole museum](#), which has focus on documenting the early explorers of the Polar Ocean, in particular the expeditions to the North Pole, mainly with airships but also with skis, dog sledges and boats (Fig. 25).

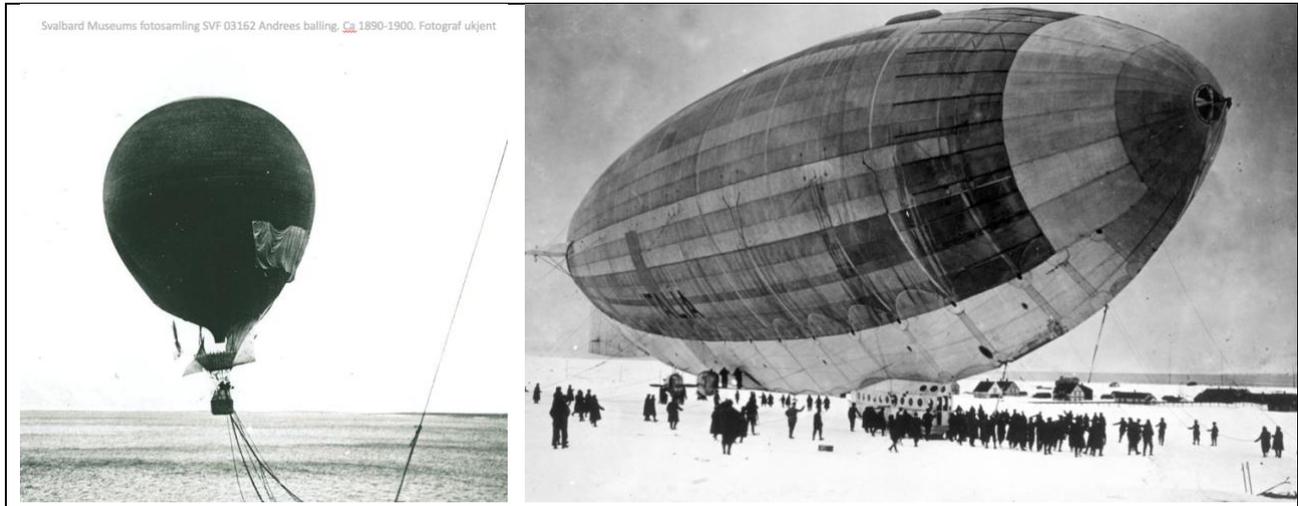


Figure 25: Left: From Svalbard Museum's photo collection SVF 03162 showing Andrees ballon from ca. 1890-1900. (unknown photographer). Right: Airship "Italia" in Ny-Ålesund (from photo collection in the North Pole museum).

6. Workshop on practices, guidelines and standards in Arctic safety: 8-9 June 2023

In Svalbard and other Arctic regions, the increased human activities requires that knowledge about safety is built up and disseminated to people who travel, work or live in these regions. There is a number of research projects addressing risk and safety for terrestrial as well as maritime activities, many of which have focus on the Svalbard region. The workshop had ca. 15 participants from institutions involved in development of Arctic safety: The Safety Centre at UNIS, the Polar Institute, NTNU, University of Stavanger, Joint Rescue Centre in Bodø, Norwegian Coastal Administration, Nord University, Longyearbyen Red Cross, Visit Svalbard and Telenor Svalbard. The presentations addressed both research on safety, volunteer organisations and operational services by governmental institutions. In the Svalbard area the Governor has the overall responsibility and provides information on safety measures for tourists and visitors regarding clothes and equipment during field excursions, polar bear protection, weather and snow conditions, and other environmental hazards.

The factors that make safety more challenging in the Arctic compared to other places are the following:

- cold conditions and extreme weather conditions, leading to higher risk that people and equipment will not function
- remoteness and long distances implies that assistance in case of accidents will take much longer time
- limited infrastructure, implying that most human activities are more difficult and time consuming
- climate change is stronger, leading to more extreme weather events and consequently more severe natural hazards

6.1 Arctic safety projects and organisations

At UNIS the [Arctic Safety Centre](#) has been established providing research, education and training in Arctic safety topics, because there is a growing demand for knowledge among visitors as well as the local inhabitants (Albrechtsen and Indreiten, 2021). UNIS has now a leading role in developing safety standards for outdoor activities in Svalbard (Figs. 26 and 27).



