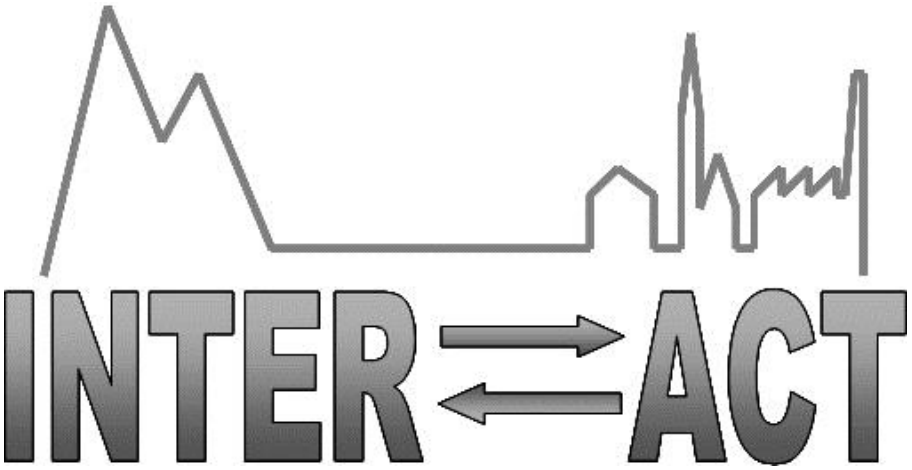
Combination of CP & CSA



D2.6 – Best practices of station management and administration at arctic infrastructures

Project No.262693– INTERACT

FP7-INFRASTRUCTURES-2010-1

Start date of project: 2011/01/01 Duration: 48 months
Due date of deliverable: 2013/03/31 (Mx) Actual Submission date: 2013/12/30

Lead partner for deliverable: NERI
Author: Elmer Topp-Jørgensen

Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the Consortium (including the Commission Services)	
CO	Confidential, only for members of the Consortium (including the Commission Services)	

Table of Contents

Publishable Executive Summary

This deliverable on best practices of station management and administration has been produced by the Station Mangers' Forum (WP2). The report has been produced as promised within the second reporting period. This is a considerable achievement because the report is approximately 250 pages long and is a comprehensive statement based on the best experiences from all the INTERACT Stations.

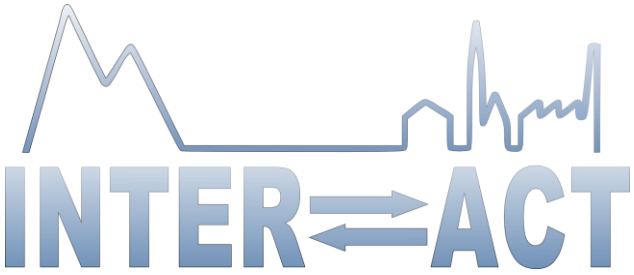
The scope of the report is to identify and describe best practices and key considerations of relevance to station management under arctic and alpine conditions, although it will be a unique and very valuable reference source for many types of research institutions. As stations in the network operate under very different legal regimes, financial conditions, environmental and climatic conditions, as well as remoteness, it was not possible to identify specific best practices that fit all stations. Instead, we have described key issues that should be considered and addressed by station management, and we have supplemented this with examples of good practices from stations operating under different conditions (e.g. different climate, remoteness or size).

Eleven themes were selected for the report by station managers:

1. Management plans and check lists
2. Policies
3. Staff
4. Visitors
5. Permit issues
6. Health and safety
7. Environmental management
8. Marketing and outreach
9. Research and monitoring
10. Training and education
11. Knowledge capture and data management

Where appropriate, chapter texts are supplemented with examples from INTERACT Stations and in some cases from external sources. Examples related to a specific theme are presented as a link in the text or at the end of a chapter, as a station example describing how the station deals with a specific theme, or in an appendix. Draft theme texts and examples from stations were sent for review within the network before completion.

The detailed contents page and an index provided at the back, allow station management to identify sections relevant for a specific management issue that is under development or review. The printed version of this report will have an attracted lay-out with the branding established by the Station Catalogue.



Management planning for arctic and northern alpine research stations

– Examples of good practices

INTERACT Management planning for arctic and northern alpine research stations

- Examples of good practices.

Project report submitted to EU in 2013.

Author:
Elmer Topp-Jørgensen, Department of Bioscience, Aarhus University, Denmark.

Contributions from:
Co-author of Theme 9:
Morten Rasch, Department of Bioscience, Aarhus University (Denmark)

Co-authors of Theme 11:
Kirsten Elger, Samoylov Research Station/Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (Russia/Germany) and German Research Centre for Geosciences, Germany
Warwick Vincent and Christine Barnard, Centre d'études nordiques/Centre for Northern Studies (Canada)

Station examples:
Station example 3.1: Kevo Subarctic Research Station (Finland), Otso Suominen
Station example 4.1: Kolari Research Unit (Finland), Mikko Jokinen
Station example 4.2: Abisko Scientific Research Station (Sweden), Christer Jonasson
Station example 4.3: Bioforsk Svanhovd (Norway), Lars-Ola Nilsson
Station example 6.1: Samoylov Research Station (Russia), Anne Morgenstern and Kirsten Elger
Station example 6.2: Cairngorms (UK), Chris Andrews and Jan Dick
Station example 8.1 Kevo Subarctic Research Station (Finland), Otso Suominen
Station example 8.2 Bioforsk Svanhovd (Norway), Lars-Ola Nilsson
Station example 8.3 Greenland Institute of Natural Resources (Greenland), Katrine Raundrup
Station example 9.1 Abisko Scientific Research Station (Sweden), Christer Jonasson
Station example 10.1 Arctic Station (Greenland), Louise K. Berg

Station managers and staff of all INTERACT stations and many observer stations have contributed to this report by discussing management themes, providing links or useful documents and commenting on draft reports.

INTERACT partner stations

Finse Alpine Research Station	Samoylov Research Station	CEN Salluit Research Station
Bioforsk Svanhovd Research Station	Spasskaya Pad Scientific Forest Station	CEN Bylot Island Field Station
Sverdrup Station, Ny-Ålesund	Chokurdakh Scientific Tundra Station	CEN Ward Hunt Island Station
Tarfala Research Station	Barrow Arctic Research Center/Barrow	Arctic Station
Abisko Scientific Research Station	Environmental Observatory	Greenland Institute of Natural Resources
Kilpisjärvi Biological Station	Toolik Field Station	Sermilik Research Station
Kolari Research Unit	Kluane Lake Research Station	Zackenberg Research Station
Kevo Subarctic Research Station	CEN Radisson Station	Litla Skard
Oulanka Research Station	CEN Whapmagoostui-Kuujjuarapik Station	Faroe Islands Nature Investigation (FINI)
Khibiny Educational and Scientific Station	CEN Clearwater Lake Station	Cairngorm
Mukhrino Field Station	CEN Umiujaq Research Station	
Numto Park Station	CEN Boniface River Station	

Observer stations

NERC Arctic Research Station	ALPFOR, Alpine Station Furka	Igarka Geocryology Laboratory
Netherlands Arctic Station	Sonnblick Observatory	Aktru Research Station
Polish Polar Station – Hornsund	Krkonoše (CZ)/Karkonosze (PL) NP	Igloolik Research Center
Petuniabukta Station	Labytnangi Ecological Research Station	

Citation: INTERACT 2013. Management planning for arctic and northern alpine research stations – examples of good practices. DCE - Danish Center for Environment and Energy, Aarhus University, Denmark.

The report is available in PDF format from the INTERACT website www.eu-interact.org.

About INTERACT

INTERACT is a network of terrestrial field bases in arctic and mountain areas of the Northern Hemisphere. The network provides an efficient platform for coordinated research, monitoring and logistics by sharing experiences and coordinating activities and by making the network infrastructures available to specialised scientific networks and organisations as well as to research and monitoring programmes and projects.

A key aim of the network is to build capacity for terrestrial ecosystem research and monitoring to improve our ability to identify, understand, predict and respond to the impacts of diverse environmental changes throughout the environmental and land-use conditions represented at INTERACT sites. INTERACT seeks to improve the logistic and scientific services offered to the science community by providing a platform for activities that will increase our understanding of the processes and our knowledge of the status and trends of biota and physical characteristics.

INTERACT provides a one-stop-shop of information for scientists who are looking for one or more sites for their activities in the vast northern areas. INTERACT stations already host and operate numerous top level research and monitoring initiatives, and we welcome proposals for new initiatives from any scientific discipline related to terrestrial environments.

INTERACT comprises more than 55 terrestrial field stations. Among these, 33 'INTERACT Stations' were included in the network already from the beginning of the project while new station participate as 'stations with observer status'. The participation of these Observer Stations is based on self-financing and their number is growing.

INTERACT is funded by the EU's 7th Framework Programme for the period 2011-2014. In addition to the focus on international cooperation and coordination, INTERACT also has a 'Joint Research Activities' component focusing on development of: i) virtual instrumentation, ii) improved instrumentation for measurements of feedback mechanisms from terrestrial ecosystems to climate change, and iii) improved methods for data management. Furthermore, INTERACT has a 'Transnational Access' component that offers funding to users groups for access to 20 of the INTERACT stations in Europe and Russia. Calls for proposals are advertised biannually.

Detailed contents of the report

Introduction and how to use this document

Introduction

A central element of INTERACT is the Station Managers' Forum (SMF). A forum established with the main objective to provide a platform for exchange of information between station managers and other participants within INTERACT, and to use this platform to collect and disseminate knowledge embedded within the network. One of the tasks of the Station Mangers' Forum is to produce a report on best practices of station management and administration.

The scope of this report is to identify and describe best practices and key considerations of relevance to station management under arctic and alpine conditions. As stations in the network operate under very different legal regimes, financial conditions, environmental and climatic conditions, as well as remoteness, it was not possible to identify specific best practices that fit all stations. Instead, we have described key issues that should be considered and addressed by station management, and supplemented this with examples of good practices from stations operating under different conditions (e.g. different climate, remoteness or size).

The participating stations selected a number of themes that should be covered by the report:

- Management planning and check lists.
- Policies.
- Staff.
- Visitors.
- Permitting issues.
- Health and safety.
- Environmental management.
- Research and monitoring.
- Marketing and outreach.
- Training and education.
- Knowledge capture and data management.

This report can be used as inspiration for station managers/management teams that are revising or developing management practices.

The report describes key considerations for station management for a number of management themes and provide practical examples from INTERACT stations.

The INTERACT network consist of more than 50 research stations located in 15 Arctic and European countries. While INTERACT stations are very diverse in nature and subjected to different legal regimes, they also face similar challenges of operating research infrastructures in often remote and climatic challenging environments. However, as stations are subjected to different financial regulations and reporting requirements (depending on national legislation, and institutional and donor requirements, etc.), these issues will only be dealt with in a general manner.

The process

The purpose and general themes to be covered in the report were discussed already at the first INTERACT Station Mangers' Forum meeting in Abisko, January 2011. Since then, the structure and the themes were developed and revised over a number of meetings before the stations in 2012 were asked to describe their 'good' practice for one or more themes. As the network expanded, new stations joined in and contributed with examples on a voluntary basis.

Inspired by these examples and other information sources, key issues and considerations were described for the eleven themes. These themes have been discussed and revised during three SMF meetings and a draft report has been circulated among all INTERACT stations for comments.

The structure of the report

The report covers 11 themes selected by station managers in the INTERACT network. Each theme includes an introduction, sub-themes, summary of key actions for station management followed by examples of 'good' practices from INTERACT stations or external sources.

Theme introduction:

The introduction is meant to provide an overview of the theme and explain the importance of the theme and sub-themes.

Sub-themes:

Sub-themes highlight general recommendations and summarises key considerations that station management should address when developing station management practices. The diversity of stations in the INTERACT network means that some of the recommendations are general in nature and may not be useful for all stations. All themes, however, highlight important tasks station management needs to address when developing or revising management practices.

Examples:

Examples from the INTERACT network of stations and external sources will supplement theme texts either within the text, at the end of each theme, in an appendix or via a link to a website. The examples presented in this report have been selected to reflect the diversity of stations in the INTERACT network, thus, presenting examples of both large/small and remote/easy access stations. Examples are presented without any editing to reflect the real nature of station management (some documents have been translated, but in such cases the layout has been kept close to the original document).

Examples from the INTERACT network are highlighted in blue and external sources in green.

Index:

An index referring key words to specific themes and sub-themes can be found at the end of the document. This will allow station managers to quickly find the information needed on the different topics covered in the report.

How to use the report

The report seeks to provide station management with an overview of important considerations and key actions related the management and continued development of research stations. The report need not be read from one end to the other, but can be used as inspiration for station management who are revising or developing specific areas of station management.

> **How to use the report**
>
> *Quick guide to station managers:*
>
> 1. *Identify the area of station management that you are dealing with (use contents page or index).*
> 2. *Read relevant texts and study related links and examples (also links to other themes/sub-themes).*
> 3. *If relevant, contact other INTERACT station managers to ask for advice.*
> 4. *If needed, develop or revise management practices with relevant stakeholder at your station.*

The report describes a number of themes and sub-themes selected by participants at the INTERACT Station Managers' Forum meetings. Each theme describes key considerations and present key actions that can be addressed by station management. However, as the circumstances vary greatly between stations (e.g. size, organisational setup, remoteness, climate, financial situation, legal framework, etc.), the specific recommendations may not always address the circumstances at all stations in the network. Hence station management need to consider the circumstances at their specific station when developing or revising management procedures and practices.

The theme descriptions are supplemented with examples from the INTERACT network or external sources, to show how others have dealt with a specific management task.

To allow station management to identify relevant sections for a given task, the report contents page is supplemented with a more detailed index. This allows station management to identify the pages relevant for working on a specific management task.

The report contains a large number of website links managed by research stations, institutions, organisations, etc. As websites are dynamic instruments for spreading and sharing information, some of these links may not continue to work. Should you therefore come across 'dead links', we encourage you to search the web for documents matching the title associated with the link, or contact the relevant station, institution or organisation.

Definitions

Station management

Decision making responsibilities in relation to station management differ between stations. The phrase 'station management' is therefore used throughout the report to represent the decision making entity of the station whether this is a person, a board or a coordination group.

Categorisation of stations

The report attempts to present examples of stations varying in size and remoteness. For this purpose, stations have been categorised according to these parameters and a short text on this is presented for all station examples.

Stations have been assigned an access category based on the accessibility from the nearest community/settlement serviced by scheduled flights.

Access:	Easy access:	in community to ca. 25 km from settlement (road/rail access).
	Remote:	25 to ca. 100 km from settlement (road access or only reachable by plane/boat)
	Very remote:	> 200 km from settlement (road access or only reachable by plane/boat)

Size[1]:	Very small:	< 10 visitors
	Small:	10-20 visitors
	Medium:	20-50 visitors
	Large:	50-100 visitors
	Very large:	> 100 visitors

[1] Maximum number of visitors that can be accommodated on the station at the same time.

List of possible plans, documents and check lists used at arctic and northern alpine research stations

There is a wide range of documents that can be developed for managing research stations in the Arctic and northern alpine areas. What plans are relevant depends on size and complexity of station operations, legal regimes, environmental and climatic conditions, terrain, type of activities, etc. Station management should therefore identify and develop appropriate documents relevant for their specific station.

Below is a list of potential plans, documents and check lists that can be developed at Arctic and northern alpine stations. Note that the requirement for plans, documents and check lists may change over time as the station develops.

Plans

- Master plan / Strategic plan.
- Vision.
- Mission.
- Concept.
- Terms of Reference (ToR) (station and staff).
- Policies.
- Strategy and implementation plan.
- Programme plan.
- Data management plan.
- Land use plan.
- Facility plan.
- Business / financial plan.
- Safety plan.
- Emergency plan.
- Environmental action plan.
- Communication and outreach strategy.
- Fundraising plan.

Application documents

- Internal application handling procedures.
- Visitor guidelines.
- Application form.
- Permit/user agreement.

Forms and check lists

- Application handling.
- Visitor communication check list.
- Emergency check lists (e.g. search and rescue, evacuation and natural disaster/fire).
- Inventories (e.g. workshop, science equipment, kitchen, etc.).

- Opening and closing of station.
- Maintenance check lists.

Monitoring for station management

- Incident and ‘near miss’ reporting system.
- Resource use and waste monitoring system.
- Visitor satisfaction monitoring.
- Environmental risk assessment.
- Workplace risk assessment.

1. Management plans and check lists.

1.1 Introduction to management planning

Planning is fundamental to the development, success and safety of a research station, especially in cold, remote and harsh environments. This relates to both general planning that provides a framework for the station's operations (e.g. description of vision, mission, scientific strategies, facilities, land use and financial roadmap) and planning of specific activities at the station (e.g. planning of visits, construction and maintenance operations).

Under this theme, we describe general planning elements related to the development of a research station, while issues of relevance for the planning of specific activities at the station are dealt with under specific themes (See e.g. Themes 3. Staff), 4. Visitors), 5. Permit issues) and 6. Health and safety (disclaimer, insurance, emergencies))).

In the planning process it is important to involve all relevant stakeholders (e.g. station owner, funding agencies/donors, advisory boards, users, local communities (if relevant), etc.). Stations may also benefit from participating in international infrastructure networks that will allow the station to seek inspiration from stations with similar challenges within specific managerial fields. For some tasks, it may also be necessary to obtain advice from other external experts (e.g. environmental accreditation, sustainable energy solutions, medical and safety training, etc.).

There is a wide range of documents that can be developed for managing research stations in the arctic and northern alpine areas. However, stations should only develop the documents that are considered relevant for the specific station. What plans are relevant depends on size and complexity of station operations, legal regimes, economy, environmental and climatic conditions, remoteness, terrain, type of activities, etc. Station management should therefore identify and develop appropriate documents relevant for their specific station.

It is important to note that planning documents can develop over time. Below are examples of types of plans and how they interact. Documents can be made separately or fused into one or more documents depending on the operational size, remoteness and complexity of activities at the station. As the station develops, management documents should continuously be updated. If the planning documents reach a significant size, it can be an advantage to have several documents as these can be updated individually whenever needed. The responsibility and frequency for updating plans and documents should be clear and described in the planning documents.

1.2 Master Plan/Strategic Plan and other management planning documents

The Master Plan/Strategic Plan describes the overall framework for the operation of the station. The Master Plan/Strategic Plan can include a number of sub-plans, but these can also be developed in separate documents depending on the organisation of the station and the complexity of operations.

A Master Plan/Strategic Plan should as a minimum include (see details for each bullet below):

- Vision, Mission and Conceptual Framework of the station.
- Terms of Reference (ToR) for the station, including:
  - Description of ownership and organisation (boards, committees, secretariats, station manager, logisticians, etc.).
  - Description of decision making (roles and responsibilities of all employees and advisory functions).
- Strategy, including:
  - Programme plan for scientific, educational and outreach activities.
  - Implementation plan

Vision and mission statements

Vision and mission statements are useful for stating the overarching goals of the research station. They can be made separately or combined in one. It is important that they provide guidance to what the station wants to achieve.

Vision Statement

A Vision Statement outlines the future of the station – what you strive to become. It communicates both the purpose and values that the station is built on.

Example: A zero-emissions platform providing the best facilities and services for international research and monitoring.

Mission Statement

A Mission Statement describes in general terms the purpose of doing what you are doing. It defines the purpose and primary objectives by formulating broad immediate goals and measures of success. Each operational area may have its own mission, goals and objectives.

How to achieve the formulated mission is described in a Conceptual Framework and a Strategy (Programme and Implementation Plan) and should be integrated in all other plans and activities at the station by describing goals, objectives and activities for the relevant operational areas.

Each Mission Statement should answer three questions:

a) What do we do?
b) How do we do it?
c) For whom do we do it?

Each mission should be elaborated on in strategies, plans and programmes by setting more specific goals and objectives.

Example: Continuously work to reduce emissions from in-house operations and visitor activities. Develop facilities to accommodate all natural sciences disciplines at the station. Engage in international networks, organisations and programmes to coordinate activities and attract the best researchers in the world. Communicate the relevance of the work to the research community, donors, authorities and local communities to attract funding and create awareness of climate change to a wider audience.

Example, Zackenberg Research Station:
The objective of the research station is to facilitate ecosystem research in the high Arctic. According to the Framework Programme of Zackenberg Ecological Operations (ZERO) this includes:

- Basic Quantitative documentation of ecosystem structure and processes.
- Baseline studies of intrinsic short-term and long-term variations in ecosystem functions.
- Experimental studies enabling predictions of ecosystem responses to Global Change.

This is done by:

- Providing facilities, logistic services and accommodation at Zackenberg.
- Offering logistic support to and from Zackenberg.
- Providing access to a wide range of both biological and physical data from the long-term monitoring programme, Zackenberg Basis.

Example, Toolik Field Station:
The mission of Toolik Field Station is to support research and education that creates a greater understanding of the Arctic and its relationship to the global environment.

Conceptual framework for the station

A conceptual framework describes the preferred approach of the station for achieving its vision and mission objectives. It is a theoretical structure describing principles and assumptions comprising a broad concept.

It can describe focus areas for the stations' operations, e.g.:

- Aims of in-house and external research and monitoring programmes and projects.
- Scientific disciplines (e.g. climate, biology, cryosphere, hydrology, etc.).
- Specific focus areas (e.g. food webs, climate feedback mechanisms, biodiversity, gradient studies, etc.).
- Target environmental envelopes (Arctic dessert, taiga, boreal forest, mires, etc.).
- Approach (e.g. ecosystem approach, species approach).
- National and international cooperation (e.g. links to national and international programmes and scientific networks).

Terms of Reference (ToR) for station operations

ToR - Ownership and organisation
Most research stations are owned by a sponsoring institution (e.g. a university, a government institution or a museum), but there are also examples of self-governing stations usually managed by a non-profit cooperation/organisation.

The organisation, however, differs greatly among stations depending on country, ownership, size, complexity of operations, etc. It is important that all levels of management are aware of their roles and responsibilities, and hence who they refer to and what is expected from them. It is also important that external partners (e.g. funding agencies/donors, researchers and other stakeholders) can find out who is responsible for the overall management of the station. It is therefore important with a clear description of ownership, organisation and decision making responsibilities. This is described in a ToR document.

The Terms of Reference should include:

- The owner of the station.
- The organisational relationship for all employment categories and advisory functions (including funding agencies/donors/advisory boards).
- Descriptions of decision making responsibilities of all functions at the station (advisory boards, director, manager, scientific leader, logisticians, etc.).

Critically important are a clear line of communication up the organisational chart to the funding institution/donors and a clear flow of information on funds, expectations and information from the sponsoring institution/donors to the relevant levels of management at the station. An Organisational Chart can provide a quick overview of organisation, information flow and responsibilities.

The information can be posted on the website (keep updated) to make it clear to everybody what the roles and responsibilities are of involved parties. This may also be important in relation to staff turnover.

ToR - Roles and responsibilities (See also 3. Staff)
It is important that clear roles and responsibilities are described for all functions at the station. This makes management more efficient and ensures that everyone knows what is expected from them. This is especially important in relation to emergencies and health and safety issues at the station where quick and appropriate decision making may be critical. It is also important to have clear decision making responsibilities in relation to land use conflicts and conflicts between people at the station.

The size and complexity of the station and its operations determines the number of employees needed for running the station (can range from few to many). Below are descriptions of key functions that should be covered by the staff.

Director/manager, scientific leader and logistics coordinator
There are a number of functions related to station management. These can be included in one or more positions depending on the size of the station, funding and complexity of operations.

Following functions should be addressed by one or more persons:

- Contact with owner institution, donors and advisory boards.
- Formulation, implementation and revision of strategies, plans, policies and regulations.
- Responsibility for coordination of in-house science programmes, education and outreach.
- Responsibility for handling applications from external scientists.
- Logistical operations (maintenance of facilities and equipment, kitchen service, cleaning and if relevant, travel planning assistance for visitors).
- Health and safety functions.
- Financial administration.
- Handling of staff and visitors at station.
- Conflicts handling (between projects and individuals).
- Ad hoc decisions of scientific and logistic relevance during the operational period.

These functions should be described in the Master/Strategic Plan for the relevant positions at the station.

Other positions may include financial officer, researcher, research assistant, kitchen staff, service staff, health and safety officers/experts, etc. For these positions it is also important with a clear description of responsibilities and who they refer to.

Advisory Groups

Many research stations benefit tremendously from using advisory boards/committees, who in addition to providing advice for station management and research also can market the station in a wider scientific community. These groups will meet at least once a year to discuss policy issues, strategies, action plans, etc. to provide advice for management in line with the vision and mission of the station.

Steering board/committee

Depending on the organisation of the station, it can be important to have a steering board/committee with representatives from relevant stakeholders (e.g. station director/manager, scientific leader, funding agency/donors, station owner or local community). This will create a strong and direct link between donor expectations and management of the station. The steering board/committee could also act to ensure that the station integrates international activities in the work (e.g. Arctic Council working groups, international organisations and scientific networks) and it could be a forum for dialogue to ensure that stakeholder views are included in the activities.

Research advisory board/committee

Research advisory boards/committees exist at most stations. Their role is to provide advice on what research should be conducted at the station and how it can be implemented. The board (or a sub-coordination group) can also be responsible for solving conflicts in site selection, i.e. where two groups propose work that conflicts in space or effects. The board/committee should be comprised of researchers from the station and other national /international experts that will ensure highest possible standards for all relevant scientific disciplines and integration of international activities (e.g. Arctic Council initiatives, organisations and scientific networks).

Advisory groups could also be involved in fundraising functions.

Memorandum of Understanding (MoU)

MoUs can be made with collaborating partners to provide a framework for the cooperation and describe intended roles and activities. This can be scientific programmes, research networks, Non-Governmental Organisations (NGOs) or other stakeholder groups such as the mountaineering community, artists or musicians.

Strategy, including programme and implementation plan

A strategic plan describes activities agreed upon to meet the vision and mission objectives (a programme plan) and places these in a timeline, including information on responsible persons and participants for the different activities (an implementation plan).

A strategic plan should be made in cooperation between station staff, financial officers, donor representatives, researchers (programme responsible) and logistics staff and should at least cover a five year period. The Plan should be examined once each year and adjusted to continuously have a plan that reaches at least 2-3 years ahead.

A Programme Plan (activity plan)

A programme plan should describe the research, educational and outreach activities of the station (See Themes 8. Outreach and marketing, 9. Research and monitoring and 10. Training and education). The description should set the target for in-house research relating to the financial means available at the station, and describe the intentions towards externally funded activities (see 9. Research and monitoring). If the station intends to host courses, education or training, or host artist and musicians, this should also be described and be in line with facilities, finances and logistical constraints (see also 10. Training and education). Intended outreach activities can also be described here (see also 8. Outreach and marketing).

The Programme Plan should thus include a description of intended in-house and external research activities, education and outreach strategies. Participants in the preparation of a Programme Plan should include station managers, scientists, national/regional/local authorities, funding agencies/donors and possibly international scientific networks, NGOs and local communities.

1.3 Other plans and regulations

Land Use Plan

The Master/Strategic Plan (or another document) should also include a Land Use Plan (see Appendix 1 – Management plans and check lists). A Land Use Plan describes and depicts on a map, what activities are appropriate for what areas. It is important to be aware of the framework under which the Land Use Plan is developed. Station management need to be aware of legislation that influence what restrictions stations can impose on visitors and the public, possible agreements/lease issues with local authorities, station regulations, and requirements for research and monitoring.

Within this framework, a Land Use Plan can set aside areas for:

- Housing and storage construction (accommodation, laboratories, workspace, kitchen, workshops, storage (equipment, fuel, etc.) and other infrastructure needed for the run of the station).
- Transport and parking (roads, paths/trails, boards, etc.).
- Scientific areas (possibly separate for *in situ* research and manipulation studies).
- Reference area with no activities (or very limited low impact research that does not influence the natural state condition).
- Educational area (if relevant for kids, visiting groups, courses, etc.).
- Public use (if relevant for local communities or tourists).

The task is to identify spatial interests for all user groups (managers, scientists, logisticians and the public) and within the legal framework, regulations and interests, agree on a spatial distribution of activities (see above) and types of facilities (housing, storage, workshops, laboratories, parking, roads/paths/trails/boards and other infrastructure).

Relevant participants in the preparation of a Land Use Plan include station managers, scientists, logisticians, and possibly national/regional/local authorities, funding agencies/donors, NGOs and local communities.

Communication of the Land Use Plan is important in relation to other users of the area (if any), e.g. local communities and tourists.

A Facility Plan

The Master Plan/Strategic Plan (or another document) should include a Facility Plan describing the infrastructures needed to support the Programme Plan. Infrastructure is in this context both buildings and scientific instruments like e.g. a climate station.

The Facilities Plan thus evolves from the Programme Plan. When the scientific goals have been set, a plan for providing the appropriate facilities for the activities should be developed (laboratories, workspace, storage, workshops, accommodation, kitchen, toilet/bath facilities, sauna, etc.). The spatial layout of facilities is fed into the land use plan. So, the Facility Plan is a detailed description of existing and intended infrastructure development in the zones described in the Land Use Plan.

The task is to identify facilities needed to operate the science, education and outreach activities (including housing and other infrastructure needed for the run of the station) in line with the Vision/Mission of the station, and decide on the spatial layout. The station should continuously seek funding to achieve the goals of the Facility Plan.

The Facility Plan should show existing infrastructure and provide an outline of how the station will develop into the future. When building station infrastructure it is important to consider type of buildings, size and location and there are a number of issues that should be taken into consideration, for example:

- Present needs and future aims should be identified and used for infrastructure planning. When developing a facility plan, it is important to try to foresee future developments of the station as any decision taken regarding infrastructure design and layout may affect future possibilities.
- The spatial outline of buildings affects the requirements for tubing. As temperatures decrease, the risk of freezing of outdoor tubes increases. Thus, the spatial layout of buildings should be designed to minimise tubing and hence reduce heat-loss and energy consumption.
- Storage of hazardous materials, chemicals, and fuel depots should be kept separate.
- Noise from generators can be a nuisance to people at the station and hence could be located away from residential areas and office space and thereby create 'zones' that are residential, research and laboratories, vehicles and generators, shipping and receiving, etc.
- Driving around at the station pose a risk to other people at the station. Station facilities can be designed to minimise risks, by e.g. keeping access roads and parking space at the perimeter of the station facilities.
- The Facility Plan should not conflict with research and monitoring interests, e.g. by ensuring emissions do not compromise research and monitoring programmes.

Participants in the preparation of a Facilities Plan include station managers, scientists, logisticians, funding agencies/donors and possibly national/regional/local authorities, NGOs and local communities.

Example Toolik Field Station
http://toolik.alaska.edu/directory/facilities.php

Example Spasskaya Pad Forest Station
http://www.eu-interact.org/uploads/media/Scheme_of_SPa_Dec2009.pdf

Business Plan / Financial Plan

The Business Plan lays out a financial roadmap for addressing the funding of station operations. This plan describes different funding sources (owner institution, funding agencies, donors, users, etc.) and costs of projected in-house scientific programmes, station management and facility maintenance and development.

The most important part of the Business Plan is a budget (at least going one year ahead and preferably much more – i.e. up to five years).

The financial contributions to a station determine what can be achieved. It is therefore paramount to have a good relationship with funding agencies/donors and continuously be proactive in developing the cooperation by discussing needs and objectives of on-going work, and at the same time search out new areas of opportunity (see also Themes 5. Permit issues and 8. Outreach and marketing). A fundraising/promotion plan and marketing of the station can be important parts of a business plan to attract users and potential funding.

Changes in funding will most likely result in changes to strategies and plans, and should be addressed immediately. The effect of revised strategies and plans should be communicated to funding agencies/donors to make them aware of the effects of changes in the financial situation of the station.

Example of mechanisms for ensuring financial sustainability of research stations – Ecological Society of America
http://www.esa.org/esa/?post_type=document&p=2678

Other relevant plans

Other plans may include a Safety Plan (see 6. Health and safety (disclaimer, insurance, emergencies)), Emergency plan (see 1.4 Check lists and 6. Health and safety (disclaimer, insurance, emergencies)), Environmental action plan (see 7. Environmental impact of station operations), Communication/outreach strategy (see 8. Outreach and marketing), Data management plan (see 11.5 Formulation of a 'Data Management Plan') and Fundraising Plan. The latter is often a part of the Business Plan/Financial Plan and activities may be integrated in advisory board functions.

Policies

Polices agreed to at the station should be described in a management document for the station (see 2. Policies). If a station has different policies for different people (e.g. staff, visitor, researcher, student, etc.), this should be made clear in relevant documents.

Description of procedures, rules and recommendations

When operating research stations in cold, hazardous and sensitive environments and with potential dangerous wildlife, machines, equipment and chemicals around, it is necessary to develop procedures and rules that ensure proper management and safety of all operations.

This knowledge should be written down in structured management documents to ensure that relevant information is transferred to new staff and visitors. This is crucial as many remote research stations experience a high turnover of staff. Preferably, there should also be temporal overlap between old and new staff as this enables newcomers to experience and learn more details of station management and to enquire about uncertainties.

Procedures, rules and recommendations for working at a research station may be many and overwhelming, especially in remote harsh environments. Procedures and rules may relate to administrative processes and to activities at the station or in the field. Administrative procedures describe how things are done, when and by whom. It may be a step procedure (e.g. application handling procedure) or a one-time activity (e.g. procedure for maintenance of vehicles) (see also 1.4 Check lists). Procedures and rules can also relate to specific activities or expected behaviour at station or in the field (e.g. snow mobile driving, alcohol policy, off-limit reference areas, etc.).

Rules can originate from national/regional/local legislation or be developed by the stations themselves (within the legal framework). While rules should be adhered to, a station can also make recommendations for visitors, which are not binding. Rules should for example be developed for important matters related to health and safety and environmental protection (e.g. make it compulsory to bring certain equipment and safety materials to the field, no removal of vegetation/soil, etc.), while recommendations can be for matters that are less important or will make the stay more enjoyable for the visitor (e.g. bring wellington boots in the summer season, wear signal colours in the field, bring books to read, etc.).

Stations and the environment they operate in differ. Hence, each station should carefully consider what procedures, rules and recommendations are necessary at their specific station. These should be written down and there should be a mechanism for developing new ones based on the experiences of station operations and as needed as the station develops.

Below are listed some of the issues for which procedures and rules can be developed.

Procedures can be described for:

- Handling of access applications (e.g. advertisement, advising applicants, decision making procedures, communication with applicants and archiving information) (see 1.4 Check lists and 5. Permit issues).
- Handling of job applications for positions at the station (e.g. advertisement, decision making procedure, communication with applicants and archiving information).
- Tenders (e.g. invitations to submit tenders, decision making procedures, communication with applicants and archiving information).
- Introduction of the station to new staff and visitors (e.g. procedures for how to welcome new people to the station and what they should be informed of or shown) (see 4. Visitors).
- Conflicts (e.g. investigating conflicts, decision making procedure, communication with involved parties and archiving information) (see 4. Visitors).
- Emergency situations (e.g. tasks and decision making) (see also 6. Health and safety (disclaimer, insurance, emergencies)).
- Maintenance activities and inventories (e.g. describe task, frequency, responsible person, information flow and archiving information) (see 1.2 Check lists).

Rules or recommendations can be described for:

Fieldwork – safety (see 6. Health and safety (disclaimer, insurance, emergencies)):

- Bring safety equipment to the field (e.g. first aid kit, wildlife deterrent, means of communication, etc.).
- Bring radio or satellite communication equipment in the field.
- Safety training course for visitors (e.g. first aid, deterrent handling, glacier training, climbing, river crossing, etc.).
- Notifying station staff of where the research group is going every time they leave the station.
- Minimum number of people in the field.

Environmental protection – fieldwork (see 7. Environmental impact of station operations):

- Restrictions on types of activities in specific areas (e.g. sampling of materials, manipulation studies, use of vehicles, instrumentation and emissions).
- Removal of field equipment and measuring stations after use.
- Littering.
- Use of open fire.

Environmental protection – at station (see 7. Environmental impact of station operations):

- Rules on water consumption (e.g. showering and washing machine), garbage handling (recycling), energy use, heating, etc.
- Rules for use of different chemicals and other hazardous or polluting substances.
- Rules for use of fuel (how, how much and where).

Transport (see 6. Health and safety (disclaimer, insurance, emergencies)):

- Adhere to traffic regulations (also set regulations on the station to minimise risk of incidents).
- Use of safety equipment in/on vehicles/boats (e.g. helmets, lifejackets, seat belts, etc.).
- Insurance issues.

*Workshop and laboratories (see Themes 6. Health and **safety** (disclaimer, insurance, emergencies) and 7. Environmental impact of station operations):*

- Some types of equipment/machines may only be used by experienced staff/people.
- Cleaning of workshop and laboratories after use (chemicals, tools, equipment or machines left out can injure other people).
- Use of hazardous chemical substances.
- Handling of live animals.

Kitchen:

- Use of kitchen facilities to avoid accidents (e.g. restrictions on the use of certain types of equipment).
- Cleaning of kitchen and dining facilities to avoid contamination.
- Food access and storage (to avoid contamination and ensure that kitchen staff has knowledge of amounts and consumption level).

1.4 Check lists

Check lists are used to ensure that all relevant tasks are completed in daily, weekly, monthly or annual routines, and in emergency situations. Check lists can be used for many different purposes, e.g.:

- To make sure that all applications for access to the station goes through the same handling process and that applicants are informed accordingly.
- To ensure that all visitors are properly informed prior to and/or upon arrival at the station.
- To make sure that health, safety and emergency training cover all relevant issues during regular emergency rehearsals.
- To ensure all relevant tasks are completed for start-up and closing of the station.
- To ensure thorough check up of buildings, equipment and other infrastructure to make sure they are all in good condition.
- To make inventories of tools/equipment/machinery and medicine/medical equipment to make sure that everything needed for station operations are in place and in good working condition.

It is not possible to make checklists that suit all stations, but key issues for most often used checklists are presented here.

Application handling – check list

It is important to ensure that all applications are treated alike and that a standard procedure is kept during changes in staff. A checklist can be used to ensure that all evaluations are conducted according to agreed procedures.

The checklist can include (see 5. Permit issues *for details):*

a) Check that all relevant information is included in the application.
b) Acknowledge receipt of application and if relevant request missing or additional information.
c) Screen application for relevance and suitability of the proposed research project. If needed, contact applicant to solve identified problems.
d) Identify potential additional permits needed to conduct the research. If needed, apply for permits or inform applicant of the necessity to obtain other permits.
e) Send application for scientific evaluation (to expert or advisory board).
f) Inform applicant of the outcome of evaluation. If conditional, ask applicant to respond to conditions before arrival at the station, or ask applicant to resubmit and send application for re-evaluation if needed. If successful, send approval/permit to applicant and inform of expected logistics (if this is done by the station).

Checklists should be adapted to fit the individual research stations.

Visitor information – check list

It is important to provide visitors with all relevant information about the station prior to and/or upon arrival. A checklist can be used to ensure that the person receives all relevant information to work and interact at the station. For details on visitor handling see 4. Visitors and Appendix 1 – Management plans and check lists.

The check list may include:

Upon arrival:

a) Inform others of new arrivals (the day before arrival or at breakfast).
b) Welcoming the visitor upon arrival at the station and hand out relevant information material (important also to tell people that they are always welcome to ask about all practical issues as well as physical and mental problems).[2]
c) A guided tour of the station including information of restrictions and no access areas (at the station and in the field).
d) Information on policies and code of conduct at station (e.g. alcohol and drug policy, environmental protection, expected behaviour, etc.).

[2] At Toolik Field Station, visitors are given an opportunity to contact a 'scientific liaison' who can help address problems with staff or policies that they are not willing to settle through normal channels. The liaison is usually a senior scientist with lots of experience at the station and who can give advice or contact staff or management on behalf of the user. This has worked well and gives visitors, students and others a choice of who to go to.

e) Health and safety aspects at the station and in the field (including weapon handling, conditional field equipment, expected behaviour in the field, means of communication, emergency and SAR, wildlife, etc.).
f) Information on water availability, shower, laundry, kitchen opening hours, office space, e-mail access, and how messages are passed on to visitors during the stay, etc.
g) Social activities (movie nights, photo shows, games, presentations, etc.).
h) Presentation of staff and their responsibilities.
i) Presentation to other visitors.

This may be a lot of information to lay on a new arrival, so if necessary the information can be broken up in two or more parts (e.g. a-f and g-i).

Upon departure:

j) Evaluation of the stay and debriefing.
k) See visitors off.

Check lists should be adapted to fit the individual research stations.

Emergency operations – check lists (see 6. Health and safety (disclaimer, insurance, emergencies) for more details on health and safety at research stations)

Check lists can be very important in emergency operations as staff and visitors may be under intense stress and important decisions needs to be made. It is also very important that everyone knows what to do in case of emergencies. The description of procedures (including roles and responsibilities) is therefore of major importance in relation to emergency operations, and it is essential that the information is available and easily seen by both staff and visitors. Furthermore, station manager and staff are advised to rehearse these procedures at least annually to be prepared for emergency situations.

It is essential to have one central person at the station to coordinate activities and to keep a log of activities and information regarding the operation. This person should remain on the station, gather relevant information, contact relevant people, keep a log of activities and information, and be responsible for debriefing at the station and reporting. It is important to stay calm, get advice and to have guiding response rules. At unstaffed stations, the group should identify a person to take lead of the emergency operation.

All emergency operations are also a potential risk for rescue personnel. Station management should therefore prevent individuals from initiating rescue missions of their own as they risk putting themselves in danger and thus worsening the emergency operation and adding risks to the rescue personnel. Station management should stay calm and ensure that all elements of the rescue operation are conducted in a safe manner to prevent people from injuring themselves and limit the risks of the emergency operation.

In remote locations help may be far away and communication can be a challenge. It may therefore not be possible for people working at remote stations to take care of communications with relatives, insurance companies, the press or others with interest in the emergency operation. It can therefore be a good idea to have a ‘back office’ (a person) at the owner institution, who can take care of certain elements of the

operation, and the communication and follow up activities related to the emergency operation. This will allow station staff to focus on the emergency operation at the station.

It is necessary with clear descriptions of what is expected by staff at the station and what are the responsibilities of others (e.g. police, insurance company and owner institution). Key roles include:

- Gather basic information on incident.
- Alarming police/rescue service.
- Initiate search and rescue/evacuation/medical attention.
- Communication (e.g. with doctor, relatives, home institution of the affected person and insurance company).
- Follow up after the incident to learn if changes to procedures or rules at the station are needed to prevent similar accidents and to assist the affected person in getting the required medical and psychological assistance needed.

Note that emergency situations may have psychological effects on some persons (both the affected person and other visitors or staff). It is therefore important to identify people in need of emergency (and long-term post-emergency) emotional, psychological and potentially psychiatric support after the incident.

All emergency operations should be evaluated (preferably by all participants) to continuously improve safety at the station and efficiency of emergency procedures. Check lists could therefore include an evaluation element including lessons learned (possibly in the form of a report that also can be used to document the course of the operation).

Stations/institutions should have procedures for how to handle the press and next of kin in emergency situations. In an emergency situation, there may be a great interest from the press, politicians, or next of kin in getting information about the incident. In such cases, it may be a good idea to limit information sources to ensure that the information coming out is correct. Station management should ask people not to spread information about the situation at the station until station management has informed relevant authorities, institutions, relatives, etc. Ask people not to spread information via social media.

Below are key elements of check lists for emergency related topics. For more, see 6. Health and safety (disclaimer, insurance, emergencies) on Health and safety.

Search and rescue check list for the research station (see also 6. Health and safety (disclaimer, insurance, emergencies))

When one or more persons are missing, the station management may decide to initiate a search and rescue operation depending on the situation[3]. At unstaffed stations, the group should identify a person to take lead of the emergency operation. Before initiating an operation, the responsible person may gather basic information on the situation and ask for advice (from colleagues, back office, police, rescue services, etc.).

[3] In some cases station management may want to try alternative means of communication or await daylight and thus not initiate a physical search immediately.

If the decision is that a search and rescue operation is needed, there are some key elements that could be included in a search and rescue check list:

Identify lead person of the operation at the station. This person should be the heart of the operation and should be made aware of all relevant actions and information related to the incident. This person can also have the check list and fill in a log book of all information and actions related to the operation.

Following tasks should be included:

Immediate actions (with information on who is responsible for this):

a) Identify person taking charge, and who will coordinate and keep a log of the search and rescue operation (person to remain on the station).
b) Rescue leader should assess whether self-help can be safely initiated or whether assistance is needed. In this process the rescue leader may ask relevant people/institutions/authorities for advice.
c) Gather basic information, but contact police /rescue service immediately (with information on who is responsible for this).
    i. Who is lost (or how many).
    ii. Where (last known position, including accuracy of this information (e.g. expected geographical position and time of last confirmed position – from sign in/out board, field record book and communications).
    iii. Their status if known (what has happened, injuries and time of this information).
    iv. Communication equipment (satellite phone number, radio frequency, etc.) and colouration of clothes, tents, etc.
    v. Weather conditions.
    vi. Initiated self-help (if any).
d) Contact police/rescue service (with information on who is responsible for this support).
    i. Ask for immediate help if needed.
    ii. Inform of situation (see above) and possible assistance required.
    iii. Note agreement of actions to be taken, next contact and who should initiate this (police/rescue service or station).
e) Identify people in need of help/treatment and long-term post-emergency emotional, psychological and potentially psychiatric support at the station (with information on who is responsible for this, e.g. trained staff or doctor).

Secondary actions (with information on who is responsible for this):

f) Contact 'back office' (person at owner institution who is responsible for specific tasks).
    i. Contact back office and inform of situation. Back office should have 24/7 support and have access to all personnel records including contact details for next of kin and home institution of visitors.

   ii. Note agreement of actions to be taken, next contact and who should initiate this ('back office' or station).

g) Brief people at the station and explain what is expected from them. This could include asking them not to spread information about the incident until the situation has been dealt with, facts uncovered and relevant authorities, institutions and relatives have been informed.
h) Assign tasks to specific persons (if needed).
i) Debriefing of all relevant people at the station.
j) Evaluation report. All emergency operations should be described and evaluated (preferably by all participants) to continuously improve safety at the station and evacuation procedures.
k) Initiate after care; how to get the person back to the station/home. This can be dealt with by the station or the back office (whatever is agreed at the station).

Back office tasks (described in emergency procedures for the station, see 6. Health and safety (disclaimer, insurance, emergencies)*):*
It is important that the station has clear and well established procedures on how to handle emergency situations, including who to contact and what information should be passed on.

a) Contact relatives and the institution of the sick/injured person.
b) Contact emergency services, hospitals, insurance companies or transport companies that should assist in the emergency operation (e.g. providing transport or medical assistance/advice).
c) Handle the press/send out press release.

Evacuation check list (see also 6. Health and safety (disclaimer, insurance, emergencies))
When an incident happens at the research station, it is the station managers' responsibility to assess the situation and decide on a plan for action. The station manager can ask for advice at home institution, doctor, police or rescue service before making a final decision. If the decision is that an evacuation is needed, then here are some key elements that could be included in a check list.

Identify lead person being responsible for the evacuation. This person should be the heart of the operation and should be made aware of all relevant actions and information related to the operation. This person can also have the check list and fill in a log book of all information and actions related to the operation. Following tasks should be included:

Immediate actions (with information on who is responsible for this):

a) Prevent further injury.
b) Assess casualties and stabilise injured/sick persons.
c) Identify person taking charge, coordinating and keeping a log of the evacuation operation.
d) Gather relevant information on the incident (name(s), known injuries, location).
e) Contact doctor if needed and follow instructions (leave room on form for noting instructions or note down in log).
f) Alarm police/rescue services and provide relevant information:
   i. Type of illness or injury.
   ii. Status of the person.
   iii. Location of sick or injured person.

iv. Provide personal details: name, sex, age, medical history (record of medical conditions, handicaps, medication, allergies, etc.).
v. Provide contact details for next of kin and home institution.
vi. Note agreement of actions to be taken, next contact and who should initiate this (police/rescue service or station).

Secondary actions (with information on who is responsible for this):

g) Inform 'back office' (if there is no 'back office' a person at the station has this role)
h) If people return to the station, be in close contact to identify people in need of treatment and/or emotional, psychological or psychiatric support. Note that staff and other visitors also may react emotionally to the emergency operation.
i) Brief people at the station and explain what is expected from them. This could include asking them not to spread information about the incident until the situation has been dealt with, facts uncovered and relevant authorities, institutions and relatives have been informed.
j) Assign tasks to specific persons (if needed).
k) Debriefing of all relevant people at the station.
l) Evaluation report. All emergency operations should be described and evaluated (preferably by all participants) to continuously improve safety at the station and evacuation procedures.
m) Initiate after care; how to get the person back to the station/home. This can be dealt with by the station or the back office (whatever is agreed at the station).

Back office tasks (described in emergency procedures for the station, see 6. Health and safety (disclaimer, insurance, emergencies)*):*
It is important that the station has clear and well established procedures for how to handle emergency situations, including who to contact and what information should be passed on.

a) Contact relatives and the institution of the sick/injured person.
b) Contact emergency services, hospitals, insurance companies or transport companies that should assist in the emergency operation (e.g. providing transport or medical assistance/advice).
c) Handle the press/send out press release.

Fire/natural disasters (avalanche, earth quake, mud slide, glacial lake outburst, etc. check list (see also 6. Health and safety (disclaimer, insurance, emergencies))
An Emergency Plan should describe what to do in case of fire/natural disasters. Rescue services are often not available or far away from research stations in the Arctic or northern alpine areas. Many stations can therefore not expect immediate assistance. It is important to identify one person who should quickly get an overview of the situation and coordinate activities.

Immediate actions (with information on who is responsible for this):

a) Locate people (using available information, e.g. sign in /sign out boards, field record book, etc.).
b) Get people to a safe area (e.g. agreed gathering point in case of emergency).
c) Identify person to plan and coordinate the operation and keep a log of activities (person to remain on the station).
d) Gather basic information (type of incident, number of missing persons, significant damages to infrastructure), but contact police/rescue service immediately.

e) Alarm police/rescue service and note down possible instructions in log.
   i. Type of incident (fire, natural disaster)
   ii. Number of missing persons.
   iii. Last known location of missing persons (and time of this information).
   iv. Number and status of injured persons (including type of injury).
   v. Location of injured persons.
   vi. Provide personal details: name, sex, age, medical history (record of medical conditions, handicaps, medication, allergies, etc.).
   vii. Provide contact details for next of kin and home institution.
   viii. Note agreement of actions to be taken, next contact and who should initiate this (police/rescue service or station).

Secondary actions (with information on who is responsible for this):

f) Inform 'back office' (if there is no 'back office' a person at the station has this role).
g) If people remain on the station, be in close contact to identify people in need of treatment and/or emotional, psychological or psychiatric support (with information on who is responsible for this, e.g. trained staff or doctor). Note that staff and other visitors also may react emotionally to the emergency operation.
h) Brief people at the station and explain what is expected from them. This could include asking them not to spread information about the incident until the situation has been dealt with, facts uncovered and relevant authorities, institutions, relatives have been informed.
i) Assign tasks to specific persons (if needed).
j) Debriefing of all relevant people at the station.
k) Evaluation report. All emergency operations should be described and evaluated (preferably by all participants) to continuously improve safety at the station and evacuation procedures.
l) Initiate after care; how to get the person back to the station/home. This can be dealt with by the station or the back office (whatever is agreed at the station).

Back office tasks (described in emergency procedures for the station, see 6. Health and safety (disclaimer, insurance, emergencies)*):*

It is important that the station has clear and well established procedures how to handle emergency situations, including who to contact and what information should be passed on.

a) Contact relatives and the institution of the sick/injured person.
b) Contact emergency services, hospitals, insurance companies or transport companies that should assist in the emergency operation (e.g. providing transport or medical assistance/advice).
c) Handle the press/send out press release.

Opening and closing of research stations - check lists

For stations that are not open all year round, it may be a good idea to have a checklist and description of what to do when opening or closing the research station for the season. Especially important are starting/closing of generators that may need to follow specific procedures and water supply system that needs to be emptied to prevent freezing and damages to tubes. Depending on the size of the research station, there may be many other installations that need special attention during the start-up and closing phases, so each station needs to develop their own check list and procedure.

Maintenance of buildings, equipment and other infrastructure – check lists

Arctic research stations are often challenged with long distances to the nearest shop, and delivery of spare parts and new equipment may take significant time. To ensure continuous operations, it is essential that buildings, equipment and other infrastructure is maintained properly and that relevant spare parts are to be found at the station.

It is therefore important at regular intervals to check and maintain houses, water supply system, heating systems, sanitary installations, electrical power supply system, communication system incl. battery power on portable communication means, weapons, equipment, machines, vehicles/boats, etc. to ensure that they are all in a good working condition. How frequent this should be done depends on the type of equipment, but an annual check-up is recommended as a minimum (battery power for communication equipment is recommended before every field trip).

It is the responsibility of the station manager/logisticians to ensure that the station is maintained and everything is kept in good working condition. An inventory of spare parts, tools, equipment, machines and vehicles should also be kept (see Inventories below)

Inventories – check lists

Research stations operating in remote areas need to ensure that all relevant equipment and medicine are available at all time on the station. This is especially relevant for emergency and health related items.

Researchers may also expect that research stations have some basic tools that can be used to repair minor mishaps or errors on their equipment. Inventories can be a good 'tool' to ensure that basic items are in stock and available in a specific place.

Inventories are important for:

Medicine - regular inventories are important to ensure that all medicine on stock has not expired. This is especially important at remote stations challenged with long distances or infrequent connections to major towns/cities.

Tools and equipment – regular inventories are important to ensure that all tools and equipment (incl. spare parts) are there and in good working condition (including e.g. workshop, kitchen, laboratories and office stationeries).

Fuel chemicals and other substances with an expiry date may also be controlled using check lists to ensure that adequate amounts are available at the station.

Checklists should be adapted to fit the individual research stations.

1.5 Key considerations for station management

- *Develop vision, mission and concept for the station.*

- *Develop and regularly update relevant management plans, including:*
  - Strategy plan.
  - Facilities plan.
  - Land use plan.
  - Programme plan.
  - Financial plan.
  - Implementation plan.
  - ToR for station operations (describing e.g. organisation, roles, responsibilities and financial agreements) and staff (describing e.g. roles and responsibilities).
- *Develop policies, rules and procedures for station operations.*
- *Develop policies, rules, procedures and recommendations for visitors.*
- *Develop relevant check lists for station operations.*

Examples

Example of operations manual for network of biological field stations (USA)
An Operations Manual for Field Stations and Marine Laboratories (2001). Susan Lohr (ed.), Organization of Biological Field Station (USA).
http://www.obfs.org/assets/docs/obfs-adminhandbook.pdf

Example of emergency preparedness, response and recovery check list.
American Health Lawyers Association (2004). Emergency preparedness, response and recovery checklist: Beyond the emergency management plan.
http://www.healthlawyers.org/hlresources/PI/InfoSeries/Documents/Emergency%20Preparedness%20Checklist.pdf

Example of conceptual framework for Zackenberg Ecological Research Operations
(Small to medium sized, very remote station reached by chartered plane)
Rasch, M., Rysgaard, S., Meltofte, H. and Hansen, J. B. (2003). Zackenberg Basic: Climate Change Effects in a High Arctic Ecosystem at Zackenberg, Northeast Greenland - The concept (chapter 9). In: Rasch, M. and Caning, K. (eds.) 2003. Zackenberg Ecological Research Operations, 8th Annual Report, 2002. Copenhagen, Danish Polar Center, Ministry of Science, Technology and Innovation, 2003.
http://www.zackenberg.dk/fileadmin/Resources/DMU/GEM/Zackenberg/pdf/zero-8-annual-report-2002.pdf

Example of conceptual framework - Nuuk Ecological Research Operations, Greenland
(Large, easy access station located in a community; field stations small and remote)
Forchhammer, M. C., Rasch, M. and Rysgaard, S. (2008). A conceptual framework for monitoring Climate effects and feedback in arctic ecosystems (chapter 8). In: Jensen, L. M. and Rasch, M. (Eds.) 2008. Nuuk Ecological Research Operations, 1st Annual Report, 2007. – Copenhagen, Danish Polar Centre, Danish Agency for Science, Technology and Innovation, Ministry of Science, Technology and Innovation, 2008.
http://www.nuuk-basic.dk/fileadmin/Resources/DMU/GEM/Nuuk/Low_Nuuk20Ecological.pdf

Example of strategy and work Programme – Greenland Ecosystem Monitoring (Zackenberg Research Station and Greenland Institute of Natural Resources, Greenland)
(Small to medium sized, very remote station reached by chartered plane) and (Large, easy access station located in a community; field stations small and remote)
Rasch, M., Schmidt, N.M. and Juul-Pedersen, T. (eds.) (2012). Greenland Ecosystem Monitoring Strategy and Working Programme 2011-15. DCE – Danish Centre for Environment and Energy, Aarhus University.
http://www.zackenberg.dk/fileadmin/Resources/DMU/GEM/Zackenberg/Nye_Zac_files/GEM_01.pdf

2. Policies

2.1 Introduction

Policies are principles, rules and guidelines formulated or adopted by an organisation to reach its long-term goals. Policies should be expressed in procedures and rules and in the daily management of the station. Policies are thus designed to influence and determine all major decisions at the station, and ensure that all activities take place within the boundaries set by them.