Figure 26. Arctic safety is a central part of most human activities and infrastructure: snow avalanche protection in Longyearbyen, rescue operation of a grounded ship, scooter trips with risks for accidents, and iceberg calving with risks of ice pieces hitting personnel or equipment (from M. Indreiten, Arctic Safety Center)

 MSc COURSES	 PRACTICAL COURSES	 AVALANCHE FORECASTING	 TECHNOLOGY	 SAFETY ASSISTANCE	 RESEARCH Arct-Risk
<ul style="list-style-type: none"> • Safety Management • Emergency Preparedness and Response • Risk handling in the Arctic context 	<ul style="list-style-type: none"> • Courses: <ul style="list-style-type: none"> - Polar Bear - Avalanche - Field safety • Continuing Education Course 	<ul style="list-style-type: none"> • Field observations • Instruments • Information and teaching 	<ul style="list-style-type: none"> • Development and testing • Snow sensors • IoT technology 	<ul style="list-style-type: none"> • Standard Operation Procedures • Courses • Accident investigation • Learning reports 	<ul style="list-style-type: none"> • Start april 2021 • Funding from RCN • Case: Longyearbyen avalanche safety
<ul style="list-style-type: none"> • 3 courses - 10 ECTS • Total of 75 students • Master thesis • Bachelor course 	<ul style="list-style-type: none"> • Target groups: Local community Industry Rescue & Emergency preparedness 	<ul style="list-style-type: none"> • Service for: Longyearbyen Lokalstyre SvalSat Rescue service (SMS) 	<ul style="list-style-type: none"> • Cooperation with: Telenor Svalbard og Longyearbyen Lokalstyre • Project: DRIVA Nordkapp 	<ul style="list-style-type: none"> • Local customers: SNSK SvalSat NP 	<ul style="list-style-type: none"> • Merging science and practice • Local, national and international participation



Figure 27. Activities of Arctic Safety Centre at UNIS and the participating institution (From M. Indreiten)

One project developing knowledge and tools to deal with risks and other effects of climate change is [ArctRisk](#) (Risk governance of climate-related systemic risk in the Arctic). The project uses a transdisciplinary approach involving perspectives from technology, safety science, natural science and social science. New sensors to monitor snow avalanche risk are demonstrated in collaboration with the Local Government, the Safety Centre and other partners. In Svalbard the Governor, UNIS, the tourist operators and others who brings visitor to the region are responsible for providing information on safety measures regarding clothes and equipment during field excursions, polar bear protection, weather and snow conditions, and other hazards (Fig. 28).

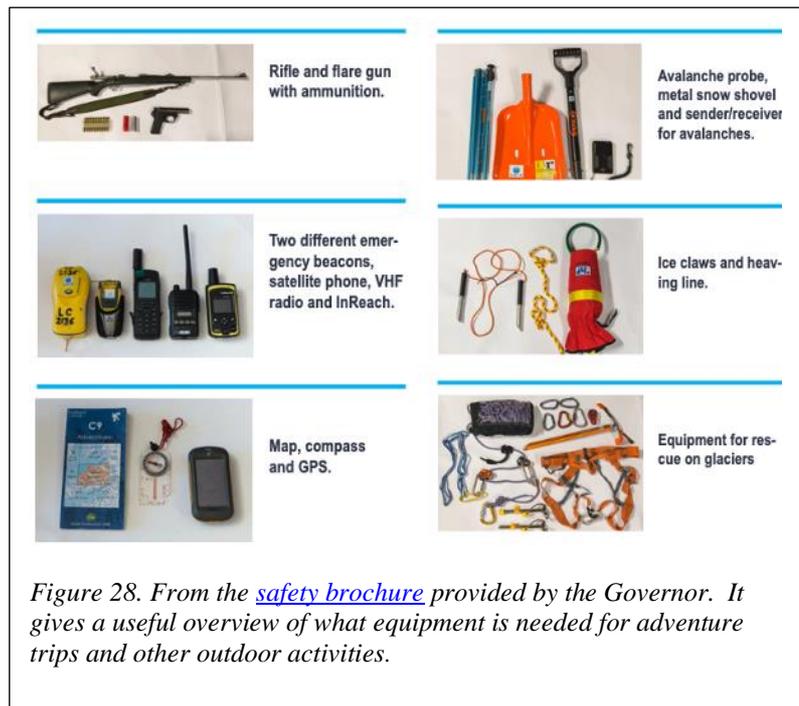


Figure 28. From the [safety brochure](#) provided by the Governor. It gives a useful overview of what equipment is needed for adventure trips and other outdoor activities.

In addition to the safety activities in the Svalbard area, there are Pan-arctic maritime safety arrangements under the Polar Code (from 2017) and the Arctic Council (from 2011). The first international agreement made exclusively for the Arctic region was signed at the ministerial meeting in Nuuk, May 12, 2011. The [agreement](#), which deals with search and rescue of aeronautical and maritime vessels and passengers, is also the first international agreement made under the auspices of the Arctic Council. The agreement delineates the search and rescue areas for the Arctic nations, where Norway has responsibility for the area around Svalbard and up to the North Pole (Fig. 29). In the Norwegian sector the Coast Guard icebreaker KV Svalbard play a key role in search and rescue operations in addition to other tasks such as enforcement of rules and regulations, support to research and collaboration with other civilian and governmental agencies.