Stations should identify and formulate policies relevant for the operations. Policies should be general in nature, but may subsequently be specified in procedures, rules and guidelines related to the policy. Policies should be communicated to staff, visitors (see Themes 3. Staff and 4. Visitors) and to other relevant stakeholders (e.g. contractors, consultants, local communities, etc.) in relevant documents, on website, in plans, reports, etc.

Policy needs and contents vary greatly between stations. What policies are needed is determined by a number of factors, e.g.:

- National legislation - Legislative requirements differ between nations and possibly also between regions and local authorities with possible implications for station policies. Station policies cannot conflict with government and local policies and laws.
- Remoteness - Remote stations need to have 24 hours care of visitors (accommodation, food, work space, etc.). Remote stations also need to have more focus on health and safety aspects as hospitals and medical assistance may be far away.
- Type of activities undertaken at the station - Certain types of activities may require policies and related operational rules (e.g. for glacier work, use of vehicles/boats, work far from station facilities, use of certain types of machines/equipment/chemicals, etc.).
- Landscape and climatic conditions – The landscape may include features that poses a risk to people and necessitates specific policies and guidelines (e.g. rivers, glaciers, mires, cliffs, etc.). Climatic conditions at arctic and alpine stations can be a risk if people are not properly prepared with policies and guidelines (e.g. cold temperatures, strong winds, snow, ice and rapid changes in weather).
- Sensitivity of the natural environment – Environmental policies can be needed to guide station activities in line with the station's vision, mission, setting, concept and strategy.
- Need for undisturbed reference areas or non-manipulated areas (e.g. control areas).
- Presence of dangerous wildlife – Dangerous wildlife may necessitate policies for conflict avoidance. This can be specified in related rules and recommendations (e.g. advisable behaviour during encounters, and use of deterrents or weapon for self-defence).

Due to the different conditions at research stations, policies need to be developed specifically for each station. However, stations subjected to similar legal regimes, remoteness or environments can inspire and learn from each other. Policies should be reviewed regularly and updated in relation to changes in legislation and developments at the station.

In this theme we will present the most common policies relevant for stations operating in artic and northern alpine areas and provide specific examples from stations in the INTERACT network.

2.2 Examples of types of policies

Environmental protection policy
An environmental protection policy should in broad terms describe the stations view on environmental protection and may present specific procedures, rules and guidelines. The policy may relate to protection of the nature surrounding the station and emissions from station operations (e.g. water and energy consumption and garbage handling). Environmental policies may be based on legislation or be necessitated by station vision, mission, concept, strategy, science policy, land use plan or ethical considerations.
(See example in Environmental policy and 7. Environmental impact of station operations)

Ethics policy (may include science ethics and camp ethics)
An ethics policy may include science ethics (including policies on how to handle sensitive personal information, traditional knowledge, live animals, acknowledgement of data providers in publications, etc.) and camp ethics (including policies on expected behaviour).

Camp ethics may include alcohol, smoking, drug and sexual harassment policies, quiet hours in sleeping quarters, garbage sorting, water use restrictions, no littering and other general behaviour guidelines (e.g. treat others like you want to be treated).

Stations working close to or with local communities can also have policy for how researchers and station staff interact with locals.

Ethic policies should be described in staff and visitor information documents.
(See example in Ethics policy)

Extreme weather policy
For stations located in areas where extreme weather can occur, it may be relevant with a policy for how the station operates under these conditions (e.g. restriction on services for visitors, additional restrictions on field work, etc.).
(See example in Extreme Winter Weather Operation Guidelines)

Health and safety policy
A health and safety policy can formulate what is expected from the visitor and what the visitor can expect from the station in relation to health and safety at the station. At most stations, visitors are responsible for their own safety, while stations provide limited support within their capacity and often facilitate emergency and rescue operations. Stations should be very specific about what can be expected from the station in terms of assistance and liability. The policy can also include a staff element, a weapon policy and evacuation policy.

The policy should be elaborated on in relevant management documents (e.g. emergency plans, and health and safety related documents).
(See example in Health and safety policy and 6. Health and safety (disclaimer, insurance, emergencies))

Information policy (data and publication sharing policy)
An information policy describes how the station envisages sharing of data and publications from the station. It may be necessary to discern between in-house science programmes and external projects. Note that there may be legislation demanding free access to actual data acquired by publicly financed research projects (e.g. in freedom of information acts), and it may be a prerequisite for funding from some donors.
(See example in Freedom of Information Statement and 11. Knowledge Capture and Data Management)

Press and communication policy
A press and communication policy describes how the station will make use of different media in relation to general information and marketing of the station and its activities. It should also describe how to handle emergency situations in relation to police/rescue services, relatives, media and other stakeholders.
(See 8. Outreach and marketing)

Science policy
A science policy describes the aim of in house science programmes and the intended use by external research and monitoring projects and programmes. It may include other elements on international collaboration, data sharing and publication strategy. It should be written for external parties and present a short summary of intended science support based on the Science Programme/Strategy.
(See Themes 1. Management plans and check lists. and 9. Research and monitoring)

Sponsorship policy
'Sponsorship' means payment by a private sector organisation or individuals in return for public association with a project, the station or owner institution. Sponsorships can help a station to achieve their objectives by financing specific activities. Sponsorships should always adhere to the vision, mission, concept and strategy of the station and be in line with the ethical principles of the station.

A sponsorship policy describes the view of the station on private sector or individual funding of station activities or infrastructure. As part of the policy, a station may develop specific guidelines and principles for sponsorships.
(See example in Sponsorship Principles)

Staff policy
A staff policy can describe what type of staff you seek, what you do to attract them and a possible time constraint. This policy can be elaborated on in the Terms of Reference for the station (see Theme 1) or other planning documents used at the station.
(See example in Staff policy and 3. Staff)

Transport policy /vehicle use policy
A transport policy describes conditions for use of vehicles at the station. The policy may include procedures for access to vehicles, as well as conditions and rules for driving on station, in field or on public roads,

including age and experience required for drivers. Conditions and rules may be vehicle specific. Use of snowmobiles may for example be allowed in the field (along specified transport routes and driving areas) providing that the ground is frozen and that there is a sufficient snow cover to protect the vegetation.

A transport policy can also express the intent to coordinate transport to/from the station and within the study area to increase efficiency and limit emissions.

Transport policies should be included in relevant staff and visitor information documents and made available to other stakeholders (e.g. on the web, in plans or in reports).
(See example in Barrow Field safety **– external link to snow mobile safety training course**)

Under-aged and family policy
Arctic and alpine research stations are often located in extreme environments with challenging logistics and working conditions. Some stations may therefore find it necessary to limit access to the station for children and relatives. However, if conditions allow, it could be considered a possibility for people (often young scientist) to bring their kids and arrange for caretaker responsibilities.
(See example in Policies for parents with dependent children at Toolik Field Station (TFS) (0 to 5 years old))

2.3 Key considerations for station management

Circumstances at the research stations differ significantly. Station management should therefore develop policies relevant for their specific station. Below sources of information can be used to formulate station specific policies:

- *Identify and adopt relevant policies of the owner institution.*
  Many research stations are part of a university or a larger institution. The owner institution may have policies that the station is obliged to follow and may also have relevant policies that the station would like to follow. By identifying policies of the owner institution, stations can easily identify relevant policies to be adopted by the station and thus save time in developing their own similar policies.

  Note that some policies of the owner institution may need to be adapted to the special conditions that apply at the research station as this often differs greatly from the conditions at the location of the owner institution (e.g. natural environment, hazards, job description, etc.).

  Note also that there may be specific procedures for approving policies at the owner institution, before these can be implemented on the station.

- *Identify legislation to be formulated as station policies.*
  Station managers should be aware of all relevant legislation that affects activities at the station. This obviously should be included in the management of the station (procedures and rules), but may also be formulated in policies on specific management themes (e.g. environmental protection, and health and safety).

- *Identify relevant policies of other organisations that can be adopted.*
  Station may also find inspiration for policies at other stations or in other organisations. Note that some policies may need to be adapted to the special conditions that apply at the research station.

- *Develop additional policies relevant for station operations.*
  Stations can develop additional policies that they find important for operating the station in line with its vision, mission, concept and strategy. In this respect, it is important to note that the legal framework for operating the station may have implications for which additional restrictions a station can implement (e.g. stronger restrictions on land use in some areas to protect reference areas, use of firearm as wildlife deterrent during field work and insurance requirement for visitors).

Examples

Example of policies and guidelines for visitors at Toolik Field Station, Alaska, USA
(Large, very remote station with road access)
Including extreme weather, snow mobile use, dependents, scientific liaison/bad behaviour and data/IT.
http://toolik.alaska.edu/user_guide/policies.php

See other examples in Appendix 2 - Policies (station examples).

3. Staff

3.1 Organisation, roles and responsibilities

It is important with clear roles and responsibilities for all staff at the station, for the owner of the station and for the advisory boards/committees. All employees should know what is expected from them and who they refer to. Roles, responsibilities and lines of communication should be clearly communicated, e.g. via ToR, contract or other document. At some stations, new employees are asked to sign a document with the rules and policies of the station and are herein informed of possible consequences if these are breached. An organisational chart can provide a good overview of the interrelationship between the different staff at the station. See also

Terms of Reference (ToR) for station operations.

3.2 Attracting and keeping good staff

Working at remote arctic or alpine research stations is a dream for many adventurous people, and it is often not difficult to get applicants for vacant positions. However, reality at remotely located stations in harsh and often cold environments with a limited number of people can also be a challenge for many – and different from what they dreamed about.

When looking for new staff it is therefore important to make a reality check during job-interviews to make sure that the person understands the situation at the stations and what responsibilities and tasks they will have. This is even more important in situations where a personal interview is not possible (e.g. due to remoteness of the station), as it makes it more difficult to assess the interviewee. Depending on the location of the station, people may need to be able to cope with working in isolated places and endure time away from family and friends. It is also important to make sure that they understand all tasks associated with the job, including the less fancy elements. One example is to ask if the person prefers to scrub the toilet clock-wise or counter-clock-wise to make them understand that this is part of the work.

It is of course important to find people with the right skills required for the position. Advertising broadly (e.g. in international networks and organisations) may help recruit well qualified staff. It is, however, also important to see how the person fits into the work environment developed by the other employees at the station. The working environment is an essential attractor for stations with a limited number of staff. Stations often develop unique cultures, creating a specific atmosphere at the station that make people want to stay. Skills and how applicants fit into the existing group of staff is therefore essential when hiring new staff. For stations with frequent visit by foreign nationals, English skills are preferred, although this may not always be possible.

Many remote research stations are challenged with relatively high turnover rates for staff (all or specific positions). This continuous removal of knowledge may be a significant challenge for some stations and hence transfer of knowledge is essential, e.g. via documents or overlap between resigning and new employee (see also 11. Knowledge Capture and Data Management).

Capacity building, knowledge capture and information

It is important to ensure that staff possesses the relevant skills for working at the station. Although it may take significant time to train new personnel (especially young inexperienced people), it is essential for station operations to build capacity. This can be done by offering relevant training/courses (safety training especially important for all staff) (see also 10. Training and education), having required documentation of procedures and practices at the station (see themes 1. Management plans and check lists. and 5. Permit issues) or building capacity through transfer/exchange of knowledge between new staff and current/former staff and other station managers (e.g. visits to other stations).

Relation to local communities

It is important to ensure good relations between station staff and local people. Hiring people from the local community often brings in a lot of added value/local knowledge that the station can benefit from (possession of relevant skills being a prerequisite).

3.3 Key considerations for station management

Staff qualifications, roles and responsibilities

Station management should ensure that staff possesses relevant skills and qualifications, and make sure that they are aware of what is expected from them.

- Station management need to describe in detail the organisational setup and describe roles and responsibilities of the different positions. This can be communicated to employees through a ToR or other document.
- Identify key qualification for the different positions and hire people with right combination of work and social skills.
- Identify and provide relevant training and education to continuously build staff capacities
- If possible and relevant, provide opportunity for knowledge exchange with former staff and other networks, organisations or stations.

Transfer of knowledge

Station management should facilitate transfer of knowledge to new employees by:

- Documenting regulations and procedures, and continuously update these to capture the knowledge that should be transferred to new employees.
- Allowing (if possible) for overlap between old and new employees, as direct communication on site regarding the work at the station provides a unique opportunity for transferring of knowledge between experienced and new staff.

Creating good atmosphere at the station

There are three fundamental things that should be considered by station management when seeking to create a good working environment at the station:

- The tasks and responsibilities. These should be in line with the interests and competences of the employee. Career development and courses to strengthen competences can be thought into the positions.
- Team spirit of staff. Ii is important to hire people that fit the specific culture at the station (or to change the culture at a station). Some stations provide exclusive logo-wear for staff.
- Spare time activities. Although work may take up much time, there will be spare time where employees need things to do. The surroundings may attract outdoor people that stay happy as long as they can go hiking once in a while, but others may require leisure facilities and entertainment at the station. Examples of leisure time activities includes sauna, books, movies, games, presentations by visitors, fitness machines, volleyball, badminton, basketball, soccer, horse shoes, tetherball, frisbee, baseball gloves, etc.

Station example

3.1 Kevo Subarctic Research Institute, Finland

(Large, easy access station with road access)

By Otso Suominen

Staff policy and organisation

Major guidelines for staff the policy comes from the University of Turku's staff policy that emphasises expertise, equality and openness. The expertise and knowledge of the staff is recognised as the most important resource

of the university. Efficient and open communication within the unit and within the university is of highest importance. Continuous training and education of the staff in the rapidly advancing methods and technologies is important.

Kevo Subarctic Research Institute is an independent institute of the University of Turku. The station manager is the leader for all other staff members. The main staff categories are the technical and research assistants, kitchen and property maintenance staff and administrational staff. For some persons, the roles include more than one of these categories. The station manager is the only senior researcher among the staff. Most of the research conducted at Kevo is led by faculty members of the University of Turku and other universities and research institutions.

The research assistants and technical staff are responsible for the station's long term monitoring programmes and experiments, data bases, and assisting of all kinds of research conducted at the station. This includes field and laboratory work, data management, expertise on study localities, and construction and maintenance of experimental infrastructure and equipment.

The responsibilities of the other staff categories are obvious. There are temporary employees at the kitchen during the main field season. Management and administrational staff and one research technician work mostly at the university in Turku (1,300 km from the station) during winter season and stay more permanently on the station only during the main field season May-September.

A recognised problem is the transfer of knowledge of the retiring or otherwise changing staff. This is especially the case with local technical staff at the field station. They have got an immense knowledge of the local environment, people, tradition and history, most of which is not documented in any way.

Attracting and keeping good staff

At a relatively remote station where the number of permanent staff is small and management works away from the station more than half of the year, there are some key things to consider when hiring staff. All employees should be flexible and ready to assist colleagues. Everybody should also be capable to work independently and initiate work on their own initiative without constant supervision.

The station is located in a small municipality with long distances to larger settlements and services. Thus, the ability to solve sudden technical and other problems without expert help is desirable. The majority of the local people are indigenous Sami people. While working in such a small community it is good if at least some of the employees of the station are also local Sami people.

The, in a way, exotic location of the station and nationally well-known name of the station make open positions at Kevo Subarctic Research Institute quite attractive. On the other hand, job applicants may often have an unrealistic view of how it is to work at the station and live in a small remote community. Sometimes during the screening of applicants this is quite obvious. But, sometimes it is difficult to judge how a person will settle into the station's work community and life in Utsjoki.

Good staff is, of course, an invaluable resource that we wish to keep. Salary levels at Finnish universities are not especially poor compared to other jobs, but money is not the key issue that attracts and keeps the staff at the station. Security in the job, work environment, changing tasks, 'exotic' visitors, etc., are issues considered

important by applicants. So, in order to keep good staff it is important to have good spirit in the working community, and give people tasks that they find interesting and according to their competences. Of course, it is important for the employees to know that the management, co-workers and visiting research groups value their work.

An activity that our staff has found particular rewarding is visits to other stations, both for the spirit among the staff and for developing their own competences. We have visited other (INTERACT) research stations in northern Fennoscandia with most of our permanent staff taking part. Instead of having only station manager meetings, it is good for the technical and kitchen staff to see how their colleagues at other stations are doing their work. Usually we find new ideas for our own work, and also issues that make us feel proud of our own solution.

4. Visitors

4.1 Introduction

Detailed information about the conditions at the station and a clear description of application procedures are very important, as well-informed applicants tend to become more happy visitors, to ask fewer questions and to be better prepared for the conditions at the station. A good dialogue before, during and after the visit is important, and personal contact is recommended in the pre-application phase as this establishes a closer relationship between the applicant and the station. Personal contact also allows for more indebt discussions about the scientific objectives, conditions at the station, logistics, conditional requirements, procedures, etc.

As always, it is important to be welcoming, polite and respectful when communicating with other people and to understand that it can be a new and challenging experience for your visitors to go to remote field sites. Operating stations in harsh and remote environments, however, also require stations to be direct in communicating relevant health and safety risks at the station and to engage in discussions on the feasibility of proposed studies. This will help ensure a good match of station and the projects proposed of the visiting scientists, and it will help synchronise expectations.

Clear information about responsibility in relation to the health and safety of visitors is essential. At most stations, visitors are there on their own risk and stations take no responsibility for the actions, health, etc. of the visitors. See Themes 5. Permit issues and 6. Health and **safety** (disclaimer, insurance, emergencies) for information about disclaimers, insurance requirements and other health and safety related issues.

How a station communicates with and treats applicants is part of a stations identity and may have an impact on how attractive a research station is to researchers. Clear procedures for handling applicants and visitors may help ensure that this is done in line with station ethics and policies (see 1.4 Check lists), 2. Policies and 5. Permit issues).

In the application phase, it is important that applicants (and other stakeholders) can get in contact with the station at all times. During holidays, field work and changes of staff, it should always be possible to reach a relevant member of staff. It is therefore advisable to have an institutionalised e-mail address (e.g. info@'station name'.com) that can be accessed by the relevant staff member on duty.

At the station, staff should be visible and willing to engage in close dialogue with visitors. Visitors should, however, also be made aware of that station staff has a number of tasks and hence may not be available at all times. This should be communicated to visitors to ensure they know what to expect and how best to get in contact with staff during their stay. This theme is described from a staffed station perspective. For unstaffed stations, the visit phase information should be included in the pre-visit phase (to the degree this is possible).

The size and conditions at research stations differ immensely between stations; i.e. ranges from unstaffed stations to staffed stations supporting over 100 visitors at a time, from stations located in towns or along

public roads to isolated stations hundreds of kilometres from the nearest community, from very exposed to sheltered locations, etc. It is therefore not possible to develop standardised information materials or a template that suit the needs of all stations and each station should develop individual information documents and communication strategies. There may, however, be much to learn from stations located in the same general environment and under similar logistical challenges.

A written procedure for communication with applicants may be divided into three phases i) enquiry and application, ii) visit, and iii) post-visit phases (see also 5. Permit issues). Below are key considerations and suggestions for issues related to communicating with applicants/visitors and information documentation in application, visit and post-visit phases.

4.2 Pre-visit phase (application phase)

Communication with potential applicants

In the pre-visit phase there are various ways for communicating with applicants. First of all, stations can provide a lot of information on the web-site that allow applicants to learn about the station, environmental conditions, previous/on-going research and monitoring, health and safety issues, conditional requirements and application procedures.

It is important that the applicants receive all relevant information that will ensure a successful stay at the station (see also 5. Permit issues).

- Make pre-visit information available for potential applicants (see below).
- Make guidelines and application forms available for applicants (see also 5. Permit issues).
- Provide visitor guide (site manual) to approved applicants (see below).

While many issues can be dealt with by providing information on the web and via e-mail, direct communication (meetings or phone calls) is the best way of ensuring a good match between the applicant and the station. Station management can initiate this (if this is not done by the applicant) to show that enquiries are handled professionally. Direct communication allows station management and the applicant to discuss in more detail the suitability of the proposed project and it allows the manager and applicant to address and discuss uncertainties about application procedures and conditions at the station.

Some station has special policies for journalists and film makers, who want to spend time with researchers or students. As it may take substantial time, disturb research activities and potentially lead to unwanted publicity, it is important to have clear policies and guidelines for developing agreements between journalists/film makers and the research community.

Website

Use website to inform about the station, logistics, services, natural environment, environmental concerns at the station, health and safety related issues and permitting issues.

Personal contact (phone)
Seek to have personal contact with all applicants at least once to discuss the feasibility of proposed projects and to address any uncertainties that the applicant may have in relation to application procedures, logistics, stay at the station, etc.

Important information that can be included in information documents to visitors

The important information for applicants in the application phase is to learn if their research objectives can be fulfilled at the station. Applicants should also be made aware of application procedures, conditions for access, and health and safety risks related to working at the station and in the field.

Detailed information about daily routines and where to find what at the station can be presented at later stage when applicants have been granted access (see visit phase information hereunder). This does not count for unstaffed stations. Here visitors needs to be fully informed prior to arrival at the station including instructions for starting up the station (generator, heating, water, etc.) and what to do in case of an emergency.

Below lists are meant as inspiration and should not be seen as templates or complete lists of issues. Station management should identify the relevant information related to their specific station and develop relevant information material based on this.

Pre-visit information should therefore inform potential applicants about:

- The natural environment and its physical and climatic conditions.
  - Landscape and habitat types.
  - Weather conditions including temperature, precipitation and extreme weather events.
  - Possible challenges in the field (e.g. terrain, wildlife, avalanches, etc.) and mitigations measures (and conditional requirements).
- Environmental protection (see also Themes 2. Policies and 7. Environmental impact of station operations).
  - Water consumption.
  - Energy consumption.
  - Garbage handling.
  - Nature protection.
- Health and safety related concerns.
  - Risks when working at the station and mitigation measures (see also 6. Health and safety (disclaimer, insurance, emergencies)).
  - Risks when working in the field and mitigation measures (see also 6. Health and safety (disclaimer, insurance, emergencies)).
  - Insurance and liability issues.
- Facilities at the station.
  - Housing.
  - Laboratories.
  - Workshops, equipment and tools.
  - Kitchen and food.
  - Storage.
  - Library.

  - Conference facilities.
  - Leisure time facilities.
- Services and science support.
  - Workspace availability and conditions for use.
  - Existing science programmes and data access.
  - Field assistants (what can be expected of station staff and what needs to be agreed upon in advance).
  - Equipment for data sampling or field experiments.
  - Safety equipment for fieldwork (e.g. radio, first aid kit, weapon, wildlife deterrents, etc.).
  - Laboratory equipment for tests or experiments.
- Logistics.
  - Means of transport to and from the station (may differ with season).
  - Means of transport to and from the field (may differ with season).
  - Fuel availability.
  - Storage possibilities/facilities.
  - Means of communication in the field and at the station (e.g. phone, satellite phone, e-mails, web-access and radio).
  - Electricity (availability and type of plug).
- Permit application process
  - Conditional requirements for access to the station (e.g. required health standard, compulsory equipment, documentation of specific expertise/skills, acknowledgement in publications, payment of access fee, etc.) (see also Themes 2. Policies, 5. Permit issues and 6. Health and **safety** (disclaimer, insurance, emergencies)).
  - Station access application form and procedures (see also 5. Permit issues).
  - Permits required by local, regional or national authorities (see also 5. Permit issues).
  - Costs per day/night working at the station (and what this includes).

4.3 Visit phase

Communication with visitors at the station

When researchers arrive at the station they should be greeted by staff, provided with relevant visitor information documents (if not provided before arrival – or if they forgot them), and given a personal tour of the station and its facilities. Take good time to inform the visitors of daily routines at the station, health and safety issues at station and in the field, and discuss practical implementation of the research/monitoring project (including site selection in accordance with land use plan).

If relevant, station management can also request to see that permit requirements have been met by the visitors.

It is important to have regular contact with visitors during the stay to help them achieve their research or monitoring aims. It should also be made clear to them that they can always come to staff with practical problems related to their research and stay at the station, and that they should not hesitate to involve staff in social or emotional challenges during stays. Regular contact can be important for ensuring successful stays as it allows visitors and managers to discuss developments of the research projects and identify

improvements or mitigation measures. It will also make visitors feel more at home and ensure a better integration at the station.

If necessary, some information can be communicated via e-mail or boards, but personal contact during the stay is always to be preferred.

The integration of visitors at the station can be of tremendous importance for ensuring a successful and fun stay for the visitor. Although many visitors are busy with their scientific activities during their stay, there may also be time for interacting with other visitors. This social side of life on a research station is important for the well-being of visitors and may in addition add to the scientific side by allowing for sharing knowledge and experience and potentially develop new research collaborations. Introducing newly arrived visitors, scheduling research project presentations and arranging social events are ways of integrating visitors.

Visit phase information for visitors can include:

- Introduction meeting with individual visitors or groups of visitors upon arrival (see Visitor information – check list).
- Guided tour around the premises.
  - Facilities (e.g. toilets (always to start with), accommodation, dining/kitchen, workshop, laboratory space, workspace, library, sauna, leisure area and no go areas) and services offered at the station.
  - Introduction to the natural environment, relevant research sites and no go areas.
  - Emergency procedures.
  - Environmental policy and regulations (including water and electricity use, garbage handling, rules for field work, etc.).
- Site manual.
  - The natural environment, physical setting and climate regime.
  - The station and general activities
  - Land use plan (see also 1. Management plans and check lists.).
  - Policies and regulations (see Themes 1. Management plans and check lists. and 2. Policies).
  - Facilities and services.
  - Logistics (transport to/from station and in the field, freight, etc.).
  - Daily routines (including meals, information meetings, logistics, etc.).
  - Expected behaviour at station and in the field.
- Daily meetings during visit.
  - Regular information meetings (e.g. every morning/evening).
  - Introduction of newcomers and information on departing visitors.
  - Upcoming activities and events (e.g. maintenance operations, science presentations, social events, etc.).
  - Weather conditions and possible precautionary measures.
- Board with information on people at the station (staff and their role, and visitors and their projects) and activities. Photos are especially helpful for identifying specific people at larger stations.
- Ad hoc questions/requests from visitors.

- End of stay meeting/feedback.
  - To discuss the successfulness of the stay, receive visitor feedback and inform about reporting requirements and/or submission of publications related to the study.

Creating a good atmosphere at the station

It may not be straight forward to create a good atmosphere on a research station, but there are a number of issues that station management should be aware of. Visiting researchers are often dedicated and focus very much on their research objectives. It is therefore important that visitors are aware of conditions at the station and what facilities and services are offered there, and that staff are friendly and ready to provide help and assistance when needed.

Although work may take up much time, there will be spare time when visitors and staff can relax and enjoy themselves or the company of others. While the surroundings and hiking possibilities may keep some people happy, others may enjoy leisure facilities and entertainment at the station. Examples of leisure time activities includes sauna, books, movies, games, presentations by visitors, fitness machines, volleyball, badminton, basketball, football (soccer), horse shoes, tetherball, frisbee, baseball gloves, etc.

Providing visitors with an opportunity to present their work to others is often highly appreciated and may facilitate scientific and social interactions at the station. In fact, research stations are perfect sites for establishing inter-disciplinary cooperation. Some stations have short popular science talks once a week.

Conflict mitigation and mental health problems

Conflicts may arise between staff and visitors, or between visitors or groups of visitors. Conflicts may be related to research projects (e.g. land use conflicts), but may also be personal in nature (e.g. sexual harassment, disagreements, threats, mental health problems, etc.).

Although conflicts are rare, it is important to be prepared for them. This is best done by having clear behavioural guidelines that are communicated to visitors, clear rules for what to do if these are not followed and a clear decision making procedure with one responsible person. Following conflicts, it is important with proper debriefing of relevant staff and visitors to ensure that they know what decisions has been taken by station management and why in order to restore a good atmosphere at the station.

There are also examples of people with mental health problems coming to research stations, and their behaviour may potentially cause physical and psychological harm to other visitors. Station staff may not possess the skills to deal with such issues, but it is important to develop procedures for what to do in such cases. External assistance from back-office (owner institution) or a psychologist may be needed.

The application form can include elements related to mental health problems and can hence be a way of identifying applicants for whom additional information is required before they are granted access (see 5. Permit issues). However, this process may not identify all people with mental health problems, and hence it is important to be properly prepared for such situations.

Student groups should generally be considered less well-prepared than other researchers (or Ph.D. students) who stay at research stations for longer periods and have more previous experience. Student groups should therefore have a responsible course leader, who can prepare, guide and advice student to ensure a successful stay. Course leaders who know the students may also be aware of potential physical or mental health issues. Course leaders should not engage in irresponsible behaviour and it might be a good idea to draft guidelines for course leaders to make them aware of what is expected from them in relation to preparations and handling of students during the visit. (See also 10. Training and education)

Example of action guidelines for conflicts at the station:

Immediate actions

- Prevent the situation from expanding.
- Identify the person who should lead the process (e.g. the person with decision making power, possibly represented by the station manager if this person is not on the station).
- Gather information from involved parties (and share this with the person with decision making power).
- The person with decision making power will take a decision and communicate this to the involved parties (possibly represented by the station manager if this person is not at the station). External experts may be contacted to get advice on how to act in relation to people with mental health problems.
- Stay alert and identify people in need of emergency (and long-term post-emergency) emotional, psychological and potentially psychiatric support at the station.

Secondary actions

- Arrange logistics for expelled persons.
- Debriefing of all relevant people at the station and continued talks with conflicting parties until the atmosphere at the station is restored.
- Evaluation report. All conflicts and mental health problem experiences should be described and evaluated (preferably by all participants) to continuously improve guidelines, rules and procedures.

Example of a statement on dismissal - Toolik Field Station, Alaska, USA
(Large, remote station with road access)
'The station manager has the ultimate responsibility to remove from the station any staff member, contractor, or member of the scientific community if that person's behaviour creates a serious problem for the community. Persons will be asked to leave camp immediately if they engage in physical intimidation, sexual harassment, or behaviour that endangers themselves or others. Repeated infractions of camp rules may also result in expulsion from camp if these behaviours are not corrected after being brought to the perpetrator's attention.'

4.4 Post-visit phase

Post-visit information often relates to evaluation, reporting, settling of financial issues or sharing of data and publications. This can be done by e-mail, but, if complicated, phone calls may be useful.

A formalised questionnaire for visitors is a good way of receiving standardised information about what has been achieved and to receive feedback in relation to the stay at the station. This information can be used to continuously improve station management.

Many research stations require visiting scientists to provide a report, copies of reports and/or published papers (paper or electronic versions) for use in the station libraries and to document output from the station. This is often forgotten by researchers, and it may be necessary in some cases for station management to develop procedures for follow up on this issue.

4.5 Key considerations for station management

Handling of visitors

- Develop visitor information materials relevant for application and visit phases (for website or documents to be send or handed out) (see also 5.4 Application procedures and form for station access).
- Develop internal communication procedures on how you want to communicate with applicants and visitors, and what information should be communicated to the applicants/visitors in what phase (application phase, visit and post-visit), how it should be communicated (website, document, e-mail, phone, etc.) and by who (station managers, logistician, etc.) (see also Press and communication policy and 5.4 Application procedures and form for station access).
- Make a plan for how to welcome and integrate visitors (including what information should be presented).
- Make a plan for how to support visitors during their stay to help them achieve their research aims.
- Make a plan for how to evaluate visits and see people off.

Creating a good atmosphere at the station.

- See to create a good atmosphere at the station and among supporting staff. This can be achieved through various means, e.g. communication strategy, staff policy, facility plan, etc.
    - Develop visitor information documents and communication strategy that allow visitors to be well prepared and ensure that research objectives can be met (see also 5. Permit issues).
    - Hire staff with the right competences and social skills (see 3. Staff).
    - Develop station facilities and activities that provide people with leisure opportunities and stimulate interactions (both scientific and social).

Conflicts and mental health problems.

- Develop procedures and guidelines for how to deal with conflicts and mental health problems encountered at the station.
    - Formulate expected behaviour and inform staffs and visitors of this in relevant documents (see example from Toolik Field Station below).
    - Identify grounds and thresholds that will trigger dismissal of guests or staff.

- Develop clear decision making responsibility and decide on how decisions should be communicated to the visitor.

Examples

Example of visitor information - Zackenberg Research Station Greenland
(Small to medium sized, very remote station reached by chartered plane)
The website link below contains a number of documents intended for visitor use before, during and after visits. These includes a 'to do' list, application form, site manual, restrictions folder, relevant legislation, price list, logistics plan, packaging list and safety related documents.
www.zackenberg.dk/access/

Example of visitor information – NERC Arctic Research Station, Svalbard
(Small to medium sized, very remote station accessed by plane or boat)
The website link below contain information about the area, facilities and equipment, application process and form, preparations for fieldwork (including how to pack and safety issues) and logistics.
www.arctic.ac.uk/infrastructure/research-station/

Example of station description – Whapmagoostui- Kuujjuarapik Research Station, Canada
(Small to medium sized, easy access station located in a community)
Example of station description from small to medium sized station located in a community.
www.cen.ulaval.ca/en/page.aspx?lien=stationkuujjuarapik

Example of user guide - Sermilik Research Station, Greenland
(Unmanned, small and remote station reached by helicopter or boat)
An example of a user guide from an unstaffed, small and remote research station can be seen in User guide for Sermilik Research Station, Greenland.

Example of user information – Finse Alpine Research Center, Norway
(Small, easy access station accessed by train, van or snow machine)
An example of user information document including conditions for use of the stations, safety guidelines and permitting issues (including links to relevant authorities) can be seen in User guide for Sermilik Research Station, Greenland.

Example of general visitor guide for Antarctica – CONMAP
(Council of Managers of National Antarctic Programmes)
https://www.comnap.aq/Publications/Comnap%20Publications/comnap_guidelines_visitguide_1995.pdf

Station examples

4.1 Kolari Research Unit, Finland

(Very small, easy access station reached by road or train)
By Mikko Jokinen

Pre-visit information

Before visit it is essential for visitors to have a general overview about the station and its surroundings. The website is the primary source of information for potential applicants, but personal contact is important for matching the expectations of the visitor with the conditions at the station, and it is also the most effective and pleasant form of communication. Applicants that have additional questions concerning accommodation, permits, facilities, physical conditions, etc., can contact the customer manager, who can be contacted by e-mail or telephone.

Handling of visitors

If visitors arrive at the station within business hours, they will be shown around and introduced to buildings, accommodation quarters and facilities. Visitors have access to an office with desktop computers and internet. Visitors are also informed about the daily routines at the station such as food, use of entrance keys, etc. and they receive a visitor information document (see User guide for Sermilik Research Station, Greenland). If visitors arrive outside business hours an envelope with instructions and keys will be left in the mailbox outside the building. Usually visitors also have a local contact person who they can call if they encounter problems or specific and urgent questions arise.

During the stay visitors tend to work individually, but if they need assistance, station staff is there to help.

There are always permanent staffs at the station who can assist or advice visitors. During summer time there might be just a couple of persons available due to field work and vacation season. In that case, we try to arrange work practices to minimise implications for the visitors.

At present, there is no visitor feedback or reporting system which is something we need to improve. We also still do not have any kind of conflict mitigation or action plan which is a weakness. There has been one incident which showed that the station manager and the staff lacked knowledge and skills on how to handle a situation with a mentally ill visitor. These are therefore issues that we will need to address in the management of the station.

Integration of visitors

If visitors stay long (weeks, months), we have found a good way to integrate visitors by involving them in the organisation of recreational activities (e.g. hiking, parties, sauna-evening, etc.) together with members of staff. Individual workers have also asked visitors to join them and their families for dinner or other leisure time activities.

In order to create a god atmosphere at the station, you need to be welcoming towards visitors and make them feel as full members of the community at the research station. Personal characteristics play of course a great role, and are something that needs to be considered when hiring new staff.

4.2 Abisko Scientific Research Station, Sweden

(Large, easy access station reached by road, bus or train)
By Christer Jonasson

Pre-visit information and application handling

The planning of the Abisko field season starts with an announcement on the possibility to apply for accommodation/working place at the Abisko Station. This is sent out broadly to Swedish and European Universities, previous guests and relevant web portals. We announce in February and have dead-line for applications on April the 1st. We try to inform visitors if they will be granted access to the station before May the 1st. Normally, we do have several e-mail/telephone contacts with potential/future visitors up to the deadline.

We do not see a huge need for active transferring of information to the visiting scientists before they have applied for coming to Abisko. Most of the relevant information is available on the homepage and we expect potential visitors to seek out the relevant information here.

After visitors have applied for coming to Abisko, station management evaluates the applications. This evaluation is mainly related to scientific quality but also to assess if the project is feasible for practical reasons. We also try to establish links between related projects, both for synergy effects and to prevent redundancy. During the evaluation of the applications we will identify what strengths and weaknesses the different projects represent. The application form is designed to detect special needs, risk for environmental impacts, needs for permits, etc.

Handling of visitors

New researchers/research groups are taken care of by station staff. Visiting scientists that have been at the station before do normally take care of themselves to a very large extent. Over the last decades we have encouraged visiting scientists to be as independent as possible. What we (with big success) mainly have offered is access to the surroundings, science support by our lab and technical staff, and research cooperation.

Normally we do not have specific safety training courses. We inform visiting scientists (in an information package, see Abisko Scientific Research Station (ANS)) about the risks associated with working in the sub-Arctic. We encourage them to note on a public designated board where and when they are conducting fieldwork at distant locations. However, we are clear in communicating that they stay at Abisko Station on their own risk and responsibility, and that they are being sent out by their home universities/research institutes.

We consider our visiting scientists in the same way as a hotel regards its guests. We are responsible for their stay within the station area, but their field work is carried out on their own risk and responsibility.

We request visiting scientists to send in copies of scientific papers.

Integration of visitors
In accordance with the strong Swedish tradition 'fika' (coffee/tea-break), all staff and available visiting scientists normally meet at 10 AM. This is a great chance to meet staff and other researchers in an informal way, and this has been a great success. During the last years we have also started a lecture series on Thursday evenings where visiting scientists present their projects in a popular science way.

4.3 Bioforsk Svanhovd, Norway

(Large, easy access station reached by road)
By Lars-Ola Nilsson

Pre-visit information
Good communication is important throughout the whole process from preparations, implementation and post-visit reporting. As part of the preparations, it is important for the hosting field station to understand the main aims of the project, including which ecosystems and organisms that would be sampled, where, when, necessary treatments, etc. Knowledge of these issues allows station management to set the timing of the visit and plan the visit. Logistics (accommodation, use of facilities and transportation) needs to be solved before the exact dates for the visit is set. Needs for laboratory space, equipment, chemicals, transportation to field sites, etc. should also be taken into consideration to avoid overcrowded labs, reduce travel costs, etc. Most of the communication is handled by e-mail, but some phone calls should be included as well in order to solve potential problems and to avoid misunderstandings.

A good written presentation of the station is very important and should be available on the web. The obligation for visiting scientists to acknowledge the host station in publications should be clearly stated, and that possible co-authorships are agreed upon in advance.

Handling of visitors
Upon arrival, station staff provides primary information about accommodation, meals and other basic services. This introduction should also include information on emergency routines. We try to inform visitors about risks and how to handle them, e.g. we give advice on how to behave if brown bears are encountered during sampling tours, etc.

We aim at having an introduction meeting about the research soon after arrival to find out the exact aims and needs of the visitors, e.g. where to find relevant species and ecosystems. At this meeting we also try to solve practical questions related to the stay at the station.

The best way of preventing conflict is to have a good communication all the way from the preparations and throughout the stay at the station. The only 'conflicts' we have experienced so far is that host personnel

sometimes are busy with other tasks and cannot be available immediately to solve problems and support the visiting researchers.

When the stay is about to end, we try to have a sum up meeting to sort out the impressions from the stay, remaining things to be solved, etc.

Integration of visitors
It is important with good communication between hosts and visitors. It is very important that personnel at the station are available for information and for instant solving of practical issues (either in person or via phone). A good introduction and regular meetings, e.g. every morning, are highly useful for creating a good and relaxed atmosphere.

The visit of researchers from different institutions and countries provides unique possibilities for networking and contact establishments and sometimes for development of new project ideas. Informal discussions are important, but more formal scientific meetings at which researchers are encouraged to present their project, research, etc. is also recommended. The value of such knowledge transfer should not be underestimated and may be very useful for both the visitors and the staff at the station, and also highly important for potential further network building and collaborations.

5. Permit issues

5.1 Introduction

Access to arctic and northern alpine research stations and permission to conduct research or monitoring projects in the surrounding area often necessitates permits from the station and sometimes also permits or dispensations from authorities (due to national and local legislation). Authorities may require permits for specific activities (e.g. handling of wildlife, export permits, sample collection, installations, etc.), access to specific areas (e.g. remote or protected areas) or visa for foreign nationals. National legislation and the research stations themselves may also describe conditional requirements for working in the area (e.g. compulsory safety equipment, insurance, means of communication, etc.).

In addition to the legal requirements, the research station may develop additional conditions for access in order to address health and safety risks and to ensure that activities are carried out in line with the vision, mission, concept, strategy, policies and regulations developed by the research station. Furthermore, granting of access and conditions for access may be influenced by previous and present monitoring and research activities in specific research areas (e.g. areas used for manipulative and extractive activities, for long time-series, by other projects or as reference areas).

As stations are subjected to different national legislative regimes, logistical challenges, environmental and climatic conditions, hazards, risks, etc., the need for information and conditional requirements for access differs between stations. The permit system (application form and procedures) therefore needs to be developed to meet the specific requirements at the individual stations. However, stations subjected to the same legal regime or located in similar environments can inspire and learn from each other.

In addition to formal permitting systems, researchers should be aware of and sensitive to subsistence hunting or other activities conducted in or near the communities where they may wish to work. These may or may not be addressed with written permits. Where research projects may interfere with local activities, it is recommended that projects are discussed with community representatives or coordinating groups to ensure acceptable timing, space use and effect levels of activities.

In this theme, you can read more about the following sub-themes:

5.2 National legislation and permits.
5.3 Communication with authorities.
5.4 Station access application form and procedures.
5.5 Communication with applicants.
5.6 A geo-referenced project management tool.

5.2 National/regional/local legislation and permits

National/regional/local legislation may regulate access to an area by requiring permits for specific types of activities and access to specific areas, and by stipulating rules and regulations for working in the country or parts of the country (e.g. protected or remotely located areas). Projects applying for access to research

stations in the Arctic and in northern alpine areas may therefore need one or more permits from authorities depending on the type of research and the areas in which it is conducted (e.g. protected area or remote area with specific legislation). Note that some national legislation is directly linked to the implementation of international agreements (e.g. the Convention on Biological Diversity (CBD)[4], the Conventional on International Trade in Endangered Species of Wild Fauna and Flora (CITES)[5], the Convention on Wetlands of International Importance (RAMSAR)[6], etc.).

National/regional/local legislation of relevance for scientific activities at research stations includes:

- Regulations for access to remote or protected areas (e.g. CBD and RAMSAR).
- Regulations for specific research activities (e.g. manipulation studies, handling of wildlife, sampling of species/soil/rocks/genetic resources, etc.).
- Regulation of import/export of species/soil/rocks/genetic resources (e.g. CBD, and, CITES).
- Regulations for setting up infrastructure/equipment (e.g. area allotment).
- Regulations or conditional requirements related to health and safety aspects of working at the station or in remote areas (e.g. need for insurance statement, health statement, compulsory communication equipment and related permits, firearm permit, etc.).
- Visas for (some) foreign nationals.

When permits are required by authorities, stations can:

- Let the applicant obtain required authority permits. An access permit to the station can be made conditional of the applicants obtaining relevant authority permits.
- Offer to obtain (all or some of) the required authority permits on behalf of the applicant.

Stations should therefore:

- Be familiar with national legislation that necessitates permits from authorities to be able to inform applicants of what permits they need to obtain, or to ensure that the station receives the information needed to apply on behalf of the applicant.
- Stations should be able to provide advice to applicants on where to find relevant legislation. Information is often available on government websites in the form of legislation, guidelines, cover letter or as website information.
- Be aware of authority permits requirements and continuously keep updated on legislative developments and engage in an open dialogue with authorities by exchanging information on application contents and procedures.
- Early in the application process, inform applicants of which permits they need, as time may be an issue in relation to obtaining multiple permits.
- Avoid time constraints when handling applications. Many stations have set deadlines for applying allowing time for internal application handling and obtainment permits from authorities.

Notice that some permits may be subject to an application fee and that this should be communicated to the applicants.

[4] http://www.cbd.int/
[5] http://www.cites.org/
[6] http://www.ramsar.org

See example of national, regional and protected area guidelines for research expeditions (Canada and Greenland) in Theme 5 examples.

5.3 Communication with authorities and local communities

It is important that stations are familiar with national legislation and engage in a good and constructive dialogue with authorities to be able to provide relevant advice to potential visitors and ensure that all national legislation requirements are met.

Establishing good communications with authorities may provide opportunities to exchange information on the contents and usefulness of existing or planned legislation and related procedures. Regular contact with relevant authority staff may also make it easier to enquire about and get a better understanding of legislative elements and authority decisions. It may also be useful for getting information on new and revised legislation or procedures that need to be incorporated into station management procedures and forms. This is also a precondition for being able to provide relevant advice to applicants on issues related to national legislation.

Where research activities may interfere with the activities of local communities, stations should also develop a mechanism for communicating with relevant representatives of these communities to avoid conflicts with subsistence activities. This can be through information meetings with relevant stakeholders, public meetings, advertisements (in shop, offices, local newspapers, etc.), etc. One example is the oral presentation of proposed research activities on the sea ice during springtime near Barrow, Alaska to the Barrow Whaling Captains Association for their concurrence and agreement on conflict avoidance. Other sensitive activities may include caribou hunting/reindeer herding, seal hunting, and fishing which may be formally governed by permitting agencies but also locally managed by more informal groups.

5.4 Application procedures and form for station access

The application procedure and the content of the application form depend on national legislation, local station rules and station information needs, and hence may differ significantly between stations.

The application form used for station access applications range from simple requests by e-mail through filling in forms to fully GIS integrated web application systems (see 5.6 GIS based project management tool (WP7 contribution) and Theme 5 examples). As national legislative requirements, logistics and environmental conditions differ between stations, each station needs to develop application form and procedures that are relevant to the local context.

The application procedure should include four main elements:

a) Visitor information and application guidelines for applicants.
b) Internal application handling procedures for station management.
c) Application form and required documentation (e.g. authority permits/dispensations, insurance statement, medical statement, etc.).

d) Permit or user agreement.

Application systems (both form and procedures) should integrate conditional requirements and required permits stipulated in national legislation. How much this affects the station access application system depends on who should obtain authority permits (the station or the applicant). If permits are obtained by the applicant, station management only need to incorporate information elements in the application form that allows them to provide advice on what permits need to be obtained in relation to the specific project. The system also needs to allow sufficient time in the internal application handling procedures that enable the applicants to obtain authority permits. If permits are obtained by the station, authority application form contents and procedures needs to be fully incorporated into the station access application form and procedures. (See also 5.2 National/regional/local legislation and permits)

Providing relevant information about the conditions at the station and clear guidelines for applicants, including description of required permits and guidelines for filling in application forms, can save a lot of time for station management, as well-informed applicants tend to ask fewer questions and are better prepared for the conditions at the station (see also 4. Visitors). Ensuring adequate information through the application form is also a prerequisite for station managers to be able to provide relevant advice and service to visitors, ensure that national regulations are complied with, minimise health and safety risks and provide the best possible frame for a successful stay at the station. It is also worth remembering that all members of a research group need to be properly informed and prepared for the visit, not only the applicant. At many stations, it is the responsibility of the principal investigator to make sure that other group members have received and read all relevant documents (e.g. visitor information and permits/user agreement).

It is, however, also important that application form contents and procedures are kept simple to avoid collection of excessive information that is not used by authorities or the station manager.

The costs associated with handling of permit applications may be covered by the owner institution or included in a possible access fee depending on the financial situation at the station. Note that authorities may also demand a fee and in the case where stations obtain authority permits on behalf of the applicants, this should be taken into consideration when setting the costs.

It is important to keep a record of research activities at the station as these may impact the planning of new research and monitoring projects (e.g. certain studies may want to avoid previously manipulated or sampled areas). A fully GIS integrated system is preferred as it includes a database that allows managers (and potentially applicants) to easily track historic information of activities on spatial and temporal scales, enabling them to prepare accordingly and to ensure the highest quality of the planned research or monitoring activities (e.g. by knowing spatial distribution and temporal records of manipulation studies and collections) (see more in 5.6 GIS based project management tool (WP7 contribution)). Examples of application forms are provided below, in Theme 5 examples and in Appendix 5 – Permit issues.

Application guidelines for applicants

Guidelines for applicants should describe the application procedure to be followed by the applicant and specify what is meant under the different elements of the application form. The procedure should include a stepwise description of procedures to make it clear for the applicant what actions are required when.

Key Information needed to develop application guidelines for applicants:

- Identify application procedures for national permits and decide for each type of permit who should obtain it (the station or the applicant).
- Identify internal screening and evaluation procedures for station access applications.
- Develop procedure for how to communicate with potential applicants (see also 4. Visitors).

Key steps in application procedures for applicants:

- Consult the website of the station to read about station facilities, environmental conditions, research, application procedures and health and safety aspects of working at the station to facilitate planning of the proposed project.
- Contact the station administration to discuss the feasibility of the proposed project in relation to the conditions at the station, logistics, safety risks and possible additional permits required by authorities. In some cases this step should be accomplished prior to submitting a formal research proposal to a funding agency. The Station Management may be able to provide a Letter of Support acknowledging feasibility to strengthen the proposal.
- Fill in application form and gather all relevant documents to be submitted with the application.
- Sign and submit the application form (and if relevant pay possible access fee).
- Apply for additional permits required by authorities (if this is not done by the station). Note, that some authorities require a station permit number, before applications can be submitted.
- Respond to possible feedback from the station/authorities.

Application handling procedures for station management

Stations should develop internal application handling procedures to ensure standard processing of incoming applications. These need to be in line with the application procedures for applicants and application procedures for authority permits obtained by the station, but they need also to include steps relevant for internal evaluation of the applications (e.g. evaluations made by scientific leader/board, logisticians, etc.).

The station should identify relevant application handling processes, and clearly describe required actions and responsibilities of involved parties (applicant/station management/boards) related to the different steps in the internal procedures.

It is important that stations early in the application process inform applicants of what permits they need to obtain from authorities and which they can obtain from the research station. As time may be an issue in relation to obtaining multiple permits, many stations have fixed deadlines for applying for access that allow sufficient time for internal application handling procedures and for obtaining required permits from authorities.

The application handling process may include procedures for i) the initial contact (before application is received) and ii) application handling procedures.

Initial contact (before application) – key actions can be:

- Respond to enquiries from potential applicants (be welcoming, polite and respectful, but also direct in relation to conditions at the station).
- If possible, take direct contact to applicants (meeting or phone) to discuss in more detail the suitability of the proposed project.
- Direct potential applicants to relevant information sources on the website (e.g. station information, application form and guidelines, national legislation, etc.) or send relevant documents by e-mail (see also 4. Visitors).

  There may be extensive communications with potential applicants before an application is submitted. While it may require additional work for station management, it is important to ensure that the applicant is fully aware of the situation and conditions for working at the station, and that the proposed study is feasible (see also 5.5 Communication with applicants)

Application handling – key actions can be:

- Go through the application to see if it has been filled in correctly and identify possible missing information/documents.
- Identify additional permits required by authorities for the specific research project.
- Acknowledge that you have received the application, and if needed inform about missing information/documents and what additional authority permits the applicant need to obtain and where these can be obtained.
- Collate information needed to apply for authority permits (that the station will obtain on behalf of the applicant) and submit these to relevant authorities.
- Send proposed study for internal evaluation by scientific leader/expert/science board/logistician/etc. to evaluate the suitability of the proposed project in relation to vision, mission, concept, strategy, land use plan, facilities, logistics, scientific quality and conditions at the station (natural environment and climate), etc.
- If the internal evaluation identifies problems of a proposed study that require significant changes to a project, station management should contact the applicant to discuss how the issue can be dealt with. If needed, resend the application through the internal evaluation system. If only minor problems are encountered these may be solved by adding conditional requirements to the permit/user agreement.
- If the authorities identify problems with a proposed study, applicants may be informed that the application has been approved with some binding conditions. This should be communicated to the applicant. The applicant may also be asked to address identified problems and resubmit the application. If station management obtain permits on behalf of the applicant, station management should contact the applicant to discuss how the issue can be dealt with, and, if needed, resubmit the application to the relevant authority.

Approval of applications

- For approved projects, send letter of approval including all relevant permits to the applicant (including conditions added by authorities or the internal evaluation process). Stations may grant access permits on the condition that relevant authority permits are obtained by the applicant or that certain conditions are met (e.g. obtaining of additional permits required by authorities, incorporate recommendations of scientific board/leader, respond to logistical recommendations, etc.). If additional conditions are added to the permit by the station or authorities, these should be communicated to the applicant prior to arrival in the permit/user agreement or a separate document.
- Tell applicant (Principal Investigator, PI) to inform other project participants on the conditions at the station (including permit contents, requirements and conditions, rules and regulations, climate, etc.), so they can prepare appropriately for working at the station (see also 4. Visitors).
- Inform applicants of logistics related to the visit (and whether this is taken care of by the station or the applicant).

Application form

Application forms are used to collect all the necessary information that enables the station to:

- Document that conditional requirements for access are met by applicants (based on national legislation and regulations and conditions developed by the station).
- Evaluate the feasibility of applied projects (e.g. to assess scientific relevance and quality, logistical setup, environmental impact, and health and safety related aspects) and ensure that activities are conducted in line with the vision, mission, concept, strategy and policies of the station.
- Identify (and possibly obtain) required permits from authorities and ensure that activities are conducted in line with national legislation.
- Collect project meta-data to a database of spatial and temporal land use that may influence future research and monitoring efforts.

Many research stations require that applicants comply with certain conditions for access. In order to meet these conditions, applicants may be asked to obtain specific documentation (e.g. radio license, medical statement, insurance statement) or agree to meet certain conditions in the application form (e.g. read user agreement or provide end of field work report). By requiring the applicant to sign the application form, you ensure that the applicant legally accepts these conditions (although this may not apply to all countries). Note that some stations require a hand written signature on the application form as only this is considered legally binding in some countries. The need for this may, however, differ from country to country and institution to institution.

There may be some information on the application form that should be treated with confidentiality, especially information on people's health. Stations should state what information will be kept confidential and what may be made available to others (e.g. project meta-data and principal investigator contact information). This should be stipulated on the application form or in related guidelines.

Key information needed to develop the application form:

- Identify information needs for station management to be able to evaluate the suitability of applied projects (including approval of science, logistics, setting up equipment or constructions, health and safety issues, etc.).
- Identify application information needs for national permits that are taken care of by the station.