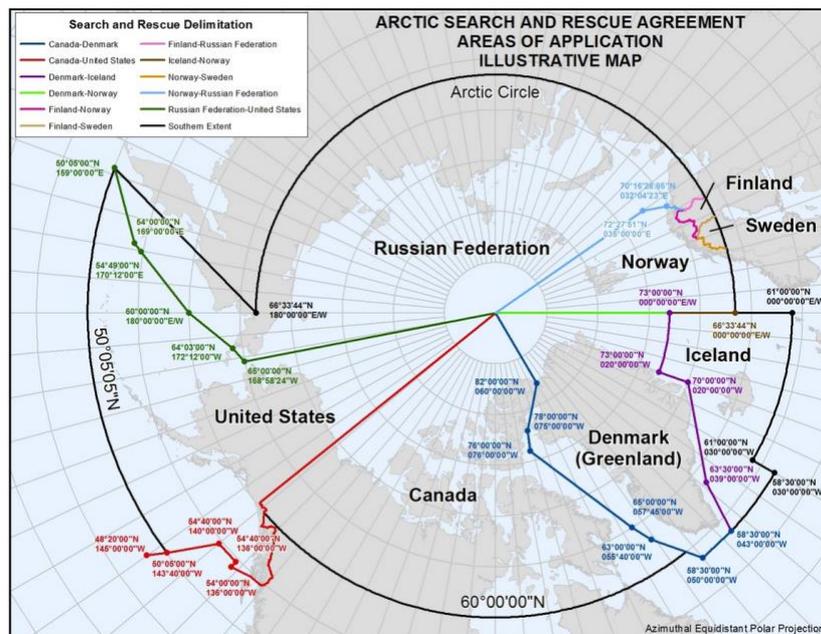


Figure 29. The search and rescue responsibility areas in the Arctic from the [agreement](#) by Arctic Council from 2011.

In Norway, the search and rescue (SAR) operations are organized by the [Joint Rescue and Coordination Center](#), (JRCC), which has a wider range of resources to its disposal for quick, safe and effective SAR operations. JRCC is coordinating the first EU funded project on Arctic safety, [ARCSAR](#) (Arctic and North Atlantic Security and Emergency Preparedness Network) from 2018 to 2024. The project involved companies, academia, NGOs and professional security and emergency response authorities and practitioners from 12 countries. JRCC has also a key role in the development of SOPs (standard operating procedures) for maritime SAR operations. Other projects dealing with preparedness and response were [MAREC](#) and MARPART, both led by Nord University.

The Arctic Council **Emergency prevention, Preparedness and Response** working group ([EPPR](#)) is running a dozen of projects related to safety and search and rescue. The ship traffic in the Arctic is expected to grow with many implications for safety and search and rescue services. Therefore, shipping operators, search and rescue agencies, NGOs and academia are enhancing their efforts to safe and sustainable shipping in Arctic waters.

6.2 Ship traffic in the Svalbard region

The Arctic Council's working group **Protection of the Arctic Marine Environment** ([PAME](#)) provides useful information on Arctic shipping projects and the Arctic Shipping Best Practice Forum. From 2012 ship traffic data has been systematically collected and archived by PAME's Arctic Ship Traffic Data project based on [AIS data from satellites and coastal stations](#). The AIS data are mandatory for ships above 300 tonnes or with more than 12 people. This means that ships are monitored in near realtime and information is presented at the website of [MarineTraffic](#). The AIS data provides useful statistics on ship traffic within the Polar Code area, showing that the highest ship traffic in the Arctic is found in the Barents Sea and around Svalbard, in the Northern Sea Route along the Russian coast and in Davis Strait / Baffin Bay (Fig. 30).