Key elements of an application form:

- Application submission address or e-mail.
- Information on applicant and research group members (including nationality, education/position, institutional affiliation, contact details, next of kin contact details, experience, health and if relevant billing address).
- Information needed by the station to evaluate the suitability of the proposed research project (in terms of scientific relevance and quality, logistics, health and safety risks, environmental impacts, etc.). This can include information needed to:
    i. Evaluate whether the proposed research or monitoring projects are in line with the vision, mission, concept, strategy and policies of the station (e.g. project description).
    ii. Evaluate the scientific relevance and quality of the proposed project (e.g. project description).
    iii. Evaluate the environmental impacts of the project in relation to the vision, mission, concept and strategy of the station (e.g. risk assessment) (see also Themes 6. Health and **safety** (disclaimer, insurance, emergencies) and 7. Environmental impact of station operations).
    iv. Identify location, dates and type of activities to assess potential conflicts with other projects at the station (spatial or temporal land use conflicts or overlapping research themes).
    v. Assess the feasibility of the project in terms of logistics (arrival, departure, means of transport to/from the station and in the field, activities in the field, accommodation, freight, etc.).
    vi. Assess the feasibility of the applied project in relation to health and safety risks (e.g. compare experience and preparedness to risks of the specific activities included in the applied project).
    vii. Assess documentation of conditional requirements for access to the station (e.g. insurance statement, medical statement, authority permits and equipment).
- Information that enables station management to identify possible additional permits required by the applicant (and possible information needed to apply for these, if this is done by the station).
- Signature of applicant.

If needed, leave space for evaluative comments by station management on the application form.

See generalised example of application form in Appendix 5 – Permit issues based on best practise examples in Appendix 5 – Permit issues.

Permit or user agreement

A station may require that visitors sign a document stating that they are familiar with conditions and regulations at the station. This can be done as part of the application form or as a separate user agreement (paper). Such documents should be signed prior to or immediately upon arrival.

A permit should be issued for the approved projects. Permits may include a standard text approving the applied project, stipulating standard conditional requirements and if needed supplemented by additional conditional requirements requested by station management or authorities.

Additional authority permits obtained by the station should be attached to the permit. Permits can be made in PDF format (or similar) to make it more difficult to make changes to the issued permit. The applicant should be able to show the required permits to relevant authorities and station management upon request.

5.5 Communication with applicants

Detailed information about the conditions at the station and a clear description of application procedures are very important, as well-informed applicants tend to ask fewer questions and are better prepared for the conditions at the station. A good dialogue before, during and after the visit is important and personal contact is recommended in the pre-application phase as this establishes a closer relationship between the applicant and the station, and help synchronise expectations.

When operating stations in harsh and remote environments, it also require stations to be direct in communicating relevant health and safety aspects at the station (see also 6. Health and safety (disclaimer, insurance, emergencies)) and engage in discussions on the feasibility of the proposed study. This will help ensure a good match of station and visiting scientists.

How a station communicates with and treats applicants is part of a stations identity and may impact how attractive a research station is to researchers. Clear procedures for handling applicants and visitors may help ensure this is carried out in line with station ethics and policies (see 1.4 Check lists, 2. Policies and 4. Visitors). The expected processing time should be communicated clearly to applicant as these can be long and non-flexible, especially if stations obtain authority permits on behalf of the applicant.

It is important that applicants (and other stakeholders) can get in contact with the station at all times. It is therefore advisable to have an institutionalised e-mail address (e.g. info@'station name'.com) that can be accessed by the relevant staff member on duty.

A procedure for communicating with applicants may be divided into three phases: Pre-visit (enquiry and application phase), visit and post-visit (see also 4. Visitors).

Pre-visit (enquiry and application phase)

The stations can provide a lot of information on the web-site that allow applicants to learn about the station, environmental conditions, previous research, health and safety issues, conditional requirements

and application procedures etc. It is important that relevant information is kept up-to-date and accessible to ensure a successful stay at the station. Ask the applicant to read the relevant information sources, arrange phone/personal meeting (if possible), respond to requests and continue dialogue as long as needed.

While many issues can be dealt with by providing information on the web and via e-mail, direct communication (meeting or phone call) is the best way of ensuring a good match between the applicant and the station. Station management can initiate this (if this is not done by the applicant) to show that enquiries are handled professionally. Direct communication allows station management and applicant to discuss in more detail the suitability of the proposed project, and it allows the manager and applicant to address and discuss uncertainties about application procedures and conditions at the station (e.g. application procedures, compulsory documents and equipment, station facilities, health and safety risks, existing back ground data, other science programmes of relevance to the project, etc.).

Visit

When researchers arrive at the station they should be welcomed by staff, provided with relevant information/training courses, and given a personal tour of the station and its facilities. If relevant, station management can also request to see that permit requirements have been met by the visitors. It is important to have regular contact with visitors and to make it clear to them that they can always come to staff with practical and emotional issues. Regular contact will make visitors feel more at home and ensure a better integration at the station. If necessary, some information can be communicated via e-mail or boards.

Post-visit

Post-visit information often relates to evaluation, settling of financial issues or sharing of data and publications. This can be carried out by e-mail, but, if complicated, phone calls may be useful.

5.6 GIS based project management tool (WP7 contribution)

Remotely located research and monitoring stations like Abisko Scientific Research Station (ANS) have double responsibilities in hosting research and monitoring activities as well as the associated visiting scholars. The scholars typically apply for allowance to conduct research at the station by filling in an application form that is managed by station personnel. After evaluation and eventual approval of the application, scholars are lodged at the station while the project applied for is being conducted. In most cases, the resulting data are thereafter brought away from the station for post-experimental processing and publication. The station legacy of the project is typically an archived application form, publication references and a diffusively expanded knowledge-base.

The situation depicted above is quite generic and applies, more or less, to many remotely situated research and monitoring stations. As time goes by, archived application forms, publication references and knowledge accumulate at the station, and, ultimately, at the far side of the historic record, are facing the possibility of being forgotten. With quite large numbers of scholars annually visiting a typical research and monitoring station, several hundred at some stations, the total amount of information passing by in the form of applications, publications and diffuse knowledge is large. When conglomerates of stations are

considered in-common, like all terrestrial research and monitoring stations across the Polar region, the amount of information is immense.

Whether single stations or conglomerates are being considered, station planning necessarily rests on the experiences gained through, and reflected in, the record of past and current activities. By considering the record, latent as well as redundant research and monitoring activities may be identified, synergies across activities may be exploited, grounds affected by previous activities may be detected, etc. In order to utilise the record of gained experiences for decision support, it needs to be organised into a metadata catalogue that provides decision-support functionalities. With station-based research and monitoring activities typically being performed in a geo-referenced context, the associated metadata is geo-referenced with the desired decision-support functionalities operating on geographic topologies. In other words, a geographic information system (GIS) is required for utilisation of the record of past and current activities for station administration. With the Abisko Scientific GIS, such a system is provided for administration of the Abisko Scientific Research Station. Since the system is generically designed, it is open for any station that wishes to take advantage of its functionalities while simultaneously sharing the station record of activities with the rest of the world (although sharing metadata is optional).

The Abisko Scientific GIS [7] is offering the following main functionalities:

1. Text- or map-based query for current and historic research and monitoring projects.
2. Web-based visitors' application form.
3. Tools for semi-automated management of projects and visitors.
4. Tools for querying and managing publication database – integrated with system database.
5. System management, including PI accounts for database editing.

System specification

The system is, per definition, a web-based geographic information system. The associated functionalities are hence map-based and supportive of spatial input, editing, storage and analysis. Its services are given within five main application areas:

1. Historic database
   Metadata information regarding past and current research and monitoring activities are digitised and made publicly available. The database may be queried either per text or geographically per an interactive map covering the area of station activities. The theme of the back-drop map may be adapted to suite the query theme.

2. Electronic application form
   A tool for harvesting new metadata regarding the intended activities of visitors. When used as a compulsory prerequisite for entering the station, it continuously adds new metadata to the historic database, thus breathing life into the system. Essential for system survival.

3. System/station administration
   Tools for station management are easily linked to the basic facilities described above. The system hence contains tools for automatic hostel reservation and billing, where additional routines for

[7] www.abiskogis.se

things like annual reporting and economic assessment are easily added. The system may be tailored according to individual station-administrative requirements – anything goes.

4. Publication database
   The stations publication database is an integral part of the system, where publications are linked to the metadata catalogue and available for integrative query.

5. Routines for verification of data
   Metadata regarding research and monitoring activities should be verified by the principal investigators (PI) prior to publication. The system is highly supportive of such verification, and provides individual PI accounts for database editing and verification.

In addition to its built-in services, the system contains:

- On the server side
- The system is securely hosted at a highly specialised web-hotel that offers managerial services per hourly fee. The hosting fee is approximately 50 EUR annually, and may be shared across user stations.
- Education
- The training of system managers is administrated by the Swedish University of Agricultural Sciences.
- Documentation
- Full system documentation is due to December 2014.
- Expansive
- The system is ultra-flexible and open for adaptation to the special needs of individual stations – it is built on OPEN-philosophy
- Compatible
- The system is INSPIRE-compatible [8] and will eventually contain the map-services provided by the Arctic SDI [9].

Migration – inclusion of additional stations

Our goal is to suggest the system as a standard shared by INTERACT stations. The prototype has been developed at the Abisko Scientific Research Station where it will be taken into use in 2013, and thereafter we aim at migrating it throughout a selection of INTERACT stations. The inclusion of additional stations is made in the existing system, with minor additional programming being required. However, if station-specific historic metadata should be included, station resources are required for the associated inventory and digitisation.

With several stations included in the geographic metadata catalogue, queries regarding past and current activities may be conducted either within or across stations. This would provide the important possibility for individual stations to consider the activities of others in the planning and administration of research and monitoring activities.

[8] http://inspire-geoportal.ec.europa.eu/
[9] http://arctic-sdi.org/

Research on environmental informatics

Being devoted to quite basic research, the system developers (at the SLU department of Energy and Technology) overall intention is to study *the effects* of introducing a geographic metadata catalogue across research and monitoring stations. Our interests focus on whether system usage improves the cost effectiveness with which stations are managed and, ultimately, our prospects to understand environmental change.

Typical development and implementation procedures

In order to join the geographic metadata catalogue, prototyped at ANS, with a typical research and monitoring station, the following is required:

- Station-specific inventory of administrative procedures and of activities/monitoring database
- *In close collaboration with system developers*
- Digitisation of database
- *Labour intensive with total extent depending on the amount and format of data*
- Adaptation of existing web-based system (the Abisko Scientific GIS) to multi-station functionality
- Relatively small programming task – specialisation of the system developers is required
- Adaptation of resulting web-based system to station-specific metadata profile and administrative routines
- *In close collaboration with system developers*
- System implementation
- In close collaboration with system developers
- In-place training
- *In close collaboration with system developers*

There is an important choice to be made with the end-product, namely to decide whether queries regarding research and monitoring activities should be made station-specific or jointly together with other stations. If the latter is preferred, the system is touching upon fundamental strategies for national as well as international metadata dissemination.

Typical time-plan for system development and implementation

The constituents of the generic time plan given in *table 5.1* serve as project milestones, and are typically subject to consecutive reporting of development and implementation status. Constituent 6, System documentation, is typically delivered in the form of a written document. In brief; the inclusion of additional stations to the geographic metadata catalogue prototyped at ANS is typically programmed during project-year 1, and taken into active usage at the initiation of project-year 2 activities.

Indicative costs for system development and implementation

In the list of typical development and implementation procedures given above, all procedures that involve hands-on collaboration with system developers require a budget. The procedure of digitising historic metadata may be performed in-house, without much external contribution. With the associated work-load depending on the amount and format of station-specific historic metadata, the (in-house) budget of this relatively time-consuming task is difficult to estimate. However, based on experiences with a Swedish

station that wishes to join the system, 40.000-70.000 EUR per station might be an adequate indication of the total costs.

Table 5.1. *Typical time-plan for system development and implementation.*

1. Basic system development:								
2. Analysis of user requirements:								
3. System adaptation:								
4. System implementation:								
5. In-situ education:								
6. System documentation:								
Quarter:	1	2	3	4	1	2	3	4
Year:	1				2			

5.7 Key considerations for station management

National legislation and permits

- Identify what types of permits are required from the authorities (e.g. radio license, area allotment and research related permits like permits for sampling of genetic resources, handling of live animals, collection of plants, etc.).
- Decide for each type of permit who should obtain it from the authorities (the applicant or the station manager).
- For permits obtained by the station, identify procedures and information needs and incorporate these into the station application procedures and form.
- For permits obtained by the applicant, provide link or contact information to authorities. A station may decide to provide information on procedures and information needs for authority permits as a service to the applicant.
- Identify conditions stipulated in national legislation and incorporate these into visitor information documents and application form(s).

Communication with authorities

- If relevant, develop a procedure for communicating with authorities (e.g. when meetings, phone or e-mail contact should be initiated).

Application procedures, forms and permits

- Develop information materials (see 4. Visitors) and application guidelines for applicants (including description of application procedures and guidelines for filling in application forms) and incorporate relevant procedures for obtaining authority permits.
- Develop internal procedures for handling applications (including communications with applicants, evaluation procedures at the station and handling of possible authority permit applications). Allow sufficient time in the procedures to obtain authority permits regardless of whether this is done by the station or the applicant.

- Develop application form and incorporate relevant elements from national legislation.
  - Identify what information is needed to evaluate research applications at the station (including legislative requirements and information to assess scientific quality and feasibility of proposed study).
  - Identify additional permits or documents required by station management or authorities for the different types of projects/activities undertaken at the station and decide who should obtain these (the station or the applicant) (see 5.2 National/regional/local legislation and permits). If a station decides to apply for additional permits from authorities on behalf of applicants, the station should, for all relevant permits, identify application procedures and information needed to apply, and incorporate these into the stations application form and procedures. If permits are obtained by the applicants, station management should be able to inform applicants about what permits are needed for their specific study and where these can be obtained.
- Develop standard permit or user agreement. Station management should be able to stipulate additional conditional requirements in the permit or as a supplement to the user agreement (as demanded by station management or authorities).

Communication with applicants

- Describe how you want to communicate with applicants (formulated as a policy or in an internal application procedure document).
- Identify what information should be communicated to the applicants, in what phase, how and by who (formulated in an internal application procedure document) (see 4. Visitors).

Examples

Examples of application forms

Abisko Scientific Research Station, Sweden
(Large, easy access station reached by road, bus, or train)
Electronic application form (see link below or Appendix 5 – Permit issues)
http://www.abiskogis.se/appmessage.php

Oulanka Research Station, Finland
(Very large, semi-remote station reached by road)
On line room reservation system (see link below)
https://webcgi.oulu.fi/oulanka/j/index.php/en/?task=viewproperty

Application form template to be pasted into text processing programme and then filled in (see Appendix 5 – Permit issues). Application guidelines for research in protected area (see Appendix 5 – Permit issues)

Finse Alpine Research Center, Norway
(Small, easy access station accessed by train, van, or snow machine)
User registration and application form (see Appendix 5 – Permit issues). Available upon request from station management (not available on the website).

Station information on permits for environmental interventions (see link below).
http://www.finse.uio.no/user-information/rules-and-regulations/permits/

Zackenberg Research Station, Greenland
(Small to medium sized, very remote station reached by chartered plane)
Application form including information needed to apply for expedition permit and inform applicants of additional permits they need to obtain for their specific study (see Appendix 5 – Permit issues).
Application form and associated appendices are available on the website (see link below).
http://www.zackenberg.dk/news/the-2013-field-season-at-zackenberg-research-station/

Samoylov Research Station, Russia
(Small very remote station reached by helicopter or boat)
Medical examination form.
http://www.awi.de/fileadmin/user_upload/Institute/General_Services/Logistics/Standardformulare/AWI-MedExam.engl.Vers.5-2009.pdf

Examples of authority permits and guidelines

National guidelines for researchers - Greenland
Example from Greenland of a cover letter describing national legislation, including additional permits, application procedures, compulsory information, documents and equipment and relevant regulations for research expeditions (not specifically to research stations, but for field work in remote areas).
http://naalakkersuisut.gl/en/About-government-of-greenland/Travel-activities-in-remote-parts-of-Greenland/Procedure-and-forms

Regional guidelines for researchers - Canada (North-West Territories)
A Canadian example of guidelines for access to the North-West Territories; *Doing Research in the Northwest Territories - A Guide for Researchers* (see below links). The guide is regularly updated by the Aurora Research Institute and focuses on research that requires a Scientific Research License, issued by institute. The publication also serves as an introductory manual for all other types of research and research-related licensing and permitting in the Northwest Territories.
http://www.nwtresearch.com/docs/guide/doing-research-in-the-northwest-territories.pdf

Guidelines for applying can be seen at below link.
http://www.nwtresearch.com/docs/researchers/2011/04/05/researchers-guide-to-polar.pdf

Protected area permits and guidelines for researchers - Canada
Parks Canada research and collection permit system, including guidelines, conditions and on line application system (see below link).
http://www.pc.gc.ca/apps/rps/page1_e.asp

6. Health and safety (disclaimer, insurance, emergencies)

6.1 Introduction

The health and safety of staff and visitors must always have first priority. Operating a research infrastructure in arctic or alpine areas is often challenged with extreme weather, challenging terrain, difficult transport and communication, long distance to medical facilities/doctors, etc. Any emergency situation or rescue operation in remote areas can put the lives of visitors, station staff or the emergency rescue team at risk. Therefore, everything should be done to prevent such situations from occurring.

Research stations should develop safety procedures and provide them in writing for all users of the facility. Arctic research stations are subjected to the same health and safety risks as stations in more temperate regions, but they also face additional risks caused by harsh environmental conditions and remoteness. While some topics are of general nature (e.g. fire safety, illnesses, water treatment, disposal of waste, and kitchen and workshop accidents) others are of special concern in arctic or alpine areas (e.g. climate, environment, wildlife, transport, remoteness).

It is important that visitors are physically and mentally capable of enduring the conditions at the station and that any serious illnesses and dependency on medication or medical equipment is known and evaluated by station management before granting access to the station. For station management, it is important to ensure that the station possesses relevant information about the visitors. This will enable staff to provide relevant information about potential hazards and be better prepared for possible emergency situations.

Should an emergency situation arise, it is important that the station have developed clear descriptions of procedure, roles and responsibilities for on-site treatment, evacuation and search and rescue. In emergency operations it is important to have one person at the station that is responsible for coordinating activities at the station. This person should be supported by the owner institution (which should provide 24/7 back up service) and should always be able to seek advice from police, rescue services, medical experts, etc. see Emergency operations – check lists (see 6. Health and safety (disclaimer, insurance, emergencies) for more details on health and safety at research stations) and 6.4 Emergency preparedness. Clear roles and responsibilities are essential when operating a research infrastructure in cold and remote areas. This should ensure that staff and visitors are informed properly of health and safety risks and mitigation measures for work at the station, and to ensure that both staff and visitors know how to act in emergency situations.

As rescue operations are extremely expensive, especially in remote areas, it is important to consider how to cover such potential costs. It can be necessary for stations to include a disclaimer in the access application/permit describing that the stay is at the persons own risk. It may also be relevant to demand that visitors are covered by an insurance that will cover possible costs associated with emergency or rescue operations.

Station management need to identify risks associated with work at the station and develop appropriate procedures, rules and guidelines to minimise these. Station management need to provide relevant information to applicants to allow them to prepare adequately for the visit and to provide a thorough introduction to health and safety aspects for visitors. Conditional health and safety equipment should be identified based on government regulations and precautionary measures developed by the station (e.g. communication, personal locator beacon, wildlife deterrents, basic medical kit, etc.).

Stations should screen all activities at the station for potential risks (both station operation activities and proposed projects). Station management need to carefully develop conditional requirements for access to the station and to consider what information is needed by the station to enable thorough evaluation of health and safety risks related to the specific project. It is also important to ensure that the necessary information is gathered through the application form (see 5. Permit issues).

Operating in remote areas and in often challenging terrain, harsh climate, limited infrastructure and with potentially dangerous wildlife makes it difficult to prevent all incidents, but thorough considerations can minimise the risks. In this theme, we will focus on the specific risks associated with working in arctic or alpine environments, but also touch on issues of general relevance.

6.2 Health and safety policies

Health policy - Required health status for access to station

Accidents and illnesses in cold and remote areas can be fatal, with often large distances to well-equipped treatment facilities and expertise. Therefore everything should be done to prevent such situations. It is therefore important to ensure that visitors are physically and mentally capable of enduring the conditions at the station and that they are well informed of hazards in order to avoid incidents. People need to have a medical status that allows them to undertake travel to and from the station and operate under the topographical, environmental and climatic conditions in the area. Handicaps should not prevent people from visiting stations, but if a handicap has implications for the person's ability to take care of him or herself, this can be an issue in an emergency situation. Depending on the conditions at the station and the nature of the applied project, it can therefore be necessary to assess on a case-to-case basis whether a given handicap could be problematic in relation to the health and safety of the visitor.

The remoteness of many stations also means that it is important for station management to know of serious chronic or recurring illnesses of visitors that may influence the persons stay at the station. Dependency of certain types of medicine or medical equipment, distance to nearest hospital and the medical skills of station staff needs to be considered when evaluating the possibility of the station to accommodate people with such illnesses.

It is important to ensure that the information necessary for evaluating these aspects is gathered through the application form.

Research stations can formulate policies for required health standards and ability to take care of oneself in case of emergency (see also under-aged, senior and family policy below and 2. Policies). The health policy should also apply to members of staff.

Note that confidentiality is an issue and that policies should be in place for capturing, storing, using and deleting such information.

See examples of insurance policies, insurance statements, insurance statements and medical examination forms at the end of the chapter.

Under-aged, senior and family policy

When undertaking research in cold and remote areas of the world with challenging emergency logistics and perhaps limited expertise, it is important that visitors can look after themselves and act appropriately in dangerous situations in the field. Where medical facilities are limited and distances to well-equipped treatment facilities are long, it is also important to consider whether the station can accommodate vulnerable age groups (young or old). This will depend on the facilities, location of the individual station and the nature of the applied project.

Insurance policy and disclaimer

Emergency, evacuation, and search and rescue operations in arctic and alpine areas can be very costly. Stations must therefore develop a policy, and related regulations and procedures, ensuring that costs of emergency operations do not affect the budget of the station. Furthermore, working in remote and cold areas also means that accidents are more likely to happen and that help is often far away. Stations should do what it can to prevent injuries, but should not be held liable to injuries or illnesses that visitors may experience when working on the station.

Staff

Research stations should insure their own staff. Many research stations are owned by self-insured institutions, meaning that the institution will cover costs related to emergency operations related to incidents involving members of staff. It is, however, important that station management ensures that this also applies to the special conditions at the research station and that relevant costs are covered.

Visitors/contractors/consultants/etc.

In relation to visitors, stations should not be held liable to injuries, illnesses or costs associated with emergency operations. To ensure this, stations may use a disclaimer or require that visitors are insured. Liability issues may be legally complicated and varies within the Arctic. It is therefore recommended that stations seek legal advice for formulating disclaimers and develop procedures related to insurance of staff and visitors.

A disclaimer is a statement denying responsibility intended to prevent civil liability arising for particular acts or omissions. By signing a disclaimer, the visitor agrees that the research station cannot be held liable for injuries or illnesses experienced at the station (note that this may not apply to all countries). Stations should seek legal advice when developing a disclaimer, as the courts may or may not give effect to the

disclaimer depending on whether the law permits exclusion of liability in the particular situation and whether the acts or omissions complained of fall within the wording of the disclaimer (See example of disclaimer below).

Visitors can obtain insurance through a company, or in some cases researchers may come from a self-insured research institution, meaning that the institution will cover costs related to emergency operations. In both cases station management may ask to receive documentation that the insurance meets possible criteria developed by the station (e.g. estimated costs for evacuation, and search and rescue). Examples of insurance statement form can be seen in Appendix 6 – Health and safety.

Where insurances are needed, visiting researchers must document that they are covered by an insurance that meet the criteria developed by the station (e.g. by submitting an insurance statement or provide other documentation ensuring that insurance requirements have been met). This should be incorporated into the application procedures for access to the station and communicated to applicants in relevant visitor information documents and guidelines.

6.3 Important risks and mitigation measures

Risk assessment

Knowledge of risks and hazards are essential for identifying mitigation measures for all activities at the station. This assessment of risks should focus both on activities at the station and in the field, and should also include transport to, from and in the area (see list of potential risks in Box 6.1). As conditions differ between stations, station management need to identify health and safety issues that are relevant for their specific station.

Risk assessments are essential parts of station management to maximise safety and minimise accidents. Risk assessments are used to:

a) Identify risks associated with all types of work at the station and develop specific policies, procedures, rules and guidelines to minimise these (see also 1. Management plans and check lists.).
b) Screen station operation activities for risks in order to develop relevant mitigation measures (e.g. when planning construction of new infrastructure).
c) Screening of applications to visit the station to assess the feasibility of the project in relation to health and safety (e.g. identify potential risks and assess expectations in relation to abilities in the application handling process) (see also 5. Permit issues).
d) On-site risk assessment of groups (for staffed stations) to ensure that they are properly prepared for working at the station (see also 4. Visitors and field work risks below).

For environmental impact assessment, see 7. Environmental impact of station operations and for workplace risk assessment see ‘at station – risks and mitigation measures’ below.

Risk assessment of the station and surroundings to develop policies, procedures, rules and recommendations

For all identified risks, station management should develop relevant and appropriate policies, procedures, rules, guidelines and recommendations that can minimise risks associated with activities carried out at the research station (see 1. Management plans and check lists., example of risk assessment at the end of the chapter – link and in Appendix 6.3). These should be communicated to staff and visitors in relevant documents (see Themes 3 and 4).

Screening of station operation activities

Station operation activities should be screened for potential hazards. This could be building of new infrastructure or development of new operational routines. For new activities, relevant risks and mitigation measures should be identified, developed and communicated to relevant persons.

Screening of applications to visit the station

Station management must ensure that all project applications are screened for potential hazards (part of the application handling procedure, see Theme 5). Station management should identify relevant mitigation measures and possible conditions for access should be communicated clearly to the applicants.

Certain types of activities may require specific training or documented experience and the planned project activities need to be in line with the abilities of the applicants. This is especially important for unstaffed stations, where station management cannot assess capabilities of group members at the station and whether the group has brought relevant safety equipment.

On-site risk assessment of groups

When groups are at the station, station management should make sure that the group has all relevant information related to health and safety at the station, and that groups are properly prepared for working at the station and in the field (see also Theme 4). This may include knowledge of what compulsory equipment to bring to the field, communication requirements in field, what to do in case of accidents or getting lost, how to operate specific machinery/equipment/vehicles, safety in laboratories, etc. It is also important to assess whether the skills and abilities of group members match their expectations and what they set out to do, and that activities are adjusted to current and projected climatic conditions.

Unstaffed stations cannot assess group preparedness and abilities at the station and need to make a thorough pre-visit screening of applied projects.

Box 6.1. List of potential dangers associated with work at arctic and northern alpine stations. Below list is not complete, but is meant as inspiration for station managers identifying threats at their station.

Danger list **(issues that may require the development of station specific procedures, rules or recommendations)**

General risks

- Distances to proper medical facilities and rescue services.
- Medication (for medicine dependent persons).
- Differences between expectations and abilities.

Transport risks

- Inexperience and inattention.
- Planes and helicopters (getting on/off, accidents and engine failure).
- Boat (accidents and engine failure).
- Vehicles (car, snowmobile, ATV, etc.) (accidents and engine failure).
- Bicycles (accidents).

Risks in the field

- Inexperience.
- Fatigue, desire to get back and difference between expectations and abilities.
- Hypothermia, frost bite and cold injuries.
- Remote location (distance to station and emergency and medical assistance).
- Camping, tents/huts cabins (heating CO, cold, wind, wildlife, etc.).
- Glacier fieldwork.
- Glacial lake outbursts/floods.
- Avalanches.
- Working below cliffs.
- River crossings.
- Climbing.
- Polar bear/wildlife.
- Riffles/ammunition.
- Fire.
- Etc.

Risks at the station

- Fuel and chemical storage and use.
- Manual handling of heavy goods.
- Laboratory work.
- Workshops and equipment use.
- Electricity.
- Kitchen.
- Fire.
- Etc.

Transport - risks and mitigation measures

For safety around helicopters and fixed wing aircrafts, see example at the end of the chapter.

Boat
Using boats in arctic waters can be extremely dangerous. The water is cold and may be dotted with icebergs or ice floes (some of which can be very difficult to see), and the wind can rapidly change. Extreme care should therefore be exercised when using non-commercial boats in the Arctic.

In smaller boats, feet will be in contact with the hull of the boat where the temperature is usually close to freezing. Insulated rubber boots or oversized regular rubber boots with layers of wool or pile socks inside are recommended.

In open boats it is also advised to bring clothing for covering all parts of the body (including face) as wind and cold temperatures can result in cold injuries.

In non-commercial and smaller boats, you should always wear life jacket or survival suit and passengers should be informed of emergency and evacuation procedures. Communication equipment and GPS equipment is also essential to bring.

See more in Station examples 6.1 and 10.1.

Cars/ATVs
Transport to and from the station often constitutes the highest risk associated with work at a research station. It is therefore important that staff and visitors adhere to national regulations for driving and adjust the speed to the specific circumstances.

Some stations are accessed via roads and vehicles may be used to get into the field at some stations. If possible, the station facilities should be placed to minimise the risk of accidents (e.g. by separating living areas from parking lots, workshops, storage facilities and road access). If driving takes place within the station area, make sure that visitors are informed hereof and if needed, set up signs.

Use of snow mobiles
A snow mobile is an effective means of transport which should be used with care. Snow mobiles can drive very fast, but it is essential to continuously adapt the speed to the conditions and the skills of the driver. It is difficult to see bumps and dips in snow - especially in backlight.

The most common accidents are associated with inexperience and inattention. It is therefore crucial always to stay alert when driving and to adjust the speed as mentioned above. It is also a good idea that inexperienced people are trained before driving in the field and to have at least one experienced driver in the group.

Station management should develop rules for use of snowmobiles at the station, building on national regulations and adding additional station specific rules where needed. These can include (see also field safety below):

- Make sure that the snow mobile is in good working condition before driving out.
- Always wear a helmet.
- Go at least two people on two snowmobiles together.
- Be at least one experienced driver or require appropriate training.
- If equipped, the dead man's handle must be connected to the driver.
- Never remove the cover of the engine room or remove the chassis that screens the movable parts when the engine is running.

Snow mobiles may also cause damages to the ground (that can result in increased risk of erosion) and vegetation (see Theme 7). See snowmobile policy examples in Appendix 2.8a and 2.8b.

Ice travel

Although INTERACT is a network of terrestrial stations, many offers access to sea ice or frozen lakes. It can be extremely dangerous to travel and work on sea ice and it is advised that stations develop clear guidelines for such activities.

The Ny-Ålesund Science Managers Committee (NySMAC) raise important points in their safety guide[10] that should be considered when working or travelling on sea ice, but many also apply to fresh water ice on lakes and rivers:

- There is no substitute for experience.
- Fast ice should be weeks old and have endured several storms before you attempt to ski on it. Test the ice with a chisel, pick or ice drill.
- Unlike fresh water ice, sea ice is quite elastic. Dull grey areas may indicate wet 'rotten' ice which is soft and weak.
- Thick sea ice that has been solid for months can break up in minutes. A swell generated by a storm in the distant open sea is the most common cause of destruction.
- The ice is often weak above submerged rocks, between islands, and areas where there is a tidal current. Weak areas will also be found near points of land, rocks, and the area surrounding ice bergs or pack ice locked in the sea ice.
- Strong winds can shake block of sea ice protruding above the ice surface causing the ice to break up.
- Do not go near icebergs locked in the ice. The ice surrounding the berg will have been weakened by the bergs movement and the berg (85% submerged) may suddenly capsize.
- Open leads in the ice may indicate that the ice is about to break up.
- A dark cloud over the ice may be a 'water sky' above an open ocean. A bright glare in the sky might indicate ice to the horizon. It is important to remember that such indicators are not always reliable.
- In early winter the tidal zone between land and sea will break the ice into blocks. Later in the winter most cracks and holes will be concealed by deep snow.

[10] http://discoveringthearctic.org.uk/downloads/NY-ALESUND_safetyguide.pdf

- The surface pressure of a snow scooter is less than a human on foot. Beware of getting off a snow scooter on sea ice.

Field work - risks and mitigation measures

Most accidents happen at or near the station. Research groups working near the station may feel that 'home' is always nearby and are often less prepared for changing conditions and less precautious. Groups that have been out for longer periods may be eager to get back and may thus be more likely to take chances when the station is approached. This is sometimes the case if people need to get back for travel, duties at the station or a traditional Saturday special dinner.

This is an important issue to raise for all visiting groups. Arctic and alpine areas are located in harsh environments and conditions can change very fast. It is therefore important to be properly prepared even when working close to the station, and groups should stick to health and safety procedures no matter how close and tempting the station may be.

Preparations for field work and what you need to bring varies with the landscape, season, type of work, distance and time away from the station. Research stations should therefore develop specific procedures for field work and recommendations for what health and safety equipment groups should bring to the field (see Box 6.2).

As the conditions differ greatly at research stations, station management should identify risks and develop relevant mitigation measures (procedures, rules, guidelines, etc.) that suit their specific station and the activities undertaken there.

It is essential that groups can take care of themselves in the field, know where they are and can communicate with station staff (or others that can provide assistance). To ensure that visiting groups are properly prepared and that station management are properly informed of fieldwork activities, station management may develop:

- A list of required skills/experience for specific activities (e.g. driving (license), climbing, diving, etc.) (see also Theme 5).
- A list of compulsory equipment to be brought into the field for specific activities (see box 6.2) (see also Theme 5).
- Guidelines for how groups should prepare for fieldwork (e.g. to ensure that all know where they are going (group members and station management), what they will be doing and what they should do in case of emergencies) (see Box 6.3)
- A mechanism for knowing group whereabouts and expected time of return (e.g. discuss prior to departure from station, sign in/out boards, fieldwork plan (for unstaffed stations), etc.).
- Rules and procedures for communication (e.g. frequency of call when working in dangerous or remote locations) (see box 6.4).

In relation to fieldwork safety at unstaffed stations, it is recommended that visiting groups are properly screened for potential risks and informed prior to arrival of relevant risks, conditional requirements, procedures, rules and guidelines that they should be aware of.

At staffed stations, station management are able to have direct contact with the visitors and may use this opportunity to ensure that groups are adequately prepared for working at the station. This can be done through information meetings upon arrival and/or prior to field work, regular radio contact during field work, daily sharing of weather forecasts, etc. Such personal meetings also provide an opportunity for station management to assess whether the skills and abilities of group members correspond to their expectations and the activities that they will undertake. It also allows for adjusting activities and recommendations in relation to current and projected weather forecasts.

Below are descriptions of some common risks and mitigation measures (see also Box 6.1, 'danger list').

Weather

Weather conditions in arctic and alpine areas can be extreme and may change rapidly. These conditions mean that people should be aware of unexpected weather conditions and be prepared for rapid changes in temperature, wind and visibility. Strong winds may destroy tent and equipment, and bad weather may last several days, so groups working at remote locations should bring extra clothes and food.

It is therefore advisable that groups know expected weather prognoses for the time they will be in the field and prepare accordingly (also means staying at the station if bad weather is expected).

It is also important that visitors are able to notify station management if they are late and, if needed, communicate their position if they are lost or in need of assistance.

Mitigation measures developed by the station management:

- Provide weather prognoses for the immediate future (e.g. 1-5 days).
- Develop rules and guidelines for what to bring to the field (e.g. first aid kit, extra food, extra warm clothes, GPS, map, communication equipment, etc.).
- Develop rules for communication (e.g. if delayed return, in need of assistance, etc.).

See example of weather precautions at the end of the chapter and weather policy example in Appendix 2.3.

Landscape, topography, remote locations and dangerous activities (e.g. climbing, cave exploration, diving, glacier work, river crossing, etc.)

The landscape and topography may include features that pose a risk for field work activities (e.g. hard to walk surfaces, escarpments, cliffs, glaciers, and risks of hill slides, mud slides and avalanches). Some field activities are associated with additional risks and are considered extremely dangerous in arctic environments, e.g. climbing, cave exploration, diving, glacier work, river crossing. It is therefore important that stations inform visitors of potential hazards and, if needed, develop rules and regulations for such activities (e.g. compulsory equipment, required training, number of people, how to behave and conduct activities).

Station management should identify activities that have added risks and develop relevant mitigation measures that ensure a safe execution of such activities. Note that the terrain may affect the ability to communicate with the main station.

Mitigation measures developed by the station management:

- Develop rules for communication (e.g. frequency of calls when working at remote locations or for long periods).
- Develop rules for work in hazardous terrain (e.g. minimum number of people engaged in the activity (at least three for wide river crossings)).
- Develop rules and guidelines for what to bring to the field (e.g. first aid kit, extra food, extra warm clothes, GPS, map, communication equipment allowing visitors to inform of delays or accidents, etc.)
- Ensure that people are adequately trained and experienced in relation to the specific activities they undertake. If needed, inform visitors of how to behave in hazardous terrain.
- Make sure that equipment is in a good working condition (e.g. means of communication (including adequate battery power), tent, etc.).

See example of river crossing and glacier rescue kit at the end of the chapter.

Wildlife

The Arctic is home to a number of potentially dangerous animals. Polar bears are an obvious threat when working on land or sea ice. In some areas, sub-species of brown bear have also been known to cause fatalities to humans. Musk oxen may pose a threat to people and it is recommended to keep a safe distance to the animals (different sources recommend safety distances of between 50-100 m).

Walruses and whales can be aggressive and can easily capsize dinghies, Zodiacs (rubber boat) and kayaks. Under normal conditions, most species are not a threat, but Arctic wolves and Arctic foxes may be carriers of the zoonotic rabies virus. Other species may cause minor injuries from bites or scratches that are not a direct danger, but may become infected.

The best way to avoid accidents is to avoid encounters. Scan surroundings and select travel routes with clear view of surroundings. Below are general mitigation measures for avoiding wildlife incidents followed by an example for polar bears.

Mitigation measures developed by the station management:

- Inform visitors to stay away from wildlife and advice on how to behave during wildlife encounters.
- Develop rules and recommendation for bringing wildlife deterrents to the field and ensure that these are in a good working condition (e.g. pepper spray, flares, signal gun, riffle, electric fence around camp, etc.). Note that some deterrents are not legal in all countries and that permits may be required for some.
- Bring first aid kit to the field in case of accidents (and extra warm clothes and extra food if working far from the station).
- Bring GPS and communication equipment that allows you to communicate that you are delayed or your position in case you need assistance.
- If attacked or bitten by wildlife always seek medical assistance to prevent infection and deceases (e.g. rabies is deadly if untreated).

See examples of polar bear and wildlife precautions at the end of the chapter.

Box 6.2. Examples of compulsory equipment that research groups are requested to bring to the field.

Health and safety equipment recommended for field work activities:

- Communication equipment that allows you to communicate that you are delayed or your position in case you need assistance.
- GPS and map of the area.
- First aid kit.
- Clothes or fabric in conspicuous colours that make you stand out from the surrounding landscape may help search operations to find you.
- Wildlife deterrents/weapon (if relevant).
- Bring extra food rations.
- Bring extra warm clothes (if relevant).

For some types of activities (e.g. longer stays, operations far from the station or work in potential hazardous terrain), it is recommended that groups bring additional safety equipment, e.g.:

- Personal Locator Beacon (pushing a button will alert police/rescue service).
- Shelter.
- Extra food rations.

Box 6.3. Example of agenda pre-field work preparation meeting.

Station management and research groups should prepare for field work by (at unstaffed stations, this is only done by research group members):

- Discussing the activities to be undertaken by the group, so everyone knows what they will be doing, where and for how long.
- Discussing how to get there and back, so everyone is aware of the approximate route and location in relation to the station.
- Discussing what to do in case of accident or emergency situations so everyone knows how to behave in such incidents (e.g. prevent further injuries/damages, stay together, contact station, take shelter and wait for better conditions/help, etc.).
- All fieldwork in remote areas (far away from other people), regardless of the extent of the task, must be carried out by at least two people.
- Be properly dressed for the activities and, if relevant, bring additional warm clothes to be prepared for changing conditions.
- Bring relevant health and safety equipment (see below), and make sure that all is in good working condition.
- If a team is left alone in a remote area, they must always bring camp equipment and emergency provision for a given period (e.g. 3 days to one week or more depending on the location.
- Sign out when you leave (include team leader, the number of group members, location for field work, time out and expected time of return) so the station management knows your intentions and can initiate relevant responses if the group does not arrive back at the expected time of return.
- Have scheduled calls (1-2 times per day) for work in dangerous or remote locations, make sure to use an agreed radio frequency, and that you and station management have relevant communication information (e.g. satellite phone numbers, Personal Locator Beacon numbers, etc.).
- If needed, bring relevant permits to the field.

Box 6.4. Group whereabouts and communication when in field.

Station management should always know where groups are to facilitate assistance if so required. This can be done through daily contact with station management, sign in/out boards or fieldwork plan (for unstaffed stations).

Communication equipment (and GPS or map) will allow research groups to provide a more specific location if they are in need of assistance.

Group whereabouts

Personal contact
It is advised that groups leaving for the field always inform a person form the station before going out (especially if it is for longer, periods, at remote location or include dangerous activities). Although there may be no written records, it may provide more specific information than sign in/out boards and it allows station management to provide relevant advice for the specific activity and potentially check if the group is adequately prepared.

Sign in/out boards
Some station use sign out/in boards where groups note departure time, who they are, where they are going and when they expect to be back (expected time of return). Upon return groups MUST remember to sign in.

Fieldwork plan
Groups can provide a field work plan including information of where they expect to be where. This may be most relevant for unstaffed stations that have no direct contact with visiting groups. A fieldwork plan is a less flexible approach and there should be a clear agreement of what groups should do if they need to change it (should this be communicated to station management and how).

Communication when in field

Scheduled calls
For work in dangerous areas or remote locations it is recommended that there are scheduled calls between the research group and the station management. Station management need to have procedures for what to do, if there is no contact at agreed hours (see also 6.4).

There should be specific guidelines for what to do if scheduled calls are missed (when should station management react (see also Theme 1, emergency check lists)).

Call to inform of changes (delay/position)
Communication equipment also allows groups to inform of changes while in the field. This is important if groups are delayed in relation to expected time of return and for station management to know whereabouts if something happens.

Emergency calls
It should be clear to all groups, who they should contact in case of accidents and stations should have clear procedures for what to do (see also Theme 1, emergency check lists).

At station - risks and mitigation measures

Fire safety

Fires can be more dangerous in the Arctic than elsewhere. The Arctic is characterised by relatively dry conditions and water availability is normally limited. If a fire occurs it is therefore often the case that it will continue until the building has burned out. The best way of handling fires, is therefore to prevent them from happening.

Most countries have laws and regulations that require buildings to meet certain standards related to fire prevention and emergencies (e.g. more than one escape route from all buildings, fire extinguishing equipment in buildings, no use of fire near fuel depots, emergency plan in case of fire, etc.). Station managers should be aware of national regulations and make sure that these are followed at the station.

There are five common causes of fire (source: Fire Safety Advice Centre, UK[11])

- Carelessly discarded **smoking materials** if it is allowed to come into contact with combustible materials. A fire detection system, the use of signs and the prohibition of smoking in risk areas would reduce the risk and constantly broadcast the dangers to the staff and guests.
- **Electrical appliances** can be a source of fire, especially if they have not been serviced regularly or if damaged during transport. All electrical equipment should be tested annually and the staff and guests kept informed of the possible dangers associated with the different types of electrical equipment. New equipment should be tested upon arrival before being left to run on its own.
- **Kitchens** can be a high risk area for fires, especially if the kitchen is not properly supervised. Full dining facilities increase the risk but this is lessened by having staff in attendance at all times.
- There is a high fire risk in **store rooms** where bedding, towels, flammable materials and cleaning equipment are stored; especially if possible chemical cleaner is not stored correctly. Housekeeping and ensuring the store rooms are keep as tidy as possible will reduce the risk. Also ensure the dangers are discussed at any training sessions.
- **Tradesmen** on the premises, especially those that use apparatus that is capable of starting a fire, like blow lamps, gas torches, metal angle cutters, etc. One needs to ensure a high degree of supervision during and after their presence. Give the area they have been working in a thorough inspection and make sure that no hot spots or small fires have been missed.

Stations should, in addition to the requirements stipulated in laws, identify relevant fire risks at the station and develop additional regulations and procedures that will minimise the risk of fires. Emergency plans should be developed and communicated to staff and visitors. In larger buildings, exit signs and emergency plans should be set up in appropriate places to guide people in emergency situations.

Should a fire develop, early warning is essential to increase chances of extinguishing the fire and get staff and visitors to a safe area. Smoke detectors (smoke alarms) are cheap and easy to use (some models let you know when the battery is low).

[11] www.firesafe.org.uk/category/premises-subject-to-the-fire-safety-order

In case of fire, it is important that staff and visitors know what is expected of them. All staff members should therefore know about the emergency plan and what is expected of them in such situations. It is recommended that rehearsals are conducted annually with staff, and that visitors are educated upon arrival on how to prevent fires and what to do in case of fire.

Field huts/cabins

Many small field huts/cabins are heated using petrol stoves. Burning of fuel inside the hut/cabin, can lead to CO up-build and risk of suffocation. The use of stoves and heat burners also increases the risk of fire.

Proper instructions for how to use heat burners and stoves should be provided to users on clearly visible signs and possibly also in visitor information documents.

Transport, storage and use of fuel, chemicals, radioisotopes and other hazardous substances

Fuel, chemicals, radioisotopes and other hazardous substances should be always be transported and stored in containers approved for transporting and storing the specific substance.

Storage facilities should be located to minimise risks (e.g. in proper shelf/cupboards and away from heat sources, sharp appliances, office space, high use areas, food, etc.). Outdoor storage facilities for significant volumes (e.g. fuel) should be installed with capture mechanism that contain possible spills and prevent pollution of the environment.

The use of fuel, chemicals, radioisotopes and other hazardous substances should follow prescriptions for use. Guidelines for use of hazardous substances should be available on clearly visible signs or on container. It is essential that proper chemical storage and segregation capability is provided at the station, as well as clear policies on handling and disposal of waste. Globally Harmonised System[12] guidelines must be used for labelling of chemical containers and Safety Data Sheets (where suppliers communicate information that allow safe use of their substances and mixtures[13]) must be readily available for reference by anyone on station.

Spill trays or other clean up mechanism should be readily available on site in case of accidents. Depending on the types of substances stations may require users to wear safety equipment (e.g. eye protection, respiratory protection apparatus, protective clothing/safety suits, etc.) and should have medical kits for chemical accident in place in case of accidents (e.g. eye washer, emergency shower, etc.). Even if researchers are required to provide these safety materials themselves, it is advisable for the research station to have extra stock available in case shipments are lost or delayed or researchers run short of supplies.

[12] E.g. United Nations Globally Harmonised System of Classification and Labelling of Chemicals (GHS) http://www.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html

[13] See e.g. http://echa.europa.eu/regulations/reach/safety-data-sheets

Garbage, waste handling and water treatment (see also Theme 7)
Garbage should be disposed in a way that does not cause harm to people or the environment. Transportation of all garbage to municipal treatment facilities is preferred, but this is often not possible for remotely located field stations in the Arctic.

Garbage is composed of a wide range of materials, some more hazardous than others to the environment and people. Hazardous materials and substances should be brought back to proper treatment plants, while less harmful materials may be disposed locally if done in due consideration for the environment and people.

Local garbage disposal systems include burning and grinder mill with disposal in sea/large river. Dumps should to the extent possible be avoided, but dumps are used at some stations for disposal of materials considered hazardous, non-burnable and expensive to transport (e.g. empty fuel barrels).

If garbage or ashes from burning of garbage remains on the station, the disposal area should be integrated in the land use plan and the location selected so it will not affect water sources, cause health problems for people, impact the environment and influence on research and monitoring activities (e.g. by adding nutrients or polluting study areas). This also counts for human waste.

The origin of water sources used at arctic stations varies from melting of snow, streams, ground water to national/regional water supply systems. In some areas purification of the water is considered necessary as water may be a source of disease that can spread quickly among staff and visitors. Station management should make sure that the water source used at the station is safe and take appropriate measures for purification if needed.

Workplace risk assessment - Occupational Safety and Health (OSH)
The goals of occupational safety and health programmes are to ensure a safe and healthy work environment. Occupational safety and health can be important for moral, legal and financial reasons, and station management need to ensure that employees and visitors remain safe at all times. Legal reasons for dealing with occupational safety and health relate to the preventative, punitive and compensatory effects of laws that protect worker's safety and health. OSH can also reduce employee injury and illness related costs, including medical care, sick leave and disability benefit costs.

It is the responsibility of the station management and the owner institution to ensure that the facilities and work environment does not affect the physical and mental health of the employees. Similar to Environmental Impact Assessments (see Theme 7), stations can assess the risks associated with work at the station and identify mitigation measures that will minimise health and safety risks for staff and visitors working at the station. This is called a workplace risk assessment.

A workplace risk assessment is an important step in protecting the employees and visitors, as well as complying with the law. It helps station management to focus on the risks that really matter at the station – the ones with the potential to cause harm. In many instances, straightforward measures can readily control risks, for example, ensuring spillages are cleaned up promptly so people do not slip or regular control of

potential dangerous equipment and machines. Risk assessments can help identify simple, cheap and effective measures to ensure, that your most valuable asset – your workforce – operates in a safe work environment.

The law does not expect you to eliminate all risks, but station management should protect people as far as is 'reasonably practicable'. It is especially important to work systematically for reducing negative effects of the workplace environment for long term staff as they will be exposed to risks for prolonged periods.

Workplace risk assessment includes five steps
Step 1 - Identify the hazards.
Step 2 - Decide who might be harmed and how.
Step 3 - Evaluate the risks and decide on precautions.
Step 4 - Record your findings and implement them.
Step 5 - Review your assessment and update if necessary.

A brochure with the five steps to workplace risk assessment can be seen on the below link from Health and Safety Executive (HSE) - the national independent watchdog for work-related health, safety and illness in the UK. http://www.hse.gov.uk/pubns/indg163.pdf

A large proportion of accidents happen in the kitchen, laboratories or in workshop facilities. Electrical appliances, sharp knives/tools, powerful machines, chemicals, etc. may cause injuries to staff and visitors. Many incidents are caused by negligence of common sense and inattention.

Injuries may range from smaller scratches and bruises to amputation and fatalities, and sparks, chemicals and electrical appliances may start fires.

Guidelines and training on how to install and use electrical wiring and appliances is the key to safe operations. The station should thus assess what skills are required to use the different types of equipment in kitchen, laboratories and workshops, and make sure that users know how to handle the equipment. Station management must consider if certain types of equipment should be used by trained staff only.

Tools and equipment lying about may also cause injuries. It is therefore important that kitchen, laboratories and workshop facilities are kept tidy and chemicals/tools/equipment returned after use.

First aid kits should be available in relevant facilities for rapid response in case of accidents. Depending on the risks at the station, additional medical equipment/expertise (e.g. training of staff or doctor on station) should be considered.

Common risks associated with research stations and related mitigation measures:

- Workshops (e.g. machinery, sharp effects, chemicals, heavy lifts, etc.)
  - Mitigation measures: procedures, ventilation, lift aid, etc.
- Kitchen (e.g. machinery, sharp knives, hot water, heat from oven, heavy lifts, etc.)
  - Mitigation measures: procedures, ventilation, lift aid, etc.
- Laboratories (e.g. uncomfortable work position, chemicals, leaning lifts, etc.)

    - Mitigation measures: procedures, ergonomically correct office tables and chairs, ventilation, lift aid, etc.
- Generator/fuel depots (e.g. chemical fumes, heavy lifts, etc.)
    - Mitigation measures: procedures, ventilation, lift aid, etc.
- Office space (e.g. uncomfortable work position, indoor climate, etc.)
    - Mitigation measures: Ergonomically correct office tables and chairs, ventilation, etc.
- Transport (e.g. cars, snowmobiles, boats, etc.)
    - Mitigation measures: maintenance procedures, training, guidelines, etc.

6.4 Emergency preparedness

If there is an emergency at a station, it is important to have some ground rules for visitors on how to behave and well described roles, responsibilities and procedures for station staff. It is essential to have a central person at the station to coordinate activities there and to keep a log of activities and information regarding the operation (see also Theme 1.4, Emergency check lists). This person should have 24/7 access to support from owner institution, police, rescue service and medical experts that can give advice on what to do in specific situations if so required. The person should remain on the station, gather relevant information, contact relevant people, keep a log of activities and information and be responsible for debriefing at the station and reporting. At unstaffed stations, research groups should be advised on how to select a person in charge in case of emergency.

It is the responsibility of the person in charge of the emergency operation at the station to assess the situation and decide what should be done to stop the situation from becoming worse, what the station can do without putting other people at risk and when to ask for advice or assistance to solve the situation. This person should stay calm, have some guiding response rules (e.g. when to initiate search and rescue operation, contact doctor, request assistance from police, etc.) and take contact to back office or external experts when needed. It is important to make sure that station management and the owner institution have all relevant contact information for visitors including next of kin/organisation), 24/7 back office support (owner institution), medical experts, rescue services/police, etc. (see also Theme1.4, Emergency check lists).

All emergency operations are also a potential risk for rescue personnel. Station management should therefore prevent individuals from initiating rescue missions of their own as they risk putting themselves in danger and thus worsening the emergency operation and adding risks to the rescue personnel. Station management should stay calm and ensure that all elements of the rescue operation are conducted in a safe manner to prevent people from injuring themselves and limit the risks of the emergency operation.

Visitors should be informed of ground rules and informed to stick to these in emergency situations unless told otherwise by station staff. Basic rules can include:

- Remember agreed radio calls at specific hours.
- If possible, provide accurate information of your position.
- Stay where you are expected to be, so rescue personnel know where to search.

- If lost, stay where you are or walk to nearest specified landscape feature (e.g. stream, mountain top, etc.).
- Make yourself visible to rescue personnel.
- Gather at specific location in case of fire at the station.
- Follow instructions from station staff, police and rescue service.

Stations should have basic medical kits to take care of minor accidents and common illnesses. What medical equipment and medicines a station should have also depends on the size of the station, remoteness and the landscape/environment/climate that the station is located in (see 6.5).

If a station is unstaffed, it is the responsibility of the owner institution to develop clear response guidelines for visitors informing them on what to do in case of emergency. As for staffed stations, it is important to have one person in charge at the site who communicates with the owner institution, medical experts, rescue service or police. The response guidelines should be communicated clearly to all visitors, so that there is no doubt on what to do if something unforeseen happens.

Type of emergencies that stations should be prepared for include:

- Accidents and illnesses happening in the field or at the station (e.g. broken limbs, hypothermia, fire and various illnesses).
- Evacuations.
- Search and Rescue operations.

6.5 Medical facilities

Operations in remote areas are often challenged with long distances to well-equipped treatment facilities and expertise. It is therefore important that the stations consider what types of emergency equipment is relevant for the station in relation to the types of activities undertaken at the station, available facilities and services, and distance to proper treatment facilities and expertise.

6.6 Health and safety training

All staff members at a station should be trained in first aid. Depending on the size of the station, additional training of key station staff should be considered (e.g. extended medical training). Emergency procedures developed for the station should also be known to all members of staff and regular rehearsals should be conducted (e.g. once a year) to evaluate procedures and ensure that staff knows what is expected from them in case of emergencies (see also Theme 1.4 - Check lists).

Some level of health and safety training may be required for visitors to remotely located stations or when carrying out specific tasks with increased risk of accidents. However, as the circumstances differ greatly between stations, it is up to the individual station to decide what training is required for visitors and for what activities.

Some remotely located stations require that visitors are trained in first aid including heart massage, and that they must be able to operate radios, satellite telephones and weapons as well as emergency and camp equipment. Use of specific equipment (e.g. drilling/cutting equipment), substances (e.g. hazardous chemicals or radioactive material) or means of transport (e.g. snow mobiles) may also be subjected to training requirements.

6.7 Key considerations for station management

Health and safety policies

- Station management should consider the following:
  - Is there a need for a required medical status for visits to the station. Is it possible and under what circumstances can the station accommodate people with handicaps, chronic illnesses, medicine dependency, etc.
- If relevant, develop health and safety policy.
- If relevant, identify the information needed on application form to evaluate the feasibility of having people with added health risks at the station (should be evaluated in relation to proposed activities and experience), and in what circumstances is it necessary with a Doctor's Medical Statement (e.g. handicaps, chronic deceases, old age, etc.). Incorporate in relevant application procedures and forms (see Theme 5), and visitor information documents (see Theme 4).

Under-aged, senior and family policy

- Station management should consider the following:
  - Is it necessary with restrictions of access for children (e.g. no access, remain on station, restrictions on specific activities)?
  - Is it necessary with restrictions for persons above a certain age (e.g. the station can require a Doctor's Medical Statement stating that the person can undertake the proposed activities)?
- If relevant, develop under-aged, senior and family policy. Incorporate information needs into relevant application procedures and forms (see Theme 5), and visitor information documents (see Theme 4).

Insurance policy and documentation

- Identify legal requirements for insurances for work at the research station/remote area.
- Identify insurance policy of the owner institution towards staff, visitors and contractors/collaborators/consultants.
- Identify possible additions or new policies to ensure that station staff is adequately insured for working at the station.
- Identify possible additions or new policies to ensure that visitors and contractors/collaborators/consultants are adequately insured for working at the station (e.g. need for an insurance to meet certain criteria when working at the station).
- Consult legal advice to learn if there is a need for a disclaimer and, if so, get assistance when formulating this to ensure that it is legally binding. Decide how this can be signed by applicants and incorporate into procedures for access (e.g. in application form).
- Formulate insurance policy based on the above (for staff, visitors and contractors).
  - If there is a need for station management to ensure that visitors are properly insured, an insurance statement specifying that specific conditions are met, can be developed by the

station. In this way, station management does not need to evaluate all contents of insurance agreements.

- If an insurance statement is required, estimate costs associated with emergency operations (evacuations, and search and rescue) to develop criteria to be met by insurances.
- If an insurance statement is required, develop insurance statement form or require other form of documentation that the criteria are met by all members of the group visiting the station. Incorporate this documentation requirement into the application procedures for access to the station (documentation can be submitted with the application form or at least prior to arrival at the station).
- Insurance policy and required documentation should be communicated clearly to applicants in visitor information documents (see Theme 4).

Safety at the station and in the field

- Develop procedures and rules for field work safety.
  - Identify potential hazards in the field (including transport, climbing, working on glaciers, wildlife, weather, terrain, river crossing, glacier work, etc. (see Box 6.1).
  - Develop procedures and rules to minimise risks (e.g. compulsory equipment, sign in/out boards, communication rules, first aid kit, etc.) and communicate these in relevant documents to staff (see also Themes 3 and 11) and visitors (see also Themes 4 and 5).
- Develop procedures and rules for workplace safety and health.
  - Conduct workspace risk assessment.
    i. Identify workspace hazards at the station (in buildings and outside).
    ii. Identify who they may affect.
    iii. Assess hazards and develop regulations, procedures and guidelines that minimises risks for hazards considered a significant risk.
    iv. Develop action plan to implement mitigation measures including task, responsible person, timeline and if relevant available resources. Incorporate mitigation measures in relevant staff and visitor information documents.
    v. Develop plan for re-assessment and revision of workspace regulations, procedures and guidelines (risk assessment).
  - Identify staff responsible for keeping kitchen, laboratories and workshops tidy and include in staff ToR documents (see Theme 1).
  - First aid kits should be readily available in kitchen, laboratories and workshop. Additional medical equipment and expertise on station should be considered.
- Develop incident and near miss reporting system (see also Theme 11) to identify additional hazards and mitigation measures, and include these in relevant staff and visitor information documents.
- Make plan for regular revision and updating of relevant documents describing health and safety rules, precautions and guidelines.

Fire prevention and how to deal with fires

- Identify national legislation and follow this at the station (e.g. related to constructions, alarms, fire extinguishing equipment, emergency plans, etc.).
- Identify areas at the station where fires can develop and develop regulations for use of fire and equipment that potentially can start fires (e.g. from sparks) in these areas.
- Develop regulations and provide recommendations for use of fire when camping away from the station.
- Identify areas where early warning equipment (e.g. smoke detectors) and extinguishing equipment can be installed.

- Test new equipment before it is left running on its own.
- Develop emergency plan for fires and conduct annual fire emergency rehearsals with staff (and visitors).
- Educate visitors (immediately upon arrival) on how to prevent and deal with fires.

Garbage, waste handling and water treatment (see also Theme 7)

- Identify means of disposal for the different components of garbage produced at the station (including human waste). Bring out as much as possible to proper treatment plants.
- If garbage/human waste remains at stations or are disposed locally, include this in the land use plan to avoid contamination of water sources, prevent health problems and minimise impact on research and monitoring activities.
- Assess water quality and implement a purification system if needed.

Emergency preparedness

- Describe responsibilities for station management and owner institution (back office support) in emergency situations. (see also Theme 1, Emergency check lists)
- Develop response rules (for the different types of emergencies) to assist the person in charge of coordinating activities at the station with taking decisions on:
    i. What the station staff and visitors can do to ease/solve the situation.
    ii. When to ask for advice (owner institution (back office support), medical experts, rescue services/police).
    iii. When to initiate Search and Rescue operations or evacuations.
- Develop basic rules for visitors on how to behave in emergency situations (e.g. if getting lost, being injured in field, in case of fire, natural disasters).

Medical facilities at station

- All stations should have a basic medical kit for minor accidents.
- Identify what emergency equipment is needed for a rapid (and at least temporary) response for the potential hazards at the station.

Health and safety training

- Decide what training requirements are for the different types of staff.
- Decide what basic training is needed to conduct work at the station (e.g. basic first aid).
- Decide for what type of activities additional training is required by staff and visitors.
- Develop training course at station/owner institution or refer to specific standards or external course providers.

Examples

Examples of insurance related policies, disclaimers, statements and medical examination form

Insurance policy - NERC Arctic Research Station, Svalbard (UK)
(Small to medium sized, very remote station accessed by plane or boat)
"The Government operates a policy of self-insurance on the principle that the Exchequer is large enough to carry its own risks, and extends this policy to grant aided bodies, such as NERC. NERC therefore generally bears its own risks, and only takes out insurance when it is specifically required by law, for example third party insurance for official vehicles under the Road Traffic Acts, or where there is a risk management benefit."

See the entire *Insurance Handbook - Summary of NERC insurance Arrangements* on below link.
http://www.nerc.ac.uk/about/work/policy/safety/documents/inshandbook.pdf

Disclaimer example – Samoylov Research Station
(Small very remote station reached by helicopter or boat)
See appendix 6.4

Disclaimer text included in application form – Zackenberg Research Station, Greenland (Denmark)
(Small to medium sized, very remote station reached by chartered plane)
'We kindly inform you that staying at Zackenberg is at your own risk. All project participants (including yourself) should be properly insured during their stay at Zackenberg (i.e. having relevant search and rescue insurance (SAR), company injury insurance, medical insurance and other relevant insurances) either by an insurance issued by a commercial insurance company or by self-insurance by their institution. The Department of Bioscience, Aarhus University, takes no responsibility for the safety of users of Zackenberg Research Station.'

See application form on below link.
http://www.zackenberg.dk/news/the-2013-field-season-at-zackenberg-research-station/

Insurance statement for insurance companies and self-insured institutions – Government of Greenland
See examples in appendix 6.1 and 6.2

Example of medical examination form for Samoylov Research Station
(Small very remote station reached by helicopter or boat)
http://www.awi.de/fileadmin/user_upload/Institute/General_Services/Logistics/Standardformulare/AWI-MedExam.engl.Vers.5-2009.pdf

Risk assessments and safety examples

Example of Generic Risk Assessment - NERC Arctic Station, Svalbard.
(Small to medium sized, very remote station accessed by plane or boat)
The document goes through 14 themes describing activity, hazard, hazard effect, risk evaluation, mitigation measures, etc.
http://www.eu-interact.org/fileadmin/user_upload/pdf/Station_management/NERC_Arctic_Station_Risk_Assessments.pdf

Example of Health and safety manual for fieldwork in Greenland - Zackenberg Research Station, Greenland
(Small to medium sized, very remote station reached by chartered plane)
It describes general rules, project manager responsibilities, safety at sea, health and safety in remote areas, camps, use of machines, diving work, fuel, etc.
http://www.eu-interact.org/fileadmin/user_upload/pdf/Station_management/AU_Health_and_safety_manual_for_fieldwork_in_Greenland.pdf

Example of framework and guidelines for emergency response and contingency planning in Antarctica – CONMAP
(Council of Managers of National Antarctic Programmes)
https://www.comnap.aq/Publications/Comnap%20Publications/COMNAP_ip012_emergency-response.pdf

Example of safety instructions for field work and the use of field equipment - University Centre in Svalbard (UNIS)
It describe roles and responsibilities, preparations for field work, emergency tool kit contents and how to deal with specific situations (e.g. preparations for field work, polar bears, setting up camp, transport, etc.).
http://www.unis.no/48_HSE/documents/Version8English_Safety_field_excursions.pdf

Example of safety around helicopters and fixed wing aircrafts - Zackenberg Research Station, Greenland
(Small to medium sized, very remote station reached by chartered plane)
http://www.eu-interact.org/fileadmin/user_upload/pdf/Station_management/AU_Health_and_safety_manual_for_fieldwork_in_Greenland.pdf

In connection with work in Greenland, you often approach/walk away from helicopters while the blades are still rotating, either during loading or unloading or when travelling as a passenger. In these cases the aircraft's commander is responsible for the safety and his or her directions must always be complied with. The helicopter will carry emergency equipment; therefore, some emergency equipment can be omitted if the helicopter does not leave the place of work while the task is being undertaken. However, you should always bring your own sleeping bag.

Always approach the helicopter bending over forwards and within the field of vision of the pilot. All operations must be agreed with the pilot. It is forbidden to approach a helicopter from behind due to the tail rotor, which is situated very low down. Remember that the main rotor is most dangerous when it is rotating slowly.

Survival suits must be worn all year round in Greenland when flying at low altitudes (not during scheduled flights) above water, e.g. during bird counts. Life jackets are mandatory during bird counts from fixed wing aircrafts.

For all flying, loading and unloading of aircrafts etc., the decisions of the pilot/load master must be respected. Never attempt to persuade a pilot to do things that he/she has assessed unwise. You may have to enter or leave a helicopter with the propellers running. In this case, follow the instructions given by the crew.

In general, the captain of an aircraft has the same powers as the captain of a ship, meaning that he/she is always the supreme authority on board.

Example of weather safety precautions, Nunavut Parks, Canada
http://nunavutparks.ca/english/visitor-information/safe-travel-information.html

The Arctic experiences long, cold winters and short, cool summers. Although summer brings long hours of daylight throughout Nunavut, there are areas where the sun never rises during winter. Because of greatly reduced hours of daylight and extreme cold, it is very uncommon for visitors to travel in winter. Only people with specialised skills and equipment should attempt winter travel.

Winds of 15 to 20 kilometres per hour are common year round. Winds can reach extremes of over 100 kilometres per hour very quickly. Beware of blowing sand in summer and white out conditions when there is snow.

Know the signs and symptoms of hypothermia and how to treat it. Know how to prevent hypothermia by staying warm, dry, well fed and hydrated. Carry plenty of water with you year round to avoid dehydration. Freezing temperatures and snow are possible at any time of year.

Think carefully about the clothing that you will bring.

- Windproof gloves, over-mitts, a warm hat, scarf, balaclava or neck gaiter and wool socks are standard gear year round.
- Varying temperatures and vigorous outdoor activity require layered clothing. Start with long underwear bottoms and tops followed by additional upper and lower layers.
- Depending on the weather, cover up with either windproof or breathable waterproof jackets and pants.
- Do not wear cotton. When cotton gets wet from rain, snow or perspiration it cools your body temperature, potentially leading to hypothermia.
- Bring a warm parka with a hood.
- Bring sturdy hiking boots, running shoes for around your camp and neoprene booties with water sandals if you plan to travel on water, as well as for creek and river crossings.

- Traveling by boat, your feet will be in contact with the hull of the boat where the temperature is usually close to freezing. Bring insulated rubber boots or oversized regular rubber boots with layers of wool or pile socks inside.
- Wear a hat as well as sunscreen with high sun protection factor.
- Protect your eyes with high ultraviolet filter sunglasses.

Example of crossing rivers on foot - Zackenberg Research Station, Greenland
(Small to medium sized, very remote station reached by chartered plane)
http://www.eu-interact.org/fileadmin/user_upload/pdf/Station_management/AU_Health_and_safety_manual_for_fieldwork_in_Greenland.pdf

Crossing rivers on foot is associated with high risk for several reasons. The water is cold, currents may be strong and there may be deeper channels which are not visible from the bank. There must always be two persons present. Bring a pole and use it to feel your way and to support you. Never cross barefoot as you may lose the feeling in your feet and find it hard to manoeuvre where there are stones underfoot. Use either neoprene socks or gaiters over boots. Waders should not be used.

For crossing larger rivers, you may bring a rope and tie it around each other's waist during the crossing. However, never attempt to cross a river if you are uncertain whether it is feasible. During periods of ice melt, where there may be deep waterlogged snow in the river bed, never under any circumstances try to cross such waterlogged snow as you risk sinking through the snow and drown.

Before crossing a river, **always** remember to loosen the straps of your rucksack so that you can drop it quickly if you fall.

Example of glacier rescue kit, page 9 in the University Centre in Svalbard's 'Safety instructions for fieldwork and excursions & Instructions for use of field equipment'.
http://www.unis.no/48_HSE/documents/Version8English_Safety_field_excursions.pdf

Example of polar bear safety, Nunavut Parks, Canada
http://nunavutparks.ca/english/visitor-information/polar-bear-safety.html)

Polar bears are among the largest carnivores in the world. They are strong, fast and agile on ice, land, as well as in water. The best way to be safe is to avoid them.

Avoiding Encounters
Stay alert. Always travel in groups and stay together to increase your safety. Make noise as you travel through bear country to communicate your presence. Always travel in daylight and be aware of your surroundings. Polar bears may be hard to see. Scan around with binoculars at regular intervals. Avoid areas of restricted visibility, pushed up sea ice, boulders, driftwood or vegetation. Watch for tracks, droppings and diggings.

Never approach a bear. Polar bears defend their space and may consider you a threat. Never feed bears or other wildlife. A bear that associates humans with food is dangerous. Never approach a wildlife carcass. A bear may be in the area. Leave immediately.

Polar Bear Encounters

You may encounter a polar bear by chance or because it is attracted to your activity. Polar bears are curious and may investigate any strange object, smell or noise. Always stay calm and assess the situation. Each encounter with a polar bear is unique. Good judgment, common sense and familiarity with polar bear behaviour are important.

- *Curious Bears* - If a bear knows you are there and shows signs of being curious such as moving slowly with frequent stops, standing on hind legs and sniffing the air, holding its head high with ears forward or to the side, moving its head from side to side, or trying to catch your scent by circling downwind and approaching from behind, do not run. Back away slowly. Help the bear identify you as human by talking in low tones. Move slowly upwind of the bear so that it can get your scent. Always leave an escape route for the bear. Do not run.
- *Defensive Bears* - If a bear has been surprised at close range or shows signs of being agitated or threatened such as huffing, panting, hissing, growling, jaw-snapping, stomping its feet, staring directly at a person, or lowering its head with ears laid back, do not run. Back away slowly. Do not shout or make sudden movements. Avoid direct eye contact. Act non-threatening. Be prepared to use deterrents. Do not run.
- *Predatory Bears* - If a bear shows signs of stalking or hunting you such as following or circling you, approaching directly, intently and unafraid, returning after being scared away, or appears wounded, old or thin, do not run. Group together and make loud noises. Be prepared to use deterrents. Be prepared to fight back. Do not run.
- *Bears With Cubs* - Never get between a bear and her cubs. If you come across a bear with cubs, do not run. Group together and leave the area immediately. Be prepared to fight back if she attacks.

If you experience a polar bear attack use any available weapon such as rocks, blocks of ice, knives, skis or poles.

Camping Safely

Avoid camping on beaches and along coastlines. Polar bears often travel along coastlines using points of land and rocky islets near the coast to navigate. Avoid camping in narrow valleys and passes. These may be used by bears to cross peninsulas and to move from one valley to another. Camp inland, on high ground, where you have a good view of your surroundings. Look for bear tracks before you set up camp. Move your camp if there is a bear in the area.

Keep Your Camp Clean. Cook, clean, store food, stoves, pots and all cooking gear including the clothes you cook in, as well as garbage, food scraps, or any scented products at least 100 meters from your sleeping area. Use bear proof canisters or airtight containers for storage. Faeces should be buried under rocks away from trails, at least 100 meters from your camp and away from all water sources. Put all used toilet paper and feminine hygiene products in a sealed bag with your garbage. Pack out all of your garbage including food scraps and packaging. Do not burn packaging as lingering food odours may become attractants to bears. Pick up any spilled food from your cooking and eating areas. Position your camping, cooking, storage and human waste areas so that you always have a clear escape route from a bear.

Never sleep in the open without a tent. Never bring strong smelling foods or scented products of any kind. Never cook, store food or scented products in your tent.

- *Warning Systems* - All members of your group should be familiar with handling bear encounters in a variety of circumstances. Inform yourselves about bear warning systems and deterrents. Know how and when to use them before your trip. Consider bringing and setting up a portable trip-wire or motion detector system to alert you if a polar bear approaches your camp.

- *Deterrents* - Availability of commercial bear deterrents such as noisemakers, air horns, as well as pistol and pen launched 'bear bangers' is limited in the Arctic. Most deterrents must be purchased elsewhere and transported as dangerous goods. Pepper spray may work on polar bears but has not been thoroughly tested. Be aware that pepper spray may not work when it is cold or wet.
- *Firearms* - Check with Nunavut Park staff for regulations governing carrying and using firearms.

Example of polar bear safety precautions (paper)
Clarkson, P. L. and Stirling, I. (1994). The Handbook: Prevention and control of wildlife damage – Polar bears. University of Nebraska.
http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1029&context=icwdmhandbook

Video on use of a fence to deter polar bears of campsites
http://www.youtube.com/watch?v=3txRsJ-l5cI

Example of guidelines for encounters with wildlife in Greenland
Thing, H. (1990). Encounters with wildlife in Greenland. Department of environment and wildlife management/Utakkiorfik, Nuuk, Greenland.
http://www.zackenberg.dk/fileadmin/Resources/DMU/GEM/Zackenberg/pdf/encounters-with-wildlife.pdf

Station examples

6.1 Samoylov Research Station, Russia

(Small very remote station reached by helicopter or boat)
By Anne Morgenstern and Kirsten Elger

Health and Safety

The Samoylov Research Station has been a Russian-German station owned and run by the Lena Delta Reserve (Russia) and the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (AWI) (Germany). The participation of non-Russian citizens in expeditions to the Lena Delta has been coordinated by the AWI. Until now, foreign groups that are not coordinated by the AWI are not able to visit Samoylov Station. Expeditions to Samoylov Station are led by two scientific expedition leaders, one Russian and one Germany-based. For Russian participants, the regulations differ from those for foreign scientists and visitors. The example given here is mainly reflecting the practise of Germany-based visitors, which follows the regulations set by the AWI for expeditions to the Arctic. Relevant information for participants as well as documents and forms are provided on the AWI website
http://www.awi.de/en/institute/general_services/logistics/information_for_expedition_participants

Policies

All policy issues are regulated under the responsibility of the AWI directorate, which delegates their implementation to the logistics department.

Health policy

All Germany-based participants in expeditions to the Samoylov station are required to undergo a medical examination that needs to be confirmed by the AWI physician, who has to attest their travel and expedition fitness.

Insurance policy

In general, all foreigners travelling to Russia need to document foreign travel health insurance in order to obtain a Russian visa. AWI-employed participants are health and accident insured during working time on expeditions through the institute. Non-AWI participants are obliged to have a valid foreign travel health insurance including repatriation. In addition, AWI recommends all participants to obtain a supplemental insurance that covers accidents that occur during leisure time as well as extraordinary risks typical for arctic expeditions such as helicopter flights, exposure to polar bears, etc., and has special contracts with a cooperating insurance partner that provides such policies.

Liability policy

AWI employees are insured against third-party risk. All non-AWI participants have to sign a declaration of indemnity.

Under age and family policy

The AWI does not allow accompanying persons and children during expeditions and at Samoylov Station for insurance and logistical reasons.

Important health and safety aspects and mitigation measures

For transport

Transport to and from the Samoylov station is mainly organised by helicopter (see Figure 6.1.1) and during summer by river boat (see Figure 6.1.2), which both operate on a charter basis. Safety aspects during transport are regulated by the charter companies and organisations. During winter, transport is possible on ice routes across the Tiksi Bay and along Lena Delta channels. It is organised by the Lena Delta Reserve, which is responsible for reconnaissance of the winter routes and all safety aspects during transport.

Example figure 6.1.1. Arriving at Samoylov Island by helicopter. Photo: Mathias Ulrich.

Example figure 6.1.2. Participants arrive at Samoylov Island by river boat. Photo: Anne Morgenstern.

Samoylov Island itself is a quite safe environment because of its small size of about 5 km², low tundra relief, and absence of dangerous wild life. Distances to measurement plots and investigation sites on the island are covered by foot, mainly across low-center polygonal tundra surfaces. Frequently visited plots are equipped with boardwalks. For the transport of heavy goods a quad with trailer is available; it is operated by the station manager only to prevent damage of the sensitive tundra surface. A large part of the coastline of the island is strongly eroding and builds a steep cliff up to 10 m high. Visitors are advised to keep away from the cliff, because the undercutting and detachment of ice-wedge polygons close to the cliff pose the risk of block failure.

Transport to field sites in the vicinity of Samoylov Island is accomplished by small motor boats along the Lena Delta channels (see Figure 6.1.3). All passengers have to wear life jackets that are available at Samoylov Station. For a boat with an engine of more than 5 HP the driver is required to possess a valid licence. Boats with engines of up to 5 HP can be driven without restrictions. However, they are only recommended for short distances in calm waters. The delta channels are up to several kilometres wide, navigation is guided by navigation marks. During strong winds, motor boat operation has to be stopped, because wave activity in the broad delta channels can get significant and pose a severe risk to small open motor boats.

At the station

All researchers who are going to work on Samoylov Station (see Figure 6.1.4) or use the station as a base for field work in the Lena Delta and all other visitors are introduced to safety regulations and guidelines for working and living on Samoylov Station. This is done through an annually updated document ‘Rules of

conduct on Samoylov' that has to be signed by expedition members prior to the expedition to acknowledge that they have read and understood the regulations and guidelines. Participants that have not visited Samoylov Station before receive an on-site-instruction upon their arrival at the station by the station manager.

At the station and especially in the laboratories German health and safety regulations apply. So far, two laboratories have been operated on Samoylov Station, one technical lab with computers and communication systems and one chemistry lab. Handling of chemicals is allowed in the chemistry lab only. The operation of chain saws is restricted to persons possessing a valid license.

Example figure 6.1.3. Transfer of expedition participants and equipment from Samoylov Station to a field site along the Olenyokskaya Channel. Photo: Anne Morgenstern.

Example figure 6.1.4. View of Samoylov Station located close to the eroding cliff of Samoylov Island. Photo: Anne Morgenstern.

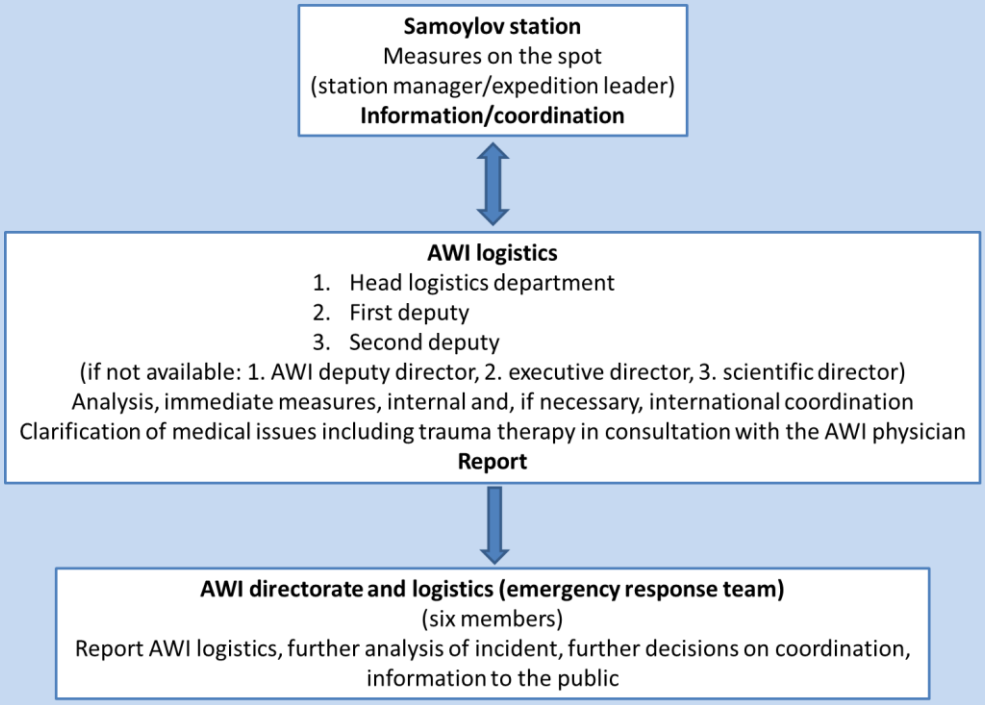
In the field

Everybody leaving the station for field work has to give notice of departure to the station manager, including information on the planned field work location and time of return. They also have to report back to the station manager immediately after return. When doing field work out of sight of the station, people must go at least in groups of two and/or bring VHF-radios for activities close to the station. Field parties doing day trips to other delta islands should take an emergency case (box with a selection of emergency equipment) as well as emergency provision and basic equipment for an emergency overnight stay in case transport back to Samoylov Station is not possible. Field parties that leave Samoylov Station for several days or weeks and live in a field camp during that time also have to take an emergency case. They should contact Samoylov Station twice a day at the time stipulated by VHF-radio or satellite phone to report on their safety.

Field plots have to be restored after completion of field work to minimise impacts and prevent disturbances in the highly sensitive tundra ecosystems.

Emergency preparedness

The AWI has implemented emergency plans for its research platforms and stations with detailed guidelines on communication and coordination. The emergency plan is distributed to all platforms and stations, i.e. the station managers and expedition leaders. Figure 1 shows an example of the communication structure in case of an emergency at Samoylov Station. The station manager and expedition leader take all necessary action on the spot in consultation and cooperation with the local partners and authorities. The leader informs the AWI logistics department. If necessary, the AWI logistics will coordinate and implement further measures on an international level together with the Russian cooperation partners.



Medical facilities

So far, there has been no medical doctor on site at Samoylov Station. All expedition groups are provided a standard emergency case by the AWI logistics department. In case of an emergency, it takes about two hours to reach the next hospital in the town of Tiksi.

Medical and safety training

A two-day medical and safety training is offered at AWI to all employees. Such training is strongly recommended for all participants of expeditions to Samoylov Station.

6.2 - Environmental Change Network Cairngorms (ECN Cairngorms), UK

(Large, easy access station reached by road, bus, or train)

By Chris Andrews and Jan Dick

Health and safety policies

Further information available from:
http://www.nerc.ac.uk/about/work/policy/safety/procedures.asp

Health policy.

The Cairngorms field site incorporates a mix of terrains some of which are steep with rough ground. The research area covers the entire catchment (approximately 10km^2) with elevation ranging from 350 – 1,100 m. There is no vehicle access beyond 350 m altitude, so all equipment must be carried. Because of this, it is expected that all researchers to the site should have a reasonable overall level of fitness.

Insurance policy. It is the responsibility of the researcher/collaborator to ensure they are adequately insured for the tasks they undertake. Natural Environment Research Council (NERC) employees are covered as explained in the NERC Insurance Handbook http://www.nerc.ac.uk/about/work/policy/safety/documents/inshandbook.pdf. All passengers travelling in NERC vehicles are covered by the 3rd party provisions of the NERC insurance policy irrespective of whether or not they are NERC employees. NERC drivers are covered by a separate Personal Accident policy.

Liability policy (from NERC Health and Safety Policy). Other parties who are working on NERC premises, such as contractors, collaborators and consultants, but who are not NERC employees and are not working under the direct control of NERC staff will be informed of the high standards required of them in relation to health and safety. They will be monitored on their compliance with all aspects of those standards. They will be expected to follow the NERC Safe Systems of Work (SSoW) where agreed as appropriate, receive training and information where necessary and ensure their own safety and the safety of other persons who may be affected by their acts or omissions.

Where visiting researchers are working under the direct control of NERC staff, NERC has a duty to provide a safe place of work for all staff and 'others', such as students, visitors and volunteers, who might be involved. This applies to field sites (fixed or temporary) in exactly the same way as buildings. In such circumstances a risk assessment is required for all work activities (NERC procedure on risk assessments, and ECN Cairngorm risk assessment).

Underage and family policy. There are no specific policies relating to underage and family members being present during fieldwork. However it is not advised that underage or family members should assist/join you on fieldwork unless trained to do so. Unless notified as part of the research group they are solely responsible for their own safety and actions when on site. If notified as part of the research group then they would be expected to adhere to the health and safety policies as set out in this document.

Important health and safety aspects and mitigation

Transport. Risks associated with driving are covered in the NERC Management of road risk http://www.nerc.ac.uk/about/work/policy/safety/documents/procedure_road_risk.pdf. Risk assessment and mitigation on driving to and from the ECN Cairngorm field site specifically are covered in the ECN Cairngorm site risk assessment and the ECN Safe System of Work (SSoW). In general terms the documents suggest ensuring the vehicle is fit for purpose, eliminating the need for the journey if possible (e.g. stay in a hotel close to the field site), take a 10-15minute break after every two hours driving, and ensure a maximum work/drive time of 12 hours per day.

CEH Edinburgh. A risk assessment exists for general office work at CEH Edinburgh, and covers general risks that can occur when working in an office environment. Laboratories are covered by specific risk assessments dependent on the tasks involved. In cases involving work with chemicals, there is a further requirement to prepare and adhere to a control of substances hazardous to health assessment (COSHH). The NERC COSHH procedure is attached. A code of practice exists on the door of each laboratory and governs general behaviour and procedure in that laboratory including information on safe systems of work,

waste disposal and evacuation. There also is a NERC general laboratory procedure which defines laboratories and general risks.

ECN Cairngorm. Risks at the ECN Cairngorm site are covered by the ECN Cairngorm site risk assessment and the ECN SSoW. The greatest risk to health is generally considered to be driving to and from the site. When on site the biggest risks are from the weather and underfoot conditions / hazards (e.g. trips, slips and falls). The risk assessment covers each of these in detail, but generally suggests that wearing suitable clothing (multiple light layers, and a wind/waterproof outer shell) and sturdy footwear (hiking boots) is the best way to reduce the risks. The SSoW provides in depth information on mitigating such risks through forward planning. Further documents on NERC loan working policies are also attached, and are also covered by the SSoW.

Emergency preparedness

Accident and illness. It is advisable that some members of a visiting team should be trained in at least basic first aid. A first aid kit must ALWAYS be carried in the field along with a fully charged mobile phone able to roam on UK mobile networks. Jan Dick and Chris Andrews of the ECN Cairngorm team are trained in outdoor first aid and could potentially provide assistance if working in the area. Minor accidents can be treated on site using a first aid kit; as with minor illness it is then advisable to vacate the field site to a more comfortable area to recuperate. It is important to remember the personal safety of the whole group following an accident to prevent anybody else becoming a victim too. More serious incidents should be treated as per 6.3.2 and 6.3.3. All accidents or medical emergencies should be reported to a member of the ECN Cairngorm team at the earliest reasonable opportunity.

Handling of evacuations. In cases of serious illness or accident when it is not possible to vacate the field site without outside assistance an emergency rescue service should be called by dialling for the **police** (999 or 112) from a mobile phone and asking for the **mountain rescue**. In these situations it is important to know **where you are** before you call and to be able to provide the rescue services with a map **grid reference**, along with as much detail about the problem as possible. It should be noted that there is still likely to be a prolonged wait after calling for rescue during which continued first aid might need to be administered. It is important to make yourself visible to rescuers at the earliest opportunity upon their arrival in the area.

Initiation of Search & Rescue. See 6.3.2.

Medical facilities

ECN Cairngorms. There are no medical facilities at the field site other than what is carried in by researchers. It is expected that as a MINIMUM teams will carry a basic first aid kit capable of dealing with minor cuts, grazes, twists and sprains etc… Emergency shelters big enough to accommodate the whole group should also be carried to provide protection from the elements during medical situations, or even as shelter for any prolonged stay on the hill.

CEH Edinburgh. At CEH Edinburgh there is a first aid room for those taken ill which is equipped to deal with minor accidents or illness. There are also several first aiders on site to help with any medical problems that arise. The names and phone numbers of which are detailed near the first aid room. A defibrillator is also located on site for use by those trained to use this equipment.

Medical and safety training

Medical and safety training policy. All NERC staff members undertake regular safety training for routine tasks related to scientific research. This includes annual training in Display Screen Equipment (DSE), manual handling and fire awareness. Chris Andrews and Jan Dick of the ECN Cairngorm team are also trained in outdoor first aid and re-train in this every three years. Certificates are also held in off-road driving and Safety management in a research environment.

Medical and safety expectations. Visiting researchers are not required to provide evidence of specific training in first aid, although they are expected to have a basic knowledge as no specific training will be provided. We will however discuss with visiting researchers all important safety aspects of working at the site. This information is also covered within the ECN Cairngorm SSoW document which is mandatory reading for all prospective researchers prior to the commencement of work.

Medical and safety manuals. None available.

Key information

Essential health and safety information for visitors. All visitors to the field site should acquaint themselves with the ECN Cairngorm SSoW as well as the ECN Cairngorm Risk Assessment. Further information is available to cover laboratory procedures dependent on work undertaken. If chemicals are to be used, it is expected that users will follow COSHH guidance which should be provided by the manufacturer, in conjunction with local laboratory SSoW.

Essential Health and safety information required from visitors. Not required, though discretionary disclosure of any serious medical conditions might be helpful in the event of an emergency situation. If you are not medically fit for walking/working in a mountainous environment in any possible weather conditions then you should consider if this is a safe working environment for yourself and your team.

7. Environmental impact of station operations

7.1 Introduction

Research stations provide platforms for studying changes to the natural environment and for studying the effects of specific stressors or human impact. Paramount for running a research infrastructure is therefore that that the impacts of the station and associated activities on the environment are kept at the lowest possible level to maintain the area as a suitable research and monitoring site.

When developing and operating a research station, it is therefore important to consider the impacts of the station infrastructure itself and the activities undertaken at the station as these can have an impact on the environment (both directly and indirectly), and hence affect research and monitoring results. Negative impacts of station activities include physical changes of the landscape/environment from building of infrastructure (housing, roads, paths, power supply, water, sewage, etc.), setting up research equipment, manipulations of the environment, wear from transport/walking, emissions (to air, water and soil), etc. But there are also positive impacts like conservation of land, increased scientific understanding and outreach activities that builds capacity among decision makers and the public. The latter (positive impacts) are not dealt with in this theme.

When developing infrastructures and related policies, regulations and procedures to minimise environmental impacts, station management should be aware of existing legislation relevant for station operations, e.g. standards for construction, use of chemicals, fuel storage, garbage handling, sewage, etc. Station management may also want to follow specific international or national standards, obtain environmental accreditation or develop stricter requirements to ensure that station facilities and activities have a minimum impact on the natural environment. Environmental impacts are also related to user behaviour (e.g. water and electricity use, garbage handling, behaviour in field, etc.). It is therefore important to develop and communicate relevant policies, regulations, procedures, etc. to both staff and visitors.

There may be huge differences in the way stations deal with environmental issues depending on remoteness, size, environmental sensitivity, national legislation, etc. Stations located in urban environments or near national electricity grid, garbage handling/recycling systems and sewage can tap into these systems (and if needed lobby for environmentally sound practices), while remotely located stations need to develop their own environmentally friendly practices to minimise the ecological footprint of the station. Either way, many of the negative impacts can be minimised by proper planning combined with sound management policies, procedures and practices.

Aside from direct and indirect benefits for the environment, stations may also economically benefit from environmentally sound practices by e.g. reducing fuel consumption for electricity or heating, minimising garbage production, increase recycling (some companies pay for certain types of metal, etc.). Payback time from investments in cost cutting environmental equipment/products can be calculated if the difference in recurrent running costs (including maintenance) and price of the investment are known. This can argue for or against investments, when considering the added benefits for the environment.

Knowing and monitoring impacts are central for working to reduce the ecological footprint of a station. Environmental Impact Assessment (EIA) and monitoring resource consumption, emissions and environmental impacts can help stations identify the most significant impacts and help focus initiatives to reduce these. A reporting system for incidents that caused (or nearly caused) pollution/damages to the environment can also help the station determine needs for revised policies, regulations or practices.

In this theme you can read about:

- Legislation and standards.
- Environmental Impact Assessment.
- Limiting impacts.
  - Energy for heating and electricity.
  - Chemicals, fuel and other hazardous substances.
  - Garbage and waste.
  - Water consumption and disposal.
  - Impacts on natural environment.
- Eco-policies.

7.2 Legislation and standards

National legislation on environmental protection may include regulations on a number of issues relevant for operating a research station, e.g. sustainability in construction, energy consumption, emissions, use of hazardous substances, recycling, garbage and waste handling, water consumption/disposal, etc. While it is important that stations stay updated on some legislation relevant for station operations (research permits, dispensation from specific legislation), other relevant legislation can be visited on an ad hoc basis when activities so demand (e.g. developing new infrastructures, revising management plans, etc.). Station management should establish good contact and communication routines with authorities in order to stay updated on relevant legislative developments related to station management and environmental issues. A record of relevant legislation can be useful especially if there are frequent staff changes.

International standards, external audits and environmental accreditation can be tools for working continuously to reduce environmental impacts of station operations. The international standard organisation (ISO) has a number of standards related to various aspects of station management (see box and examples below). There are certified consulting companies that can help implement specific standards and evaluate how these are integrated in station operations. Certified companies grant the accreditation or describe issues that need to be dealt with to comply with the standard. Note that some environmental management standards do not set specific goals for consumption/emissions/etc. but 'just' aim to ensure that stations work continuously to reduce impacts.

If a station does not have the human capacity to implement environmental management standards, external help can be sought (provided by many consultant/accreditation companies). Donors or funding agencies may require environmental accreditation as a prerequisite for becoming eligible for certain grants, thus also impacting how stations choose to deal with environmental impacts.

Box 7.1. The International Standard Organisation (ISO) and short presentations of most relevant standards.

ISO Standards[14]

What is a standard?

A standard is a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose. ISO has published over 19,500 International Standards.

What are the benefits of ISO International Standards?

ISO International Standards ensure that products and services are safe, reliable and of good quality. For research stations, they are strategic tools that reduce costs by minimising consumption, emission, accidents and impacts. The use of international standards may also ensure interoperability of databases and sharing of information.

Examples of standards:

ISO 14001:2004 - Environmental management systems

ISO 14001:2004 specifies requirements for an environmental management system to enable an organisation to develop and implement a policy and objectives which take into account legal requirements and other requirements to which the organisation subscribes, and information about significant environmental aspects. It applies to those environmental aspects that the organisation identifies as those which it can control and those which it can influence. It does not itself state specific environmental performance criteria.

ISO 14001:2004 is applicable to any organisation that wishes to establish, implement, maintain and improve an environmental management system, to assure itself of conformity with its stated environmental policy.
http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=31807

Similar to the ISO standard on environmental management, the EU has developed an Eco-Management and Audit Scheme (EMAS) which is a management tool that can be used to evaluate, report and improve their environmental performance.
http://ec.europa.eu/environment/emas/

ISO 21929-1:2011 - Sustainability in building

ISO 21929-1:2011 establishes a core set of indicators to take into account in the use and development of sustainability indicators for assessing the sustainability performance of new or existing buildings, related to their design, construction, operation, maintenance, refurbishment and end of life. Together, the core set of indicators provides measures to express the contribution of a building(s) to sustainability and sustainable development. These indicators represent aspects of buildings that impact on areas of protection related to sustainability and sustainable development.

The object of consideration in ISO 21929-1:2011 is a building or a group of buildings and the external works within the site (curtilage).
http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=46599

ISO/TS 14067:2013 - Greenhouse gases and carbon footprint
http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=59521

ISO/TR 14047:2012 - Environmental management and Life cycle assessment
http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=57109

[14] http://www.iso.org/iso/home/standards.htm

7.3 Environmental Impact Assessment

Operating a research infrastructure with focus on changes in natural ecosystems often necessitates strict regulations to minimise the ecological footprint of the station and ensure that the area is kept as close to a natural state as possible and to reduce Climate Change contributions. Research stations should therefore seek to identify environmental impacts of station infrastructures, station operations and visiting researchers, and develop appropriate mitigation measures to minimise or reduce these in line with the vision, mission, concept, strategy and policies of the station (see Themes 1 and 2).

This can be done through an Environmental Impact Assessment (EIA). The objectives of an EIA are to:

a) Examine the impact of human activities on the environment (e.g. housing and station operation, and field equipment and activities).
b) Examine the conflicts between the various activities (e.g. between resource extraction and research, between emissions (to air, water and land) and scientific measurements).
c) Recommend actions to reduce impacts and conflicts in order to maintain and restore the area as a near pristine site for environmental research and monitoring (include actions in an Environmental Action Plan).

An EIA should thus include a description of the natural environment, and seek to identify predicted conflicts and impacts of station infrastructures and activities. To provide an overview of impacts and mitigation measures, many EIAs use a form to list station infrastructures and activities that impact the environment, and for each of these describes the type of impact, significance and possible mitigation measures.

Mitigation measures for resolving conflicting interests (research activities/station operations vs. environmental protection) and significant impacts should be described in an Environmental Action Plan (that can be part of the EIA). This plan should clearly describe actions, i.e.: the task, responsible personnel and a timeline (and if needed available resources).

Means for implementing mitigation measures includes management plans, strategies, policies, regulations, check lists, and staff and visitor information documents (see Themes 1 to 4).

Example of EIA - Sverdrup Station Ny-Ålesund, Svalbard
(Very large, very remote station accessed by plane or boat)
Sander, G.; Holst, A. and Shears, J. (2006). Environmental impact assessment of the research activities in Ny-Ålesund 2006. Brief Report Series no 4, Norwegian Polar Institute, Tromsø, Norway.
ftp://ftp.npolar.no/Out/nysmac/EIA_Report.pdf.

Example of Environmental Impact Assessment Guidelines from Antarctica – CONMAP
(Council of Managers of National Antarctic Programmes)
https://www.comnap.aq/Publications/Comnap%20Publications/atcm_guidelines_envimpactassessment_2005_en.pdf

Example of generalised EIA content (see Appendix 7.1).

Example of EU EIA screening check list for assessing whether a proposed project (infrastructure or research projects) should be subjected to an EIA (See Appendix 7.2).

Other EU documents related to EIA can be found on http://ec.europa.eu/environment/eia/eia-support.htm

7.4 Limiting environmental impacts

Key elements in minimising the impacts of station activities are to regulate user behaviour and limit resource use. User behaviour can be regulated through policies, regulations, procedures and guidelines communicated to staff and visitors in relevant documents (see Themes 3 and 4). Emissions to the natural environment can be minimised by limiting resource consumption and ensure safe handling and disposal of waste, garbage, contaminants and hazardous substances. Limiting the number of people is another way of limiting impacts and ensuring that environmental conditions do not deteriorate. The size of the area and the environmental impact mitigation measures developed at the station determines how many people the station can support without significantly impacting the environment.

Costs, reliability and maintenance are important elements when stations seek out more sustainable solutions for the development of station infrastructures. Therefore, in some instances it is necessary to weigh up these issues against the environmental impact. Many emission reducing solutions can also have short payback times (purchasing cost divided by reduced running costs) and thus help the station reduce emissions and running costs at the same time. Stations should continually seek to reduce or minimise the 'ecological footprint' of the station by balancing costs of station infrastructure developments and environmental impact.

Ways of minimising environmental impacts include:

- Limit the number of people at the station.
- Limit resource use by, e.g.:
  - Planning to ensure that resources brought to the station are used (food, medicine and some fuel types have expiry dates. Unused equipment and materials are a waste of money and emissions).
  - Ask suppliers to minimise packaging.
  - Buy equipment and parts with minimum environmental impact (e.g. energy saving bulbs)
  - Buy high quality products that last longer (e.g. quality brands).
  - Use digital communication to save paper.
- Regulate user behaviour by developing regulations and guidelines for e.g.:
  - Transport (to minimise risk of spills, disturbance of wildlife, erosion, damages to vulnerable species, etc.).
  - Land use (e.g. to regulate access to specific areas, ensure sufficient distance between generators and measuring stations).
  - Use of field equipment (to minimise risk of spills and ensure removal after use)
  - Use of water, electricity, chemicals, etc. (to minimise emissions and risk of spills)

    - Littering (no littering).
- Re-use equipment or materials:
    - For other purpose.
    - For spare parts.
    - For use at other station/institution/company.
- Recycle:
    - At station.
    - Recycling plant.
- Use environmentally friendly products (e.g. equipment, cleaners, etc.):
    - Use energy saving equipment (bulbs) and environmentally friendly products. Buy products complying with international/regional/national environmental standards.
    - Use sustainable energy sources (wind, solar, hydro or bio).
- Separate waste into different components and identify best possible disposal mechanism:
    - Paper, cardboard, wood, fabric, plastic, metal, glass, food, medicine chemicals, equipment, human waste, etc.
- Reduce volume:
    - Use garbage compressor to reduce shipment volume.

Buying environmentally friendly products is also a way of minimising impacts on the natural environment. For this purpose, the EU has developed the '*Buying Green! – A handbook on green public procurement*'. [15]The handbook is a very concrete tool that helps public authorities to buy goods and services with a lower environmental impact.

Appendix 7.3 provide examples of general recommended practices for dealing with different resources and their impacts based on a case from Zackenberg Research Station, Greenland.

Energy for heating and electricity

Energy sources used at arctic or alpine research infrastructures should be clean, reliable and affordable. Energy is used for providing electricity for heating and for operating equipment at the station or in the field. Access to power thus remains one of the key services offered by research stations.

Fossil fuels are often used for electricity production or heating at remotely located stations, but the use of new alternative energy sources is increasing. Alternative energy sources are especially useful for providing power to field equipment located far from the station infrastructure, reducing the need for wiring from central generators and thus reducing CO_2 emissions and minimising impacts on landscape and terrain.

When developing a power supply system for a research station, it is important to know the required energy demand at the station (including peak use), the potential supply from the various energy sources, costs of purchase and maintenance (especially if external assistance is required) and environmental impact of emissions (e.g. transport emissions and burning of fossil fuel). The use of many different energy sources for the power supply system at research stations might increase the complexity in relation to run of the

[15] http://ec.europa.eu/environment/gpp/buying_handbook_en.htm

system, and this should be weighed against the competences and continuity, and against the external assistance that the station can afford.

Sustainable energy solutions

Alternative energy sources used at arctic research infrastructures includes wind, solar and hydro power systems. Solar power is (for obvious reasons) especially useful for summer use, while wind power may be more useful for all year operated equipment. Hydropower may be useful during warmer months, but can be problematic in winter, unless running river water is available throughout the year or hydropower dams do not freeze.

As wind and solar power generates energy only when the wind blows or the sun shines smart ways of storing energy is needed. Currently batteries are the best option, and though their capacities are generally increasing they are still a limiting factor for use as alternative energy resources, and often they constitute an environmental concern in themselves. If dams are used to accumulate water, hydropower system may enable stations to store enough potential energy that can be consumed upon demand throughout the year. However, building of dams might not be compatible with research interests.

Frequently used energy sources for field equipment are small wind mills/turbines or solar panels. Alternative energy sources may also be used for heating and electricity production at station infrastructures, but the usefulness depends on:

- Environmental impact (consumption, efficiency and emissions. Is the accumulated impact less than current practices? - compare life cycle analyses of current and proposed solutions).
- Energy demand pattern at the station (can production meet fluctuations in demand over the day/year?).
- Energy demand for different infrastructures, e.g. field equipment, heating and energy for other station infrastructure (machines, pumps, equipment, generators, etc.).
- Costs (purchase, transport, installation and running costs, incl. maintenance).
- Availability (data and conversion factors needed for potential sun, wind and water sources).
- Reliability of power supply system (availability of sources, functionality of equipment, capacity to maintain at station, etc.).
- Required training to run and maintain installations.

Fossil fuel

Most research stations operating in remote arctic or alpine locations use fossil fuels for parts of their power supply system, for transport and/or for heating of buildings. With the current limitations on battery powered engines in cold areas, it is difficult to reduce transport fuel consumption significantly. However, by buying new energy efficient models and ensure proper maintenance of vehicles, emissions can be kept at a minimum.

Heating systems using fan heaters are often more economically efficient than oil generated heat systems, as they allow for more flexible use. Oil generated heat systems tend to be on at all times, as it takes significant time to warm up a room, while fan heaters are fast and hence can be turned on upon demand.

But it is the conditions at the specific station that determines which solution is best (e.g. need for 24/7 heating, capacity of generator, size of buildings, insulation, user behaviour, etc.).

The need for a reliable energy source may necessitate the use of generators running on fossil fuels. New energy efficient models and proper maintenance can keep emissions at a minimum. If implementation and running costs allow and environmental benefits can be achieved, alternative energy sources can be used to supplement the use of fossil fuels in order to minimise emissions (and possibly also costs).

Example of best practice for energy management – CONMAP
(Council of Managers of National Antarctic Programmes)
https://www.comnap.aq/Publications/Comnap%20Publications/COMNAP_energy_management_best_practice_wp035.pdf

The energy management guiding principles developed by the COMNAP energy management group are generally adopted by National Operators within their area of influence. There is a significant recognition amongst operators that energy saving is essential to reduce environmental impact and the cost of purchasing fuel. The guiding principles are:

- Measure and clearly identify where energy and power is being used.
- Introduce an education programme to recognise the need for energy saving and encourage personnel to implement and maintain energy saving measures.
- Replace inefficient buildings or install enhanced insulation to ensure that heat loss is reduced.
- Replace power and lighting systems with energy efficient equipment and controllers that ensure that equipment is only using power when there is an operational need.
- Install energy efficient generator systems and make use of heat recovery systems where feasible.
- Investigate and where feasible install renewable energy systems to reduce the dependence on fossil based fuel.
- Reduce where possible operational activities. Particular attention to be paid to the routing of ships and the operation of engines to ensure lower fuel burn.

Example of 'zero emission station' - Princess Elisabeth Station, Antarctica
http://www.antarcticstation.org/station/

Chemicals, fuel and other hazardous substances
Chemicals, fuel and other hazardous substances must always be exported to a proper treatment facility.

Monitoring use can help identify consumption level of all substances and hence identify potential areas for reductions. It can also provide station management with exact knowledge of amounts needed for station operations and hence prevent larger quantities exceeding expiry dates (e.g. helicopter fuel and some chemicals have expiry dates).

Radioisotopes
Radioisotopes are often subjected to stricter regulations than e.g. chemicals and national legislation may dictate who can use, how to use and how to dispose. Small quantities of some radioisotopes are not

considered harmful to the environment, but station management should consult national legislation and develop appropriate guidelines for import/export, use and disposal. Note that the use of radioisotopes can 'contaminate' laboratories (and field sites) and influence studies of natural occurrence of isotopes.

Garbage and waste handling

Minimising production is the best way of minimising emissions. Careful planning, re-use and re-cycling can limit resource consumption at the station (see Appendix 7.3) and hence garbage production, but cannot eradicate it.

Garbage and human waste should be disposed of in an environmentally safe manner to reduce the risk of polluting the environment and minimise the effects on research and monitoring efforts. The garbage and waste produced at the station should be separated and ways of disposal should be developed for the individual categories of garbage and waste (e.g. paper, wood, plastic, metal, chemicals, etc.)(See Appendix 7.3).

Many countries have well-functioning garbage segregation and recycling systems that can be used by stations located in or near communities large enough to have such systems. Remotely located stations needs to have specific disposal plans for the different garbage components and waste. When developing garbage and waste disposal plans, transport costs and emissions may also influence decisions on which components can be dealt with at the station and which need to be brought to communities with proper treatment/recycling systems.

In some countries, stations can sell garbage (e.g. old batteries and metal) to recycling plants, thus recovering some of the added transport costs from exporting it.

Environmentally hazardous chemicals, substances and materials should always be exported to a proper treatment facility.

General means of limiting and disposing garbage and waste (see Appendix 7.3 for more detailed example):

- Limit resource consumption (e.g. only buy what is needed, buy high quality long lasting products, buy environmentally friendly products, etc.).
- Re-use or recycle at station (e.g. building materials).
- Burning (e.g. of paper, cardboard, wood and fuel remains). Some types of plastic can be burned in high temperature incinerators to limit the emission of polluting components, but these systems may be costly in purchase, transport and maintenance.
- Disposing in large fast flowing river or the sea (e.g. human waste and food).
- Export to proper treatment/recycle facility (e.g. plastic, metal, chemicals and hazardous materials).

Water consumption and disposal

If water is a limited resource or if consumption affects the natural environment, it is a good idea to minimise consumption. Significant volumes of water are used in both kitchen and for personal hygiene. Station management can therefore minimise consumption by buying machines (e.g. kitchen, laundry, etc.) with low water consumption and regulate user behaviour by developing water saving routines in the

kitchen and developing guidelines for the use of showers and laundry machines (e.g. max frequency, encourage short showers). Use of water saving valves and name on cups are other ways of minimising consumption.

By monitoring water use, station management can continuously assess the consumption rate and develop new or adjust existing regulations if needed.

When the water has been used at the station, it may have become polluted with cleaners, dirt particles, organic material, fluids (e.g. food, urine and human waste), etc. To minimise environmental impacts stations should use biodegradable/minimum impact products for cleaning, washing, showering, etc. To ensure that visitors also use environmentally friendly products for personal use, stations can consider providing these for both shower and laundry.

Local circumstances at the research station determine how a station should dispose its wastewater.
If stations are located in sensitive environments with limited nutrients, disposal may have significant impact on the local environment. In such cases waste water should be exported to a proper treatment facility.

Stations located at the coast or along large fast flowing rivers ending up in the sea, may dispose discharge water in the river with minimum effect on local environment and limited effect on the ocean. Note that emissions directly to the natural environment may require a permit from local or national authorities. Research stations should, before disposing waste water into the natural environment, evaluate the possible impact, for example by comparing the natural flux of nutrients and other water constituents in the river with the antropogenous contribution provided through the disposal.

Example from Zackenberg Research Station, Greenland
(Small to medium sized, very remote station reached by chartered plane)
The station is located on the shores of the Zackenberg River. This river is fast flowing (during summer when the station is open) and ends up in the sea about 1 km from the station.

Different grinding mills are used for grinding discharge of waste water, food remains, organic waste and cloak water. The grinding facilitates the degradation by microorganisms of organic matter and hence ensures fast turnover rates. Zackenberg Research Station has compared the antropogenous contribution of nutrients and other water constituents in waste water with the natural flow of these constituent in the river. The antropogenous contribution is for all relevant constituents less than 0.11 % as compared to the natural flow. A permission to emit discharge into the river has been obtained from the authorities. At Zackenberg it is not possible or environmentally feasible to transport waste water out of the research area. All transport to/from Zackenberg is by aircraft, and a thorough cost benefit analysis has therefore convinced station management that it is more environmentally friendly dispose the water in the research area than to bring out of the research area.

Example from Toolik Field Station, Alaska, USA
(Large, very remote station with road access)
The station is located at the banks of Toolik Lake, 210 km from the sea. The lake is fed by one larger and several smaller streams and an outlet lead the water through several pools and smaller lakes on the way to the sea. All waste water is collected in large plastic containers and exported to a treatment facility in Prudhoe Bay ca. 220 km away (at 1 $ per Gallon or ca. 0.2 € per litre).

Impacts on natural environment (destruction and disturbance of habitat and wildlife)
Activities in the field may impact the natural environment by changing or destroying geological features, habitats and plants or cause disturbance to animals. Some types of landscapes, habitats and species are more sensitive than others and require stricter regulations of activities.

Sensitive species and ecosystems/habitats
The International Union for Conservation of Nature (IUCN[16]) produces a Red List of Threatened Species that provides taxonomic information, conservation status and distribution information on plants and animals that have been globally evaluated using the IUCN Red List categories and criteria. The red list is produced through the IUCN Species Programme and the IUCN Species Survival Commission (SSC) who assesses the conservation status of species, subspecies, varieties, and even selected subpopulations on a global scale in order to highlight taxa threatened with extinction.