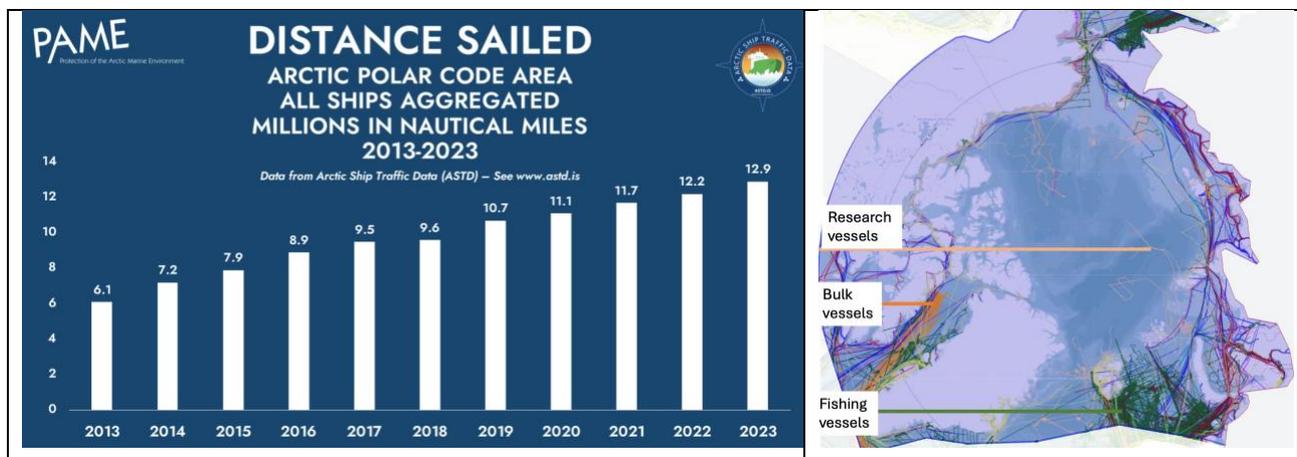


Figure 30. Ship traffic data within the Polar Code area from the Arctic Shipping Status Report provided by PAME's [Arctic Ship Traffic Data](#) service. Left: The total distance sailed by all vessels per year, showing that the traffic has doubled from 2013 to 2023. The AIS data also shows that the total number of unique vessels sailing in the Arctic has increased from 1298 in 2013 to 1782 in 2023. Right: Ship tracks in September 2019 for different types of vessels. The highest traffic is from fishing vessels in the Barents Sea and Svalbard area.

In the Svalbard area several studies of ship traffic have been published, showing how the traffic has develop in the last 10 years (e.g. Müller et al, 2023). Fishing vessels are dominating and are present year-round, because large parts of the region are ice-free throughout the year. In the summer months there is also considerable traffic with passenger vessels. The trend (Fig 31) shows a decline in 2020 due to the pandemic, followed by a strong growth from 2020 to 2022. According to Visit Svalbard the number of passengers on the explorer vessels (less than 500 passengers) grew from 22000 in 2019 to 28000 in 2022, showing that the tourist

traffic in this category is growing. The fishery traffic was rather steady before it declined from 2018 to 2020, then it increased from 2020 to 2022. A large part of research vessels, tourist vessels, and other vessels are operating in the Svalbard waters and use the services Longyearbyen can offer. The [Port of Longyearbyen](#) is the main logistic point for the ship traffic, while the airport with daily flights to and from the mainland is important for transport of tourists and other personnel to and from Svalbard.

From 2020 [Norwegian Maritime Authority \(NMA\)](#) has implemented new rules for passenger shipping in Svalbard. The regulations require all vessels to comply with IMO's Polar Code (January 2017 enforced, for polar water shipping) which is mandatory under both SOLAS (Safety of Life at Sea) and MARPOL (Prevention of Pollution from Ships) maritime conventions. NMA's new rules apply to both Norway- and foreign-[flagged](#) vessels navigating in Svalbard's waters. When the Corona virus crisis started in 2020, border closure and severe travel restrictions were imposed. In 2021, after the Corona virus restrictions were lifted, the Norwegian government imposed new regulations for ships visiting Svalbard. One was to ban cruise ships from offering helicopter tours and mini-submarine tours in Svalbard, due to concern about how tourism affects the fragile arctic environment. Useful information about [Svalbard cruise traffic](#) is also available at www.cruisemapper.com.

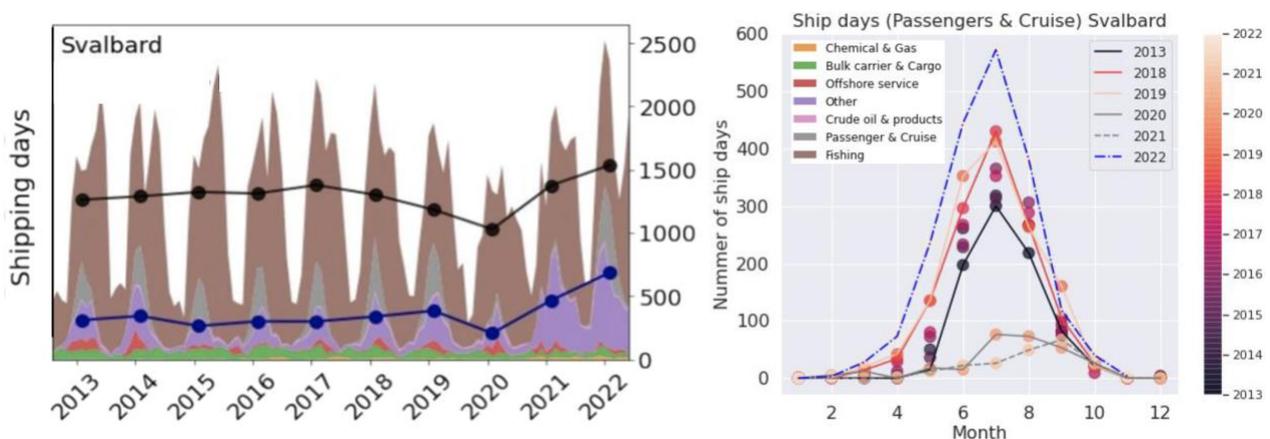


Figure 31. Left: Shipping days around Svalbard from 2013 to 2022 for different types of vessels. The black line indicates the annual mean for all sectors. The dark blue line indicates the time series of the annual mean for all sectors excluding fisheries. Right: Seasonal number of ship days for passengers and cruise vessels in the Svalbard area from 2013 to 2022 (from Müller et al, 2023).