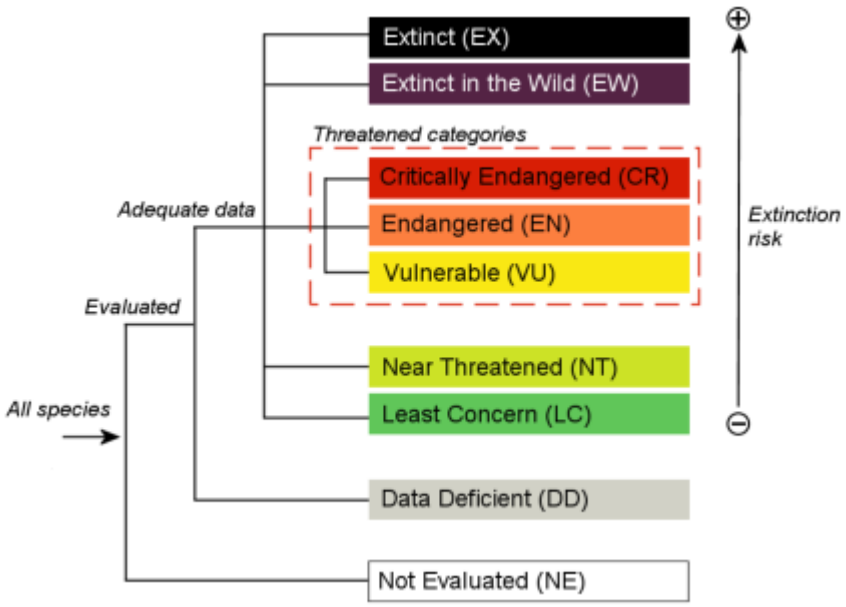


Figure 7.1. IUCN categories for threatened species.

[16] www.iucn.org

There are global regional and national red lists of species[17] and some countries also operate with yellow lists (non-threatened species in continuous decline). Similar to the red lists of threatened species, the IUCN has begun the development of a red list for ecosystems[18].

Station managers should identify sensitive, vulnerable and threatened species/ecosystems/habitats and develop regulations and procedures to prevent significant negative impacts from station operations. This should not only be limited to red listed species and ecosystems/habitats but should also include all species and ecosystems/habitats that may be negatively affected by station operations.

Certain species and ecosystems/habitats may not be vulnerable throughout the year, e.g. some species may not be around all year or may be more sensitive in the breeding period, and some habitats may be frozen during winter months and hence less sensitive to disturbance. Disturbances of animals may only have a temporary effect on the species with insignificant impact in the species survival and reproductive success. The impact and its significance depend on the species tolerance of the given activity.

Station management should therefore as part of the environmental impact assessment identify species and ecosystem/habitats for which regulation of activities or user behaviour is needed to minimise negative impacts.

Disturbances from field activities include:

- Walking.
- Driving (e.g. snowmobiles/ATV).
- Flying.
- Equipment in the field.
- Noise (e.g. talking, mechanical noise or firearm).
- Experiments and sample collection (e.g. changing habitats, removal of individuals/samples and introduction of new species).

Potential impacts include:

- Disturbance of animals (wildlife).
  - Species are especially vulnerable in breeding periods and near their breeding sites or important feeding grounds.
  - Influences of hunting success.
  - Influences of breeding success.
  - Removal of individuals (collection).
- Destruction of vegetation.
  - Destroying single species (especially problematic for vulnerable species).
  - Destroying vegetation where repeated walks are carried out (paths).
- Erosion (following destruction of vegetation).

[17] http://www.iucnredlist.org/about
[18] http://www.iucnredlistofecosystems.org/

    - Moist habitats are sensitive to weight of vehicles and possibly also people, dry areas often take long time to recover, and less vegetated areas, steep soft surface terrain and river banks are also sensitive to disturbance.
- Pollution.
    - Littering.
    - Emissions and spills.
- Introduction of invasive species and new illnesses.
    - Accidental spreading of seeds or illnesses brought to the area by visitors.
    - Experimental organisms brought to the area.
- Accidental fires (see Theme 6)

Station management should develop procedures and regulations of field activities (including behavioural guidelines for staff and visitors) that will ensure that the impact on the natural environment of station operations and related field activities remains insignificant or at absolute minimum. These procedures and regulations should be specified in:

- Management plans, strategies and action plans.
    - A Land use plan (Management Plan).
    - Policies (Management Plan, staff and visitor information documents).
    - Regulations (Management Plan, staff and visitor information documents).
- Assessments and accreditation efforts.
    - EIA (including Environmental Action Plan).
    - National or international environmental accreditation.
- Manuals.
    - Procedures (manuals).
    - Practices (manuals).
- ToR.
    - Station operations.
    - Staff.

7.5 Eco-policies

Stations can formulate specific policies related to environmental impacts and resource use. The policies may relate to protection of the natural environment, resource use and emissions from station operations (e.g. water and energy consumption and garbage handling) and should always be in line with national and local legislation.

Eco policies can also be used to influence user behaviour at station (energy and water consumption, garbage production, use of chemicals and hazardous substances, handling of wildlife, etc.), in the field (no disturbance of wildlife, no littering, remove equipment after use, no disruption of vegetation, etc.) and how to conduct specific potentially destructive activities (driving, use of snowmobiles, etc.).

Policies can also be formulated for station operations relating to reducing environmental impact by minimising resource use and emissions. If necessary, policies can be specified in regulations. Theme 2 present examples of environmental policies, wildlife handling policies, etc. (See Theme 2).

7.6 Key considerations for station management

Develop and implement environmental management and regulations

- Develop environmental policy and identify legal framework for station operations.
  - Identify local, regional and national laws and regulations related to the environment (e.g. restrictions on sampling protected species, prohibited activities, permit required for research, etc. Note that some activities are only permitted with relevant permit from authorities).
  - Identify environmental policies of owner institution.
- Conduct an Environmental Impact Assessment to develop regulations of station operations and field work that will minimise impacts in line with the vision, mission, concept, strategy and policies of the station. The EIA should:
  - Provide an overview of potential impacts and all activities, and resources used and emitted at the station.
  - Prioritise impacts by ranking these according to significance.
  - Identify mitigation measures that can reduce significant negative impacts.
    - ✓ Develop or adjust management practices and regulations (e.g. land use plan, regulation of specific activities, procedures for station operations, behavioural guidelines, etc.).
    - ✓ Investment in new infrastructure.
    - ✓ Etc.
  - Describe actions in an Environmental Action Plan (task, responsible person, timeline and, if relevant, available resources, i.e. human and/or financial).
  - Revise land use plan, policies, regulations, procedures and practices based on international agreements, national legislation and mitigation measures identified in the EIA to minimise impacts and ensure that activities at the station are in line with vision, mission, concept, strategy and policies of the station (see also Themes 1 and 2).
- Assess the need for using international standards, obtain environmental accreditation or request external audits to help the station work towards complying with specific standards.

Managing environmental impacts

- Develop screening of proposed projects as part of the application procedures by requiring visiting researchers to make a risk assessment and suggest relevant mitigation measures before they are allowed in the field.
- Develop monitoring programmes for resource consumption and emissions.
- Develop incident (or near incident) reporting system (for incidents with potential environmental impacts) (see also Themes 6 and 11).

Resource use and waste handling

- Energy consumption.
  - Limit energy consumption by using energy saving equipment and develop behavioural guidelines for use.
  - Identify energy requirements of different functions at the station and consider implementation of alternative sustainable energy solutions where possible.
- Chemicals and other hazardous substances.
  - If possible, find alternative materials.
  - Limit consumption, use appropriately and prevent spills.
  - Excess chemicals, fuel and other hazardous substances must always be exported to a proper treatment facility.
  - Develop proper protocols and procedures to clean up chemical spills if they occur (some owner institutions may have procedures for this).
- Garbage and waste handling.
  - Identify different garbage components produced at the station and seek to limit the different components (e.g. by minimising consumption and wrappings, increase recycling, etc.).
  - For each garbage component, station management should identify proper means for disposal.
  - Describe a garbage handling system and include in relevant procedure documents for staff.
  - Describe what you expect from visitors in relation to garbage separation and include in visitor information documents.
- Water consumption and disposal.
  - Limit water consumption by using water saving equipment and develop behavioural guidelines for water use (kitchen, shower and laundry).
  - Identify disposal mechanism that will not significantly influence environmental conditions.

Species and habitat protection

- Identify sensitive species and habitats within the station's operational area.
- Develop regulations and behavioural guidelines for field activities posing a threat to sensitive species and habitats and include in relevant plans and visitor information documents. (See also Theme 1, Land Use Plan, and Theme 4, Visitors).

8. Outreach and marketing

8.1 Introduction

Outreach and marketing activities are vital elements of the work at a research station, communicating abilities and results of station activities with the aim of securing continued support and development. Visibility can attract more users, help secure funding for station operations, establish links to international scientific fora for standardisation and coordination of research and monitoring efforts, improve local support, raise awareness of environmental and climate change issues and provide management advice for local, national, regional and global policy makers, etc.

The visibility of a research station can be increased through outreach and marketing initiatives. Outreach is an activity that provide information about the station or activities to all relevant stakeholder groups (raising the awareness of stakeholder communities), while marketing is the process of communicating the value of a product or service to attract potential customers.

Although it sometimes can be difficult to distinguish outreach and marketing, as both may provide information about the station and its activities and attract customers, we will in this report use:

Marketing - as an initiative targeting users and funding agencies/donors that are essential for the run of the station (scientific community, funding agencies/donors and decision makers).

Outreach - as an initiative targeting stakeholders with no or very limited economic importance for the station (e.g. initiatives that engage the general public, local community, schools, tourists, etc. in station activities).

Targeting stakeholders that provide resources for the run of the station (user fees paid by researchers and research groups, support for research and monitoring projects from funding agencies/donors, or budget support from owner institution, authorities, funding agencies, donors, etc.) is essential for station operations. Other stakeholder groups (e.g. local communities, the general public) may not be directly important in securing resources for the run of the station, but local and national outreach initiatives can be very important for securing local/national support, avoiding conflicts and improve the quality of the research.

In this theme we will describe:

- Stakeholder groups typical for arctic research stations and provide a simple tool for prioritising these in order to focus outreach and marketing strategies.
- Common means for outreach and marketing and provide examples of outreach and marketing mechanisms relevant for reaching specific stakeholder groups.
- General contents of a marketing and outreach strategy (also sometimes called a communication strategy).
- Different types of local involvement/Citizen Science.

8.2 Stakeholders and marketing/outreach mechanisms

Stakeholder groups – marketing

Marketing initiatives should seek to attract people and funding to the station to improve the economy and provide opportunities for developing the station. Target groups related to marketing effort therefore includes both the science community and funding providers:

- The science community
  - Research groups, individual researchers, young researchers and students.
  - Research and monitoring projects and programmes.
  - National and international research institutions.
  - International networks and organisations.
  - Owner institution.
- Policy makers (local, national, regional and global).
- Funding agencies/donors.
- etc.

Stakeholder groups - outreach

Outreach initiatives should seek to raise awareness and educate stakeholder groups of the station, its activities and results to build capacity and improve the understanding of the necessity of the station and associated activities. Support from local communities can be very important for minimising conflicts and building local capacity (see also local involvement/Citizen Science section at the end of this theme).Target groups related to outreach activities therefore includes a wide array of potential stakeholder groups that need to be targeted using different outreach mechanisms:

- The general public.
- Local communities (residents).
  - Old.
  - Young.
  - Schools.
  - Resource users.
  - Ethnic groups.
  - Interest groups.
- NGOs and amateur naturalists (people with specific interests)
- Teachers and educators.
- Non-resident visitors (tourists).
- Industry (interested in research and monitoring activities and outcomes).
- Media.
- Local/national/international newspapers, magazines, radio stations and TV stations.
- Etc.

It may also be relevant to target marketing stakeholder groups (see above) with outreach materials as their awareness and knowledge of station operations may be necessary for securing continued support. The need for this obviously depends on their need for knowledge and level of involvement in station operations.

It is important to focus the outreach and marketing activities on the stakeholders that are important for the station and those that have influence on its operations. A stakeholder analysis can be used to prioritise stakeholders and refine outreach and marketing strategies (see Table 8.1).

Examples of stakeholders with often high influence on station operations include:

- Funding agencies and donors
- Owner institution
- Authorities
- Local communities (depending on their relationship to the station and its activities)

Examples of stakeholder groups with high importance (for various reasons), but little direct influence on station operations:

- Local communities (e.g. for local support, development of research and monitoring initiatives, awareness, capacity building, etc.).
- The general public, amateur naturalists and tourists (e.g. for achieving education and awareness aims).
- Schools, teachers and students (e.g. for achieving educational, awareness and capacity building aims).
- Scientific community (e.g. for attracting users, international cooperation, etc.).
- Media (e.g. for educating/raising awareness of local communities, general public, decision makers).

Station management should focus outreach activities on stakeholder that are important for the aims, goals and objectives of their specific station. Station management should therefore identify stakeholders with significant influence on station operations (stakeholders with money or decision making power) and stakeholders that are important for achieving what the station aims to accomplish with its activities (stakeholders considered important for achieving aims related to science, awareness raising, education, etc.).

Station management can do this by categorising stakeholders in relation to i) importance for station operations and ii) influence on research station operations and outputs (see Table 8.1). Stakeholders with limited influence on station operation may be more important than stakeholders with more influence but of little importance for station operations (e.g. local communities may not have a huge influence on station operations, but they may be an important target for outreach activities to minimise conflicts and ensure local support). This is the reason for the slightly skewed colouration of Table 8.1.

Table 8.1. Stakeholder analysis matrix allows station management to rank and prioritise stakeholder groups in order to focus outreach and marketing strategy and initiatives. Dark colouration = increased focus on stakeholders.

		Importance of stakeholders			
		Significant importance	Some importance	Little/no importance	Unknown
Influence of stakeholders	Significant influence				
	Some influence				
	Little/no influence				
	Unknown				

Marketing and outreach mechanisms

There are numerous ways of reaching stakeholders associated with a research station. The best mechanism for reaching stakeholder groups varies with the interest of the specific group and what the station seek to achieve with the marketing and outreach initiative. Stakeholders can be targeted using one or more marketing/outreach mechanisms. Below are examples of outreach and marketing mechanisms, many of them used at INTERACT stations:

Electronic

Website

A tool for displaying information about the station and its activities that can be used to target various stakeholder groups. Especially important for providing information to potential visitors about the facilities, conditions for access and the natural environment at the station, but can also be used for dissemination of scientific results, and information for the general public, local communities, schools, etc. about the natural environment and climate change issues. Website can also be used to share electronic versions of publications (see Paper section below).

Blogs

A discussion or informational site published on the internet. Like social media (see below) this can be used to target specific stakeholder groups interested in the work undertaken at arctic research stations. Many blogs provide commentary on a particular subject or function as more personal online diaries (see for example the INTERACT blog spot[19] and Twitter under social media below).

Social media

Social medias are tools that research stations can use to create, share and exchange information and ideas in virtual communities and networks. Social media are especially important for reaching certain groups in the stakeholder community (e.g. young, amateur naturalists and individual researchers). If social media is a part of a stations outreach activities, it is important that a person is made responsible for this task and that

[19] http://arcticresearch.wordpress.com

adequate resources are set aside for continued updates. Depending on skills and expertise, it may be necessary to provide communication training for the responsible person.

Among the frequently used social media are (arranged after number of users):

- Facebook - a social networking service with more than a billion registered users.
- YouTube - a video sharing website with more than 800 million unique users per month. An example of this is the short videos (Frostbytes) from the IPY 2012 conference[20].
- Twitter - a social networking and micro blogging service (allowing short texts of 140 characters). More than 500 million registered users.
- Google+ - a social networking service with more than 500 million users.
- LinkedIn - a social networking website for people in professional occupations. More than 200 million registered users.
- Instagram - an online photo-sharing and social networking site with more than 100 million registered users.

Box 8.1. INTERACT and social media

INTERACT is active on following social media:
Facebook - www.facebook.com/InteractArctic
Twitter - www.twitter.com/INTERACT66
LinkedIn - www.linkedin.com/groups?gid=4513880
Blog - www.arcticresearch.wordpress.com/

Media (newspaper, radio, TV)

Articles and radio/TV broadcasts primarily target the general public/local community, but may also have some influence of policymakers and other groups, partly due to its influence on public opinion. Audio presentations can be pre-recorded for repeated broadcast or carried live. In some cases, an interpreter may be required if the local community includes many speakers of indigenous language.

Press release

Can be used to target local, national and potentially international media depending on the story. (See also Press policy, Theme 2)

Newsletter/annual reports

Describing new developments, results, opportunities and activities at the research station. Can be a tool for targeting the research community, decision makers, amateur naturalists and local community depending on contents.

[20] http://www.youtube.com/watch?v=MyjfYHEJ19s&list=PL39F0F0FBACD0C7FE

Print

Brochures/factsheets/inserts/flyers about the station, opportunities, activities and results
Can be developed to target different stakeholder groups. They are often used to communicate short texts about the station, its activities and results either to attract the research community, policy makers, funding agencies/donors or inform members of the public (general public, amateur naturalists, tourists, etc.). Hence, they can be considered both outreach and marketing materials depending on the intended use.

Popular science books and articles
Presentation of research and monitoring results in easily digestible formats are especially useful for reaching amateur naturalists, teachers/students/schools and also policymakers with specific interest in the subject and possibly funding agencies/donors who may benefit more from seeing the results of their contributions in a popular version of research outcomes rather than an academic version.

Scientific books, reports and papers
Used for targeting the research community, and possible funding agencies/donors and policy makers with a keen interest and understanding of the subject. Certain publications may also be of interest to the industry if this is related to its activities or impacts on environment or climate.

Visuals

Displays, exhibits
Especially useful for communicating science to local communities, students and schools visiting the station.

Posters
Can be used to advertise events in local community or present the station and associated research and monitoring programmes at international conferences and meetings.

Stickers, magnets, pens, caps, shirts, cups, etc.
May be used to attract attention and make people interested in exploring the station more through other means (e.g. website).

Workshop, conferences, meetings, etc.

Presentations, lectures, demonstrations, etc.
A great tool for targeting specific audiences, especially the research community and funding agencies/donors, but may also be used to reach the local community, schools and policy makers. Participation in international fora may help market the station to new sections of the research community, thus expanding the network of potential users (see also Theme 9 on international cooperation).

Arrange meetings

Meetings are an essential mean for keeping close contact with most important stakeholder groups, whose support is essential for station operations. These include, owner institution, funding agency/donors, authorities and possibly the local community (depending on the local situation).

Arrange conferences, workshops, etc.

Arranging conferences or workshop with specific scientific goals can be an excellent way of expanding the network of researchers and international programmes and organisations associated with the station.

Active participation by members of the public

Open days

Open day arrangements are often huge successes with the local community and may also attract local policy makers and media.

Guided tours

Essential for all newcomers to the station to inform them of station facilities, the natural environment, regulations and routines and make them feel at home (see also Theme 4). Guided tours can also be a way of reaching policy makers (e.g. VIP visits), the education sector, NGOs, amateur naturalists and local community members.

Courses/School visits

Relevant for stakeholders in the education sector (teachers/educator and students). Courses and visits should be developed to target the specific audience (See also Theme 10 – Training and education).

Earth cache

Earth cache is an outdoor recreational activity, in which the participants use a Global Positioning System (GPS) receiver or mobile device and other navigational techniques to locate specific positions where 'treasures' in the form educational information/tasks/rewards are revealed. It can be made as a 'treasure hunt', where the location of one position reveals information and a new position. In this way users can be guided through the natural environment and presented with interesting descriptions of natural phenomena. Earth cache is a great tool for targeting amateur naturalists, schools, local community members and tourists.

Citizen science/local based monitoring

Citizen science/local based monitoring is scientific research or monitoring conducted, in whole or in part, by amateur naturalists or nonprofessional scientists, but sometimes in cooperation with scientists. Engaging local communities in research and monitoring efforts provides the local community with an increased understanding of natural ecosystems and the effects of Climate Change, thus potentially providing input to local adaptation strategies. Additionally, it can be a key mechanism for building local capacity, raise awareness of station activities and create an understanding of the need, purpose and benefits of having a research station in the area. The purpose, level of involvement and incentives for locals to participate vary

greatly and need to be developed individually based on the objectives of involvement and resources available (human and financial). See local involvement/Citizen Science section below.

For input on how to communicate with users or potential users of the research station, see Theme 4, Visitors.

8.3 Developing a marketing and outreach strategy (or communication strategy)

Marketing and outreach activities can be very important for the success, development and continued support of a research station. Station management should therefore develop a marketing and outreach strategy that integrates this issue in station operations.

The strategy may include:

- A vision: What will the station try to achieve with the outreach and marketing (communication) strategy?
- A framework: Identify aims, needs and available resources (economic and human).
- A stakeholder analysis: Identify and prioritise stakeholder groups.
- A strategy: Describe objective and goals for each relevant stakeholder group, and identify marketing or outreach tools/mechanisms best suited for reaching the specific groups.
- An implementation plan: Describe in an action plan how the strategy is implemented (Actions: what should be done? When? By who? And if relevant, resources available for the activity. If needed make a short term and long term action plan).
- An evaluation plan: Monitor the effect of the outreach and marketing strategy and make adjustments when needed.

An outreach and marketing strategy should be approved by relevant managerial bodies of the station (e.g. owner institution, funding agency and advisory boards).

Table 8.2 (marketing) and 8.3 (outreach) provides an overview of stakeholder groups and what marketing and outreach tools/mechanisms that are most frequently used to reach these. It is, however, important to remember that conditions and possibilities differ among stations, and that stations therefore needs to develop their own marketing and outreach strategy and initiatives suited to the local situation and available resources.

Table 8.2. The table presents an overview of the most important stakeholder groups targeted by marketing initiatives and shows the most frequently applied mechanisms for reaching these.

Marketing mechanism	**Scientific community**					**Policy makers**		**Funding agencies/ donors**
	Individual researcher/ research groups	Research and monitoring programmes	National and international research institutions	Scientific networks and organisations	Owner institution	Local/ national	Regional/ global	
Electronic								
Website	X	X	X	X		X		X
Blogs	X							
Social media	X					X		
Newspaper, radio, TV						X		
Press release								
Newsletter/ Annual report	X			X		X	X	X
Paper								
Brochures/ inserts/ factsheets/flyers	X	X	X	X	X	X	X	X
Popular science books and articles	X					X	X	X
Scientific books, reports and papers	X	X	X	X	X			X
Visuals								
Displays/ exhibits						X	X	
Posters	X							
Stickers, magnets, pens, caps, shirts, cups, etc.	X							
Workshop, conferences, meetings, etc.								
Presentations	X	X	X	X		X	X	
Arrange meetings				X	X			X
Arrange conferences, workshops, etc.	X	X	X	X				
Participate in international networks and organisations	X	X	X	X				
Active participation at station								
Open days						X		
Exhibitions/ guided tours						X		

Table 8.3. The table presents examples of stakeholder groups targeted by outreach initiatives and shows the most frequently applied mechanisms for reaching these.

Outreach mechanism	General public	Local community						Teachers and educators	Non-resident visitors (tourists)	Industry	Media		
		Old	Young	Schools	NGOs and amateur naturalists	Resource users	Ethnic groups				Local	National	International
Electronic													
Website	X		X	X	X		X	X					
Blogs			X		X			X			X		
Social media			X		X				X				
Newspaper, radio, TV	X	X				X					X	X	
Press release											X	X	X
Newsletter/ Annual report					X								
Paper													
Brochures/flyers/ factsheets/inserts	X			X	X			X	X				
Popular science books and articles				X	X			X					
Science books, reports and papers										X			
Visuals													
Displays/ exhibits	X	X	X	X	X			X	X				
Posters	X				X								
Stickers, magnets, pens, caps, shirts, cups, etc.	X		X						X				
Workshop, conferences, meetings, etc.													
Presentations					X							X	X
Arrange meetings						X	X			X			
Arrange conferences, workshops, etc.								X					
Active participation at station													
Open days		X	X								X		
Exhibitions/ guided tours/ competitions	X	X	X	X	X								
School visits/courses			X	X				X					
Earth cache	X		X	X	X				X				
Citizen science	X	X	X	X	X	X	X						

8.4 Local involvement/Citizen Science

When involving local communities at research stations it is important to consider the purpose of the local involvement and methodological requirements (accuracy and precision needed), and put that in relation to local capacity and incentives to participate.

Purposes of local involvement include locals as research design partners, data sources, data providers, analysts and possibly involvement in management decision making related to e.g. sustainable management and climate change adaptation. Methodological requirement are determined by the specific project and the potential for involving locals depends these requirements and local capacity.

Incentives are a central element in the design of all local involvement initiatives. Incentives are needed to make the initiative viable and long lasting (if so required). Incentives can be economic (e.g. paid field assistants), but there are many other incentives for locals to participate in research and monitoring initiatives. These non-economic incentives include increased personal knowledge/capacity, increased prestige in local/regional community, feeling of doing something good for society/nature, increased influence if initiative is related to analysis and/or decision making, increased personal network and social relations, etc.

Data collection by amateur naturalists often reveals the same trends as data collected by scientist. But as accuracy and precision may vary significantly, they may not always be useful for scientific studies depending on objectives and methodological requirements. However, involving local communities can be a cheap and cost effective way of gathering large volumes of data covering a significant spatial area. Although data may not be as scientifically valid for many research purposes, it holds great potential as an early warning mechanism for covering vast areas. So, researchers can relax, it is not here to replace conventional research and monitoring, but it can add to the knowledge of the research community and serve other purposes like building local capacity, awareness and influence local decision making.

Generalised examples of local involvement/Citizen Science at INTERACT stations

Locals as research design partners

- Formulating research questions relevant for the local context.
- Programme design and implementation plan.

Locals as data sources

- Input to survey design - Meeting local communities before initiating surveys/studies in their area to discuss methodology and spatial survey design.
- Gather local knowledge - Interviews with local people (individuals/groups) to attain information on their perception of environmental or climate change issues.

Locals as data providers

- Paid field assistants – helping researchers to gather data (alone or accompanying researcher).

- Voluntary data provider - opportunistic or systematic data collection by individuals or groups (e.g. sending in observations of wildlife/rare species, providing photos of whale fins in given area for species identification and individual recognition, etc.).
- Hunting statistics and biometrics for selected species – annual hunting reports and single catch reporting forms with biometrical measurements for selected species.
- Sample collection – collecting samples of hunted species, vegetation, soil, water, snow, etc. and sending these to the researcher/station.

Locals as analysts (see examples at www.zooniverse.org*)*

- Using members of the public to analyse large volumes of data, e.g.:
  - Identification of similar whale sounds[21].
    - ✓ Species and substrate identification of large volumes of photos (Marine[22], Terrestrial (and tropic)[23]).
  - Recovering Arctic and worldwide weather data from ship observations[24].

- Involving locals in the interpretation of data – to get their view on observed or perceived changes, and possible mitigation measures if changes are perceived to be problematic in relation to sustainability and climate change adaptation.

Locals as decision makers

- Involving local in management decision making – decision making in relation to nature management are most often a task for authorities, but research stations/institutions may be involved in such efforts and can benefit from the increased knowledge production. Although accuracy may deviate from what is desired for scientific analysis, data generated by local communities can be sources of early warnings of change that can be investigated more closely.

8.5 Key considerations for station management

- Develop outreach and marketing strategy (also called communication strategy), by:
  - Developing a vision and goals for outreach and marketing initiatives at the station.
  - Identify stakeholder groups relevant for station operations and make stakeholder analysis to prioritise these.
  - Identify and develop relevant outreach and marketing mechanisms for reaching relevant stakeholders.
  - Develop implementation plan describing tasks, responsible persons, timeline and if relevant available resources.
- Incorporate specific tasks from the outreach and marketing strategy into relevant station management documents (e.g. management plans (see Theme 1) and job descriptions (see Theme 3).

[21] http://whale.fm/
[22] http://www.seafloorexplorer.org/#!/home
[23] http://www.snapshotserengeti.org/
[24] www.oldweather.org/

Examples

Examples of outreach activities on the INTERACT website.
http://www.eu-interact.org/outreach2/

Example of an outreach strategy from National Oceanic and Atmospheric Organization, USA.
http://www.nero.noaa.gov/nero/outreach/outreachplan-final.pdf

Example of an educational outreach initiative, Canada.
http://www.youtube.com/watch?v=-l0JdVtmNus

Station examples

8.1 - Kevo Subarctic Research Station, Finland

(Large, easy access station with road access)
Otso Suominen

Marketing and outreach
Kevo market the station to researchers and teachers at universities and research institutions as a place to conduct their research, hold (field) courses and conferences. We do this by trying to be visible in the university's intern media as well as in general media. We also give presentations of the station and its research in different national and international forums (lectures series, symposia etc.).

Stakeholders are identified by considering interests of different groups of people, organisations, institutions, agencies and authorities in relation to the activities at the station. It is important to note that changes/new activities may also lead to changes in the stakeholder community.

Local stakeholders
The local community in Utsjoki and the people living in northern Lapland are important stakeholders. Kevo station is nationally a well-known place, and for most Finns it is probably the only thing they know about Utsjoki. The local inhabitants are interested in our activities and we are an important and active part of life in the small community. More about this in Sub-theme 8.4

It is very important that the local communities know what we are doing and accept that. It is also important that the whole existence of the station at Utsjoki is supported by all groups of people in the local communities (e.g. regional and municipal decision makers, local citizens both Finns and Sami, reindeer herders).

Types of interaction:

- The station has open doors day for the local public at least every second year (see Figure 8.1.1) .
- Station and research are introduced in local media.

- Station introductions are given to vising groups (from tourists to experts).
- Thematic summer school for high school kids is held at the station (themes are the Sami culture and language, and the northern nature) every summer (students are from all over the country including locals).
- Kindergarten and school kid groups visit the station regularly.
- We exchange information on suitable field sites and observations on local nature regularly with the local reindeer herders, hunters and forest and park service personnel.
- The station staff as well as the visiting researchers and students participate in local events (and often visible as Kevo-people). Most of our staff participates in this interaction with the locals.

Example figure 8.1.1. Open door event at the Kevo Subarctic research Station. Photo: Kaija Kangasjärvi.

Our local staffs have a key role in the local involvement activities and are natural links to the community. The main result of this interaction is that we are a well-known and recognised institution and the local community supports our existence and research. We also benefit a lot from the information and expertise of the local people.

Kevo station (staff, students and visiting researchers) is usually taking part as one 'village' in a yearly playful competition between the villages in Utsjoki municipality (see Figure 8.1.2).

Example figure 8.1.2. Kevo staff and local communities participate in the village competition arranged by Kevo Subarctic Research Station. Photo: Otso Suominen.

Other stakeholders - Regional and national authorities and organisations:

- Reindeer Herders Association. We are active in research related to reindeer and there is cooperation in research.
- Sami Parliament. They are interested in all changes and research on environmental issues in northern Lapland.
- Metsähallitus (Forest and park service). Important cooperation partner in nature protection, research etc. Issues permits for research on government owned land and in protected areas. Sometimes our staff assists them locally
- Centre for Economic Development, Transport and the Environment in Lapland. Regional environment management authority. Issue permits for research on protected species. Cooperation in species protection and surveys.

- Boarder Guard. Issues permits and assists with transportation in road-free areas.
- Finnish Forest Research Institute. Cooperation in research.
- Game and Fisheries Research Institute. Cooperation in research. They operate two research stations in the region.
- Geological Survey of Finland. Cooperation in research.
- Finnish Meteorological Institute. Cooperation in research. Their meteorological station operates at Kevo station
- Seismological Institute. Cooperation in research. They have got a seismograph station at Kevo.
- Finnish Geodetic Institute. Cooperation in research. They have instrumentation at Kevo.

Newspaper, radio and TV articles and interviews are used to target the General public and local communities. These also reach organisations and authorities at various levels. The university's communication unit coordinates press contacts, both coordinating responses to journalist requests and promoting articles from the station.

In local media in northern Finland, we often act as experts for environmental and nature questions, e.g. the station offer species identification to photographs sent by the public to local newspaper. In national media we aim to give examples of diverse, high quality, interesting and important research conducted at the station i.e. we aim to promote public view and knowledge of the station. On the other hand we also aim to lift examples of the important environmental issues such as biodiversity loss and global change on to the media through local concrete research examples. These target both the common public and the authorities and politicians.

Networking, meetings and day-to-day communications are used to reach authorities and partner organisations, e.g. participating in workshops and meetings. Many of the partner organisations use the station for accommodation when they are working in the area.

The website has been developed to serve all stakeholder groups, www.utu.fi/kevo.

8.2 - Bioforsk Svanhovd Research Station, Norway

(Large, easy access station reached by road)
Lars-Ola Nilsson

Marketing and outreach
Bioforsk Svanhovd is part of a research institute under the Norwegian government, with main parts of its research financed by external funds. Bioforsk Svanhovd has an ambition to develop environmental and climate research in the Barents region and to be a main research and visit centre of the region. An important part of this is visits by guest researchers to the station.

Outreach and marketing of the station therefore aims to increase the awareness about the existence of the station and the on-going and planned activities for 1) the general public, 2) important research funding actors and 3) potential research co-operators. Bioforsk Svanhovd has two persons employed to work with communication. They are responsible for various communication and outreach activities (e.g. media

contacts, national park exhibitions and school projects) whereas contacts with authorities and research communities are most often in the hands of the station manager/research staff.

The public is primarily reached through local media and the website. Local newspapers are an important mean for reaching a local audience and they are often interested in covering things at activities at the station. Selected stories may be relevant for national or international media.

The website presents much information about the ecosystems and species found around the station. The website has recently been restructured and an English version is in the making to attract international researchers.

Marketing towards the group of authorities, funding agencies, donors and research community has primarily been via networking activities, personal contacts, etc. Bioforsk Svanhovd has a very tight cooperation with the regional and national administration on environmental monitoring (in the Norwegian-Russian borderline) and we are often committed as subcontractors in, or preparing for, larger monitoring programmes, arranging meetings, making cross-border contacts etc. The regular contacts also lead to requests e.g. from regional and local administration for making environmental surveys of many kinds such as flora and fauna mapping, environmental impact and water quality assessments.

Outreach is, thus, an important mechanism for marketing the station in relation to authorities and funding agencies/donors. Promotion of activities and results of research and monitoring conducted at the station will increase the knowledge of these stakeholders and may increase chances of getting support for project applications, etc.

Svanhovd is seeking to develop routines for outreach activities. In this process, the station will:

- Develop aims for the outreach and marketing activities
- Identify important target groups (stakeholders)
- Develop mechanisms for reaching relevant target groups with relevant information at regular intervals.

Press policy

Bioforsk (the owner of Svanhovd) has a central press policy. Svanhovd aims to get publicity that renders a representative picture of activities at the station. It is important to include dissemination issues in research project plans to ensure that the news potential of activities are fully exploited and not forgotten.

www.Svanhovd.no

8.3 - Greenland Institute of Natural Resources, Greenland

(Large easy access station located in a community)

Katrine Raundrup

Marketing

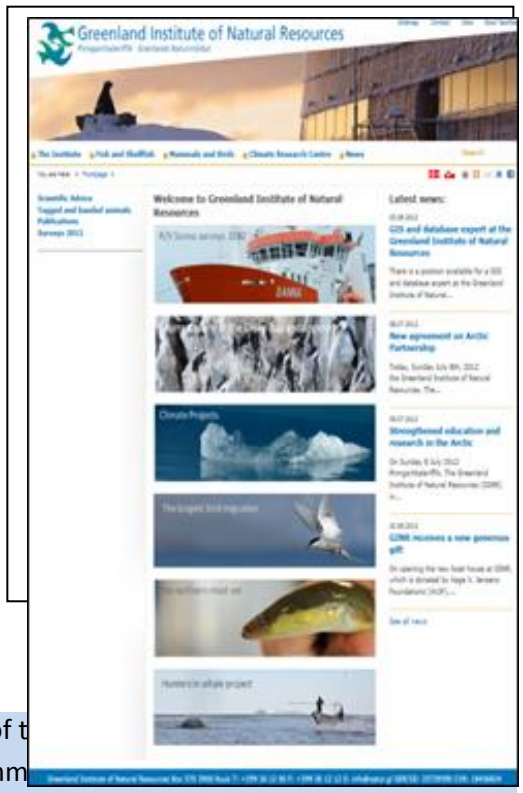
GINR is obliged by law to publish the results of the research taking place at the institute due to the fact that GINR is funded by the Greenland Government. Furthermore GINR must participate in communication and information relating to the environment, nature and research within the research areas at the institute. The purpose of marketing of GINR are four-fold: 1) Inform non-scientists about the work being carried out at the institute, 2) Actively participate in a dialogue with the users, 3) Writing papers for the scientific 'world', and 4) Fundraising.

Each year the GINR Annual Report is published in Greenlandic and Danish (Figure 8.3.1). The report is mainly used for documenting what has been going on during the past year and includes short descriptions of work carried out by each of the departments, notes on the organisation, board, and financing of GINR, externally financed projects, field stations, boats and ships, meetings attended (internationally and nationally), list of staff, lists of meeting documents, scientific papers, reports, other written communication (e.g. popular-scientific papers), oral communication, and lists of field work planned for the coming year. The main target group is the board of governors and decision-makers in the respective governmental departments.

Example figure 8.3.1. Recent annual reports by GINR 2008 - 2011.

At GINR we have a communications office with 2 employees plus an affiliated student. They handle most of the external communication. All employees at GINR have a copy of the GINR 'Staff Handbook' in which the 'Communication and handling the press' is described.

The communications office is responsible for press releases, the Annual Report and for maintaining the GINR webpage (www.natur.gl). The webpage is in Greenlandic, Danish and English (Figure 8.3.2) and contains information on the institute in general (e.g. list of all employees with photos, and booking formulas for accommodation and lab facilities), the two departments (Mammals and Birds, and Fish and Shellfish), Greenland Climate Research Center, selected hunted species.



Stakeholders and how to reach them

The most important GINR stakeholders are the decision makers (Government of Greenland, politicians, and the civil service) and the users of the living resources: fishermen and hunters along with the 'society' in general. Approximately 80 % of t
generated by the living resources in the sea making the local comm

The relation between the fishermen/hunters and the GINR is two-fold:

1) GINR gives e.g. assessment and advice on sustainable exploitation of living resources to the Greenland Government for the civil service to determine hunting quotas and regulations regarding the particular hunted species that are not regulated by international bodies.
2) The hunters and fishermen report their catch of e.g. caribou and muskoxen to GINR making us able to 'follow' the development in different herds in great detail.

The different stakeholders are targeted in different ways. The Greenland Government is primarily targeted via advisory documents on specific hunted species, scientific papers and regular meetings.

Hunters and fishermen are often reached via national media - newspapers, radio and/or television. Further we address the local communities by way of public lectures/talks or 'open-ship' arrangements when doing fieldwork at the different towns and settlements in Greenland (Figure 8.3.3). We have two research vessels (R/V Sanna and R/V Pâmiut) and when they are in harbours along the coast we often have 'open-ships' where the public are welcomed on board to see the facilities, have a cup of coffee and the researchers tell about their work etc. The public lectures and 'open-ship' arrangements are normally advertised on the local 'Information board' in the different towns and settlements once the ship has arrived at the harbour, in local radio and on www.natur.gl.

Public talks in larger towns e.g. Nuuk are announced in the local papers and on www.natur.gl. We give talks at local public schools and high schools on different subjects. The students also have the opportunity to visit the institute and have day-tours or overnight stays at our cabin in Kobbefjord.

Example figure 8.3.3. GINR employee giving a public talk. Photo: Katrine Raundrup.

Recently we have started a dialogue forum at our homepage called Ilisimasavut (which translates into 'our common knowledge') where locals and researchers can share knowledge on nature, fish and the hunted species in Greenland. Furthermore, Greenland Institute of Natural Resources wish to make people aware of the fact that the institute use the valuable knowledge of the users of our nature. The platform may be used for reporting specific observations on wildlife or vegetation, and e.g. debates related to features in newspapers can easily be directed into Ilisimasavut for all users to see. Hopefully this will create a way of making research and in particular the results of our work more easily accessible to the local community. Further, we hope to reinforce the cooperation with the fishermen, hunters and all other users of the nature and strengthen the common understanding of interactions and conditions in nature. Users without computer access have the opportunity to gain access to Ilisimasavut via phone or by text message. The general language in Ilisimasavut may be either Greenlandic, Danish or English.

Press policy

Within the relatively small Greenlandic society rumours tend to spread very fast. As a researcher you are close to the public and to the press, and there is great potential to be misunderstood or misinterpreted. The debate in the press and within the community in general is often very political and mostly very emotional. Hence, we have a strict procedure to follow when we are being contacted by the press - either by newspapers, radio or television.

All enquiries or questions with a political content are directed to the director or the head of communications of GINR. Specific scientific questions are directed to the relevant head of department who subsequently refers the question to the appropriate researcher. We use a pre-printed form (Figure 8.3.4) to make sure all relevant information regarding the enquiry are noted (please see the attachment). Unless the enquiry is to be used in a direct-transmitted radio/TV program (most often not the case, because it would need to be translated/dubbed into Greenlandic) we ask to see the statement before it is printed or otherwise published.

GINR - Press contact form

In order to coordinate PAFU's (Dept. of Mammals and Birds) press contact and to keep the direction up to date you MUST always fill in the press contact form when you have been in contact with the media or a communication department at another institution in relation to your work.

Please forward the filled-in form to: xxx@natur.gl Name

Who have you been in contact with?	Name of journalist: Name of media:
Date of contact (dd-mm-yyyy):	
Subject (Write a few cues)	
What did you say/write? (Write the essence of your statement)	
In what relation will your statement be used? Ask the journalist	
When will it be published?	

Example figure 8.3.4. GINR press contact form that should be filled in every time an employee has had contact with the media.

We are proactive in making use of the radio media, especially the morning radio in National Broadcasting KNR, which is the main source of information for some of our stakeholders.

The dialogue with the press is by no means a one-way communication. GINR actively contacts the press via press releases when e.g. new and interesting research is taking place, and presenting results of recent studies.

Last but not least we announce the yearly assessment on the important stocks of fish and shellfish through press releases and press conferences. Further we are very pro-active in relation to communicating the work that is being done at the institute. The stories we try to get out to the public are both documentation of what has been done and presentations of results. This may be presented in features in national newspapers and those stories often results in general debate on the subject presented.

The recent years we have focused our stories on the collaborative work of the scientists and the users to meet a widespread, but wrong myth of non-collaboration.

The target of press releases and features in newspapers are both the political system in Greenland and the general public.

Interactions with local communities

At GINR we engage in interactions with the local community in several ways. This may be one-way during talks, lectures and our exhibition in our main building or two-way communication via e.g. dialogue meetings with stakeholders at the institute. Further, we usually enquire local fishermen and hunters before a particular survey or field work to learn about the local conditions and distribution of the stock. By using the local users of the living resources we are able to get valuable knowledge on subjects that might be beyond the scope of the particular survey. And the hunters and fishermen get to see the 'back-ground' knowledge and research that results in the advice we provide for the Greenlandic Government.

We get many direct enquiries from people all over Greenland either via mail or phone. Locals from Nuuk often come by the institute if they have questions relating to nature in general. They might bring specimen of e.g. insects and vegetation they have not seen before and would like an expert opinion on the particular species, etc. The interaction between researchers and locals might therefore be initiated by both parties.

Once a year GINR participates in Cultural Night (Kulturnatten) which is an evening where public and private businesses open their doors to the public. The Cultural Night is held on the same day all over Greenland. On that evening GINR offers a variety of different experiences including posters, talks, touch the animals from the sea floor, count the birds on bird cliffs and identify the humpbacks from the Godthåbsfjord based on their tails (Figure 8.3.5).

When researchers are out doing fieldwork around Greenland they are encouraged to give talks and invite locals to stop by for an informal update on what they are working on.

As mentioned above, GINR has recently opened the dialogue forum Ilisimasavut on our webpage and we hope this will result in an active dialogue between researchers and the users of our nature.

Example figure 8.3.5. GINR researchers and visitors at the annual Cultural Night event. Photos: Peter S. Mikkelsen and Lars M. Rasmussen.

9. Research and monitoring

9.1 Introduction

The primary purpose of research stations is to provide a platform for research and monitoring whether undertaken by the owner institution itself or external researchers or research groups. Research and monitoring strategies help set scientific aims of research stations and are often designed to address societal needs, scientific interests and/or donor driven questions.

The research and monitoring schemes at research stations vary greatly among stations in the INTERACT network ranging from covering few scientific disciplines sampling a limited number of parameters to multidisciplinary programmes sampling more than 3000 variables. Data capture and sharing should also be part of research and monitoring strategies in efforts to make optimum use of the gathered data (see Theme 11). Research and monitoring strategy and working programme can be part of a wider programme plan including educational and outreach components (see Theme 1).

Station management should seek high quality in scientific outputs by attracting top-level research initiatives and cooperate with national, regional and international programmes, networks and organisations. The quality of in-house science programmes can also be greatly enhanced by obtaining advice from top-level researchers and international networks and organisations, e.g. through a scientific advisory board.

It is also the responsibility of station management to assess the scientific quality of incoming applications and seek to avoid redundancy and conflicting interests (e.g. that projects or building of new infrastructure does not conflict with other projects or compromise future research or monitoring interests). Station management should therefore ensure screening and coordination of activities, e.g. through a coordination group/board.

Logistics is closely related to research and monitoring efforts as station infrastructure determines how many people can get to the station (e.g. where coordination of transport is required), how many can stay at the station (e.g. accommodation, kitchen and research facilities) and what activities can be undertaken (e.g. available machinery and equipment, local transport options, laboratories, health and safety equipment, etc.). The competences of staff should therefore include both science and logistic functions (in one or more persons).

In this chapter you can read about organisational set-up of science and logistics functions, potential contents of research and monitoring strategies and find short descriptions of important international programmes, scientific networks and organisations.

9.2 Organisational set-up of science and logistics functions

Operating a research station often requires scientific and technical skills and competences to address a multitude of tasks ranging from ensuring scientific quality and assessing health and safety risks to knowing how to operate generators, unscrew knots and bolts, sort garbage and clean the toilet (see also Theme 3). It is therefore recommended that science and logistics functions are coordinated in one unit/group. These functions can be in one or more persons, depending on the complexity and budget of the research station (e.g. scientific leader and logistics leader supplemented by possible seasonal science and logistics assistants).

Below are key scientific and logistical functions related to station operation.

Key science related functions at research stations:

- Development of research and monitoring strategy (owner institution/scientific leader assisted by advisory board).
- Engage in national, regional and international cooperation (owner institution/scientific leader assisted by advisory board members).
- Screening of incoming research project and monitoring programme applications for scientific quality and relevance (owner institution/scientific leader assisted by coordination group/board).
- Publications and reporting owner institution/scientific leader and visiting researchers).
- Data capture and sharing (owner institution/scientific leader).
- Outreach and marketing of the station as a platform for research and monitoring to attract users and address stakeholder interests (owner institution/scientific leader assisted by advisory board members, researchers working at the station, etc.).

Key logistical functions at research stations:

Permit issues and logistics

- Handle authority permit issues for station operations and visitors (obtain or provide advice on authority permits).
- Handle incoming access applications and screen incoming research project and monitoring programme applications for health and safety risks.
- Issue access permits including conditions for access.
- Visitor logistics (e.g. coordinate transport, book accommodation, office space, laboratories, etc.).

Facilities and daily operations

- Building and maintenance of facilities and infrastructure.
- Purchase and maintenance of tools, materials, equipment and vehicles.
- If relevant, purchase of scientific equipment and materials.
- Daily operations (cleaning, daily health and safety procedures, emergency preparedness and operations, food provisioning (for remote stations), water, heating, etc.).
- Handling visitors at station and evaluating stays.

Scientific advisory board – research and monitoring strategy

A scientific advisory board is a great asset for many research stations. A science board can provide advice for station management in relation to the development of research and monitoring strategy for the station, in-house science programmes, help prioritise external project applications, help market the station in various fora, attract funding, etc.

The role and responsibilities of the board should be clearly described and communicated to board members so they know what is expected from them if they agree to be part of the board (see also Theme 1). It is recommended that stations look nationally and internationally for experts that complement each other in terms of scientific expertise and seek strong linkages to national, regional and international networks and organisations. This should ensure high quality in research and monitoring efforts and may lead to opportunities to join or develop cooperation with international projects, programmes, network and organisations.

The composition of the advisory board should be relevant for the vision, mission, aims and activities at the station. Potential members include:

- Scientific leader of the station (a must).
- Expert representatives from relevant scientific disciplines.
- Experts represented in national, regional and/or international networks and organisations.
- Donor representatives (if relevant).
- Decision maker representatives (if relevant).
- Other stakeholders, e.g. local communities and NGOs (if relevant).

The frequency of meetings of the advisory board depends on the tasks. If the board only provides advice for the strategy, they only have to meet when developing, evaluating or revising the document.

Coordination group/board – screening of applications

Evaluation of incoming project applications are essential for ensuring quality science, keep the area close to a pristine state ideal for research and monitoring, and ensure that present projects does not conflict with other activities or compromise future research and monitoring interests.

With many projects at the station, it is therefore essential that activities are coordinated. The size and composition of a coordination board depends on the size and complexity of station operations and in-house and external research projects, as well as the variety of scientific disciplines studied at the station.

The primary roles of a coordination group/board are to:

- Assess the scientific quality of research and monitoring applications and if necessary provide recommendations for adjustments e.g. to improve quality of survey design and avoid redundancy (see also Theme 5).
- Assess the feasibility of research and monitoring applications (e.g. health and safety aspects, timing in relation to other activities, etc.) (see also Theme 5 and 6).
- Identify possible conflicting interests between projects (find solutions and/or prioritise).

- Identify possible conflicts with future research and monitoring aims and interests (find solutions and/or prioritise).
- Identify possible conflicts between station facility and infrastructure development and scientific aims and activities (find solution and/or prioritise).

A coordination group/board can include:

- Scientific leader of the station (a must).
- Logistics leader and staff (a must)
- Representatives from relevant scientific disciplines working at the station.
- Other stakeholders, e.g. local communities and NGOs.

The frequency of meetings in the coordination group/board depends on the tasks. The group/board can e.g. meet after application deadlines (or at regular intervals if there is no fixed deadline), or they may meet as required to evaluate field seasons or discuss other issues related to station management and logistics (e.g. transport, accommodation, health and safety, etc.).

9.3 Research and monitoring strategy and working programme

A research and monitoring strategy and working programme should, for a defined period (typically three to five years), describe the mission, concept and aims of the station and specify these in a working programme that include descriptions of projects/tasks, milestones, deliverables and time tables. The strategy and working programme should the framework and address both in-house and externally driven projects and programmes and may include a science policy for the station.

Science policy (see also Theme 2).

A science policy describes the aim of in house science programmes and the intended use by external research and monitoring projects and programmes. It may include other elements on international collaboration, data sharing, publication strategy and ethical considerations.

In-house science projects and programmes

In-house science programmes should aim to ensure scientific quality and to address the interests of all relevant stakeholders (e.g. society, authorities, science community, donors, etc.). Input from international experts can be a great asset when developing a strategy and working programme as they may be able to link to top-level research initiatives and put the research and monitoring efforts into an international perspective (see science advisory board above).

In-house research and monitoring efforts should aim at understanding processes and identifying changes that can be used to predict and respond to significant environmental and climatic changes.

Research

Research should aim at closing knowledge gaps to provide insight into processes and linkages governing ecosystem functions and climate. Manipulation studies and modelling are central for predicting future environmental and climatic scenarios, and should also be considered when developing research strategies

and working programmes. If relevant (and if funding is available) research projects may be turned in to long term monitoring programmes.

Monitoring

Monitoring should aim at providing information on the status and trends of key environmental and climatic parameters. In-house monitoring programme should aim at being long-term to provide a basis for observing and understanding long-term environmental and climatic changes and their effects on biodiversity and ecosystem functioning. The longer that stations are collecting data, and the more kinds of overlapping research they foster, the more valuable they become if well maintained. When developing in-house monitoring programmes, station management can consider including:

- Developing long-term monitoring programme: including a minimum set of long-term monitored climate parameters that can be used for basic comparisons by other research and monitoring projects (this issue will be included in an up-coming report from INTERACT).
- An interdisciplinary approach: integrating a variety of scientific disciplines.
- Application of best practices: in relation to methodology and instrumentation for scientific measurements.
- Opportunities for predicting and upscaling effects: from plot or site scale to national, regional or global scales (e.g. by combining ground surveys, drones, remote sensing, modelling, citizen science, community based monitoring, etc.).
- Station facility development: to continuously be able to support new projects taking on new technological developments that can improve science, and create new ways for scientists to collaborate with each other and new avenues for citizen science through remote technology (e.g. mobile phone apps and sensors).

External science projects and programmes

Externally driven research or monitoring projects can add to the scientific achievements of a research station, but cannot as easily be influenced by station management as the number of projects and their focus depends on the interests of the scientific community (and their ability to get funding). Station management can, however, do much to attract researchers, by engaging in international cooperation and contacting single discipline networks they would like to see implemented at the station. With marketing and outreach activities (see Theme 8) the station can also target specific scientific disciplines or researchers, networks and organisations in general. A strategy can therefore also contain a communication element that describes how the station will attract relevant scientific stakeholders to the station.

Budget

All activities in a strategy and work plan need to be within budgetary constraints (see also Theme 1). The financial situation at the station therefore often put limitations to research and monitoring strategies and what can be achieved. The strategy and work programme can therefore include actions that will happen and actions that depend on additional financial support (but with ideas of how to target funding sources).

Data management and sharing (see also Theme 11)

Station management should ensure optimum use of resources by limiting overlap between in-house and external projects, and by sharing knowledge and making data freely available.

Publication strategy (see also Theme 8)

A scientific publication strategy may be part of a stations outreach and marketing strategy. Scientific publications in peer-reviewed journals are important for showing to the international science community what goes on at the station and to show donors and funding agencies that the outputs from the stations are internationally of high standards and relevance.

Other types of publications may target different stakeholder groups (e.g. annual reports, popular science magazines, newspaper articles, etc.).

Example of general contents of a research and monitoring strategy and working programme:

Introduction

- Background.
- Process.
- Structure of document.

Research and monitoring strategy

- Scientific mission, concept and aims (and policy if relevant).
- National and international cooperation (fora to be targeted, why, how and by who).
- In-house science programme.
  - Overall aims.
  - Research questions to be addressed (describe title and contents, specify activities in working programme).
  - Long term monitoring programme (describe title and contents, specify activities in working programme).
- External research and monitoring projects and programmes.
  - Overall aims.
  - Describe what type of projects, programmes and scientific networks you would like to attract to the station (e.g. to address gaps in scientific understanding and monitoring).
  - Identify target groups and describe marketing and outreach activities to target above groups (describe briefly, specify activities in working programme).

Working programme

- Describe research and monitoring activities (in-house and externally driven projects and programmes). Including task description, responsible person (principal investigator), milestones, deliverables, time table and budget.
- Describe marketing and outreach activities targeting science related stakeholders. Including task description, responsible person, milestones, deliverables, time table and budget.

See example of research and monitoring strategy and working programme, Zackenberg Research Station, Greenland, in Appendix 9.1 and see contents and methodologies of the five long-term monitoring programmes on below link:
http://www.zackenberg.dk/monitoring/

See example of monitored variables, Abisko Scientific Research Station, Sweden, in Appendix 9.2 and see description of methodologies on below link:
http://www.eu-interact.org/fileadmin/user_upload/pdf/Station_management/Abisko_Station_monitoring_methodologies.pdf

9.4 International scientific networks, organisations and projects with an arctic focus

Research stations can benefit enormously from engaging in international networks and organisations. International cooperation may help guide the scientific strategy of the station by helping identify research questions of national, regional (e.g. arctic) or global concern, or by facilitate cooperation that attract top-level research groups and initiatives to the station. Overall it may increase scientific activities at the station and ensure a high quality of scientific outputs.

In this section you can read about a number of research and monitoring initiatives from Arctic Council (AC) and the International Arctic Science Committee (IASC), through circumarctic multidisciplinary networks, programmes, to single discipline arctic networks and selected global organisations. The described organisations and activities are by no means complete, but represent a number of relevant initiatives related to the terrestrial compartment of the arctic ecosystems.

Some of the networks, programmes and projects described here are led or carried out by one or more organisations or networks. Some programmes and projects may therefore be listed under single discipline networks or international multidisciplinary programmes and projects, and not under their lead partner that may also be described elsewhere in this chapter.

Arctic Council[25]

The Arctic Council is an intergovernmental forum for arctic governments and peoples. The Arctic Council consists of the eight Arctic States: Canada, Denmark (including Greenland and the Faroe Islands), Finland, Iceland, Norway, Russia, Sweden and the United States. Six international organisations representing Arctic Indigenous Peoples have permanent participant status. Observer status in the Arctic Council is open to: (1) currently 12 non-arctic states; (2) currently 9 inter-governmental and inter-parliamentary organisations, global and regional, and (3) currently 11 non-governmental organisations. The Arctic Council has 6 working groups:

- Arctic Contaminants Action Program (ACAP).
- Arctic Monitoring and Assessment Programme (AMAP).
- Conservation of Arctic Flora and Fauna (CAFF).
- Emergency Prevention, Preparedness and Response (EPPR).
- Protection of the Arctic Marine Environment (PAME).
- Sustainable Development Working Group (SDWG).

[25] www.arctic-council.org

Here we will elaborate on the most relevant working groups for terrestrial research stations: CAFF and AMAP. Information about other working groups can be found on this link: http://www.arctic-council.org/index.php/en/about-us/working-groups/114-resources/about/working-groups

Conservation of Arctic Flora and Fauna (CAFF)/Circumpolar Biodiversity Monitoring Programme (CBMP)
CAFF is the biodiversity working group of the Arctic Council. CAFF serves as a vehicle to cooperate on species and habitat management and utilisation, to share information on management techniques and regulatory regimes, and to facilitate more knowledgeable decision-making. It provides a mechanism to develop common responses on issues of importance for the Arctic ecosystem such as development and economic pressures, conservation opportunities and political commitments.

CAFF may establish expert groups with specific mandates related to key activities. These expert groups ensure that scientists, conservationists and managers have a forum to promote, facilitate and coordinate conservation, management and research activities of mutual concern. These groups have been invaluable in synthesising, coordinating and publishing research.

CAFF Expert Groups

Circumpolar Flora Group (CFG)[26]
CFG encourages and coordinates the conservation of Arctic flora, habitats and research activities. It enhances the exchange of information affecting status and trends in Arctic flora.

Circumpolar Seabird Group (CBird)[27]
The Circumpolar Seabird Expert Group (CBird) promotes, facilitates and coordinates conservation, management and research activities among circumpolar countries and improves communication between seabird scientists and managers inside and outside the Arctic.

Circumpolar Protected Area Network (CPAN) (dormant)[28]
The Circumpolar Protected Areas Network (CPAN) was operational from 1996-2010 and was designed to oversee and advance the CPAN program and provide the CAFF Board with advice on needed actions. It aimed to ensure sufficient protection of all habitat types in the Arctic. CAFF's protected areas work has since been picked up in other projects and programs including the Circumpolar Biodiversity Monitoring Program and the Arctic Biodiversity Assessment. CPAN is now dormant.

Circumarctic Rangifer Monitoring and Assessment Network (CARMA) (Network hosted by CAFF)[29]
CARMA is a network of researchers, managers and community people who share information on the status of the world's wild Rangifer (reindeer and caribou) populations, and how they are affected by global changes, such as climate change and industrial development.

[26] http://www.caff.is/flora-cfg
[27] http://www.caff.is/index.php?option=com_content&view=article&id=702&Itemid=1109
[28] http://www.caff.is/index.php?option=com_content&view=article&id=716&Itemid=1118
[29] http://www.caff.is/carma

Circumpolar Biodiversity Monitoring Programme (CBMP)

CAFF also runs the Circumpolar Biodiversity Monitoring Program (CBMP), which is an international network of scientists, governments, Indigenous organisations and conservation groups working to harmonise and integrate efforts to monitor the Arctic's living resources. The goal is to facilitate more rapid detection, communication, and response to the significant biodiversity-related trends and pressures affecting the circumpolar world.

CBMP has established four expert working groups that have or are developing and implementing monitoring plans for their specific environmental compartment:

- Marine Expert Monitoring Group[30].
- Coastal Expert Monitoring Group (group not yet activated)[31].
- Terrestrial Expert Monitoring Group[32].
- Freshwater Expert Monitoring Group[33].

CBMP also have established expert groups dealing with protected area monitoring (supplementing CPAN) and seek to integrate community based monitoring in all aspects of CBMP.

- Arctic Protected Areas Monitoring group (APAM)[34].
- Community Based Monitoring[35].

AMAP - Arctic Monitoring and Assessment Programme [36]

AMAP is the Arctic Council Working Group mandated to monitor and assess the status of the Arctic region with respect to pollution and climate change by documenting the levels and trends, pathways and processes, and effects on ecosystems and humans, and to propose actions to reduce associated threats for consideration by governments. AMAP produces sound science-based, policy-relevant assessments and public outreach products to inform policy and decision-making processes.

AMAP is managing a number of programmes and projects:

Programmes

AMAP Trends and Effects Monitoring Programme (ATEMP)[37]

The AMAP Trends and Effects Monitoring Programme (ATEMP) is a harmonised programme for monitoring the trends and effects of contaminants and climate change across the circumarctic region. ATEMP is based

[30] http://www.caff.is/index.php?option=com_content&view=article&id=491&Itemid=1037
[31] http://www.caff.is/coastal
[32] http://www.caff.is/index.php?option=com_content&view=article&id=516&Itemid=1054
[33] http://www.caff.is/index.php?option=com_content&view=article&id=511&Itemid=1049
[34] http://www.caff.is/publications/view_document/4-circumpolar-protected-areas-monitoring-arctic-protected-areas-monitoring-scheme-background-paper
[35] http://www.caff.is/community-based-monitoring
[36] http://www.amap.no/
[37] http://www.amap.no/about/the-amap-programme/amaps-monitoring-programme.

largely on ongoing national and international monitoring and research activities and AMAP national implementation plans. ATEMP is coordinated with and complements the Circumpolar Biodiversity Monitoring Programme (CBMP) and both of these programmes contribute to the Sustaining Arctic Observing Networks (SAON) initiative.

Projects

Arctic Climate Impact Assessment (ACIA)[38, 39]
ACIA is an international project of the Arctic Council (coordinated by AMAP in collaboration with CAFF) and the International Arctic Science Committee (IASC), to evaluate and synthesise knowledge on climate variability, climate change, and increased ultraviolet radiation and their consequences. The results of the assessment were released at the ACIA International Scientific Symposium held in Reykjavik, Iceland in November 2004. It also supports policy-making processes and the work of the Intergovernmental Panel on Climate Change (IPCC).

Arctic Health Risks (ArcRisk)[40]
ArcRisk is an international EU funded research activity that is looking at the linkages between environmental contaminants, climate change and human health.

Snow, water, ice, permafrost in the Arctic (SWIPA)[41]
An assessment of the snow, water, ice and permafrost in the Arctic (SWIPA) that is coordinated by AMAP and produced in collaboration with the International Arctic Science Committee (IASC), World Meteorological Organisation/Climate and Cryosphere (WMO/Clic) and International Arctic Social Sciences Association (IASSA).

International Arctic Science Committee (IASC)

IASC is governed by a Council consisting of one delegate appointed by each of the 21 national member organisations. These organisations are scientific bodies covering all fields of Arctic research (so members are from the scientific community contrary to the Arctic Council where council members are politicians). Each organisation has its own mechanism for ongoing contact between the IASC Council and its Arctic science community. IASC aims to encourage, facilitate and promote cooperation in all aspects of Arctic research in all countries engaged in Arctic research and in all areas of the Arctic region.

To achieve this mission IASC:

- Initiates, coordinates and promotes scientific activities at a circumarctic or international level.
- Provides mechanisms and instruments to support science development.
- Provides objective and independent scientific advice on issues of science in the Arctic and communicates scientific information to the public.

[38] http://www.amap.no/arctic-climate-impact-assessment-acia
[39] www.acia.uaf.edu
[40] http://www.arcrisk.eu/
[41] http://www.amap.no/swipa

- Seeks to ensure that scientific data and information from the Arctic are safeguarded, freely exchangeable and accessible.
- Promotes international access to all geographic areas and the sharing of knowledge, logistics and other resources.
- Provides for the freedom and ethical conduct of science.
- Promotes and involves the next generation of scientists working in the Arctic.
- Promotes bipolar cooperation through interaction with relevant science organisations.

IASC is heading or participating. IASC operates with a number of working groups, action groups and advisory groups that initiates or participates in numerous circumarctic initiatives and networks

IASC groups

IASC Working Groups[42]
IASC Working Groups identify and formulate science plans, research priorities, encourage science-led programs, promote future generations of arctic scientists and act as scientific advisory boards to the Council.

IASC has six working groups (Cross Cutting, Terrestrial, Marine, Cryosphere, Atmosphere, and Social and Human).

Terrestrial working group[43]
The scientific scope of the Terrestrial Working Group is formulated rather broadly as '… any scientific research on arctic terrestrial and freshwater environments, landscapes and biota, and their responses to, and interactions with, other components of the Earth system'. The terrestrial working group has identified a number of research priorities and formulated immediate goals that drive their activities.

IASC Actions Groups[44]
IASC Action Groups (AGs) provide strategic advice to the Council and Working Groups on both long-term activities and urgent needs. They are dynamic groups that act within a limited timeframe of two years.

IASC has three Action groups (Bipolar Action group, Data Policy Action Group and Action group on Geosciences).

IASC Advisory Groups[45]
Advisory Groups address a more structural need on recurring or ongoing research topics. These groups work with a long-term vision and provide in-depth scientific and technical expertise in their field of specialty.

[42] http://www.iasc.info/home/groups/working-groups
[43] http://www.iasc.info/home/groups/working-groups/terrestrial
[44] http://www.iasc.info/home/groups/action-groups
[45] http://www.iasc.info/index.php/home/groups/advisory-groups/isira

IASC has one Advisory Group (The International Science Initiative in the Russian Arctic (ISIRA) is a Russian and international cooperative initiative to assist Russian Arctic science and sustainable development in the Russian Arctic).

IASC initiatives: [46]

'To promote Arctic science at a global level, IASC is involved in science planning and the initiation and development of research programs. Although IASC is not a funding organisation it does make its connections, expertise, and secretarial support available for selected major international science initiatives. All past and current initiatives are carried out in cooperation with other Arctic and international players.'

IASC initiatives include:

- International Conference on Arctic Research Planning (ICARP III).
- International Polar Initiative (IPI).
- Snow, Water, Ice and Permafrost in the Arctic (SWIPA, in collaboration with AMAP) (see above).
- Sustaining Arctic Observing Networks (SAON, in collaboration with AMAP) (see Sustaining *Arctic Observing Networks (SAON)*).
- International Study of Arctic Change (ISAC) (see below).
- State of the Arctic Coast 2010.
- International Polar Year IPY 2007-2008.
- ASSW (Arctic Science Summit Week).

IASC Networks[47]

'IASC provides seed money and in-kind support for the founding and development of thematic networks that assist the organisation in fulfilling its scientific mission. In general IASC supported networks are international, encourage circumarctic activities and strive to involve early career scientists.'

IASC networks include:

- Network on Arctic Glaciology (NAG).
- Polar Archaeology Network (PAN).
- Arctic Coastal Dynamics (ACD).
- Circum-Arctic Lithosphere Evolution (CALE).
- Arctic Climate System Network (ACSNet).
- Palaeo-Arctic Spatial and Temporal Gateways (PAST Gateways).
- Arctic in Rapid Transition (ART).
- Arctic Freshwater Synthesis (AFS).

[46] www.iasc.info/home/initiatives

[47] www.iasc.info/home/networks

International multidisciplinary programmes and projects

Sustaining Arctic Observing Networks (SAON)[48]

In 2007, the Arctic Council Ministers requested AMAP, to cooperate with the other Arctic Council working groups, the International Arctic Science Committee (IASC), and other partners in efforts to create a coordinated Arctic Observing Network that meets identified societal needs (Salekhard Declaration). Sustained Arctic Observing Networks Initiating Group (SAON IG), composed of representatives of international organisations, agencies, and northern residents involved in research and operational and local observing, has been formed to develop a set of recommendations on how to achieve long-term Arctic-wide observing activities that provide free, open, and timely access to high-quality data that will realise pan-Arctic and global value-added services and provide societal benefits.

International Study of Arctic Change (ISAC)[49]

ISAC is an arctic environmental change programme initiated by the International Arctic Science Committee and the Arctic Ocean Sciences Board. ISAC is a program that provides a scientific and organisational framework focused around its key science questions for pan-Arctic research including long-term planning and priority setting. ISAC establishes new and enhances existing synergies among scientists, networks, organisations and other stakeholders engaged in arctic environmental research and governance.

ISAC has formulated three overarching goals

1) Observing Change: An international, integrated, comprehensive, and sustained arctic observing system responsive to scientific and societal needs for information on arctic change.
2) Understanding Change: To improve projections of the arctic system and identify emerging issues.
3) Responding to Change: Developing and communicating science for problem solving, managing, and adapting to future arctic changes.

Science Plan[50]

ISAC is an open ended, international, interdisciplinary arctic environmental change program. To succeed ISAC requires observation and tracking of arctic changes, understanding their nature and causes, and the feedbacks and connections among them. ISAC encompasses pan-Arctic, system-scale, multidisciplinary observations, synthesis and modelling to provide an integrated understanding of arctic change and projections of future change. The ISAC Science Plan provides a vision for integrating research among diverse fields and varied users and stakeholders, and contains nine detailed research questions.

Arctic Observing Summit (AOS)

ISAC has hosted the Arctic Observing Summit (AOS) which is a high-level, biennial summit that aims to provide community-driven, science-based guidance for the design, implementation, coordination and sustained long-term (decades) operation of an international network of arctic observing systems. The AOS is a platform to address urgent and broadly recognised needs of arctic observing across all components of

[48] http://www.arcticobserving.org/
[49] http://www.arcticchange.org/
[50] http://www.arcticchange.org/storage/ISAC%20Science%20Plan%20Final%20Publication.pdf

the arctic system, including the human component. The AOS 2013 is an implementation activity of the ISAC and it is a contribution to the Sustaining Arctic Observing Network (SAON) initiative.

Single discipline networks, programmes and projects

International Tundra Experiment (ITEX)[51]

The International Tundra Experiment is a network of researchers examining the impacts of warming on tundra ecosystems. Currently, research teams at more than two dozen sites throughout the world carry out similar, multi-year manipulation experiments that allow them to examine vegetation change across the tundra biome.

Each ITEX study site is expected to collect similar data following established protocols provided in the ITEX Manual. Collectively the ITEX network is able to pool its data sets to examine vegetation response at varying levels, for example genetics (from ecotype to functional type), across space (from habitats to ecosystems) and over time.

Integrated Carbon Observing System (ICOS)[52]

ICOS provides the long-term observations required to understand the present state and predict future behaviour of climate, the global carbon cycle and greenhouse gases emissions. ICOS tracks carbon fluxes in Europe and adjacent regions by monitoring the ecosystems, the atmosphere and the oceans through integrated networks.

ICOS mission statement:

- To provide the long-term observations required to understand the present state and predict future behaviour of the global carbon cycle and greenhouse gas emissions.
- To monitor and assess the effectiveness of carbon sequestration and/or greenhouse gases emission reduction activities on global atmospheric composition levels, including attribution of sources and sinks by region and sector.

The Global Terrestrial Network for Permafrost (GTN-P)[53]

The Global Terrestrial Network for Permafrost (GTN-P) is the primary international observing network for permafrost initiated by the Global Climate Observing System (GCOS) (see below) and the Global Terrestrial Observing System (GTOS), and is managed by the International Permafrost Association (IPA). It monitors the Essential Climate Variable (ECV) permafrost that consists of permafrost temperature and active-layer thickness, with the long-term goal of obtaining a comprehensive view of the spatial structure, trends, and variability of changes in the active layer and permafrost. The network's two international monitoring components are (1) CALM (Circumpolar Active Layer Monitoring) and (2) Thermal State of Permafrost (TSP).

Circumarctic Active Layer Monitoring (CALM)

[51] http://www.geog.ubc.ca/itex/index.php

[52] http://www.icos-infrastructure.eu/home

[53] http://ipa.arcticportal.org/activities/gtn-p.html

The primary goal of the Circumpolar Active Layer Monitoring (CALM) program is to observe the response of the active layer and near-surface permafrost to climate change over long (multi-decadal) time scales. The CALM observational network, established in the 1990s, observes the long-term response of the active layer and near-surface permafrost to changes and variations in climate at more than 200 sites in both hemispheres. The majority of sites measure active-layer thickness on grids ranging from 1 ha to 1 km², and observe soil temperatures.

The broader impacts of this project are derived from the hypothesis that widespread, systematic changes in the thickness of the active layer could have profound effects on the flux of greenhouse gases, on the human infrastructure in cold regions, and on landscape processes. It is therefore critical that observational and analytical procedures continue over decadal periods to assess trends and detect cumulative, long-term changes.

Installation instructions can also be found on the website[54].

Thermal state of permafrost (TSP)

The International Permafrost Association's (IPA) main contribution to International Polar Year was the development of a spatially distributed set of observations on past and present status of permafrost temperatures and active layer thicknesses. Emphasis is on permafrost temperatures since there is currently no global database that defines the thermal state of permafrost (TSP) for a specific time period (snapshot). The TSP data set will serve as a baseline for the assessment of the rate of change of permafrost temperatures and permafrost distribution, to validate climate model scenarios, and to support process research in order to improve our understanding of permafrost dynamics. TSP measurements, a field component of the WMO/GCOS Global Terrestrial Network for Permafrost (GTN-P), address questions related to climate warming and the attendant environmental and societal issues in the cold regions of Planet Earth (both polar regions and mid-and lower-latitude mountains and plateaus).

Manual for monitoring and reporting permafrost temperatures can also be found on their website[55].

Similar to the GTN-P, GCOS has also initiated programmes for glaciers[56] and rivers[57].

PAGE21[58]

PAGE21is a four year project financed by the EU that will aim to understand and quantify the vulnerability of permafrost environments to a changing global climate and to investigate the feedback mechanisms associated with increasing greenhouse gas emissions from permafrost zones. This research will make use of a unique set of arctic permafrost investigations performed at stations that span the full range of arctic bioclimatic zones.

[54] http://www.gwu.edu/~calm/research/install.html
[55] http://ipa.arcticportal.org/images/stories/tsp_manual.pdf
[56] http://www.gtn-g.org/
[57] http://www.bafg.de/GRDC/EN/04_spcldtbss/44_GTNR/gtnr.html
[58] http://www.page21.eu/

Selected global scientific organisations

Group on Earth Observation (GEO)/Group on earth Observation System of Systems (GEOSS)[59]
GEO is a voluntary partnership of governments and international organisations. It provides a framework within which these partners can develop new projects and coordinate their strategies and investments. As of 2013, GEO's Members include 89 Governments and the European Commission. In addition, 67 intergovernmental, international, and regional organisations with a mandate in Earth observation or related issues have been recognised as Participating Organisations.

The Group on Earth Observations is coordinating efforts to build a Global Earth Observation System of Systems, or GEOSS. GEO is constructing GEOSS on the basis of a 10-Year Implementation Plan for the period 2005 to 2015. The Plan defines a vision statement for GEOSS, its purpose and scope, expected benefits, and the nine 'Societal Benefit Areas' of disasters, health, energy, climate, water, weather, ecosystems, agriculture and biodiversity. The GEO Secretariat has experts responsible for each of these areas that can be contacted for further details.

GEO also arranges the Earth Observing Summit and a number workshop, symposia and meetings addressing various aspects of earth observations. GEOSS also provides an opportunity to tag metadata and actual data (see also Theme 11).

Biodiversity Observation Network (GEO BON)[60]
The Group on Earth Observations Biodiversity Observation Network – GEO BON – coordinates activities relating to the Societal Benefit Area (SBA) on Biodiversity of the Global Earth Observation System of Systems (GEOSS). Some 100 governmental, inter-governmental and non-governmental organisations are collaborating through GEO BON to organise and improve terrestrial, freshwater and marine biodiversity observations globally and make their biodiversity data, information and forecasts more readily accessible to policymakers, managers, experts and other users. Moreover, GEO BON has been recognised by the Parties to the Convention on Biological Diversity. More information can be found on the GEO BON web pages.

World Meteorological Organisation (WMO)/Global Climate Observing System (GCOS)[61]
The World Meteorological Organisation (WMO) is a specialised agency of the United Nations. It is the UN system's authoritative voice on the state and behaviour of the Earth's atmosphere, its interaction with the oceans, the climate it produces and the resulting distribution of water resources.

As weather, climate and the water cycle know no national boundaries, international cooperation at a global scale is essential for the development of meteorology and operational hydrology as well as to reap the benefits from their application. WMO provides the framework for such international cooperation.

[59] http://www.earthobservations.org/about_geo.shtml
[60] http://www.earthobservations.org/geobon.shtml
[61] www.wmo.int/pages/prog/gcos/index.php?name=AboutGCOS

Among the programmes lead by WMO is the Global Climate Observing System (GCOS), which is a co-sponsored programme of WMO, the IOC of UNESCO, UNEP and ICSU. The GCOS is built on existing operational and scientific observing, data management and information distribution systems.
The vision of the GCOS programme is that all users have access to the climate observations, data records and information which they require to address pressing climate-related concerns. GCOS users include individuals, national and international organisations, institutions and agencies.

The role of GCOS is to work with partners to ensure the sustained provision of reliable physical, chemical and biological observations and data records for the total climate system – across the atmospheric, oceanic and terrestrial domains, including hydrological and carbon cycles and the cryosphere.

GCOS is intended to be a long-term, user-driven operational system capable of providing the comprehensive observations required for:

- Monitoring the climate system.
- Detecting and attributing climate change.
- Assessing impacts of, and supporting adaptation to, climate variability and change.
- Application to national economic development.
- Research to improve understanding, modelling and prediction of the climate system.

GCOS addresses the total climate system including physical, chemical and biological properties, and atmospheric, oceanic, terrestrial, hydrologic and cryospheric components.

GCOS builds, to the extent possible, on existing observing, data management and information distribution systems, both operational and research, and on further enhancements of these systems. These include the:

- WMO Global Observing System (GOS) for atmospheric physical and dynamical properties.
- WMO Global Atmosphere Watch (GAW) for atmospheric constituent and chemical properties.
- The climate module of the IOC/WMO/ICSU/UNEP Global Ocean Observing System (GOOS) for physical, chemical and biological properties.
- The FAO/ICSU/UNEP/WMO Global Terrestrial Observing System (GTOS) for land surface ecosystem, hydrosphere, and cryosphere measurements[62].
- WCRP GEWEX Baseline Surface Radiation Network (BSRN) for surface radiation budget measurements.
- International Geosphere-Biosphere Project (IGBP) and World Climate Research Project (WCRP) research networks, for monitoring of terrestrial ecosystems, clouds and the hydrological cycle, the earth's radiation budget, ice sheets and precipitation over the oceans.
- Data communication and other infrastructures necessary to support operational climate forecasting, including the World Climate Data and Monitoring Programme (WCDMP) and the Climate Information and Prediction Services (CLIPS).

[62] www.fao.org/gtos/index.html

Other major international and arctic organisations include:

- Association of Polar Early Career Scientists (APECS)[63].
- European Polar Board of the European Science Foundation (EPB-ESF)[64].
- International Arctic Social Sciences Association (IASSA)[65].
- International Council for Science (ICSU)[66].
- Intergovernmental Oceanographic Commission of UNESCO (IOC)[67].
- Scientific Committee on Antarctic Research (SCAR)[68].
- University of the Arctic (UArctic)[69].
- United Nations Environment Programme (UNEP)[70].
- World Climate Research Programme (WCRP)[71].

9.5 Key considerations for station management

Organisation of research and monitoring coordination efforts

- Identify a scientific leader and a logistical leader for the station (can be one person).
- Establish a scientific coordination group/board that can help evaluate and coordinate proposed research and monitoring activities at the station (include scientific leader and logistical leader).
- Establish a scientific advisory board that can help develop a research and monitoring strategy and working programme.

International cooperation

- Identify relevant international and thematic research projects, programmes, networks and organisations and seek active participation in these (e.g. by becoming partner, participant, include key persons in the science boards of the station, etc.).
- Identify relevant international research and monitoring projects and programmes that could be adopted at the station and seek ways of implementing these.
- Be proactive in developing new initiatives with other researchers, research stations, research groups, networks, organisations, etc.

Research and monitoring strategy and working programme

- Identify framework within which the strategy and working programme needs to be developed.
  - Identify stakeholder interests (e.g. research community, authorities, donors, local communities, etc.).
  - Develop science policy (see also Theme 1).

[63] http://apecs.is/
[64] http://www.esf.org/hosting-experts/expert-boards-and-committees/polar-sciences.html
[65] http://iassa.org/
[66] http://www.icsu.org/
[67] http://ioc-unesco.org/
[68] http://www.scar.org/
[69] http://www.uarctic.org/
[70] http://www.unep.org/
[71] http://www.wcrp-climate.org/

  - Expected budget and potential financing mechanisms.
  - Develop procedure for producing and revising the strategy and working programme (including composition and role of scientific advisory board).
- Develop research and monitoring strategy and working programme. Use in-house and external experts (e.g. organised in a scientific advisory board) to formulate research and monitoring strategy including:
  - Introduction (background, aims, concept and science policy).
  - In-house research and monitoring projects and programmes (if funding available for this).
  - Policy towards externally driven projects and programmes (e.g. define aims, how to achieve this and develop internal mechanism for approving projects in relation to station priorities and science quality (see also Theme 5)).
  - Working programme (including project, Principal investigator, actions/milestones, deliverables, time table and funding (costs/source)).
  - Data management (see Theme 11).
  - Publication strategy (see Theme 8)
- Develop procedures for coordinating research and monitoring efforts at the station (e.g. through a scientific coordination group), including:
  - Develop procedures for applying for access and how to handle visitors (see Themes 4 and 5).
  - Assessment of the scientific quality and feasibility of proposed activities at the station (e.g. in relation to health and safety, logistics, and the vision, mission, concept and strategy of the station) (see also Theme 5).

Station example

Abisko Scientific Research Station, Sweden

By Christer Jonasson

Research and monitoring strategy

As the Station less than 2 years has changed ownership, role and intention, there are no obvious research or monitoring strategy at the moment. The following text has internally been developed during the last months:

Vision

The Abisko station sees itself as a collaborative partner in the cutting edge research of the world leading scientists who are attracted to operate here. We offer laboratories, libraries, history and access. Its quality is understood by the scientific community. It has in recent years, within the context of a century of research, developed into an internationally recognised center for excellent research in northern terrestrial and freshwater ecosystem processes and how these interact with climate helping to define the questions that will drive the next generations of natural sciences. This vision provides the context of this proposal to further develop the station to maintain and expand the capabilities and services of the ANS to continue our role in the international scientific community and society at large. The station will use the proposed support to maintain its status as the world leading research station in the circumpolar North with an emphasis on impacts of climate change on subarctic terrestrial and freshwater ecosystems and their subsequent consequences for local communities.

We see the Abisko Scientific Research Station developing into an even more attractive and international flagship observatory and an organisational focal point for more specialised and remote field stations involved in research in Arctic Sweden. By using new monitoring techniques and by increasing the accessibility of environmental data, the station will be able to serve also as a remote research station, not only as a field site, but to a larger extent also as a database center where scientists easily can down-load monitoring and research data and information.

A further aspect of the vision is that the station will expand on its role as initiator and implementer of major international research efforts into climate change and its impacts in the subarctic and arctic environments. These research efforts will have implications both for local as well as global communities and as such be relevant for policy makers at all levels. A part of this will also be to make the best use where possible of indigenous knowledge in judging and evaluating impacts of the changing climate.

Mission

The Abisko station holds a unique experience and expertise in conducting monitoring of a range of important parameters that are holding keys to understanding impacts and feedbacks in a changing subarctic climate. From a strategic point of view, there are a number of themes/activities that needs to be focused on in practice:

- Logically the first will be securing existing and developing of future monitoring activities/programmes of key interest in a changing subarctic environment.

- Maintenance and continued flow of existing ecosystem monitoring – security, quality, storage, accessibility

- GIS/Remote sensing coordination for spatial extrapolation and documentation of local study impacts as well as ecosystem processes at a landscape scale.

- Stordalen, a key site for studies of climate sensitive environments; coordination and maintenance. The Stordalen site is an excellent example on large scale field experiments for national research within an international context (see attached Stordalen research info)

- Experimental sites around the Abisko Station which are amongst the longest running in the world.

- Securing of other field site activities. The station is very fortunate in being able to offer access to logistical facilities along an alpine gradient in climate which has given rise to much recent high impact scientific literature. Support is needed to maintain this offer.

- Encouraging young scientists; we would like to offer positions as field assistants as well as internships for students interested in arctic/subarctic science

- Developing outreach programmes; we would like to further work with the local Saami community. The Abisko station has for several years been cooperating with them. There have been transfers of knowledge between the Abisko-scientists and the Saami. It has been shown that the traditional ecological knowledge and the more scientific oriented, do complete each-other

Development process and key considerations

The process

It has been a very long process. The two most important reasons for the monitoring program of the Abisko Station is that it has been built up gradually, ensuring that we will be able to maintain the different monitoring activities. Over the last 15- 20 years the monitoring data also has been strongly connected to other scientific activities; Manipulation studies and Modelling.

Stakeholders

The monitoring program/scientific activities at the Abisko Station are to a large extent the result of internal intentions and ideas. Of course several of the visiting scientists have independently come to Abisko and conducted their research without involvement of the Station leaders.

Objective

The Station has for long time had a very simple and generous objective: we should ensure that visiting scientists do conduct research at Abisko and we should also conduct research with our own staff. The majority of the research carried out at the Station is of course by visiting scientists, the number of in-house researchers has quite dramatically decreased over the last decade.

National cooperation and linkages to national/regional strategies

Both the strength and the weakness with the Abisko Station has been its very independent situation. We have been able to identify scientific weaknesses and to promote research to fill scientific gaps etc. The strength has been that we have been able to do this fast, efficient and on own initiative. However, this also

means that we have been dependent on an extremely well skilled and qualified Station Director (which we have had for almost 15 years). To a large extent, the strategies have been developed locally.

International cooperation and linkages to international organisations, networks, programmes and projects
When the new Director was appointed in 1996 the activities at the Abisko Station developed far more outward looking than previously. The ANS has played prominent roles in international high-level science coordination. Important roles include representation on the UNEP panel on ozone depletion effects, leadership of IASC, (International Arctic Science Committee) projects and provision of secretariats, leadership of the Arctic Council of Ministers Arctic Climate Impact Assessment, contributions to IPCC, ACIA, AMAP and CAFF, co-ordination and participation in EU Framework projects etc. During the period 2004-2008, the Abisko Station was the initiator and coordinator for the EU-project ATANS (Access to Abisko Naturveten-skapliga Station). This project enabled EU-scientists to spend almost 1000 man-days per year at the Station during the 4-year period.

The Abisko Station initiated the SCANNET network in late 1990s. This was a collaboration between terrestrial field stations in Northern Europe. To start with, this was a 3-year EU project with less than 10 participants. The rest is history (today SCANNET runs the EU-funded INTRACT project including more than 50 stations)!

External projects and land use conflicts
The absolute majority of the projects at ANS have been, still are and will be external. We have actively and long-termed established very good contacts with most local stakeholders, like the Sami population, the tourist entrepreneurs/hotels, local political community and schools. We also have to follow a number of legal regulations. Combined, this has been very successful and we have very seldom experienced significant conflicts.

10. Training and education

10.1 Introduction

Training and education are central elements of station management that should ensure that staff and visitors possess relevant skills for working in the Arctic and that the station builds capacity of future generations of naturalists.

In this theme:

- Training will be used to describe initiatives to ensure that people at the station possess relevant competences for working in the Arctic
- Education will be used to describe initiatives that build capacity of next generation of scientists (graduate students/PhDs/etc.), station staff and, if relevant, local communities, NGOs and amateur naturalists.

Depending on the local circumstances (remoteness, terrain, climate, etc.) station management may require or recommend that researchers/visitors have undergone specific training courses before they are allowed in the field or to use specific types of equipment (e.g. drills, snow mobile, etc.).

Some stations/owner institutions have the capacity to arrange some types of training courses at the station (or at the owner institution). In some countries training courses are also offered by outdoor schools, organisations (e.g. Red Cross) or private companies.

Research stations should take on the obligation to build the capacity of young researchers and if possible stakeholders with a keen interest in environmental or climate change issues. Many research stations are run by universities providing obvious opportunities for building capacity among local/national/international students by letting affiliated researchers give courses in arctic environment and Climate Change issues using the station as a platform or information source. Coordinated efforts in this field are required to ensure that all scientific fields are represented in the next generations of scientists (e.g. there seems to be a lack of taxonomists specialised in some taxonomic groups). Internationally there are several initiatives that seek to strengthen transnational capacity building efforts by coordinating graduate/PhD courses, sharing experiences and educational materials, arranging courses for teachers and educators, etc. (see below).

In this theme you will find information on:

- The most common training courses related to field work safety at arctic research stations.
- Educational programmes and examples of international groups and networks who seek to build capacity of next generation of professional scientists and amateur naturalists.

10.2 Training

Training is the acquisition of knowledge, skills and competences as a result of the teaching of vocational or practical skills and knowledge that relate to specific useful competences. Training has specific goals of improving one's capability, capacity and performance.

At arctic research stations, training in health and safety related issues are important for the safe execution of research activities, especially at remote stations, in hazardous terrain and under challenging environmental and climatic conditions (e.g. training in first aid, emergency preparedness, use of firearms (dangerous wildlife), glacier work, climbing (bird cliffs), snow mobile driving, use of certain types of equipment, etc.).

Research stations may request or recommend that staff and visitors have received training on specific issues before being allowed on the station, in the field, to conduct specific activities or use specific types of equipment. Research stations may offer these courses or identify courses held by others that meet the requirements of the station in relation to course contents and quality. Professional training centres can often offer more detailed and thorough training (depending on the subject). Unstaffed stations should ensure that visitors have received appropriate training before arrival.

It is important to build capacity and ensure that staff remain updated and in possession of relevant skills to operate the research station as a safe work environment for staff and visitors alike. Staff with relevant skills should always be available at the station (this is especially important for health and safety related aspects and emergency operations). If station management require that visitors are trained (in whatever areas, e.g. communication, firearm, health and safety, etc.), station management should ensure that documented abilities are of newer date (e.g. training received within the last two years is recommended).

As circumstances differ significantly between stations, station management should identify compulsory and recommended courses relevant for the local context.

Training courses at arctic research stations includes:

Staff - recommended compulsory courses

- First Aid and field safety (extended).
  - Essential for providing emergency assistance for most common types of accidents and emergency situations.
- Emergency preparedness (at station, in field, on boats, etc.).
  - Essential for providing extended support for a broader set of life threatening situations. Important with clearly defined roles and responsibilities in emergency situations (see Theme 1, Check lists)
- Communication (in areas with no mobile phone connectivity).
  - Abilities to communicate via VHF Radio, satellite telephone, etc. is essential to keep contact to field groups during normal operations and in emergency situations.

Visitors – potentially relevant safety related courses (can also be relevant for staff)

- First Aid and field safety (basic).
- Emergency preparedness (at station, in field, on boats, etc.).
- Communication (in areas with no mobile phone connectivity).
- Weapon (firearm handling for protection against wildlife).

- Glacier (for working in glaciated areas).
- Climbing (e.g. vertical bird cliffs).
- River crossing.
- Diving.
- Snow mobile driving.
- Driving on icy roads.
- Laboratory use.
- Use of specific equipment and machines.
- Etc.

Example of contents of First aid courses:

General health and safety training courses

- Airway, breathing and circulation Emergencies (also known as ABC)
  - Developed as a memory aid for rescuers performing cardiopulmonary resuscitation, and the most widely known use of the ABC system is in the care of the unconscious or unresponsive patient, although it is also used as a reminder of the priorities for assessment and treatment of patients in many acute medical and trauma situations, from first-aid to hospital medical treatment.
- First Aid for Respiratory and Cardiac Arrest.
  - Manual assistance.
  - Automated External Defibrillator (AED). An AED is a portable electronic device that automatically diagnoses the potentially life threatening cardiac arrhythmias of ventricular fibrillation and ventricular tachycardia in a patient, and is able to treat them through defibrillation, the application of electrical therapy which stops the arrhythmia, allowing the heart to re-establish an effective rhythm.
- Sudden Medical Emergencies and Environmental Emergencies.
  - Injuries or illnesses that are acute and possess an immediate risk to a person's life or long term health.
  - Sudden-onset disasters or accidents resulting from natural, technological or human-induced factors, or a combination of these, that causes or threatens to cause severe environmental damage as well as loss of human lives and property
- The Emergency Medical Service (EMS) System.
  - Type of emergency service dedicated to providing out-of-hospital acute medical care, transport to definitive care, and other medical transport to patients with illnesses and injuries which prevent the patient from transporting themselves. It is important with clear emergency preparedness procedures and responsibilities at arctic research station often located far from proper medical facilities and expert personnel (see Theme 1, Check lists).
- Head, spine, bone, muscle and joint injuries.
- Wound care.

Station specific training needs for arctic field work include:

- Training in what to do in case of emergencies in the field.
  - Communicating with research base and emergency services.
  - How to behave (prevent further injury, contact help, stay warm, make yourself visible, etc. (see also Theme 1, Check lists and Theme 6, Health and safety).

Examples of training programmes

CH2MHILL Polar Service - Arctic Field Training programmes (USA based, but with operations also in Canada, Russia and Greenland)
Here station management can find inspiration for health and safety related documents and training programmes offered by or recommended by CH2MHILL Polar Service (used by US National Science Foundation).
http://www.polar.ch2m.com/SingleHTMLTextArea.aspx?P=241eb697e7b14000b13f6bc01a167fb2

Arctic Response – Field safety courses (Canada based)
Here station management can see an overview of courses related to field safety offered by Arctic Response Canada Ltd, including course contents.
http://www.arcticresponse.ca/courses/field-safety/

University Centre Svalbard (UNIS) - The Svalbard Guide Training Course (Svalbard based)
Here station management can see courses offered by the Svalbard Tourist Office for expeditions to Svalbard, including polar bear safety, glacier, summer and winter survival training, etc.
http://www.unis.no/45_LOGISTICS/SGO/

10.3 Education

Educating visitors on procedures, rules and regulations at the station should be done prior to or upon arrival at the station (see Theme 4). Rules and guidelines on how to use equipment, laboratory space and other infrastructure or facilities at the station should be available for visitors in relevant documents/buildings.

Education programmes and courses
Research stations are excellent platforms for in-situ practical field courses. Station management can arrange courses themselves or provide the platform for courses arranged by other research institutions and organisations. The target audience may vary from local school classes to graduate and PhD students.

Stations in the INTERACT network differ immensely in size and logistical challenges. The potential for hosting courses therefore also varies. Remoteness, transport costs and available economical and human resources affect the potential for developing and running comprehensive educational programmes.

Courses developed by the station should be integrated into the educational programme of the owner institution, if this is a university, and advertised in international fora (e.g. UArctic, see below).

If courses cannot be hosted at the station, the knowledge generated there and the people working there can be used for developing courses held at owner institutions or at other educational facilities. Station management should seek to develop courses related to activities undertaken at the station and in this way contribute the capacity building for the next generation of earth observing scientists (and amateur naturalists if courses target lower levels of education).

Visiting researchers provide a good opportunity for ad hoc presentations for staff, other visitors and local communities. If relevant to the local context, station management are recommended to encourage this (see also Theme 8, outreach and marketing).

Internationally, there are a number of circumarctic organisations and initiatives that are engaged in developing and coordinating educational activities in the arctic (see examples below). These organisations and initiatives provide a great opportunity for station management to stay informed and potentially contribute to these coordinated efforts that seek to build capacity within all fields related to arctic research and monitoring.

10.4 Key considerations by station management

Training

- Identify training requirements for staff and ensure that these are regularly updated.
- Identify training requirements for visitors.
  - Compulsory courses of general nature and for specific activities (e.g. glacier work, diving, etc.). Include in relevant staff related documents (see Themes 1 and 3).
  - Recommended courses of general nature and for specific activities. Include this information in relevant visitor information documents (see Theme 4).

Education

- Develop courses and educational programmes that can be hosted at the station or at another (more accessible) educational facility (school /university). Courses can be developed for both:
  - Research communities (local/national/international).
  - Local communities (e.g. schools, the general public, NGOs, amateur naturalists, etc.)
- Advertise the station as a platform for courses and other educational activities, nationally and internationally.
- Identify relevant organisations and initiatives related to educational activities in the Arctic (see below) and identify staff or other persons to actively coordinate efforts and promote courses at the station.
- Invite and encourage visiting scientists to give talks for station staff, visitors and local community.

Examples of organisations related to educational initiatives in the Arctic

University of the Arctic[72]

The University of the Arctic (UArctic) is a cooperative network of universities, colleges and other organisations committed to higher education and research in the North. Members share resources, facilities and expertise to build post-secondary education programmes that are relevant and accessible to northern students. The overall goal of UArctic is to create a strong, sustainable circumpolar region by empowering northerners and northern communities through education and shared knowledge.

UArctic promote education that is circumpolar, interdisciplinary and diverse in nature, and draw on the combined strengths of member institutions to address the unique challenges of the region. The University of the Arctic recognises the integral role of indigenous peoples in northern education, and seeks to engage their perspectives in all of its activities.

Research stations, universities, institutions and organisations can advertise courses in the UArctic Catalogue, and here students can search for courses throughout the Arctic related to their specific interests.

IASC[73]

The International Arctic Science Committee (IASC) is a non-governmental, international scientific organisation. The IASC mission is to encourage and facilitate cooperation in all aspects of Arctic research, in all countries engaged in Arctic research and in all areas of the Arctic region. Overall, IASC promotes and supports leading-edge multi-disciplinary research in order to foster a greater scientific understanding of the Arctic region and its role in the Earth system.

IASC recognises that the next generation of Arctic researchers will be faced with increasingly critical challenges due to the impacts of Climate Change on the region and their global significance. The Committee therefore believes that it is of great importance to foster these young researchers, and promotes and involves early career scientists working in the Arctic by:

- Striving for representation of early career researchers in the organisation.
- Providing endorsement, support and dissemination of information on activities, projects and requests for participation.
- Providing travel grants to early career scientist for selected conferences.

With these instruments IASC aims to include more young researchers from the starting phase in the organisation of workshops, in science planning activities and research programmes.

IASC has an official partnership with the Association of Polar Early Career Scientists (APECS) to further the professional development of early career researchers and endorses Polar Educators International (PEI).

[72] www.uarctic.org
[73] www.iasc.info

APECS[74]

APECS is an international and interdisciplinary organisation for undergraduate and graduate students, postdoctoral researchers, early faculty members, educators and others with interests in polar regions and the wider cryosphere. The aims of APECS are to stimulate interdisciplinary and international research collaborations, and develop effective future leaders in polar research, education and outreach. This will be achieved by:

- Facilitating international and interdisciplinary networking to share ideas and experiences and to develop new research directions and collaborations.
- Providing opportunities for professional career development.
- Promoting education and outreach as an integral component of polar research and to stimulate future generations of polar researchers.

APECS have strong ties to the International Arctic Science Committee (IASC) and Scientific Committee on Antarctic Research (SCAR).

Polar Educators International (PEI)[75]

A global professional network for those that educate in, for and about polar regions. PEI intends to move science education forward by connecting the cultures and enthusiasm of polar education and polar science across the globe. The group consists of more than 250 leading educators, scientists and others who will develop innovative teaching resources and practices designed to bring the importance of the polar regions closer to home. PEI intends to excite students about learning and about their planet, and thereby change the terms of debate and the framework of education, to rekindle student and public engagement with global environmental and climatic changes.

Experiences and resources are shared in the PEI Facebook group.

PolarTREC[76]

PolarTREC (Teachers and Researchers Exploring and Collaborating) is a program in which K-12 teachers spend 2-6 weeks participating in hands-on field research experiences in polar regions. The goal of PolarTREC is to invigorate polar science education and understanding by bringing K-12 educators and polar researchers together. By fostering the integration of research and education, PolarTREC will continue the momentum established during the International Polar Year (IPY) by addressing the following program objectives:

- Improve teacher content knowledge of multidisciplinary polar science.
- Improve teacher instructional practices, especially the use of inquiry-based learning to translate polar science to the classroom.
- Improve polar researchers' understanding of and engagement in K-12 education to strengthen and enrich the outreach and dissemination of their research.

[74] www.apecs.is
[75] https://www.facebook.com/groups/247660677828/#_=_
[76] http://www.polartrec.com/

- Increase students' understanding of and engagement in the polar regions and interest in polar science, technology, engineering, or mathematics (STEM) careers.

The PolarTREC program is managed by the Arctic Research Consortium of the United States (ARCUS) and housed in Fairbanks, Alaska.

Station example

Station example 10.1 - Arctic Station, Greenland

(Small to medium sized, easy access station located in a community)

Arctic Station is located in the outskirts of the town Qeqertarsuaq in central West Greenland at the north western edge of Disko Bay to the west of the Ilulissat Ice Fjord. The waters are dotted with icebergs in all shapes and sizes and although rare, polar bears are sometimes found nearby.

Visitors at Arctic Station need to have acquired the following information or training:

- General introduction to the station and its surroundings.
- Communication skills in operating VHF and or Satellite telephones are needed for field work away from the station.
- Weapon handling (instruction may be given when needed).
- Passengers sailing on 'R/V Porsild' and working from it must comply with the general safety rules for sea based work (safety helmets, life west, rules when handling wires and winches).
- On longer trips on 'R/V Porsild' they need to be aware of availability and use of rescue equipment.

General introduction to the station and surroundings

When visitors arrive at the station they are given an introduction talk, including:

- Health and safety.
  - When visitors at Arctic Station are leaving the station for field trips, they are obliged to write in a book, with details regarding time of departure and safety gears, name of destination, number of people leaving and expected date and time on arrival.
  - Health and safety equipment expected to be brought to the field. Simple first aid equipment, GPS and satellite phone are obliged.
  - In case of an emergency, a communication procedure is planned before leaving the station.
- Ethics (how to behave in the field).
  - Be sure you have the right permits for scientific collections.
  - All items (including waste) that are brought into the field are to be returned to the station for proper disposal.
  - Excavations and samplings are to be kept at the lower most possible and only with a genuine scientific purpose and without negative effect to the environment.
  - Camping and disturbance of the nature around protected areas is not allowed.
- Policies and efficiencies:
  - Visitors are informed of garbage and waste handling, water use, expected behaviour at the station, etc.

Communication

Being able to communicate is of utmost importance in emergency situations in remote areas. It is therefore compulsory to bring satellite telephones in the field and visitors must know how to use it.

Weapon handling and shooting training
When camping in the area, researchers need to bring a firearm for protection against wildlife. Although dangerous wild life is rare in the summer, they may occur. Basic weapon handling and shooting training is provided at the station, to ensure that people working in the field are prepared for encounters with dangerous wildlife.

Training programme for longer research trips on the research vessel 'Porsild'
'Porsild' is a small travel and research vessel with one skipper and 1-2 crew members, and it can accommodate 12 passengers during daylight operations. The cabin accommodates eight people over night. Essential training in the use of survival suits, rescue boats and general safety procedures on board are important. Therefore, all people on board will be given an introduction in how to use the rescue boats and general safety on board. Survival suits are essential in cold waters, and it is important that people know have to put them on in emergency situations.

Educational programmes and courses
A variety of educational activities take place at Arctic Station. Lectures and presentations are given to the local community regarding the scientific research. Lectures are given mainly by visiting scientist from University of Copenhagen during the summer months. Furthermore, Arctic Station has the capacity to host educational activities for the local police, the local museum and for the Government of Greenland.

High school students from Aasiaat, Greenland, participate every autumn in a course organised at the premises of the Arctic Station.

The University of Copenhagen offers a number of courses under an educational programme focussing on arctic and polar environments. This programme includes an Arctic Field Course held at the Arctic Station. A pre-condition for participation in the field course, is that other courses in this programme have been completed. These courses are held in Denmark with input from researchers that have visited the Arctic Station.

The Arctic Field Course (2-4 weeks) is organised every summer at the Arctic Station for students at the Faculty of Science at the University of Copenhagen (typically after their 6^{th} or 8^{th} semester). The courses are organised according to a 4-year rotational schedule in the fields of biology (every second year), physical geography (every fourth year) and geology (every fourth year).

The number of participating students is typically 12 (2 teachers). Some courses are available for participants from Greenland or students from abroad. The courses focus on practical field work providing students with an intimate understanding of the arctic environment. The research vessel 'Porsild' is extensively used both as a research platform and for transportation purposes in connection with setting up of remote camp sites. Comprehensive reports from all courses are on display in the Arctic Station Library.

The Arctic Station periodically hosts Ph.D. courses, workshops and field excursions for professional societies, the 'Peoples University' and others.

Example of course presentation	Description of the 'Arctic Field Course' held by University of Copenhagen at Arctic Station, Greenland http://sis.ku.dk/kurser/viskursus.aspx?knr=131031&languageid=1
Title:	Arctic Field Course –Biology
Edition:	Spring 2013 Science
ECTS Credits:	7,5
Point:	7,5
Department(s):	Department of Biology
Educational level:	Master level
Aim:	The aim of the course is to give the students the opportunity to practise the theoretical knowledge acquired during the course in Arctic Biology. Get the experience of accomplishing a field project under arctic settings. Obtain basic knowledge of the terrestrial and aquatic physical, chemical and biological conditions through the field project. Know the most common plants and animals in arctic communities. Strengthen the professional and social relationships during the project work. Mediate own results to an audience.
Course description:	The course uses the Arctic Station, University of Copenhagen, at Qeqertarsuaq as the main platform for its activities. The participants apply for the opportunity to participate in the course by formulating a project to be carried out during a three weeks stay at the Arctic Station. The application should include: A description of the project. Why is it interesting? Why go to Arctic Station to do it? How realistic it is to carry out the project during 3 weeks under arctic conditions? How much money is needed? How to obtain external funding for the project. Each project includes two to three students. The successful students carry out their project with supervision of the involved teachers. At the Arctic Station lectures are arranged in the evenings. The scientific leader of the station as well as guests and the teachers at the course are talking about their current projects. During the travel to and back from Arctic Station shorter stays in Kangerlussuaq and Ilulissat are undertaken to get experiences of the different communities found there.
Expected Competences:	Dependent of the theme of the project, the students can after completing the course: Discuss and understand the scientific process from the idea of a project to completing a report of the study. Carry out practical field work with all its challenges and changes during the

	accomplishment. Analyse accumulated data statistically. Include general morphological, physiological and reproductive strategies in arctic organisms in the discussion of the acquired results. Include general population dynamics in relation to the theme of the project. Include general element cycling of the Arctic in the discussion of the acquired results. Include general knowledge on arctic abiotic conditions in the treatment of the results of the project. Mediate the ideas of the project and the acquired results in terms of a project report and in an oral presentation of the investigation.
Recommended qualifications:	It is a pre-request that the course Arctic Biology has been successfully passed either before or during the same year as the field course.
Assessment:	For each project students will write a report in English based on the results of their investigations. The report is similar to the format of a scientific paper. The examination is a 20-minute oral examination where the students individually present their study and its results. The presentation is followed by questions to the report as well as relevant background literature to the project. Finally an English report based on all project reports performed during the Arctic Field Course will be published on behalf of Arctic Station. Evaluation after the 7-point grading scale. Internal censorship.

11. Knowledge Capture and Data Management

Co-authors Kirsten Elger, Warwick Vincent and Christine Barnard

11.1 Introduction

Terrestrial research stations such as those in the INTERACT network both generate and require large amounts of information. Some of this information is essential for the efficient management of day-to-day operations at the station, including for reservations, logistics, health and safety, reporting and project management, as well as for seasonal and long term planning; for example, to coordinate research projects and to ensure the on-going development of relevant environmental monitoring protocols.

The researchers and professional staff at INTERACT stations also generate a wide range of scientific data types, and there is an increasing need to develop and implement efficient tools to share these data within and outside the research community.

This theme presents examples, approaches, and recommendations for addressing these diverse needs in knowledge capture and information exchange for operations (11.2), research (11.3), data-related outreach and education (11.4), followed by more specific recommendations for station managers in the formulation of a data management plan and a data storage system for all station-related metadata and data (11.5).

11.2 Operational data for station management

Capturing changes in management regulations and procedures is important for transferring knowledge, accumulated over time, between employees at the station and during changes in staff. It is therefore important to write down regulations, procedures, etc. in one or more logically structured documents. This should also capture changes in legislative requirements that necessitate changes to station procedures and regulations.

Although station managers work to minimise risks, accidents may happen at stations or in the field. In such cases it is important to have a system that captures incidents to assess whether existing regulations/procedures need to be changed or developed. This is especially important in relation to health and safety aspects (e.g. recording and discussing incidents and near misses).

Visitors can also contribute to the improved management of the station via evaluations of stays, allowing management to learn how the stay was experienced from a guest's point of view (e.g. evaluations in person, on paper, or via a suggestion box). Written (and possibly anonymous) evaluations/suggestions may be better than meeting in person as this may make some people more reluctant to make negative comments (see also Theme 4).

Obtaining and providing spatiotemporal information on past and present activities is of importance for the planning of future research and monitoring efforts and can help minimise conflicts between

research projects (e.g. who measured what, where and when?). Several research stations oblige their scientists to provide this information within expedition reports that are also available at the station. It is important to store this information and make it accessible at the research station, so anyone interested may consult an overview on present and past activities at the station, including the researcher's contact information.

Station management also needs to capture project-related data to assess the feasibility of applied projects and safety-related issues (e.g. emergency plans, health and security information). Furthermore, stations must retain relevant information about applicants and next of kin in case of accidents or illness. This information should be captured through the application form (see 5.6 GIS based project management tool). In addition to this, information should be recorded regarding the field accessibility (e.g. road conditions) or 'exceptional events' affecting the station or the research areas (e.g. tundra fires, landslides, flooding).

We recommend that station management create an information space on their station website where all these documents (including emergency plans, health and safety information, and also the activity overview) can be accessible from a single portal. This information should complement what is already online at several stations such as equipment, boat, aircraft and vehicle availability, and an online calendar for accommodation availability (e.g. the CEN Network).

11.3 Management of metadata and actual data

Terrestrial field stations are key sites for environmental monitoring as well as for research experiments and observations. The result is that most stations and their researchers have extensive data records that could feed into knowledge syntheses, understanding of environmental processes, and policy decisions on environmental management. Very often, however, these data are not used to their full extent because they are not systematically archived or made readily accessible. Another impediment to free and open data exchange is the reluctance of researchers to share their data in the absence of appropriate credit for the large investment of time and intellectual effort that went into collecting the data, as well as concern that their data may be misused or misinterpreted.

Internationally, there is an increasing expectation by research funding agencies that close attention should be given to data management, and many research agencies and organisations require that grant proposals explicitly address the plans for metadata and data archiving. The International Arctic Science Committee (IASC) has recently formulated their Arctic Data Management Policy[77], which states that all research projects seeking endorsement by IASC must adhere to the principle of 'full and open access' to data, and must make metadata (basic descriptive information of collected data) available 'in an internationally recognised standard-format to an appropriate catalogue or registry'. The policy states that 'IASC should actively encourage adherence to the principles and may withdraw project endorsement if necessary' (Statement of Principles and Practices for Arctic Data Management, IASC Council, 16th April 2013). The free and open sharing of data now also has broad

[77] www.iasc.info/home/iasc/data

political support: at the first meeting of the G8 Science Ministers and the respective presidents of the national science academies, held in London on 12th June 2013, several principles for open access were discussed and agreed upon[78], including that 'to the greatest extent and with the fewest constraints possible publicly funded scientific research data should be open, while at the same time respecting concerns in relation to privacy, safety, security, and commercial interests, whilst acknowledging the legitimate concerns of private partners'.