7. A synthesis of the CAPARDUS case study in Svalbard

The CAPARDUS H2020 (2019-2023) project studied how practices, guidelines and standards evolve in selected topics of importance for people living and working in the Arctic. The topics addressed included observing systems, data sharing, protection of nature and culture, resource exploitation, shipping, tourism, and safety of operations. In all these topics research plays an important role as basis for new knowledge needed to adapt to the changing conditions in the Arctic. The project used workshops, dialogue meetings and outreach events, in collaboration with other research projects, to engage local community members and various non-academic groups to discuss issues of concern in four regional case studies across the Arctic.

The case study in Svalbard had focus on dialogue with the [Local Council](#), tourist operators, cultural heritage actors, shipping, safety and research projects dealing with these topics. The Norwegian government provides extensive resources to build up research, education and knowledge development in Svalbard, where the University Centre in Svalbard (UNIS) and the SIOS Knowledge Centre play a key role. Since it was established in 1993, UNIS has become a major Arctic research and education facility. It hosts more than 800 students attending academic courses in Arctic physical sciences and plays a central role in the Svalbard community.

SIOS is a research infrastructure to support long-term measurements of climate and environment in and around Svalbard and provide data management services. SIOS has 28 member institutions from 10 countries and employs a staff of 7 people in the Svalbard Science Centre in Longyearbyen.

In addition, research activities are conducted by numerous scientists from universities and research institutes in many countries, making Svalbard a hotspot for Arctic research. Most of the research in Svalbard deals with climate and environmental changes with impact on global, regional and local scale. Until recently, there has been little focus on research with aim to support the local community in Svalbard, but this is now changing through the new [strategy of UNIS](#), including initiatives such as the establishment of the Arctic Safety Centre. The centre has a leading role in developing Arctic safety to become an interdisciplinary scientific topic where several academic disciplines as well as non-academic actors need to contribute with their expertise. The strategy of UNIS has increased focused on issues that are of high priority for the Svalbard community, such as the green shift with transition from fossil fuel to renewable energy and adaptation to climate change while reducing the environmental footprint of human presence. The mandate of UNIS states that the research and education shall contribute to the development of the society in Svalbard in line with the Norwegian Svalbard policy.

The project had meetings and workshops with researchers from different disciplines, tourist operators, shipping companies, the Coastal Administration, search and rescue organisation and other actors in Svalbard. The goal was to explore how standards, guidelines and practices evolve in their professional work and how research can become more useful and help in sustainable development in Svalbard. The research needs to be of transdisciplinary character in order to address societally relevant problems, facilitate mutual learning and create solution-oriented knowledge. This means that projects need to involve natural and social science disciplines as well as governmental agencies, municipalities, private sector and other local knowledge holders. The participants invited to the workshops were all engaged in various societal challenges in Svalbard with different perspectives. The scientists, through their projects, seek to advance the research in their fields, where Svalbard offers unique facilities for Arctic research. The non-academic actors were most interested in finding practical solutions to their daily challenges, and often they don't know if or how scientists can help them. In practice, most research projects are designed and driven by scientists, where local community actors may or may not be involved. Traditionally, scientists in Svalbard work within their research areas without any interaction with local actors, except for logistical support and obtaining permissions for field work. In recent years several research projects have been established to address specific challenges in the Svalbard community, such as permafrost thawing, cultural heritage protection and snow avalanches.

Transdisciplinary research can be developed by engaging local community members, tourists and other actors in citizen science (CS) or community-based monitoring (CBM) projects dealing with environmental issues. CBM-CS projects can range from large global-scale observing programmes to local initiatives on topics of importance in specific areas. In Svalbard snow avalanche observation is a concrete example of a topic where the public can contribute with local knowledge and data collection and thereby be involved in research on safety related to snow avalanche risk. Common for all CBM-CS projects is that they are societally relevant for a specific region and appealing to the public so they become interested to participate. An important CS-activity in Svalbard is [beach cleaning](#) because marine litter is a serious problem caused by fisheries and shipping in the Barents Sea and the areas around Svalbard. Tools for mapping and cleaning up marine litter are developed by the [Norwegian Centre Against Marine Litter](#) to help local communities in their efforts to clean beaches. Projects with objective to collect environmental data need to have scientists involved to ensure that quality and management of the collected data follows standards and good practices. In the Svalbard region several global citizen science projects are active where tourists and other visitors contribute to collecting data on birds, whales, and many other natural phenomena. Such data from Arctic regions are very valuable because they fill a gap in areas where little or no data are collected.