With the advent of electronic publishing and the ease of exchange by internet, there is now a variety of new solutions to address each of these challenges and concerns. This includes geo-referenced systems such as web-based geographic information systems and other databases in which queries can be made regarding the spatial distribution of research and monitoring projects, as well as the availability of the associated datasets, e.g. the Abisko GIS[79] in which the extensive research conducted over almost 100 years at Abisko, Sweden, has been catalogued and presented (see 5.6 GIS based project management tool). There are several data journals such as the online European publication 'Earth Science System Data' (ESSD[80]) that specialises in the publication of data-related scientific articles, with cross reference to citable datasets that are each archived under a unique Digital Object Identifier (DOI). Datasets are increasingly archived in World Data Systems (WDS), former World Data Centres (WDC), data archives that were originally created to archive and distribute data collected from the observational programs of the 1957-1958 International Geophysical Year by the International Council of Scientific Unions (ICSU). Most WDSs contain large archives of data and associated metadata for long-term data conservation, and which can also be referenced and cited via DOIs.

Within the INTERACT network of field stations, there are several approaches towards data and metadata management. In the sections below, we first provide background information on metadata and DOIs, and then give subset of some existing solutions for data and metadata management, including publication of actual data, with examples from the Alfred-Wegener Institute for Polar- and Marine Research (AWI, Germany) and the CEN Network of northern Canadian stations (Centre d'études nordiques; Centre for Northern Studies[81]). The introduction to the Canadian Polar Data Catalogue[82], designed for metadata and spatial discovery of datasets, is followed by two examples for DOI-referenced publication of actual data: PANGAEA[83] is an AWI example of a global, Earth-observation database focussing on metadata and actual data (WDS) and Nordicana D[84] a Canadian example of a multidisciplinary data report series for Arctic environmental datasets. Several INTERACT stations assess permafrost monitoring data within the frame of the Global Terrestrial Network for Permafrost (GTN-P) and its sub-programs TSP[85] (Thermal State of Permafrost = permafrost

[78] https://www.gov.uk/government/news/g8-science-ministers-statement
[79] www.abiskogis.se
[80] www.earth-system-science-data.net
[81] www.cen.ulaval.ca
[82] www.polardata.ca
[83] www.pangaea.de
[84] www.cen.ulaval.ca/nordicanad/en_index.aspx
[85] www.ipa.arcticportal.org/activities/gtn-p/tsp/15-tsp.html

boreholes) and CALM[86] (Circumpolar Active Layer Monitoring). Within the EU FP7 project PAGE21 'Changing Permafrost in the Arctic and its Global Effect on the 21st Century'[87], led by AWI, a new dynamic database was created for borehole temperatures and active-layer measurements of GTN-P, which is described in section 0.

The examples in this theme are from the Canadian CEN Network (eight research stations and within a national network) and the AWI (also a large research institute) and focus on existing regional, national, global or thematic solutions for data management (mostly beyond the needs and capacity of a single research station) with the aim to show different solutions for data and metadata archiving and publication. We do not recommend every station to develop a large Oracle-based metadatabase (like PDC) or create a data report series (like Nordicana D), but it is strongly recommended that each research station develop an appropriate way to store station-related information. This is essential to keep track of station related research activities and enables the distribution of data and metadata upon request. Such a data repository could be very simple, such as an Excel file or a small database, and may be sufficient for small stations. A station could additionally consider submitting their metadata and/ or data to existing regional, global, or thematic databases, such as those introduced in this theme.

Introduction to Metadata and DOI

What is metadata?

'Metadata is structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource. Metadata is often called *data about data* or *information about information*'[88]. There is a general difference between structural metadata that is necessary to understand and work with the actual data (e.g. technical information, applied functions or processing steps, etc.) and descriptive metadata that is aimed for data discovery (e.g. the information of the existence of a dataset, its description, measurement period, contact information of the data originator or distributor, and possibly, but not necessarily, information about where to obtain the actual data). Descriptive metadata is available via websites or metadatabases for data discovery, e.g. the Polar Data Catalogue[89], that may also contain links to the actual datasets, but it is also requested for the publication of DOI-referenced actual datasets (se examples in 11.3).

For developing a new metadatabase it is recommended to use existing metadata standards (e.g. ISO 19xxx, INSPIRE or FGDC) to ensure the maximum interoperability with other metadatabases and facilitate metadata and data discovery, also because search engines increasingly query several metadatabases from a central portal (e.g. Arctic Data Explorer[90]).

[86] www.gwu.edu/~calm
[87] www.page21.org
[88] www.niso.org/publications/press/UnderstandingMetadata.pdf
[89] www.polardata.ca
[90] www.nsidc.org/acadis/search

In contrast to metadata, actual data reflect the measured variables, e.g. temperature time series, satellite data, soil profiles, and many more. A metadatabase may be associated with actual data, but not necessarily. However it would be useful to provide information about how to obtain the actual data within the metadatabase, e.g. by providing a link or by giving the contact information of the data originator.

What is a DOI and why is it important?
A Digital Object Identifier (DOI) unequivocally and permanently identifies objects. It associates metadata with objects, allowing it to provide users with relevant pieces of information about the objects and their relationships. The DOI system is implemented through a federation of registration agencies (e.g. Datacite[91]) coordinated by the International DOI Foundation[92], which developed and controls the system.

In science, the DOI is mostly associated with the publication of scientific articles and their citation. The retrieval of a DOI, however, is also possible for a dataset, for e.g. time series of air temperatures measured at one or several climate stations. A dataset with a DOI is a citable dataset ensuring the acknowledgement of the data originator. All datasets that have been assigned a DOI must be permanently archived and available in their original form (a requirement of the International DOI Foundation). Later versions (or data releases) have either a new DOI or may be permissible with the same DOI and a new version number, but only if all original version numbers are also permanently archived and available, and if there is also an explicit description of the version history on the DOI landing page.

Data discovery and data publication

The first online-accessible research databases focussed on descriptive metadata for data discovery, where the user could find information about present and past research projects, including contact information of the data originator and the description of datasets acquired within the respective research project. Due to the increasing need by the scientific community, politicians, local communities, and requests by funding agencies to make actual data publically available (i.e. open-access data), it has become necessary to develop new solutions, not only for long-term data archival, but also to make the stored actual datasets citable and acknowledge the data originators using Digital Object Identifiers (DOI).

There are different possibilities for data publication and more are developing rapidly. A dataset can be published via a data journal, such as, e.g., Earth Science System Data (ESSD[93]), where the authors publish a scientific, peer-reviewed article about a dataset or database. The actual dataset is stored in a data archive for download and can be cited via the DOI citation of the data journal. Alternatively, the dataset itself can be directly referenced via a data-DOI, for example in PANGAEA or the report series Nordicana D which both contain descriptive metadata and the downloadable actual data. Peer-

[91] http://www.datacite.org/
[92] www.doi.org/
[93] www.earth-system-science-data.net/

review and quality assurance protocols are currently under development to apply to DOI-referenced datasets and to assure their reliability as bona fide references in peer-reviewed articles.

The data management examples in this theme (Polar Data Catalogue, Pangaea, and Nordicana D) have certain differences, but they all share these three components: searchable metadata, actual data archiving, and DOI-referencing.

Polar Data Catalogue for metadata archiving and discovery – example of a circumarctic interdisciplinary database with emphasis on descriptive metadata

The Polar Data Catalogue[94] (PDC) is an online database of metadata that describes, indexes, and provides access to diverse interdisciplinary datasets generated by Arctic and Antarctic researchers. The records follow the international metadata standards of the Federal Geographic Data Committee (FGDC) to allow exchange between databases, and they cover a wide range of disciplines, from natural sciences to policy, health, and social sciences. The catalogue includes a geospatial search-tool that allows searching for spatial data using a web-based mapping interface. To facilitate data searches, it also allows combining spatial referencing with multiple keywords, categories, authors, and date (see **Figure 1**).

PDC was cofounded by the Canadian Cryospheric Information Network[95] (CCIN) at the University of Waterloo, and the Canadian Network of Centres of Excellence program ArcticNet[96] with the input of many other partners. ArcticNet involves several hundred researchers and students working across the Canadian North, and PDC began as a metadatabase for ArcticNet that came online in 2007. It was later expanded to include not only metadata but also full access to many actual datasets, including more than 20 000 remote sensing images of the Arctic and Antarctica from the Canadian satellite RADARSAT-1. PDC was adopted by the Canadian International Polar Year 2007-2008 as a long-term archive for data sets (metadata and actual data, now DOI-referenced). PDC also acts as a metadata discovery portal for Nordicana D, which archives and publishes environmental data from the CEN Network of field and monitoring stations as well as other northern data sets.

The specific objectives of PDC are:

- To implement systems that facilitate information exchange among researchers and user groups, including northern communities and international programs.
- To develop, maintain, and update an ArcticNet metadatabase, with emphasis on international standards and compatibility across multiple platforms.
- To work with other relevant national and international projects (for example the International Polar Year 2007-2008), towards an integrated data management system.

All projects funded by ArcticNet require the annual reporting of descriptive metadata to PDC, and evidence of plans for full data archiving in PDC or in a recognised data repository elsewhere (such as Nordicana D). For example, microbiological studies within ArcticNet provide metadata records to

[94] www.polardata.ca
[95] www.ccin.ca
[96] www.arcticnet.ulaval.ca

PDC, while DNA and RNA sequence data are deposited and referenced in GenBank[97], as required by most microbiological journals at the time of manuscript submission. PDC is increasingly being used to house metadata from other projects within Canada (e.g. the Beaufort Regional Environmental Assessment[98]) and internationally, for example the Circumpolar Biodiversity Monitoring Program[99] (CBMP).

The CEN Network of field stations within INTERACT uses PDC primarily as a way to archive metadata of projects that take place at each of its stations. Some of these projects are funded by ArcticNet, but many are not; for example, the project 'Arctic Development and Adaptation to Permafrost in Transition' (ADAPT[100]), which takes place at many locations across Canada including several in the CEN Network. PDC provides an attractive solution in that it has a user-friendly interface for metadata entry which ensures that the final record conforms to international metadata standards, currently FGDC-STD-001-1998 (see Table 1 and **Figure 2**) but with conversion in progress to an ISO-19115 standard. This standardisation is important to ensure interoperability, because it allows the records to be exported to and accessed/ queried by other databases. There is also a quality-control step overseen by the ArcticNet data coordinator to ensure that only bona fide records are entered, and to check that all fields are filled correctly prior to approval and public dissemination.

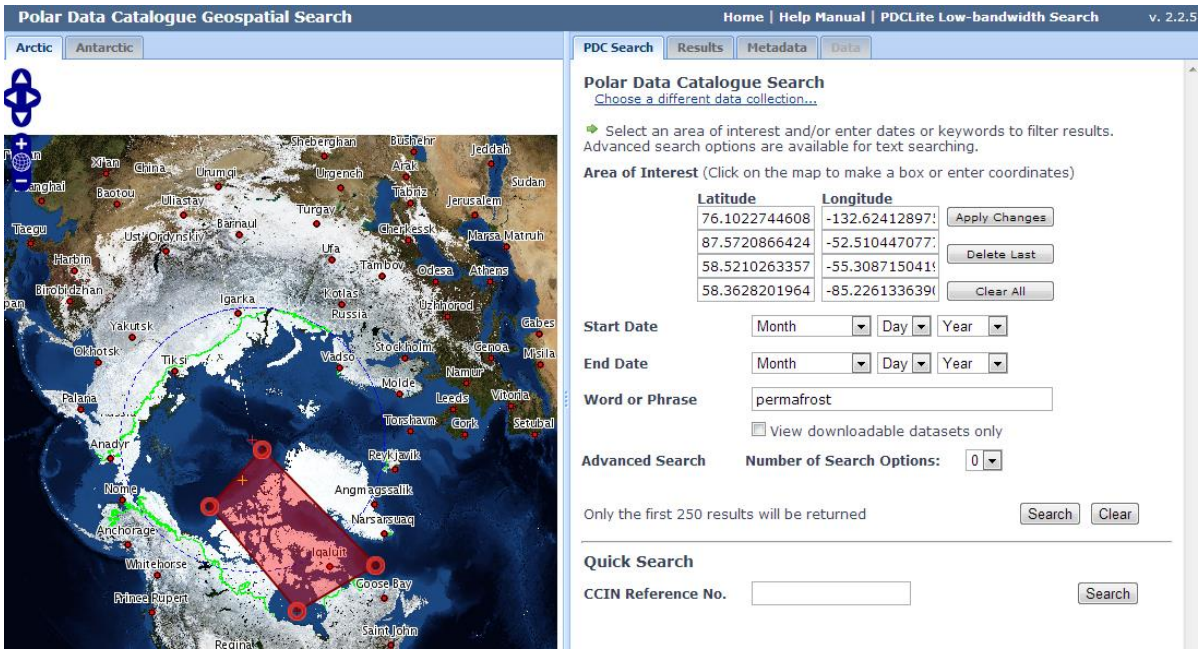


Figure 1. The Polar Data Catalogue is outfitted with a geospatial search tool that allows data search using a web-based mapping system (left). To facilitate data search, it also allows combining spatial referencing with keywords, categories, authors, date, etc. (right). Geographical coordinates may be either retrieved with the map-based search tool or entered directly in the respective fields.

[97] www.ncbi.nlm.nih.gov/genbank
[98] www.beaufortrea.ca
[99] www.caff.is/monitoring
[100] www.cen.ulaval.ca/adapt

Table 1. Required descriptive metadata fields to fulfil FGDC standards.

Category	Sub-category
Citation information	responsible parties, research program, title, citation, link to data
Description	purpose, abstract, plain language summary
Temporal coverage	begin date, end date
Status	progress, maintenance and update frequency (if needed)
Spatial Domain	north bound coordinate, south bound coordinate, west bound coordinate, east bound coordinate
Keywords	
Place	study site
Constraints	access constraints, use constraints
Point of contact	contact organisation, contact person, address, city, province, postal code, country, phone, fax, email
Distributor Information	contact organisation, contact person, address, city, province, postal code, country, phone, fax, email
Metadata Reference Information	metadata date, contact organisation, contact person, address, city, province, postal code, country, phone, fax, email
Metadata Standard Name	(e.g. FGDC Content Standards for Digital Geospatial Metadata)
Metadata Standard Version	(e.g. FGDC-STD-001-1998)

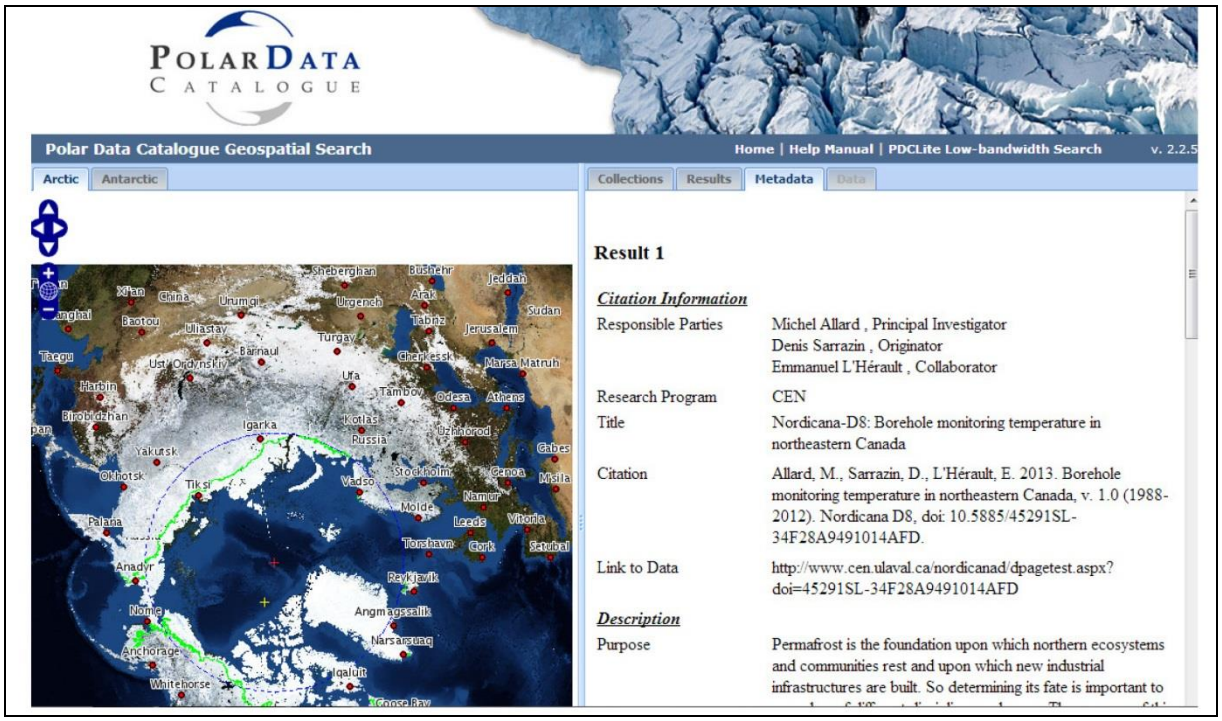


Figure 2. An example from the Polar Data Catalogue for the data published by Allard et al. (2013) in Nordicana D. See Table **1** for a complete list of metadata fields required by the Federal Geographic Data Committee (FGDC).

Considerable effort has gone into the development of the geospatial search tool in PDC (**Figure 1**), with extensive beta-testing and consultation, including with northern communities. The latter has been especially important, since the Inuit communities specifically requested a map-based search tool that would allow them to see the research projects that have taken place in their regions, with information on how to contact the researcher and access that data, as presented in the PDC metadata records. In further response to their requests, a PDC-lite[101] version has been developed, allowing searches to be made based on community locations. This has been tailored so that it is fully operational under low internet bandwidth connections which are currently found in many parts of the Canadian North.

PANGAEA: a World Data System for publishing Earth and Environmental Data –example of a global, DOI-referenced archive database

The World Data Centre (WDC) system was created to archive and distribute data collected from the observational programs of the 1957-1958 International Geophysical Year by the International Council of Science (ICSU). The WDCs were funded and maintained by their host countries on behalf of the international science community. Originally established in the United States, Europe, Soviet Union, and Japan, the WDC system expanded to other countries and to new scientific disciplines and later included up to 52 Centres in 12 countries. All data held in WDCs were available for the cost of copying and sending the requested information. At the end of 2008, following the ICSU General

[101] www.polardata.ca/pdclite

Assembly in Maputo (Mozambique), the World Data Centres were reformed and a new ICSU World Data System (WDS) established in 2009 building on the 50-year legacy of the ICSU World Data Centre system and the ICSU Federation of Astronomical and Geophysical Data-Analysis Services. Today, many former WDCs changed to multi-disciplinary World Data Systems that also provide a data-DOI for archived data (e.g. PANGAEA with its predecessor WDC Mare).

In Germany, PANGAEA[102] is the World Data System for publishing Earth and environmental data. The open access library aimed at archiving, publishing and distributing geo-referenced data from Earth system research with guaranteed long-term data availability. It is hosted by the Alfred-Wegener Institute for Polar and Marine Research (AWI) and the Centre for Marine Environmental Sciences (MARUM). Most data are freely available and can be used under the terms of the license mentioned on the data set description or via contact with the researcher.

Each dataset can be identified, shared, published, and cited by using a Digital Object Identifier (DOI). Data are archived as supplements to publications or as citable data collections. The guiding principle of PANGAEA is open access to its content by research and education communities. The policy of data management and archiving follows the Principles and Responsibilities of ICSU World Data Centres and the OECD Principles and Guidelines for Access to Research Data from Public Funding[103]. Authors submitting data to the PANGAEA data library for archiving agree that all data are provided under a creative commons license[104].

Nordicana D – Canadian example of a multidisciplinary, DOI-referenced data report series for Arctic environmental data sets

Nordicana series D is a formatted, online, DOI-referenced data report series archived at the Centre d'études Nordiques (Centre for Northern Studies, CEN). Nordicana series D ('D' for data) was launched by CEN at Laval University in February 2013, and is evolving rapidly as a convenient and online-accessible environmental data repository. It is produced only in electronic form and is freely and openly accessible to the user. Each issue is published in the two official languages of Canada (French and English), and is indexed via an assigned Digital Object Identifier (DOI). An issue may be updated, for example with new data or the re-instrumentation of a borehole, as a new version number, but retains the same DOI; all version numbers are accessible, as required by the DOI assignment, but this approach allows the user to see and access additional data that may not have been available at the time of citation, as well as any recalibration history of the data. This feature, as well as its structured journal-like format for citation, has made it a useful option for individual researchers and for research projects wishing to make core data sets accessible. Each issue contains actual data sets and metadata that explain the origin and the format of the data, the history of updates via different version numbers, and the format that must be adopted to cite the data, ensuring that the data user properly acknowledges use of the data, thereby giving credit to the researcher. A peer review process is also being developed. All Nordicana D issues are cross-referenced in PDC (and vice versa) to ensure that data sets are catalogued and described according

[102] www.pangaea.de/
[103] http://www.pangaea.de/curator/files/pangaea-data-policy.pdf
[104] www.creativecommons.org/

to international metadata standards (as required by IASC), and to allow the data sets to be readily discovered using the PDC map and keyword-based search tools.

The first datasets published in Nordicana D were long-term time series (up to 25 years) of climate and permafrost monitoring data of the CEN Network. The CEN Network is composed of nine research stations and 80 automated climate stations, and extends across a 3500 km gradient of eco-zones (30 degrees of latitude), from northern boreal forest in Subarctic Québec to extreme polar desert environments in the Canadian High Arctic. In addition to climate data, permafrost temperatures have been recorded in boreholes throughout this region, in many cases down to 20 m, and since 1988. Each climate and permafrost dataset is freely downloadable in various formats, i.e. ASCII files in different temporal resolution, from the Nordicana D website[105]. Additional data sets in preparation include a circumpolar atlas of diatoms, and permafrost soil variables such as organic carbon and nitrogen stocks, ice content and granulometry, from the pan-Canadian project ADAPT (Arctic Development and Adaptation to Permafrost in Transition[106]).

Figure 3 and Figure 4 are examples from a permafrost borehole issue of Nordicana D. Figure 3 shows the header information, with the citation details and an overview map of all sites with data included in this issue. **Figure 4** shows the links to the PDC, the version number and the measurement site overview table, followed by the data download section where the user can select the temporal resolution of the data for download.

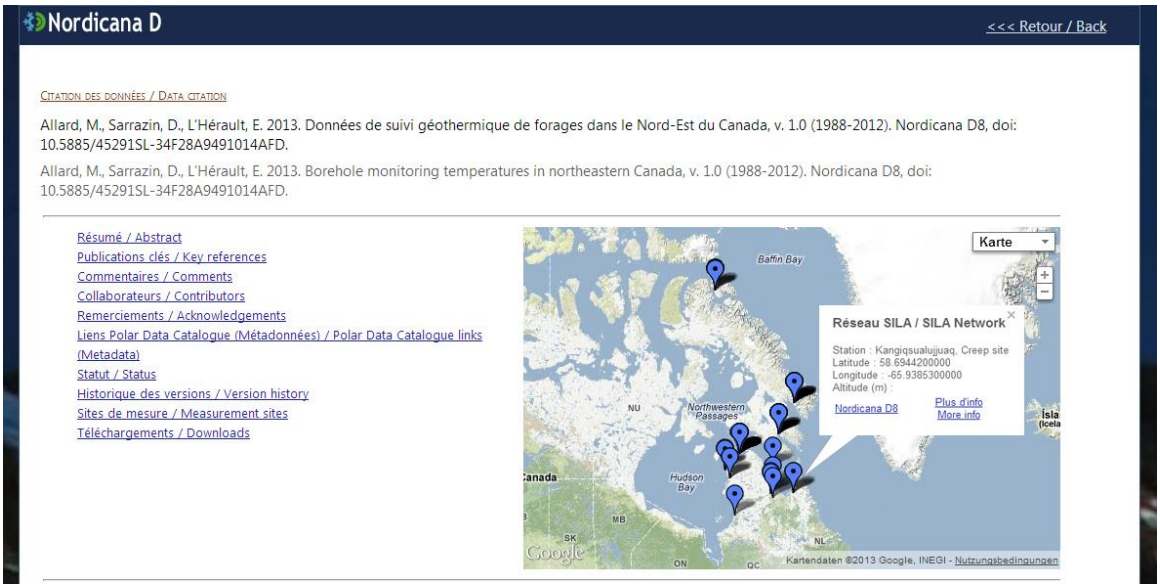


Figure 3. Example of a Nordicana D issue: Allard et al. (2013) Borehole monitoring temperatures in northeastern Canada (version 1.0) Nordicana D8, DOI: 10.5885/45291SL-34F28A9491014AFD. Below the data citation statement to the left, there is an overview of metadata given on this website with links to the specific feature (e.g., data download). The map to the right shows the location of all sites related to this publication. Site information pops up by clicking on a bullet.

[105] www.cen.ulaval.ca/nordicanad/en_index.aspx
[106] www.cen.ulaval.ca/adapt/

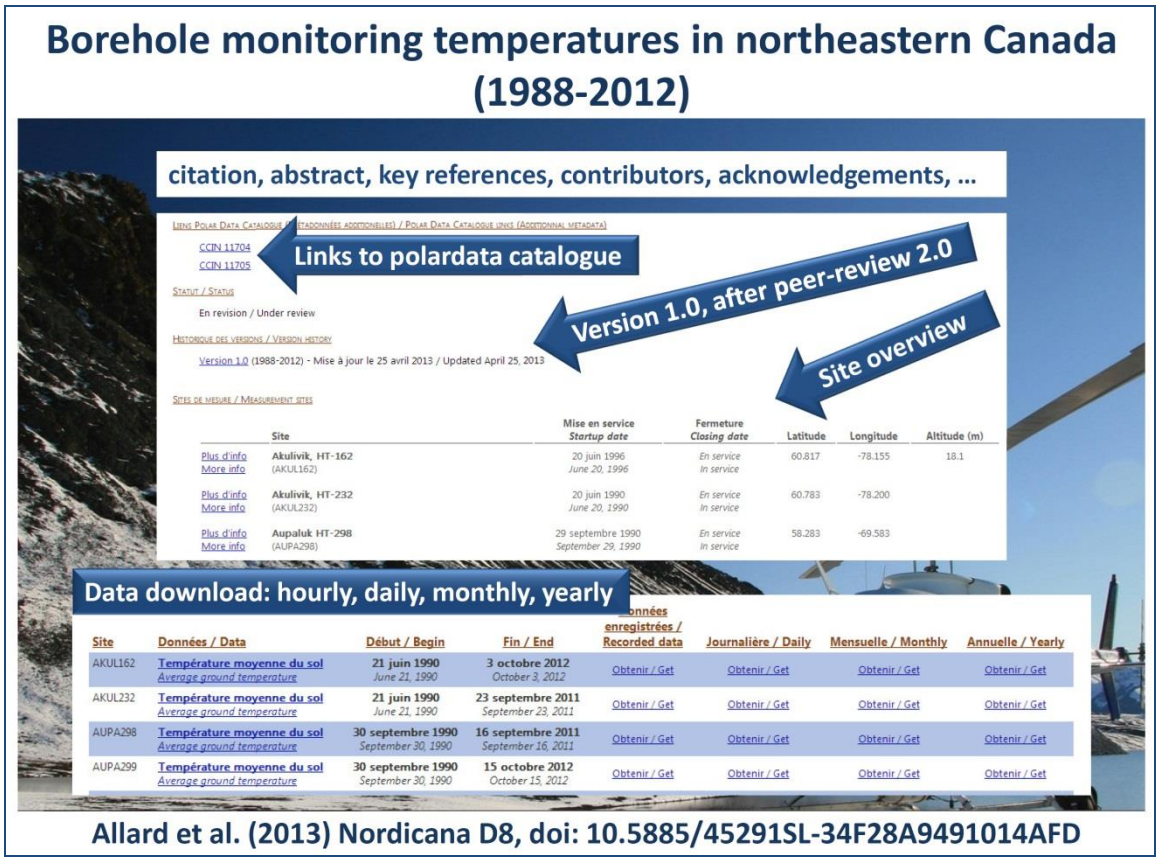


Figure 4. Example of Nordicana D, volume D8: The citation statement and map (see Figure 3) is followed by the abstract, key references, information of data contributors and acknowledgements. This figure shows the lowermost part of the issue: links to the Polar Data Catalogue metadatabase, the information on the version of this dataset (here version 1.0), a site overview with information on the starting and closing data of the dataset, geographical coordinates, and altitude. Additional metadata, detailed map and site photographs pop-up in a separate window. The lowermost part is the direct access to the data. Each dataset can be downloaded in different temporal resolutions: recorded data, which are the averages of 60 measurements during the past hour, and daily, monthly, and annual averages. The downloaded ZIP file contains a readme file and a data file in text format (ASCII).

A new central database of the Global Terrestrial Network for Permafrost – an example of a global theme-specific dynamic database focussing on metadata and actual data

The Global Terrestrial Network for Permafrost (GTN-P) is the primary international observing network for permafrost initiated by the Global Climate Observing System (GCOS) and the Global Terrestrial Observing System (GTOS), and is managed by the International Permafrost Association (IPA). It monitors the Essential Climate Variable (ECV) permafrost that consists of permafrost temperature and active-layer thickness, with the long-term goal of obtaining a comprehensive view of the spatial structure, trends, and variability of changes in the active layer and permafrost. The

network's two international monitoring components are (1) CALM (Circumpolar Active Layer Monitoring) and (2) Thermal State of Permafrost (TSP). Both programs have been thoroughly overhauled during the International Polar Year 2007-2008 and extended their coverage to provide a true circumpolar network covering all permafrost regions in the Arctic, Subarctic, Antarctic, and mountainous regions.

In 2013, the TSP network includes c. 850 permafrost boreholes, ranging from <1 m to c. 900 m depth (variables: air, surface and ground temperatures). About 80 % of all boreholes are shallower than 25 m (see Figure 5). The CALM network incorporates 220 sites where the active layer is being measured in regular grids (1ha – 1 km^2), thaw tubes, or boreholes at least once per year since the 1990s. About 70% of the sites are located in Arctic and Subarctic lowlands underlain by continuous permafrost. Discontinuous and mountain permafrost areas contain respectively 20% and 11% of sites. The distribution of sites is not uniform, a situation attributable to historical circumstances and logistical constraints. More than half of the INTERACT and INTERACT Observer Stations are directly or indirectly involved in GTN-P (see **Figure 6**).

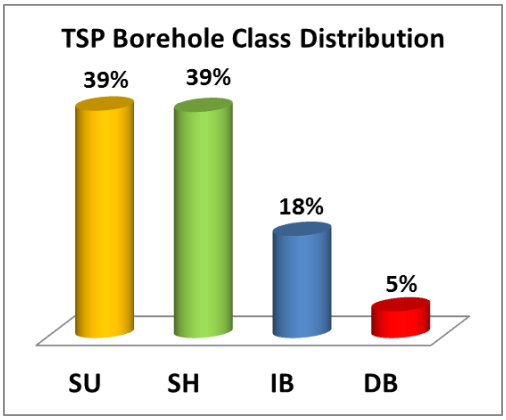


Figure 5. Distribution of TSP boreholes according to their depth classes in % (n=856). Depth classes: SU = surface boreholes (<10 m), SH = shallow boreholes (10-25 m), IB = intermediate boreholes (25-125 m), DB = deep boreholes (>125 m).

GTN-P has gained considerable visibility in the community by providing the baseline against which models are globally validated and incorporated in climate assessments. It was until now operated on a voluntary basis, and is now being redesigned to meet the increasing expectations of the science community. To update the network's objectives and deliver the best possible products to the community, the IPA organised a workshop in 2011 to define the users' needs and requirements for the production, archive, storage and dissemination of the permafrost data products it manages. Following this workshop, GTN-P developed a new management structure (with an Executive Committee, an Advisory Board, and National Correspondents who have recently been nominated) and released a new GTN-P Strategy and Implementation Plan for 2012-2016[107].

Since the beginning, GNT-P adopted an open data policy with free data access via the World Wide Web. The existing data, however, is far from being homogeneous: it is not yet optimised for databases, there is no framework for data reporting or archival, and data documentation is incomplete.

As a result, and despite the utmost relevance of permafrost in the Earth's climate system, the data has not been used by as many researchers as intended by the initiators of these global programs. The

[107] http://www.wmo.int/pages/prog/gcos/documents/GTN-P_SiP_Nov_2012.pdf

European Union FP7 project PAGE21[108] has created an opportunity to develop this central database for GTN-P data throughout the duration of the project and beyond (cooperation between AWI, Germany and the Arctic Portal, Iceland). The database aims to be the central location where the researcher can find metadata and actual data on all the relevant permafrost variables for a specific site. Each component of the Data Management System (DMS), including variables, data levels and metadata formats were developed in cooperation with GTN-P and the IPA. The general framework of the GTN-P DMS is based on an object-oriented model (OOM) and implemented into a spatial database. To ensure interoperability and enable potential inter-database search, field names are following international metadata standards. A quality control is also implemented.

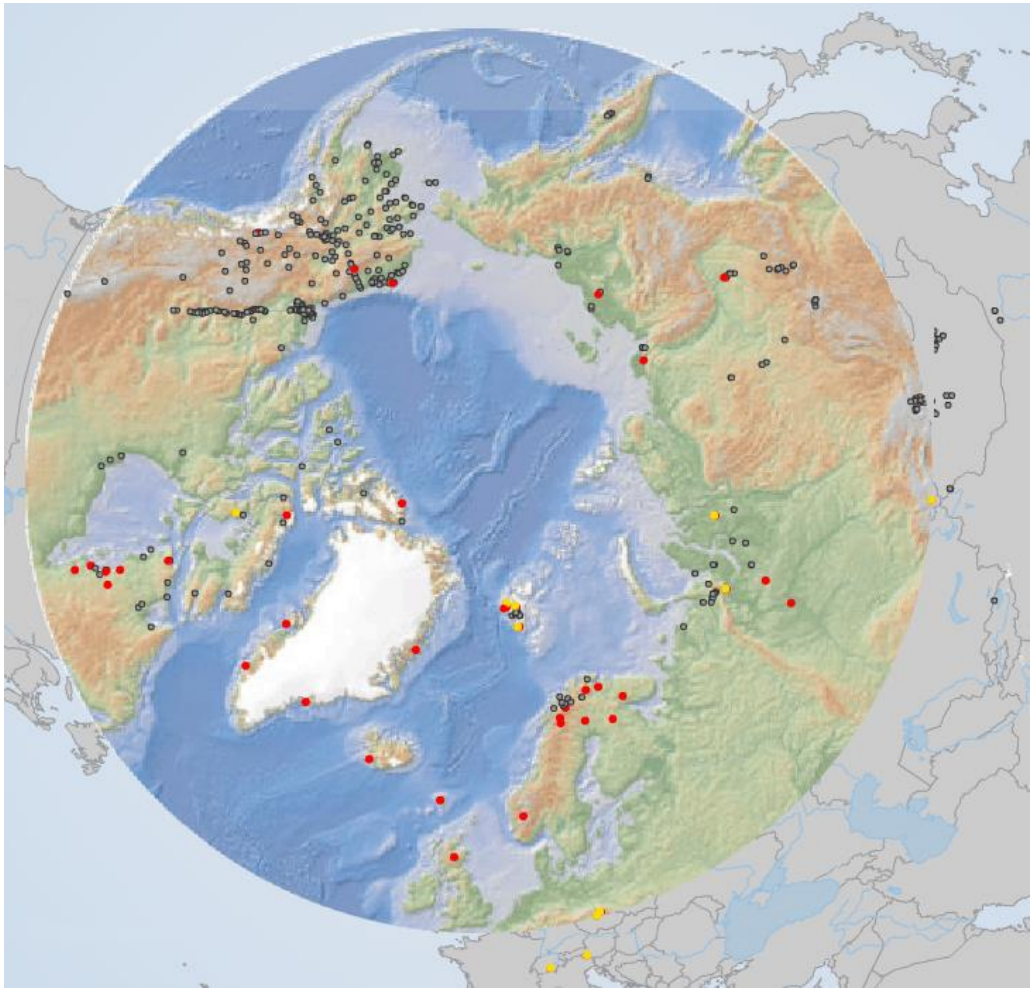


Figure 6. Map of INTERACT Stations (in red) and INTERACT Observer Stations (in yellow) and their spatial relation to permafrost boreholes (grey) of the Thermal State of Permafrost Program (TSP) of the Global Terrestrial Network for Permafrost (GTN-P). Modified after: Inter-Map, Arctic Portal, Iceland[109].

[108] www.page21.org
[109] www.arcticportal.org

The outputs of the DMS will be tailored to the needs of the modelling community, but also to the needs of other stakeholders. In particular, new products will be developed in partnership with the IPA and other relevant international organisations to raise awareness on permafrost in the policy-making arena. The DMS was released to a broader public during the GTN-P National Correspondents Workshop[110] in May 2013 in Geneva (CH) and the first active data upload – via an online interface for data and metadata upload, query and data download (**Figure 7**) – is expected after the 2013 summer field season.

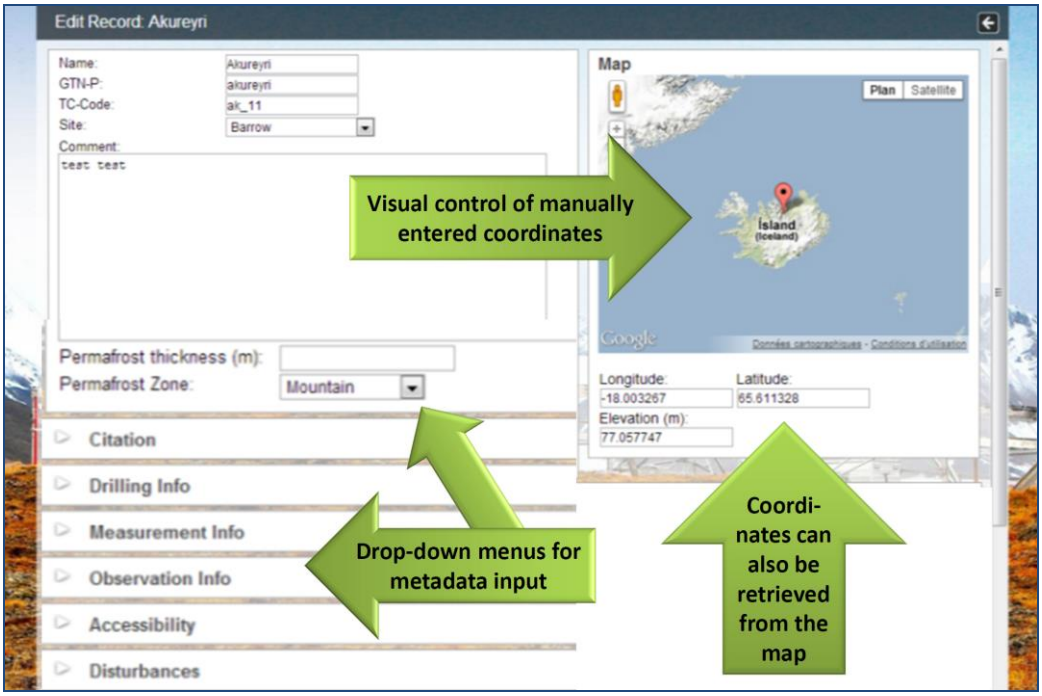


Figure 7. Example from the GTN-P Data Management System: Metadata upload via an online interface. The map provides visual control of the entered coordinates as part of the quality control. Drop-down menus with selectable answer lists help to minimise spelling inconsistencies and errors.

Data policies

All of the metadata and data archiving resources described above have required a clearly defined data policy that expresses the intentions and limits the publisher's responsibilities, as well as the ethical and legal responsibilities of the data users. For example, the data policy of the World Data System PANGAEA follows the Principles and Responsibilities of ICSU World Data Centres and the OECD Principles and Guidelines for Access to Research Data from Public Funding[111]. Furthermore, it has adopted the Creative Commons license procedure, which provides a simple, standardised way to give the public permission to share and use creative work, according to the conditions established by the author.

[110] http://ipa.arcticportal.org/activities/gtn-p/gtnp-workshop-2013.html
[111] http://www.pangaea.de/curator/files/pangaea-data-policy.pdf

The Nordicana D data policy[112] was derived from the PDC's[113] data policy, and in both cases users must accept the terms before accessing or entering the metadata or data. The PDC Terms of Use include legal statements on: the use of the database, database access, the absence of any warranties, the exclusion of any liability, ownership and confidentiality, damage to others, and governing law. The Nordicana D data policy (which also applies to all CEN data management activities) outlines general principles, along the lines of those developed for the International Polar Year 2007-2008:

- Respect confidentiality requirements and researchers' rights to publication.
- Recognise that human health and sociological studies will have specialised issues when it comes to data and privacy.
- Ensure that the databases are widely and easily accessible to a variety of users.
- Ensure long term preservation of data sets.
- Use existing knowledge and infrastructure, wherever appropriate.
- Encourage excellence in data collection, management and accessibility.

The policy specifies how the data set must be cited, and addresses other important issues such as ownership and intellectual property, notification of the author of any derived works, and redistribution conditions.

Data management is also a key issue for the Sustaining Arctic Observing Networks (SAON[114]), an initiative co-sponsored by the Arctic Council[115] and the International Arctic Science Committee (IASC[116]). A series of white papers at the Arctic Observing Summit 2013 (AOS) addressed this SAON issue from national and international perspectives (e.g., Moore et al. 2013[117] for the USA, and Pulsifer et al 2013[118] internationally), and recommended the development and implementation of an overarching data policy for Arctic research. The new IASC Data Policy[119] provides a major step towards addressing this need. The AOS synthesis of all white papers on data management also emphasised the importance of a common metadata standard to allow interoperability, and the need for dataset attribution to make sure the data providers are given proper credit and citation for the data provided, for example by the use of Digital Object Identifiers for datasets. There are now initiatives to develop 'metadata brokering systems' where a single portal will allow access to multiple databases. The Polar Data Catalogue provides a spatial search approach towards identifying databases for the Arctic or particular sub-regions (using the keyword 'database'), while the Arctic Data Explorer[120] operates across many catalogues and allows searches and access to datasets based on keywords, latitude/ longitude ranges and time periods. These initiatives are continuing to evolve

[112] www.cen.ulaval.ca/nordicanad/document/en_datapolicy.pdf
[113] www.polardata.ca/pdc/public/termsofuse.ccin
[114] www.arcticobserving.org
[115] www.arctic-council.org
[116] www.iasc.info/
[117] www.arcticobservingsummit.org/pdf/white_papers/data_management_perspective_iaon.pdf
[118] www.arcticobservingsummit.org/pdf/white_papers/data_management_revised.pdf
[119] www.iasc.info/home/iasc/data
[120] http://nsidc.org/acadis/search

towards the ultimate goal of a common circumpolar master directory where all Arctic data are fully accessible from multiple entry points.

One such approach toward a common directory is the Icelandic Arctic Portal, which is a comprehensive gateway to Arctic information and data on the internet. It was established in 2006 as an IPY-project operating in cooperation with the Arctic Council Working Groups Conservation of Arctic Flora and Fauna (CAFF) and Protection of the Arctic Marine Environment (PAME), but today includes other partners, ranging from international organisations and research centres to international projects, indigenous peoples associations and other Arctic stakeholders. More than 40 websites are hosted at the Arctic Portal, including Arctic Data, Fishernet, IPY, PAGE21, PAME, Virtual Learning Tools (VLT), Arctic Species Trend Index (ASTI), CAFF, Polar Law, SAON, IASC, IPA, and the reindeer portal.

One important outreach product is the Arctic Portal Mapping System. It provides visual information about Arctic related topics through various databases and WebGIS layers that can be freely chosen and combined according to the user's need. The Arctic Portal has also worked with INTERACT to develop a web-based version of the INTERACT Station Catalogue that allows the viewer to see which stations possess specific environmental features and to select various theme specific background maps. Both features can help researchers identify stations that are most suitable for their research or monitoring projects.

11.4 Data-related outreach and education (see also Theme 8)

As Arctic researchers and operators of field stations, we are in a prime position to access and make available data not only to the research community, but also to the public, including local communities and decision-makers. In the context of climate change and the rapidly changing Arctic, it is scientifically and socially important to set-up relevant and reliable tools to involve the local populations in learning about research through outreach and educational activities, and also by involving them in community-based monitoring activities. It is one thing to make the data available from a researcher's perspective, but another to make this data comprehensible, interesting, and relevant to northerners. Education and information exchange (traditional and academic) are important steps towards community empowerment and capacity building towards the sustainable development and management of the circumpolar North.

Several INTERACT stations already have in place educational programmes and activities that involve and target local communities (youth and elders), decision-makers and visitors. A few examples of such activities are: visitor tours comprising information on the research conducted at the stations; some stations have permanent exhibits about the station's research activities with information on the local natural history and environment; 'open-door days' are popular with educational activities for the visitors and information sessions on the research conducted; some offer courses on a variety of subjects and target young people, especially from the local communities; some offer excursions in the field to accompany scientists in their work. In Canada, the CEN station at Whapmagoostui-Kuujjuarapik hires a science education coordinator to organise science activities with local Cree and

Inuit schools via its Community Science Centre to spark interest in science, to use the data produced at the station through educational activities, and to transfer information on the station's research activities.

Websites are also important educational tools for numerous stations. For instance, Svalbard hosts a website for the public that is packed with information on its activities and research projects[121]. Another example is the 'Abisko eye' public website[122] (in Swedish only). The Web hosts numerous sites with information on research in the Arctic (e.g. the Arctic Portal[123] or Discovering the Arctic[124]). This array of tools and activities for outreach develops awareness while the population's active contribution of data and knowledge creates a dynamic milieu for bilateral exchange.

The project Avativut, which means 'our environment' in Inuktitut, is an example in terms of education and data production. Avativut is an outreach initiative on community-based activities and was developed by CEN researchers in collaboration with the Kativik School Board in Nunavik. It aims to make science and technology practical and meaningful for Inuit youth by involving them in the actual data collection related to their environment. The goals are to:

- Set up a long term environmental monitoring program through hands-on learning activities that are embedded into the science and technology school curriculum.
- Support northern teachers' efforts by developing adapted course material.
- Spark interest for environmental sciences among Inuit Youth.
- Preserve and centralise datasets.
- Encourage the sharing of information and knowledge.

The involvement of students is done through various Hands-On Learning Activities (HOLA) integrated into school lessons on science and technology. The educational material integrates simple monitoring protocols of soil temperatures, berries, snow and ice, permafrost (upcoming), local and traditional knowledge as well as Inuktitut vocabulary to better connect the students to their environment. Data are collected according to standard protocols developed by scientists and provided to students as part of HOLA. The web portal[125] allows input, access and archiving of data, and photos collected during the HOLA in all Nunavik communities. The portal also allows consultation of scientific protocols, watching video clips, communication between classes and with scientists through a forum, and location of experimental sites. The database will grow in value over time and will help to archive the state of the environment in real time, thus providing an 'environmental snapshot' of the Nunavik.

A gap identified by communities in northern Canada is a central place to find out who is working where, when, and what they are doing. Those conducting the research have already filled in a wide array of project descriptions, permits, license requests and reservations for diverse agencies relative to their work, but this information is not centrally available to the public in real-time. There therefore

[121] www.kingsbay.no/index.php?option=com_content&view=frontpage&Itemid=114
[122] www.linnea.com/~ans/abiskoogat/index.html
[123] www.arcticportal.org
[124] www.discoveringthearctic.org.uk/
[125] www.cen.ulaval.ca/avativut/

is a need to create a user-friendly platform that would provide up-to-date information and links to all of the projects conduced in the North. This may also be useful for researchers seeking collaborations, access to field sites, complementary data and samples.

11.5 Formulation of a 'Data Management Plan'

An explicit data management plan is increasingly required by research funding agencies, and is now expected for any IASC-endorsed research project. The rapidly increasing demand for data sharing and circumpolar data synthesis also highlights the need for improved data management. However, the development of such plans is still in its infancy and ongoing discussion is needed to determine the best practices that will meet all stakeholder needs. This includes the selection of standards to facilitate data exchange and comparisons, for example among INTERACT stations and with global databases. Ongoing developments within SAON are likely to help guide data management strategies in the future, and this important issue will require increasing attention by station managers and researchers.

A data management plan should describe the framework for handling data and information generated at the station, including the metadata and actual data produced by in-house as well as by external projects. Each station or cluster of stations will likely develop its own station-specific data management plan including local data capture and storage mechanisms and with the view toward national and international efforts to standardise data collection, data capturing and data sharing in national, regional, global or thematic databases. The structure and contents of data management plans may vary from station to station, country to country, but here are some of the elements that could be addressed in a data management plan:

Data policy

- Describe any obligations that exist for capturing and sharing data collected at the station (if necessary differentiate between in-house and external projects). These may include obligations from funding agencies, institutions, other professional organisations, legal requirements or policy developed by the station.
- Address any ethical or privacy issues with data sharing.
- Address intellectual property and copyright issues: Who owns the copyright? What are the institutional, publisher and/or funding agency policies associated with intellectual property?
- Describe the intended future uses/users of the data.
- Include information about how the data will be shared, including when the data will be accessible, how long it will be available, how data access can be gained, and any rights that the data collector reserves for using the data, e.g. a temporal embargo until the first publication of the data by a graduate student.
- Indicate how the data should be cited by others and include the assigned DOI, if applicable.

Information about data and data format

- Describe the data generated at the station (in-house and external projects). It is recommended that you develop a standardised set of descriptive metadata that can be easily uploaded to other databases. Consult the databases referred to above to view the descriptive fields in the metadata (data originator, title of data, abstract, keywords, geographic coordinates, etc.). These fields are fairly common across databases. Describe how the data is acquired (if needed differentiate between in-house and external projects, between different scientific disciplines, etc.) and in what formats metadata and actual data should be stored and forwarded to other databases (see below).
- What quality assurance and quality control parameters will be implemented in the data management system (e.g. measures that will be taken during sample collection, analysis, processing, but also the completeness and quality of the submitted metadata, like e.g. the resolution of geographical coordinates).
- How will the data be managed? It is important to also consider the following topics:
  - Backup, recovery and data products with options for long-term storage; for large database, a database mirror, e.g. in a research institute, may be considered to minimise damage of the database in case of, e.g., electricity failure or hacker attacks.
  - Security and protection of data and data products (who will have access to which data and how? It may also be possible to provide data access via the principle investigator).

Long-term storage and data management (metadata and actual data)

- Local data handling mechanism:
  - Develop data capture and storage mechanism at the station (or for a cluster of stations, see section **Error! Reference source not found.** for key issues that can be addressed when developing data handling mechanism at the station).
- Identify and establish linkages to local, national regional, global or thematic databases:
  - Station management can select one or several local, national, regional, global or thematic databases in a network approach using intermediate data repositories from where global databases can harvest data. Station managers are advised to follow national and international initiatives as this is an area under development (e.g. the SAON initiative of the Arctic Council and several national initiatives). The station management should consult colleagues and professional societies in their discipline to determine the most appropriate databases, and include a backup archive in their data management plan in case their first choice goes out of existence. Note that some research institutions and funding agencies may require specific databases to be used to store data generated using their funding.
  - Identify the data that will be stored in the selected (preferably open access) repositories (if necessary differentiate between in-house and external projects). By identifying relevant archives early in the project, the data can be formatted, transformed and documented appropriately to meet the requirements of the archive. Usually, preserving the data in its most raw form is desirable, although data derivatives and products can also be preserved. Again, note that there may be some

requirements by funding institutions/agencies to use specific databases possibly including specific data formats. It is recommended that station management select a DOI-providing data archive for open-access (actual) data, if possible.
- Identify primary contact person(s) for archived data, and ensure that contact information is always kept up-to-date in case there are requests for or information about the data.

Budget

Data management and preservation costs may be considerable depending on the nature of the project. By anticipating costs ahead of time, the station management ensures that the data will be properly managed and archived. The data management plan should include how these costs will be paid. Potential costs include:

- Personnel time for data preparation, management, documentation, and preservation. Who will be responsible for data management in the long term?
- Hardware and/or software needed for data management, back-up, security, documentation, maintenance, and preservation (including regular hard- and software updates c. every 5-7 years).

Revision of Data Management Plan

- Identify a timetable for evaluating the effectiveness of the Data Management Plan and undertaking revisions, as needed.

11.6 Key considerations for station management

Operational data for station management

- Ensure that all policies, rules, regulations, procedures, etc. are written down and available for consultation (website, up-to-date manuals on site, etc.) to ensure uniformity in management and facilitate knowledge transfer between old and new staff and between station and visitors.
- Seek to continually improve station management (e.g. adjust rules and regulations) through:
  - Participation in international networks and organisations, external reviews, and by seeking inspiration from similar stations.
  - Incident or near-misses reporting system.
  - System to track developments in legislation, the legal status of the station and agreements with local and government authorities.
  - User evaluation system.

Metadata and data management

- Develop a station data management plan, including:
  - Data policy.
  - Data description.

  - Data storage mechanism at station (for both metadata and actual data).
  - Consider the use of local, national, regional, global and thematic databases (see the examples above) and the use of international standards for data and metadata to facilitate interoperability between databases (for both metadata and actual data).
  - Budget. Station management should ensure sufficient funds for development and maintenance of the database.
  - Implementation plan that ensures that the databases are widely and easily accessible to a variety of users. The implementation plan should also include a plan for revision of the data management plan.
- Develop data capture and storage mechanism at the station (in accordance with data management plan).

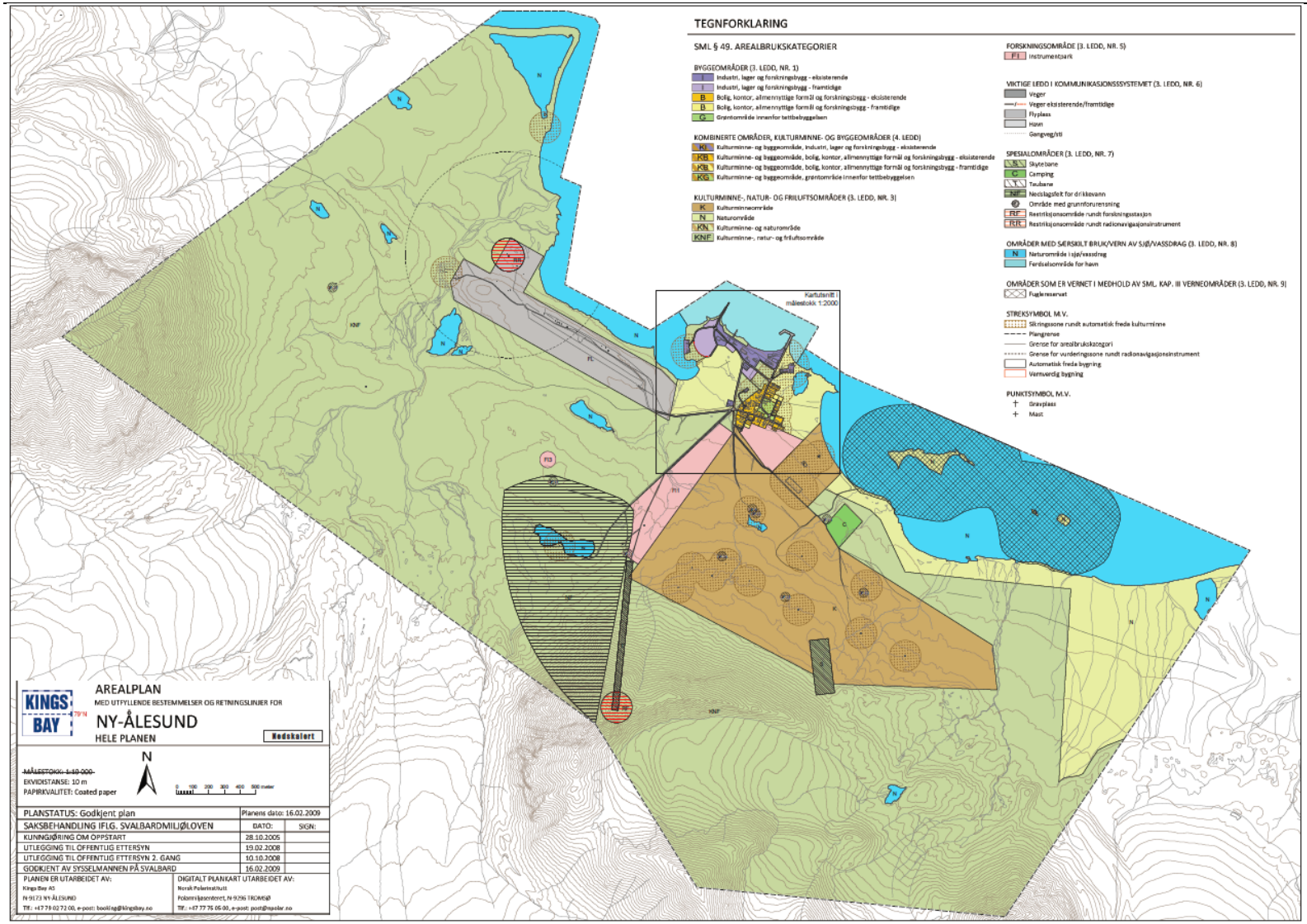
Develop data-related outreach and education

- Develop information sharing and educational programmes targeting the general public, schools, and relevant local stakeholders.