One group of projects, which deal with cultural heritage research, demonstrated how they collaborate the Local Council, the Directorate for Cultural Heritage, the Governor of Svalbard and local companies such as Store Norske. Cultural heritage represents an important part of Svalbard's identity and a major motivation for tourists to visit the area. The main issue is that many cultural heritage sites are under serious threat from climate change, inadequate safeguarding, and new use of land areas with cultural heritage sites. The research has focus on assessing the possibilities for the long-term preservation of legally protected archaeological and built

cultural heritage sites in the context of geo-hazards caused by changing climate conditions, and to suggest innovative tools for risk assessment, mapping, evaluating, and prioritising management of heritage sites.

Another group of projects deal with tourists and environmental impact. Tourism in Svalbard is increasing year by year and is identified as a key economic pillar for future development in the region. Although tourism provides new economic opportunities, it can often result in pressure on environment and infrastructures and contribute to problems for the local inhabitants. For instance, port facilities and services for the cruise vessels can be congested and overloaded in the high season when many vessels and tourists arrive at the same time. The tourist traffic has impact on the environment in various ways, such as disturbance to feeding, nesting and denning areas for birds and mammals in both terrestrial and marine environments. The traffic on the tundra can also cause soil erosion, trampling of vegetation, and damage to cultural heritage sites. The regulations of human traffic in Svalbard under the [Environmental Protection Act](#) has become stricter in recent years, limiting the tourist activities to reduce the environmental impact. Previous and ongoing projects are creating knowledge to support planning and development of the Svalbard society. The keyword is knowledge-based management, where the decision-makers can make a well justified trade-off between protection and development (e.g. tourism).

The expedition cruise companies play an important role in the Svalbard tourism (Fig. 31). Through their organisation [AECO](#) (Association of Arctic Expedition Cruise Operators) the companies are obligated to comply with national and international laws and regulations. In addition, they have agreed to follow an extensive set of guidelines to ensure operations are in accordance with a number of [site-specific guidelines and guidelines for visitors](#) to the Arctic. Citizen science has become a central part of the expedition cruises, because it has become a demand from the customers. The involvement of tourists in research and data collection gives them direct access to observation of the climate change and thereby a deeper understanding of the environment they are visiting. For the scientists, the expedition cruises offer a way to collect more environmental data from larger areas, compared to what the scientists can do alone. The collaboration between tourists and scientists is of mutual benefit, where the educated tourists can become ambassadors for the environment. The cruise operators have to comply with the new rules for passenger shipping in Svalbard, implemented by the [Norwegian Maritime Authority \(NMA\)](#) from 2020.



Figure 32. Tourist expedition cruises around Svalbard is one of the most popular tourist activities, and stricter regulations of this traffic will limit what these expeditions can do. Photo: Spitsbergen Travel.

The tourist operators have strong focus on developing sustainable tourism, which means that the quality in all parts of the industry should be improved and that the value creation for the society should increase. Education and training of tourist guides is a key factor in developing the tourist industry in a sustainable way, which means that the operator must have focus on quality, safety and minimal human footprint of their activities. The

major operators offer internal training for their guides, but the need for more formal education becomes more important as the industry is growing.

The increasing human activities in Svalbard and other Arctic areas requires that knowledge about safety is built up and disseminated to people who travel, work or live in these regions. The [Arctic Safety Centre](#) at UNIS has been mentioned as a unique establishment to provide research, education and training in Arctic safety for the local community, scientists, students, tourists and others operators. The centre has a leading role in developing safety standards for outdoor activities in Svalbard, while the Governor provides information on rules and regulations.

There is a number of research projects addressing risk and safety for terrestrial as well as maritime activities where Search and Rescue (SAR) is a central component. Maritime safety arrangements are regulated under the Polar Code (from 2017) and the Arctic Council (from 2011). Norway has responsibility for SAR in the region with the highest Arctic ship traffic, namely in the Barents Sea and around Svalbard. The SAR operations in Norway are organized by the [Joint Rescue and Coordination Center](#), (JRCC), which has a wider range of resources to its disposal for quick, safe and effective SAR operations. JRCC is coordinating the first EU funded project on Arctic safety, [ARCSAR](#) (Arctic and North Atlantic Security and Emergency Preparedness Network) from 2018 to 2024. The project involves companies, academia, NGOs and professional security and emergency response authorities and practitioners from 12 countries. JRCC has also a key role in the development of SOPs (standard operating procedures) for maritime SAR operations. The ship traffic in the Arctic is expected to grow with many implications for safety and search and rescue services. Svalbard's strategic location with communication, infrastructure and other resources is very important for development of safety and SAR services (Fig. 33). In this effort shipping operators, search and rescue agencies, NGOs and academia are enhancing their efforts to safe and sustainable shipping in Arctic waters.

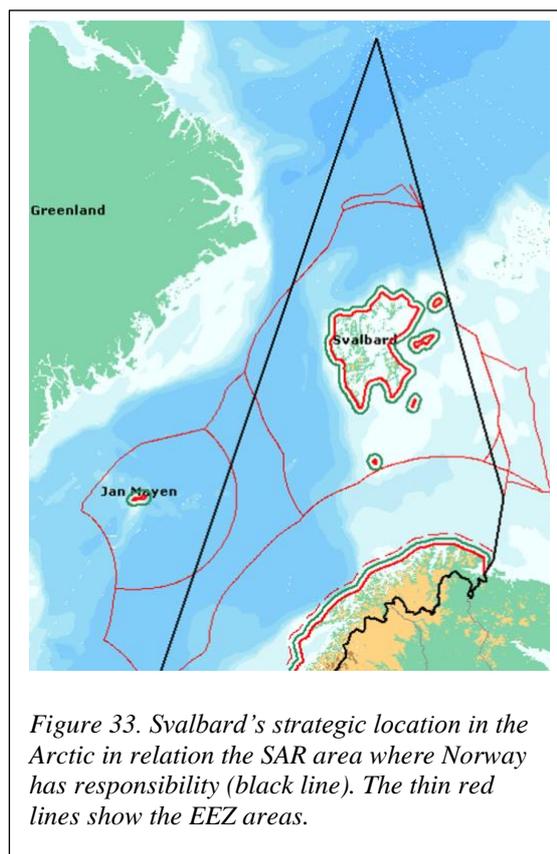


Figure 33. Svalbard's strategic location in the Arctic in relation the SAR area where Norway has responsibility (black line). The thin red lines show the EEZ areas.

Development of standards, guidelines and practices in Svalbard and other Arctic areas is often a bottom-up process which is ongoing in all the topics addressed in CAPARDUS. The different actors build up their experience on how to do things and provide documentation, which develop into practices as they gain support from a wider community. For example, the scientific methods in different disciplines are built up over time as adopted and approved by the scientific community. Practices are closely connected to culture and traditions.

Standardisation can also be a top-down process based on regulations from governmental agencies, international conventions or other high-level decisions. Examples of top-down processes are when high-level bodies (e.g. UN, EU, international agreements) define official standards related to transport, food, construction, etc. Standards are often connected to regulations, legal framework, treaties, etc. An example is the [Polar Code](#) implemented by IMO after development by the member countries over many years. The regulations in the Polar Code are expected to spin-off standard development related to safety and responsibility of shipping in the Arctic (and Antarctic).

Standards can act as common language and practices among stakeholders when aiming to share and use observing systems, data, ensure safety, and many other activities in the Arctic. It is vital that the standards development process ensures that all interested parties work together in the context of openness and transparency. Standardization is a human process that takes place between individual or groups of people, institutions, norms, and practices. Standardization is a challenging and complex process and even defining the

concept of standard can be difficult. As a geographically defined domain, the Arctic is highly complex and contains many knowledge systems, research disciplines, and operational activities, cultural activities and adoption of new technologies that change peoples' lives and work.

8. Selected documents, references and links

Documents and information	Links
Svalbard White paper to the Storting 2015-2016, 119 pp	The main policy document on Svalbard by the Norwegian Government. https://www.regjeringen.no/en/dokumenter/meld.-st.-32-20152016/id2499962/
Information and documents from the Governor	https://www.sysselmesteren.no/en/
Information from Longyearbyen Local Council	https://lokalstyre.custompublish.com/?find=
Information from Visit Svalbard	https://en.visitsvalbard.com/
Climate in Svalbard 2100 – a knowledge base for climate adaptation.	Assessment report to the Norwegian Environment Agency in 2018. https://munin.uit.no/handle/10037/18819
Snow avalanche warning in Svalbard, 2020	Norwegian Water Resources and Energy Directorate (NVE) has produced a report on snow avalanche warning and risk management in Svalbard, https://publikasjoner.nve.no/rapport/2020/rapport2020_35.pdf
Local avalanche warning for Longyearbyen, 2022	An evaluation of the present warning system, by Øien and Albrechtsen, SINTEF report, https://munin.uit.no/handle/10037/27034
Snow avalanche protection planning in Longyearbyen area	A number of documents are available at https://www.lokalstyre.no/skredsikring.486358.no.html
Coastal erosion affecting cultural heritage in Svalbard	A research publication led by NIKU assess the danger of coastal erosion damaging cultural heritage sites as a result of climate change. Sustainability 2020, 12, 2306; doi:10.3390/su12062306
State of Environmental Science in Svalbard (SESS report) 2022	The SESS report is an annual report published by the SIOS Knowledge Centre in Longyearbyen. https://sios-svalbard.org/SESSreport
Some research publication cited in the report	<p>Hovelsrud G K, Veland S, Kaltenborn B, Olsen J, and Dannevig H. (2021) Sustainable Tourism in Svalbard: Balancing economic growth, sustainability, and environmental governance. Polar Record 57(e47): 1–7. https://doi.org/10.1017/S0032247421000668</p> <p>Hovelsrud Grete K., Bjørn P. Kaltenborn & Julia Olsen (2020): Svalbard in transition: adaptation to cross-scale changes in Longyearbyen, The Polar Journal https://doi.org/10.1080/2154896X.2020.1819016</p> <p>Holmgaard, S.B., Thuestad, A.E., Myrvoll, E.R. & Barlindhaug, S. 2019. Monitoring and Managing Human Stressors to Coastal Cultural Heritage in Svalbard. Humanities, 8, 21. DOI: 10.3390/h8010021</p> <p>Øian, H. & Kaltenborn, B.P. 2020. Turisme på Svalbard og i Arktis. Effekter på naturmiljø, kulturminner og samfunn med hovedvekt på cruiseturisme. NINA Rapport 1745</p> <p>Kaltenborn, B.P., Østreng, W. & Hovelsrud, G.K. (2019.) Change will be the constant – future environmental policy and governance challenges in Svalbard. Polar Geography. https://doi.org/10.1080/1088937X.2019.1679269</p> <p>Pearlman, J., et al., (2019) Evolving and Sustaining Ocean Best Practices and Standards for the Next Decade. Front. Mar. Sci. 6:277. https://doi.org/10.3389/fmars.2019.00277</p>

Appendix

List of participants in the workshop 6-8 August 2022

Name	Institution
Stein Sandven	NERSC
Hanne Sagen	NERSC
Lisbeth Iversen	NERSC
Vibeke Vandrup Martens	NIKU
Cecilie Flyen	NIKU
Anne-Cathrine Flyen	NIKU
Anders Olsson	Riksantikvaren
Joanna Hambly	Univ. St. Andrews
Gyda Gudmundsdottir	AECO
Per Gunnar Hettervik	Norges Vel
Finn Danielsen	NORDECO
Michael Kjøie Poulsen	NORDECO
Uffe Jakobsen	University of Greenland
Jay Pearlman	IEEE
Francoise Pearlman	IEEE
Hilde Fålun Strøm	Hearts in the Ice
Dina Brode-Rogers	Univ. Louvin
Ronny Brunvoll	Visit Svalbard
Ilkka Matero	SIOS KC
Janne Søreide	UNIS
<i>Online participants</i>	
Pauline Simpson	Ocean Best Practice
Siri Jodha Khalsa	IEEE
Sigmund Andersen	Arctic Nature Guide
Hedda Andersen	Hurtigruten
Karin Strand	Hurtigruten
Helga B. Kristiansen	MARFO
Maria Antonsen	MARFO
Troels Jacobsen	AECO
Torill Hamre	NERSC

List of participants in the workshop 7-8 February 2023 at Polheim

Name	Institution
Beate A. Pedersen	NIKU
Ionut Crisi Nicu	NIKU
Dina Hestad	CCHANGE
Teresia S. Aarskog	CCHANGE
Hege Anita Eilertsen	Svalbard Museum
Lise Loktu	NIKU
Michael Kjøie Poulsen	NORECO
Ronny Brunvoll	Visit Svalbard
Aud Andersen	UNIS/local community

Astrid Stallemo	NERSC
Stein Sandven	NERSC
Hilde Fålun Strøm	Polheim
Sylviann Kårvatn	VARD (day 2)
Raphaelle Descouteaux	UNIS
Online:	
Paloma Guzman	NIKU
Karen O'Brien	CCHANGE

List of participants in the workshop 8-9 June 2023 at Polheim

Name	Institution
Martin Indreiten	UNIS/Arctic Safety Centre
Eirik Albrechtsen	NTNU/UNIS and the ARCT-RISK project
Ensieh Roud	Nord University
Mikel Dominiguez Cainzos	Joint Rescue and Coordination Centre – North Norway and the ARCSAR project
Ola Pettersen	Coastal Administration
Nataly Marchenko	UNIS, Shipping in the Arctic course
Hanne Christiansen	UNIS - Permafrost
Anatoly Sinitsyn (online)	NTNU-SINTEF – Buildings -cultural heritage
Stein Tore Pedersen	NPI – Safety responsible
Elke Mogner	Røde Kors Svalbard
Christian Skottun	Telenor Svalbard
Bjørn Ivar Kruke	Stavanger Univesity / Arctic Safety Centre
Uffe Jacobsen	University of Greenland
Jacob Taarup-Esbensen	University College Copenhagen and University of Stavanger
Ronny Brunvoll	Visit Svalbard
Hilde Fålun Strøm	Hearts in the Ice
Stein Sandven	NERSC