Appendices

Appendix 1 – Management plans and check lists

Appendix 1.1 – Land use plan, Kings Bay logistics company, Ny-Ålesund, Svalbard.



Appendix 1.1 – Land use plan, Kings Bay logistics company , Ny-Ålesund, Svalbard.

KINGS BAY 79°N

LAND-USE PLAN

WITH SUPPLEMENTARY PROVISIONS AND GUIDELINES FOR

NY-ÅLESUND

THE WHOLE PLAN

LEGEND

SML § 49. LAND USE CATEGORIES

BUILDING AREAS (3RD SECTION, NO. 1)

- Industry, warehouses and research buildings - existing
- Industry, warehouses and research buildings - future
- Dwellings, offices, common buildings and research buildings - existing
- Dwellings, offices, common buildings and research buildings - future
- Green open areas inside the settlement

COMBINED AREAS, CULTURAL HERITAGE AND BUILDING AREAS (4TH SECTION)

- KI Cultural heritage and building areas, industry, warehouses and research buildings - existing
- KB Cultural heritage and building areas, dwellings, offices, common buildings and research building - existing
- KB Cultural heritage and building areas, dwellings, offices, common buildings and research building - future
- KG Cultural heritage and building areas, green open areas inside the settlement

CULTURAL HERITAGE AREAS, AREAS OF NATURAL ENVIRONMENT AND OUTDOOR RECREATION AREAS (3RD SECTION, NO. 3)

- Cultural heritage areas
- Areas of natural environment
- KN Cultural heritage areas and areas of natural environment
- Cultural heritage areas, areas of natural environment and outdoor recreation areas

RESEARCH AREAS (3RD SECTION, NO. 5)

- FI Scientific instrument park

IMPORTANT ELEMENTS OF THE COMMUNICATION SYSTEM (3RD SECTION, NO. 6)

- Roads
- Roads existing/future
- Airport
- Harbour
- Footpath

SPECIAL AREAS (3RD SECTION, NO. 7)

- S Shooting range
- Camping site
- T Cable car
- NF Drinking water catchment area
- Ground polluted areas
- RF Restricted area around research station
- RR Restricted area around radio navigation instrument

AREAS FOR SPECIFIC USE OR PROTECTION OF SEA AND WATERCOURSES (3RD SECTION, NO. 8)

- Areas of natural environment in sea and watercourses
- Area for traffic in connection with the harbour

AREAS THAT ARE PROTECTED PURSUANT TO CHAPTER III OF THE SVALBARD ENVIRONMENTAL ACT (3RD SECTION, NO. 9)

- Bird sanctuary

LINE SYMBOLS ETC.

- Security zone around automatically protected structures and sites
- Planning area boundary
- Land use category boundary
- Evaluation area boundary around radio navigation instrument
- Autmatically protected building
- Buildings worthy of preservation

POINT SYMBOLS ETC.

- Graveyard
- Mast

N

Planning status: Adopted plan	Date of the plan: 16.02.2009	
Procedure according to the Svalbard Environmental Protection Act	DATO:	SIGN:
Start of planning	28.10.2005	
Depositing for public inspection, 1st time	19.02.2008	
Depositing for public inspection, 2nd time	10.10.2008	
Adopted by the Governor of Svalbard	16.02.2009	

The plan is design by:
Kings Bay AS
N-9173 NY-ÅLESUND
Tlf.: +47 79 02 72 00, e-post: booking@kingsbay.no

The digital maps are designed by:
Norsk Polarinstitutt
Polarmiljøsenteret, N-9296 TROMSØ
Tlf.: +47 77 75 05 00, e-post: post@npolar.no

Appendix 1.2 – User information check list, Toolik Field Station, Alaska, USA

(Large, very remote station with road access)

Toolik Field Station User Orientation 2011

1. Sign in, and remember to sign out when you depart
2. Online registration complete, alert us to changes in your departure- kitchen food
3. Medical information form complete, new one each year
4. Station Staff in camp
   - Manager/Asst. Manager – x2511 and Radio Ch. 2 Chad-7 years
   - Maintenance/Science Support – office x2523
   - Field Operations Assistants, Technicians
   - Kitchen- Laura-8 years
   - EMT/Haz-Mat and Safety Coordinator – Ben- 3 years,
   - GIS – Contact if establishing new plots- Jason & Randy
   - Lab Manager – Jorge Noguera – 6th year
   - EDC – Naturalist- Anja Kade
5. Room Assignment – Leave your room as clean as when you found it. – Supplies
6. Food Service
   - Meal Schedule: B 7:30-8:30, L 12-1, D 6-7 24 hour area
   - Sunday is kitchens half day off. Continental B, no lunch, D 6-7
   - -Use radio to reach staff, or phone
   - Vegetarian/Food allergies: sign-up sheet by kitchen.
   - Drinking water & hot water tap
   - Do not enter kitchen, ask staff for assistance
   - Sign out board, use it when off pad. *meals missed, *overdue time
7. Bathrooms: New kitchen entry, CG outhouse, porta-potties in W/P's
   - Towers - Paper in waste basket, no trash down hole. – Close doors
   - Use hand sanitiser, replace T.P. rolls,
8. Garbage disposal: Separate and Recycle
   - Burnables = all food waste, paper, cardboard
   - Non-Burnables = Styrofoam, Foil, back hauled to Fairbanks
   - ***ALL plastic-Orange bucket or with glass- melt into diesel fuel***
   - Recycle Aluminium,
   - Crush Glass: gravel off pad
   - Spent Battery bucket in staff office
   - Toner ink cartridges in staff office
   - Copper wire and piping
9. Bathing and Water Conservation – Shower Module and Cotton grass
   - **Keep Showers Short**- 2 per week, 2 min max *Use water saving valve
   - Limited waste water storage, $1.00 a gallon to dispose
   - Label your cubby – name and departure date
   - 1 load of laundry <u>every other week</u>, make sure **FULL** loads/wash buddy
   - Sauna – Men 6:30-8 Women 8:10-9:45 Open 10pm and on
   - Clothing optional *follow posted schedule M, W, F, Sa, Su
   - Rogue Saunas by approval only- wood expensive – post on white board
   - Sauna is BIG water saver

All waste water is hauled to Prudhoe Bay at $1.00 a gallon

10. Power Conservation:
    Camp loads are large, please do your part to reduce power demands, use timer, turn off heaters during the day, and turn off lights.
    Alert staff to any power needs; i.e. drying oven, -80 freezer (in shoulder).
11. Phone/Fax and Computers:
    Staff carry phones: Manager x2511 EMT x2516 Maint: x2523
    Phones dial like they are on UAF Campus. Four digit extension.
    Dial 9 for outside line
    Phone available in C/C computer lab, Library, CG
    Need calling card to call long distance – Taxi run to buy
    Wireless internet in camp, plug in when possible – saves signal strength
    Public use computers, Fax/Copier, Scanner in C/C computer lab
    All computers must have up to date antivirus software.
    NO ILLEGAL DOWNLOADS – Monitored by UAF- Computer banned
    Turn off Skype when not using. Limit video and internet radio use
12. Mail Service:
    Mail bag in staff office
    Mail boxes in C/C computer lab. Separate by first letter of last name
    Mail/freight address on board in C/C computer lab
    Mail arrives and departs on all trucks
13. Supply Requisitioning:
    Contact Expeditor Joe Franich x5159 jfranich@alaska.edu
    Home university needs purchase order on file with UAF
    Buy over phone with C.C., have Expeditor pick up
14. Freight: Brought to S/R upon arrival
    Staff deliver freight to designated lab space assignments next morning
    Freight may arrive on any truck – Check shipping log online
    New freight tracking system this year-arriving soon
    Warm storage delivered to labs in early May.
15. Medical Services:
    EMT on staff – Stabilise for transport
    Call x2516 or use the radio - knock first at residence
    Shelves in staff office – sun screen/bug spray-don't spray in office
    Wash hands often, use sanitiser
    Notify staff of any special medical concerns
16. Safety – Our number one concern
    Long way away from emergency medical assistance
    Drive safe/slowly on pad, use cut off road, not by kitchen
    Dalton Hwy (50mph max) – lights and CB on
    Helipad – **STOP** on either side away from during take off and landings.
    Boats – must have PFD, canoes avail, safety orientation
    Emergency signal – repeatedly honk horn of any vehicle
    Radio available to stay in contact with crew/camp, Bear spray, Sat phones
    Learn where fire extinguishers are in labs and around residence
    $15,000 to be air transported out of Toolik

Firearms must be turned in immediately upon arrival

17. Vehicles:
    - Park by labs but out of the way
    - NSF trucks – Sign out sheet, insurance form, copy of licence
    - Vans – Have to have taken safety course
    - Blue UAF – Sign out sheet, only on pad/airstrip unless Mike has notified.
    - MBL has own trucks self signed out
    - Fuel Dispensing: Staff only, fuel at the end of day, not in the morning
    - Spills must be reported immediately
18. Shop Facilities:
    - Tool shop in trailer, Wood shop in S/R, Tire shop
    - Use at your own risk, ask for assistance if needed.
    - Return all tools used!!!!
    - Notify staff if broken so we can replace
19. Hazmat: EMT is Haz-Mat Director
20. Clean your lab upon departure, including samples from freezers and fridges
    - Staff only empties garbage from outside trash cans.
    - Labs are responsible for cleaning and maintaining orderly lab
    - Clean up your space in the lab!
21. Camp Ethics:
    - Alcohol Policy- enjoy responsibly
    - UAF is a drug free workplace
    - No animals are allowed at Toolik
    - No littering (Cigarette butts).
    - No smoking in Buildings, 50 feet from entrances
    - Close doors quietly as a courtesy to others
    - Keep common areas neat and organised
    - Quiet zone in sleeping areas at 10:00pm until 8:00am
    - Golden Rule: Treat others as you'd like to be treated
    - Caribou antlers are by the shop if you want some-don't bring in.
22. Backfill of old buildings:
    - Old kitchen is new C/C with lecture hall, Tuesday talking shops, couches, music, games-FOOSBALL, loud area
    - Old kitchen pantry is new place to watch T.V.
    - Old D/O is new additional lab space.
    - Old C/C is new Meeting Tent- for classes, meetings, -Wired in
    - Former Meeting Trl- is new library and quiet work space-GIS still
23. Recreation
    - Toolik Health Club – By loader tent, careful of quiet hours
    - Bikes – check out Mtn bikes. Cruisers/old anyone can use
    - Sunday hikes- check out vehicles, use sign out board, advertise on white board, sign out in ANWR/Gates log book too, some maps available
    - Equip. Available: T-Ball, Volleyball, Badminton, Basketball, Soccer, Horse Shoes, Tetherball, Foosball, Frisbees, Football, Baseball Gloves
    - Meeting Trailer has T.V., VCR, DVD player, Movies, games
    - C/C office also has games

Appendix 2 - Policies (station examples)

Appendix 2.1a - Environmental Policy

NERC Arctic Research Station, Ny-Ålesund, Svalbard (NERC, British Antarctic Survey)
(Small to medium sized, very remote station accessed by plane or boat)

Environmental policy[126]

The British Antarctic Survey (BAS) is committed to delivering a programme of first class science with the minimum of environmental impact. Protecting the environment is one of the strategic priorities for achieving the BAS Vision during the period 2002 2012. BAS aims to set and achieve the highest possible standards for its own environmental performance and to be a leader in environmental management in its field.

To achieve this, BAS will:

- Comply with, and where possible exceed, all relevant national and international environmental legislation and Antarctic Treaty System requirements;
- Provide guidance and training to staff, contractors and visitors to help them to protect the environment;
- Minimise pollution and other environmental risks and impacts by appropriate and effective control measures;
- Encourage efficient use of natural resources;
- Implement the BAS Environmental Management System which sets demanding environmental objectives and targets;
- Monitor and audit activities for environmental compliance and performance and guarantee best environmental practice;
- Learn from the experience of staff, other organisations, audits, monitoring and regular reviews to continually improve environmental practice.

This policy is made publicly available. It is reviewed annually.

BAS is a component body of the Natural Environmental Research Council (NERC) and the BAS Environmental Policy is consistent with the NERC Environmental Management Policy Statement.

Signed:

Prof. Alan Rodger, Interim Director
Date: 28 November 2012

[126] http://www.antarctica.ac.uk/

Appendix 2.1b - Environmental Policy

Sverdrup Station, Ny-Ålesund, Svalbard
(Very large, very remote station accessed by plane or boat)

Environmental protection and sustainability policy
A prerequisite for Ny-Ålesund is that the local human impacts on the environment are kept at the lowest possible level to maintain the area as a near pristine environment, suitable as a reference site. This has been clearly stated as a goal from the Norwegian government. It has also been adopted by the Ny-Ålesund Science Managers Committee (NySMAC) in their Mission Statement for Ny-Ålesund.

'The purpose of this Act is to preserve a virtually untouched environment in Svalbard with respect to continuous areas of wilderness, landscape, flora, fauna and cultural heritage. Any person who is staying in or operates an activity in Svalbard shall show due consideration and exercise the caution required to avoid unnecessary damage or disturbance to the natural environment or cultural heritage. The head of project shall ensure that every person who carries out work or takes part in the activities for which a project is responsible is aware of the provisions set out in or pursuant to this Act regarding the protection of Svalbard's flora, fauna, cultural heritage and the natural environment otherwise.'

Within this framework, the Act allows for environmentally sound settlement, research and commercial activities. Impact assessments are required for projects that may have more than an insignificant effect on the natural environment.

Appendix 2.2a - Ethics Policy

NERC Arctic Research Station, Ny-Ålesund, Svalbard (NERC, British Antarctic Survey)
(Small to medium sized, very remote station accessed by plane or boat)

Ethics policy[127]
At the British Antarctic Survey (BAS), we believe it is important that we look at the ethical aspects of all the work we do. We follow the ethical principles and policy of our parent body - the Natural Environment Research Council (NERC)[128] - in all aspects of our work and in our relations with others.

[127] http://www.antarctica.ac.uk/
[128] http://www.nerc.ac.uk/publications/corporate/ethics.asp?cookieConsent=A

Appendix 2.2b - Ethics policy: Alcohol and drugs policy

Sverdrup Station, Ny-Ålesund, Svalbard
(Very large, very remote station accessed by plane or boat)

Alcohol and drugs Policy
Sverdrup Research Station follows Svalbard rules on import and quota on beer. This means that there is a certain amount of beer and liquor to be obtained from the shop each month per resident.

There is a zero tolerance of drug use.

Appendix 2.2c - Ethics policy: Alcohol and drugs policy

Toolik Field Station, Alaska, USA
(Large, very remote station with road access)

Alcohol and drugs Policy
Alcohol – enjoy responsibly.
Zero tolerance on drug use.

Appendix 2.3 - Extreme weather/winter operation policy

Toolik Field Station, Alaska, USA
(Large, very remote station with road access)

Extreme Winter Weather Operation Guidelines
http://toolik.alaska.edu/user_guide/policies.php

Winter Operations at Toolik Field Station (TFS) involve working in unique and often dangerous environmental conditions. Severe cold, high winds, blowing snow, darkness, and limited visibility are just a few variables that can cause a hazardous working environment. This document describes the Winter Weather Operation Guidelines for Toolik Field Station. Adhering to these guidelines will minimise exposure to the most extreme winter conditions and the risks associated with them. It is important to remember that Arctic winter can always be dangerous and the proper training, preparation, equipment, and procedures are essential. Ultimately everyone must accept personal responsibility for their own safety in the harsh Arctic winter. Never work in winter conditions you feel are unsafe or for which you are not adequately prepared.

Limited Camp Functions in Extreme Environmental Conditions
During extreme winter weather events most outdoor operations at Toolik Field Station will be limited to ensure the safety of the community. These include:

- All outdoor operations, maintenance, science support, and upgrade projects that are not essential to the everyday operation of the station and safety of the community. Examples of essential operations are road maintenance to ensure safe camp access to scheduled arrivals and departures, daily maintenance checks, and emergency repair work.
- Transportation between Fairbanks and TFS.

- Personal recreation further than two miles from camp without the approval of the on-site camp manager and the company of at least one partner in the field.

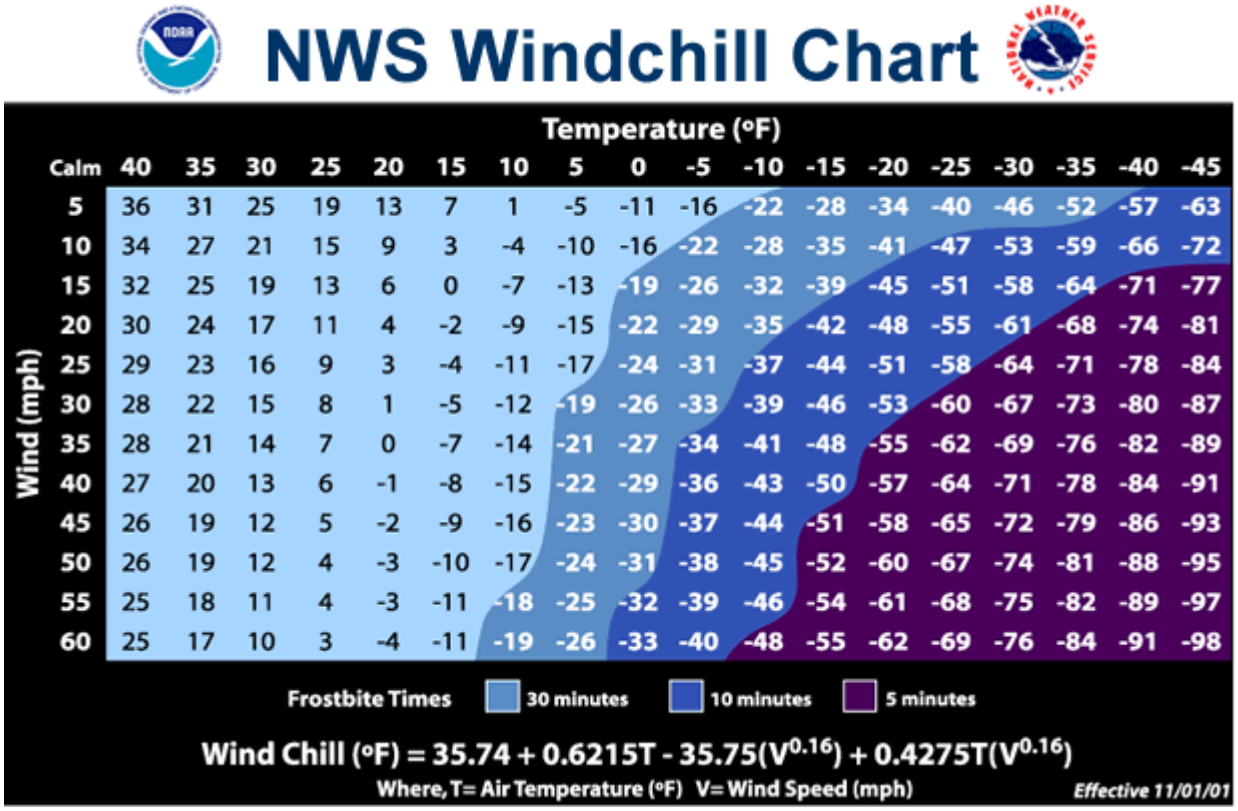
All science users are strongly recommended to limit their activities and follow these guidelines for their field work under extreme environmental conditions.

Extreme Environmental Conditions Defined

Extreme environmental conditions are any combination of meteorological variables that the on-site camp manager deems severe enough to limit outdoor activity. These include, but are not limited to:

- Temperatures below -45°F
- Wind-chill categorised as 5 minute frostbite time as determined by the NWS Windchill Chart (see figure below).

Temperatures below 0°F with substantially limited visibility (This pertains only to activity off the road system, driveway, gravel pad, or Toolik Lake and its tributaries). The on-site camp manager will determine the visibility conditions under which outdoor work can occur.



Appendix 2.4a - Health and Safety Policy

NERC Arctic Research Station, Ny-Ålesund, Svalbard (NERC, British Antarctic Survey)
(Small to medium sized, very remote station accessed by plane or boat)

Health and safety policy[129]

The British Antarctic Survey (BAS) is a world class polar research organisation based in Cambridge, UK and predominantly operates in the Antarctic and the Arctic. The polar regions present many health and safety hazards not normally encountered in the everyday workplace. For this reason the key to our continued safe operation and success is our highly skilled and experienced staff. The BAS senior management places the highest priority on the health and safety of our staff, and as a consequence is dedicated to strong and active health and safety leadership.

BAS are committed to:

- Developing and maintaining a pragmatic, positive and open culture where health and safety are recognised by all staff to be fundamental in all we do.
- Complying with, and where possible exceeding, all our legal obligations for health and safety, both in the UK and overseas.
- Continuously improving our health and safety performance.
- Maintaining our accreditation to the British Standard OHSAS 18001 and the International Business Aviation Council's IS-BAO safety management standards, and fulfilling the legal requirements of the International Maritime Organisation's ISM code.

The parent organisation of BAS is the Natural Environment Research Council (NERC), and therefore BAS also operates to the NERC Health and Safety Policy and arrangements.

BAS will:

- Implement a health and safety management system which sets demanding health and safety objectives and targets. This includes assigning clear health and safety management responsibilities.
- Identify the hazards and assess the risks created by our activities, and so far as is reasonably practicable eliminate or control those risks.
- Provide our staff with the information and training necessary for them to carry out their jobs safely.
- Appoint competent people to provide specialist health and safety advice to line managers and staff.
- Consult our staff, collaborators and union appointed safety representatives on health and safety matters.
- Manage the health and safety of all contractors and visitors (including visiting scientists and students) to our sites and ships.

Review our health and safety performance at regular intervals to identify where improvements are necessary, and implement plans to achieve those improvements as soon as possible.

[129] http://www.antarctica.ac.uk/

As far as is reasonably practicable we will seek to apply the same high standards to our operations overseas as we do to our work in the United Kingdom. In particular, in Antarctica BAS adopts a twenty four hour, seven day a week duty of care for our staff and others working on our stations, ships and in the field. The organisational arrangements for achieving this policy are set out in the BAS Safety Management Documentation.

Signed:

Prof. Alan Rodger, Interim Director
Date: 28 November 2012

Appendix 2.4b - Health and safety policy

Sverdrup Station, Ny-Ålesund, Svalbard
(Very large, very remote station accessed by plane or boat)

Health Policy

A medical health statement not older than two years is compulsory for any visitor at Sverdrup Research Station. A medical health statement developed by the Norwegian Doctor's Association (Den Norske Legeforening) is used as a standard.

There is no hospital or professional medical crew in the vicinity of the Sverdrup Research Station. In case of emergency first aid can be performed by most residents until the professional help has arrived. The residents rely on the Governor of Svalbard to bring the patient to hospital in Longyearbyen by helicopter or to the main land of Norway by airplane.

Insurance Policy

All visiting research projects need to be self-insured and responsible for their actions in the field. Researchers working for the Norwegian Polar Institute are insured by their employer.

Field work safety Policy

Following the Svalbard rules and guidelines: http://www.sysselmannen.no/en/Scientists/Fieldwork-researchers/

Compulsory shooting training and first aid course

- Annual shooting training and first aid course every second year is required.

Field safety course

- Norwegian Polar Institutes (NPI) researchers have to take one-week field course initially before they arrive at the station. Non-NPI researchers follow field safety rules of their own institution – we check general safety standard in behaviour and preparation but 'only' host them.

Group whereabouts

- Research groups report in and out when leaving and returning from field. For each research group heading out in field there has to be filled out a field party sheet to be submitted to logistics. In this sheet they list the names of the group members and the contact information of their closest relatives and set the destination points on the planned field trip.

Communication

- To make sure that the researchers can get assistance if needed we make sure that at least one of the station crew is watching the VHF radio. In cases where the scientists spend many days in the field we normally arrange a certain time to call in and report the situation.

Use of boats, vehicles devices

- Before a field plan is accepted the station crew check the field qualifications of handling boats, snowmobiles and pyrotechnical devices. In case of uncertainty the station crew assist more closely throughout the field work and advice about practical field issues and instrument setup.

NY-ÅLESUND SAFETY POLICY

Station managers or the scientific adviser at Kings Bay AS should provide visitors with information concerning their station.

A verbal brief covering the most important points should be provided soon after arrival on station.
The brief should include:

1 Fire regulations and procedures.
2 Medical care.
3 Ny-Ålesund safety policy.
4 Ny-Ålesund accident and incident policy
5 Field hazards
6 Boating regulations
7 Lab and chemical safety
8 Waste management
9 Radio training
10 Ny-Ålesund rules (no wi-fi, location of bird reserves, restricted access areas, radio silence etc.)
11 Airport regulations
12 Snow scooter routes
13 Rifle training provided by one of the following Norwegian institutions: Kings Bay, Norwegian Polar Institute or UNIS.
14 If applicable: snow scooter training
boat training
glacier training
navigation training
15 In the village, rifles will be carried unloaded with the bolt removed or withdrawn.
16 Stations will be equipped with vhf radios that monitor a private channel and international emergency channel 16 (14th NySMAC meeting, May 2001. Minute 4.4.)
17 When personnel are in the field the station radio will be monitored.
18 Before departure personnel will record field activity in a field record book or white board.
- Time of departure from station and estimated time of return to station.
(estimated time of arrival or 'eta'). Records must be monitored.

- Route and field locations.
- Radio / satellite phone/ weapon details

19 Personnel will return to station in time for their eta and will record their return in the station book.

20 The station chief or a nominated person will monitor the record book (or white board) and will take action if field personnel are overdue.

21 Stations will share new information concerning safety, including the position of crevasses, polar bear sightings and avalanche dangers. Information should be posted on a white board in the Kings Bay mess building and on the Field Log (Felt Log) web site.

NY-ÅLESUND ACCIDENT AND INCIDENT PLAN

Agreed procedure:

1. Station chiefs are responsible for his or her personnel.
2. Careful assessment of the accident or incident by the station chief.
3. Assess the merit of self-help i.e. launching a rescue. Consideration must be given to safety of personnel, their skills, experience and ability to deal with the specific emergency.
4. The decision to call the rescue services in Longyearbyen is the sole responsibility of the station chief.
5. Before calling the rescue service in Longyearbyen the station chief will inform the Kings Bay watchman.

Appendix 2.5 - Information policy (data and publication sharing policy)

NERC Arctic Research Station, Ny-Ålesund, Svalbard (NERC, British Antarctic Survey)
(Small to medium sized, very remote station accessed by plane or boat)

Freedom of Information Statement[130]

British Antarctic Survey (BAS), as part of the Natural Environment Research Council (NERC), is committed to meeting its obligations under the Freedom of Information Act 2000 and the Environmental Information Regulations 2004. BAS encourages the wide distribution of the findings of its research.

The Freedom of Information Act requires NERC to adopt and maintain a Publication Scheme stating:

- the types (classes) of information we publish, or intend to publish
- how our information is, or will be, published
- whether the information is, or will be, made available to you free of charge or on payment

The NERC Publication Scheme aims to make a significant amount of our information available to you without needing to request it specifically under the Freedom of Information Act. We also want to inform you of the range of material that is available. Copies of the Publication Scheme are available from the address below or from the NERC website.

If you cannot find the information you want from the Publication Scheme, please contact:
Freedom of Information Office
British Antarctic Survey

[130] http://www.antarctica.ac.uk/

High Cross
Madingley Road
Cambridge
CB3 0ET

Appendix 2.6 - Sponsorship policy

NERC Arctic Research Station, Ny-Ålesund, Svalbard (NERC, British Antarctic Survey)
(Small to medium sized, very remote station accessed by plane or boat)

Sponsorship Principles[131]

British Antarctic Survey (BAS) adheres to the Natural Environment Research Council (NERC) Sponsorship Principles and welcomes sponsorship opportunities.

'Sponsorship' means payment by a private sector organisation or individual in return for public association with a NERC activity, project, event, or asset. It can be in cash or in kind. Sponsorship can help NERC achieve its objectives, and will be actively sought. But it must be governed by the following principles, which have been endorsed by the Council. These principles, with the exception of number 10 below, also apply to co-funding[1] or matched funding of research and training projects and programmes.

1. The sponsorship agreement must be in writing, cleared with the lawyers of NERC and of the sponsor, and should set out unambiguously the responsibilities and expectations of each party, and the benefits which each will receive. It should also include clauses covering its review and termination.
2. Any sponsorship must produce significant benefit for NERC within its agreed strategic objectives, and without detriment to the wider public interest.
3. This benefit must outweigh any reputational or business risk for NERC through being associated with the sponsor.
4. Sponsorship must always be consistent with NERC's ethical policy. This rules out some sources, such as tobacco.
5. The arrangement must be wholly transparent, with provision for public scrutiny.
6. NERC will not endorse or give preference to sponsor products. Nor will NERC give any competitive advantage to any sponsor.
7. All IPR stemming from the sponsored activity, whether anticipated or not, remains the property of NERC, unless there is an explicit agreement to the contrary in the original sponsorship document.
8. There should be no exclusivity clause.
9. NERC's work, and its key messages, should not be influenced or contradicted by the sponsor. Any statement by the sponsor about its relationship with NERC, or use of NERC logos/brands in sponsor advertising or publications showing images relating to NERC, must be explicitly approved by NERC. This requirement should be spelt out in the sponsorship agreement.
10. Sponsorship income for a project or activity should be in addition to core funding or commissioned research. It should normally not exceed 40% of the total funds for a project or activity.
11. All sponsorship over £5,000 will be disclosed in NERC's Annual Report.
12. Any potential sponsorship in excess of £50,000 should be brought to the attention of the NERC Finance Director at an early stage.
13. Any offer of sponsorship of over £100,000, or which is novel, or which may prove contentious, must be brought to NERC Council after consultation with the Ethics Committee.

[131] http://www.antarctica.ac.uk/

Footnote 1: Co-funding is where a second party contributes to a specific project or programme in order to gain directly from the data and knowledge so produced.

Appendix 2.7 - Staff Policy

Sverdrup Station, Ny-Ålesund, Svalbard
(Very large, very remote station accessed by plane or boat)

Staff policy

Ny-Ålesund is not a place for permanent settlement. The staff at the Sverdrup station is therefore hired on fixed-term contracts, normally a two year term, with the possibility of additional two years. Seasonal personnel are hired on demand.

Appendix 2.8a – Transport: Snow machine/snowmobile use policy

Barrow Arctic research Center/Barrow Environmental Observatory, Alaska, USA
(Medium sized, easy access station located near community)

Barrow Field safety – external link to snow mobile safety training course
http://www.lounsburyinc.com/snowmachinesafety/index.html

Above website present various aspects of snowmobile safety and includes online training documents and related quizzes. Here stations can find inspiration for snowmobile safety policies.

Appendix 2.8b Transport: Snow machine/snowmobile use policy

Toolik Field Station, Alaska, USA
(Large, very remote station with road access)

Toolik Field Station Snow machine Use
http://toolik.alaska.edu/user_guide/policies.php

Toolik Field Station (TFS) operates and maintains a small fleet of snow machines. These machines are available for use by TFS scientists under the appropriate BLM and Alaska DNR permits and through scheduling with TFS staff, as explained below. Station staff also use the snowmobiles on the permit area (gravel pad) for maintenance support functions and off pad for Search & Rescue and science support.

Guidelines

Permits

All snow machine use in the Dalton Highway Corridor (within five miles of the Dalton Highway) requires a permit from either the BLM or Alaska Department of Natural Resources, or both. It is the sole responsibility of the science user to acquire and possess the appropriate permits for their snow machine use. Permits can be obtained from the proper land owner, either BLM or Alaska DNR. The minimum condition for any use of snow machines off the pad is six inches of snow on ground that is frozen. Snow machine users must abide

ALL additional stipulations of their specific permits. The only snow machine use covered by any 'TFS blanket snow machine permit' is use within the TFS lease boundary (the gravel pad) and on navigable waters of Toolik Lake. TFS requires copies of permits before allowing snow machine travel from the station.

Safety and Training
Proper preparation and training is essential for safely operating snow machines in arctic conditions around TFS. Station staff will give researchers an orientation on environmental conditions specific to the area around TFS as well as operating protocols of TFS machines. This, however, is NOT a substitute for proper snow machine and winter training. Training, preparation, and safe operation of snow machines are the responsibilities of each individual and each project, who must come prepared for work in the Arctic. TFS operates under the *Toolik Field Station Extreme Winter Weather Guidelines*. All winter TFS users must consult these guidelines.

Project-owned Snow machines
Science users may bring their own project snow machines to TFS. No maintenance or support for these machines is guaranteed at TFS other than fuelling and general maintenance advice. Projects that plan to use their own snow machines based out of TFS should contact the Station Manager in advance, preferably at the time of their reservation, and communicate their intentions for where they intend to go and for how long.

Toolik Field Station Maintained Snow machines
The small TFS fleet of snow machines is available to researchers with the proper permits on a reserved basis. The snow machines at TFS are ageing, but are maintained in top working order. They are small utility machines, best suited for limited local use. They can pull a maximum of 100 pounds.
Contact the on-site manager to request use of TFS snow machine. If extensive use is expected (i.e., more than one day of use or critical use on a specific day or time) the station manager should be contacted at the time of making your station reservation to check the availability of the machines. All users of TFS snow machines will receive an orientation on the operational characteristics of the TFS machines, as well as the environmental characteristics around TFS.

Use of TFS snow machines is limited to five miles from your starting point within the Toolik Research Natural Area. Use may further be limited by snow and ice conditions, visibility conditions, maintenance issues, group size, and operator experience.

If easier access is afforded to research sites by trailering snow machines to an alternate starting location, a snow machine trailer may be available for use. Contact the station manager for availability. TFS also has a limited supply of helmets. It is recommended that you bring your own if you want to be guaranteed a helmet.

Up to four tow-behind utility sleds are also available with reservations – contact the TFS manager.

Procedures for Snow machine Use Based out of Toolik Field Station
Snow machine use based from TFS falls into two policy categories: Local Use and Extended Use.

Local Use
Defined: Use within one mile or easy sight distance of TFS (as determined by the on-site manager); operators can easily walk back to camp if they get stuck.

Local use of snow machines at TFS is treated much like other local TFS field work. If using TFS machines users must first get machines assigned by the on-site manager. Users then get an orientation on the operation procedure of the TFS machines, as well as environmental conditions around TFS. Any other stipulations of use will also be addressed at this time. Once these procedures are completed, when going into the field users must verbally notify the on-site manager of their departure and sign out on the sign-out board. The board is located in Winter Quarters in the winter and in the Dining Hall in the spring. Users must sign back in on the board when returning to camp.

Extended Use
Defined: Use extending beyond one mile or easy sight distance from TFS (as determined by the on-site manager).

Extended use of snow machines at TFS requires more involved procedures. Users requesting to use TFS machines for extended use, as well as users using their own machines based out of TFS, must first complete the *Toolik Field Station Extended Snow machine Use Form* (ESUF) (attached below) and submit it to the on-site manager. The manager will then review the proposed trip plans and communicate any stipulations (if using TFS machines) on use. These stipulations may include mileage and geographic limits due to snow and ice conditions, light conditions, maintenance issues, group size, and operator experience.

The on-site manager must be told before each trip is made, and the sign-out board must be completed on both departure and arrival back to camp.

Other requirements for extended snow machine use

1. Mandatory to carry satellite phone and TFS contact numbers (Can be checked out at TFS)
2. Mandatory to carry a GPS (Can be checked out at TFS)

Appendix 2.9 - Under-aged and family policy

Toolik Field Station, Alaska, USA
(Large, very remote station with road access)

Policies for parents with dependent children at Toolik Field Station (TFS) (0 to 5 years old)
http://toolik.alaska.edu/user_guide/policies.php

1. Parents must provide for the transportation of their child to and from TFS.
2. Parents must provide a plan for 24-hour supervision of their child while at TFS, to be provided by the parent, or by a day care provider furnished by the parent. Supervision includes plans for feeding, recreation, naps, and sleeping.

3. Day care providers furnished by parents are required to be certified in first aid and infant CPR. Parents must submit copies of this certification to the station management prior to arrival.
4. Parents shall ensure that their children have had all appropriate vaccinations before bringing them to TFS.
5. Dependent children are not allowed in the workplace, as per UAF policy (see Chancellor's web page). Laboratories, kitchen, the generator modules, and shop facilities are considered to constitute the workplace at TFS. Children may not ride in university boats or any other mode of transportation, other than the vehicle used to get to and from the station.
6. Dependent children are permitted in the housing facilities, the dining hall, the outhouses, and the community center/day-care facility. Dependent children may play in the tundra so long as they are not in experimental plots or sensitive areas, and are under supervision. A site map outlining approved areas will be made available.
7. Dependent children will be housed with their parents in the regular TFS housing facilities. TFS provides mattresses but not bedding. Parents must supply their own bedding and cribs, if needed, for their children.
8. Parents using the community center/day-care facility must provide their own bedding and crib or nap mat, all toys, disposable diapers (if needed), and any required food beyond what is provided by the regular TFS meal service.
9. Parents or caregivers are responsible for clean-up of the center, beyond routine sweeping and removal of trash.
10. TFS will not charge dependent children any fee for the use of TFS. The fee for their caregivers to stay at TFS shall be the same as other science users covered by the co-operative agreement, which is $107.10 per day in field season 2010.
11. Parents who want to bring their dependent children to TFS must submit a request to the TFS Science Director at the same time as they make reservations for themselves, according to the published deadlines for reservations at TFS, and explain their reasons for wishing to bring their children. Requests will be evaluated on a case-by-case basis and acceptance or denial of each request will be dependent on space availability and the plan for adherence to points #1-9.

Community Center/Day-care Facility at TFS

NSF, CPS, and IAB have setup a facility at TFS that will be suitable for day-care for dependent children. The facility will also serve as a recreational center for other members of the community when no children are present, but children and their providers have priority. The facility will consist of a 20' x 30' Weatherport tent, subdivided into 4 areas intended for use as a restroom/changing area, a napping/nursing/rocking area, an open play/activity area, and an entrance area with cubbies for storage of personal items. TFS staff will be responsible for cleaning the facility and removing the trash, but will not provide other services at the facility beyond routine maintenance.

Appendix 4 - Visitors

Appendix 4.1 – User guide for Sermilik Research Station

(Unmanned, small and remote station reached by helicopter or boat)

User guide for Sermilik Research Station, Greenland

Morten Pejrup and Bent Hasholt, Institute for Geography and Geology (IGG), University of Copenhagen, Denmark

Keys

Keys to the station can be obtained by making appointment with IGG. In Tasiilaq keys can be fetched at Mogens Bisgaard Kofoed, who is looking after the station. After use, keys are delivered to Mogens together with a short report about the state of the station, e.g. damages that needs repair before winter.

Transport to the station

By foot approximately 6 hrs, remember map.
By boat, Robert Christensen (clubverl@greennet.gl) can be contacted and arrange boat trips to the station, otherwise make appointment with local boat owners.
Helicopter, charter with Air Greenland, but book in advance!

Arrival

Carry luggage safely above high water level. Place fuel in safe distance from the house. Place food in tight boxes and if possible cover under sheets.

Unscrew screens from windows, and leave bolt in the hole. Screens should be saved with a stone on top. In case of strong winds larger stones may be needed.

Heating

Diesel should be filled in the tank in the entree. Turn wheel on the thermostat to start, press button at end down. Open lid of stove and pour one spoon full of alcohol on the button of the stove. Throw a match down, keep head away-**explosion risks**! Close lid and when stove is burning safely- turn wheel down to 1 or 2 levels. To put out the fire-lift button up.
If the fire goes out, oil may enter the chamber in the button of the stove-this has to be dried up before a new attempt. **Never pour alcohol in a hot stove- explosion danger!**
If oil flow diminishes, cleaning needle may be pressed into the stove-remember to pull it to outer position afterwards. **Never leave the house for more than 5 minutes with fire on.**

Cooker

There is a gas cooker in the kitchen, mount the gas bottles to the gas tube. Open the lever on top of the pressure equaliser; Close it during night and when the house is left unattended. Light the cooker with a match, keep the knobs in for a while (security).

Drinking water
Iron drain in a small stream is found east of the house, if it is dry, sail north along the coast to a stream app. 500m. **Don't urinate in the stream or its catchment.**

Electricity
A 4000W generator is found in the new installation, it runs on gasoline. Fill the tank on the top, use funnel and wipe away excess fuel before starting the engine. Check the oil level before start. Check that exhaust tube is free and not against flammable material. Turn 220 volt off before start. Turn the key- when engine is running smoothly- turn on 220 volt. Read and note engine running hours. If the start battery is out of power, the engine may be started by hand.

The generator runs for about 20 hours using 18L of gasoline (DK: benzin). An emergency generator (1200W) is found on the shelf, it also uses gasoline. Only one generator must be connected at the same time.

HFI relay is found in the entree together with safety plugs.

Fuel and propane gas
Users staying for a week or more should bring fuel for their own use. Estimated consumption for heating during summertime is 40L diesel pr. week. Electricity is about 1L pr. hour. Propane gas is about 1 container pr. fortnight. Buy fuel at gas station in Tasiilaq harbour.

Toilet
To the right of the entree a toilet bin is found, after use **it should be emptied before leaving the station.** Dig a hole in the sand at low tide, pour content into the hole and cover with sand. Clean the bin in seawater and return it to the toilet room**. Urinate only in the small valley west of the house**, where sewage is deposited.

Garbage
Dangerous material should be brought back to Tasiilaq. Other material and kitchen garbage is deposited at the 'dump' on the west side of the radio mast and burned immediately, because of foxes and ravens. Be careful; don't pour gasoline on the dump after it has started burning. Keep the whole environment clean and collect all litter.

Safety
Polar bears have been observed near the station, recently in the summer of 2011 by INTERACT groups! Rifles are found in the entree together with ammunition. Cartridges should only be put into the chamber just before shooting. Check any rifle before use. **Never carry a loaded rifle near the house.** It is recommended that only people experienced with use of weapons are using the rifles. Clean rifles if used.

Emergency equipment are found in the toilet room, kitchen and other room- check the locations.

Fire extinguishers are found in the house and in the garage-check location.

Radio

A VHF radio is located in the radio room. Only persons with a radio certificate are allowed to operate the radio. To turn it on- press button on lower edge of black box beyond the table. Then operate with the handset. In case of emergency: Open channel 16- call 'Mayday- Mayday- Mayday, this is Sermilik station'. The operators will then answer and tell what to do.

Other equipment

Scientific equipment must be brought in for specific projects. A rubber dinghy is placed in the garage- use only according to special appointment or in case of emergency. Engine uses 2% oil.

Rules of conduct

Keep the station and environment clean. Always leave the station in a better condition than at arrival. NO SMOKING INSIDE THE HOUSE.

Leaving the house and departure

Lock the station when leaving for daily fieldwork. Save equipment outside against strong winds.
Don't leave anything that can attract foxes.
When leaving for good- clean house and environment, empty toilet bin, burn garbage. Put out all heat and electricity, disconnect propane gas.
Return all blinds on windows; fix screws on the inside of the window frame. Lock door with all iron bars.
Leave keys to Mogens Kofoed, together with a report of anything that needs immediate repair.

Fees and report

Due fees should be settled with IGG according to appointments. A short report on activities and the state of the station should be forwarded to IGG.

Recommendations

Bring satellite phone and maps
Be familiar with first aid, rifles and safety in general

Appendix 4.2 – Permit issues, FINSE Alpine Research Center

(Small, easy access station accessed by train, van, or snow machine)
www.finse.uio.no/user-information/

Conditions for use of the Research Unit

Although students and staff from the faculties of natural science at the universities of Bergen and Oslo have priority, researchers from any national and international institution may use the Research unit for research activities in the Finse area on the following conditions:

1. The center manager should always be notified before visiting the field station. New users of the station should contact the center director before the first visit. For more information, see Booking.
2. All researchers working at the center must submit a brief description of their research project(s) at Finse - see Project Registration.
3. All users of the field station are themselves responsible for obtaining the necessary permissions from the authorities and the land owners for their research. Sticks and other material used to mark up study sites must always be removed after the project has finished. If you plan to leave any installations, marking sticks etc. in the field for more than a couple of weeks, you should register the GPS positions of these. For more information, see Permits.
4. Use of lab space must be approved by the centre manager. All chemicals brought to the station must be reported to, and approved by, the station manager. Flammable or toxic chemicals must be stored safely and according to instructions. Any chemicals brought to the station and wastes must be brought back by the end of the season unless otherwise agreed. Do not discharge any toxic waste in the drain – we have a biological sewage treatment system!
5. For safety during field work, always report where you go and when you will be back - see the Safety guidelines for field work.
6. To work on the glacier, you must provide proof that you have adequate training for working on glaciers.
7. The facilities must be kept clean and tidy - we do not employ cleaners to do the job. Bedrooms must be cleaned before departure. Mark your food and do not leave food in the fridge if you leave the station for more than a few days.
8. Users who want to bring dogs to the station should read and comply with the conditions for Bringing dogs to the station.
9. The user protocol (red book in the hallway) should be signed at arrival and a User report form should be submitted either after each visit or at the end of the season (see the Rates for use of the facilities and services).
10. Always report publications resulting from work at the center to the center director. Please mention Finse Alpine Research Center in the Acknowledgement of any such publication, and give a copy to the center library if possible.

Bringing dogs to the station

You may bring your dog to the station, but dogs are not allowed inside the buildings and you must keep the dog on a leash at all times between 1st of April and 20th of August.

The University does not allow any dogs in their buildings (to show consideration for people with allergies). To protect wildlife, Norwegian law requires all dogs to be on a leash

between 1st of April and 20th of August. There are many nesting shorebirds around the station, so please make sure your dog does not get loose.

If you plan to bring your dog to the station, please contact the center manager, Erika Leslie, to talk about arrangements.

Safety guidelines for field work

- Every day before going out, put your name, a description of where you go and when you will be back on the list on the notice board.
- If the manager is not at the station, make an arrangement to report to someone else when you are back at the station (on phone if there are no other people at the station).
- Bring a cell phone and make sure you have left your number in the user protocol. Note that not all areas around Finse have cell phone coverage - consider bringing a satellite phone when working in these areas (we may have one you can borrow).
- The weather can change very rapidly - bring warm clothes and extra food in case of emergency.
- Fog (and white-out in the winter) can reduce visibility to near zero - always bring a map and a compass (a GPS is also very useful - the station has some for lending out).
- To work on the glacier, you must provide proof that you have adequate training for working on glaciers. Alternatively, we can put you in contact with certified guides.

Permits for environmental interventions

The use of snowmobiles is strictly regulated in Norway and one must obtain permission for any off-road driving. One must also obtain permission from the local authorities and land owners before carrying out any interventions in the natural landscape such as setting up fences or installing equipment that are highly visible. To collect protected species (including all vertebrate species), permission must be obtained from the national Directorate for Nature Management (Direktoratet for Naturforvaltning). Interventions or experiments causing stress or pain on vertebrates must be approved by national authorities. **All users of the field station are themselves responsible for obtaining the necessary permissions for their research. Sticks and other material used to mark up study sites must always be removed after the project has finished. Make sure you record GPS positions and keep track of any such markings. Installations and markings that are left in the field for more than a few weeks should always be registered at the research center.**

- Installations and landscape interventions
- Registrering markings and installations
- Snowmobile usage
- Collecting of protected species
- Export of biological material
- Animal welfare
- Map of park and municipality borders
- Forms and external information

Installations and landscape interventions

Note that most of the area surrounding the research station is protected (see map). Landscape interventions and traffic by snowmobiles within these areas are strictly regulated, but exemptions can be made for scientific research and education. **You must seek permissions from both the local management authorities and the landowners for putting up installations such as fences and carrying out other environmental interventions.**

Permissions from the management authorities: Applications for activities within Hallingskarvet National Park and Finse Biotopvernområde should be sent to Fylkesmannen i Hordaland or Buskerud (see information here). Applications for activities outside the protected areas or in the Skaupsjøen-Hardangerjøkulen Landskapsvernområde should be sent to the local municipality (see information here). See map for municipality and park borders.

Permissions from the land owners: The land around the research station within Ulvik municipality (see map) is owned by Statskog (state owned). Applications for activities within this area should be sent by e-mail to Kjell Inge Skierveggen at Statskog. Copy your applications to Ulvik Fjellstyre, which is the body that represents the grazing, hunting and fishing rights on the land. Contact the local municipality if you plan to work outside the Ulvik municipality (see information here).

If you are not sure whether your activities require any special permits, contact Trond Aalstad at Fylkesmannen I Hordaland.

Sticks and other material used to mark up study sites must always be removed after the project has finished. Make sure you record GPS positions and keep track of any such markings. Installations and markings that are left in the field for more than a few weeks should always be registered at the research center (see information).

If your project involves both landscape interventions and use of snowmobile, it is best to seek permissions in the same application. In the application, you should state the purpose of the study, what you plan to do in the field, location and duration of the field work, and during which dates (approximately) you plan to use snowmobile.

Registering installations and markings

Installations and marking sticks etc. left at the field sites are a potential source of conflict with other users of the Finse area. Do not use marking methods that are more conspicuous than they need to be and make sure you always remove the markings after use. Any highly visible installations must be approved by the local management authorities (see information). If you leave any marks or installations in the field for more than a few weeks, you should register the GPS position of these marks, either by making the GPS positions available on your project web pages (e.g. as a downloadable file) or by sending an e-mail to the center director . Use preferably the UTM reference system with the WGS84 map datum. Please also state how long the marks will be left in the field.

It is a good idea to mark installations that are highly visible with a name and contact information (you may use just 'Finse Alpine Research Center' / 'Finse alpine

forskningssentere' and the phone number to the research center, 56 52 71 20). If you place a laminated note with a short explanation of what the installations are, hikers and others who come across the them will generally be interested and meet us with a positive attitude rather than getting annoyed by the disturbance of their out door experience.

Obtaining permission for snowmobile usage

The field station does not have a general licence for using snowmobile for other purposes than transporting equipment and supplies between the train station and the research station. Permission for other usage must be applied for on a project-by-project basis.

Note that most of the area surrounding the research station is protected (see map). Traffic by snowmobiles within these areas is strictly regulated, but exemptions can be made for scientific research. Within the protected areas, snowmobile usage later in the season than April 30 will generally not be allowed, and projects should limit the use of snowmobiles to no more than five days per season. Snowmobile usage during weekends and undue disturbance of recreational activities should be avoided.

Applications for using snowmobiles within Hallingskarvet National Park and Finse Biotopvernområde should be sent to Fylkesmannen i Hordaland or Buskerud (see links here). Applications for activities outside the protected areas or in the Skaupsjøen-Hardangerjøkulen Landskapsvernområde should be sent to the local municipality (kommune - see links here). See map for municipality and park borders.

In the application, you should state the purpose of the study, what you plan to do in the field, location and duration of the field work, and during which dates (approximately) you plan to use snowmobile. The local municipalities provide application forms for snowmobile usage (see links here). The licence plate number of the snowmobile at the center is KC 5212.

Permission for collecting protected species

All vertebrates in Norway are in principal protected, and a number of plant species and invertebrates are also protected by law (see list). You must obtain permission from The Directorate for Nature Management to trap, kill or collect any such species. Applications should be sent to: The Directorate for Nature Management, 7485 Trondheim.

Export of biological material

Whole specimens or biological material that are legally collected can be brought out of the country with no further permissions as long as the species are not listed by the CITES convention. Note, however, that most countries have restrictions on the import of biological material. Norwegian authorities may assist in obtaining documentation needed for import.

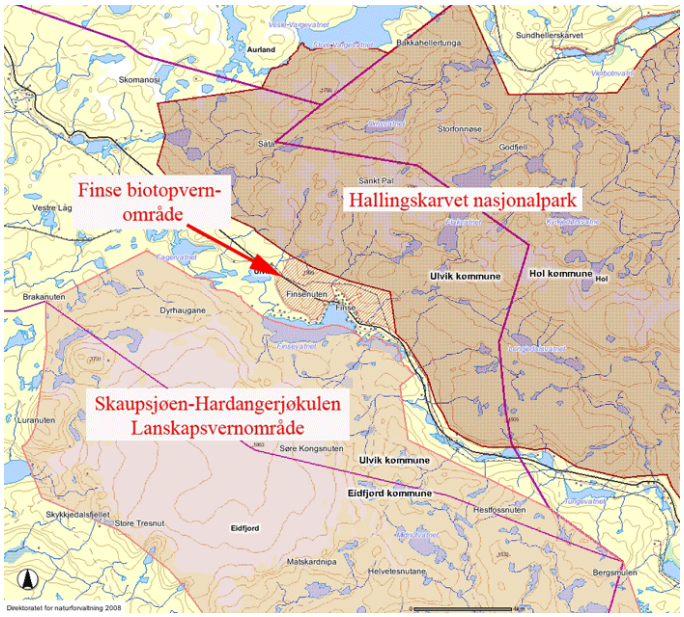
Animal welfare

Manipulations or experiments causing stress or pain on vertebrates or crustaceans must be approved by http://oslovet.norecopa.no/dokument.aspx?dokument=80&mnu=about_us.

Application forms and external information

- Application form for use of vehicles in the field: Ulvik Kommune, Hol Kommune, Eidfjord Kommune and Hallingskarvet Nasjonalpark og Finse Biotopvernområde.
- Information about Hallingskarvet National Park and Finse Biotopvernområde from Fylkesmannen I Buskerud and Fylkesmannen i Hordaland.
- Links to relevant legislation, authorities and councils
    1. Forskrift for verneplan for Hallingskarvet (protected area legislation and management plan)
    2. Forskrift om vern av Finde Biotopverneområde (protected area legislation and management plan)
    3. Ulvik Fjellstyre (local authotity)
    4. Direktoratet for naturforvaltning (national authority)
    5. Forsøksdyrutvalget (animal welfare council)
    6. Viltloven (wildlife law)
    7. Dyrevernloven (animal welfare law)

Municipalities and protected areas



Appendix 4.3 – Visitor information, Kolari Research Unit

(Very small, easy access station reached by road or train)

Welcome to the Metla Kolari Unit

METLA

The guestroom of the Kolari Unit is located next to Ylläs River. Metla charges a fee from the use of the guestroom. The exception is ones using the room during their work trip for Metla. In this booklet all the necessary and useful practical manners and services are been introduced concerning the accommodation.

Overleaf you can find more information about the services at the Kolari region.

Access Keys

Guests arriving during office hours can receive the access key from the Metla info desk. If the quest happen to arrive outside the office hours the access key will be delivered to the him/her by special arrangements. The access key to the main Metla building will only be handled to quests who enquire it for need or special purpose.

Kolari unit in November. Photo: Mikko Jokinen.

Internet

There is open wlan (Metla_Open) connection available in guestroom. If you need LAN connection you need to meet IT administrator during business hours.

Sauna

The electric sauna is mainly for the use of the permanent residents. For the guests the sauna is available, only with arrangements with residents in advance. This procedure is needed to avoid overlapping with sauna turn.

Metla main building is located in Kolari few kilometers from the village center to northeast. The guestroom can be found behind the Metla main building.

Serving Locals and Guests

Kolari is a village of about 4000 inhabitants. Kolari is best known as tourist-village. Ylläs, the international level travel center, is offering services all around the year. Ylläs is located about 40 kilometers from the village center of Kolari. Ylläs is also known from the cultural events that it offers.

Kolari people are very proud of their nature and the possibilities for outdoor activities are excellent. The village center is located beside the Muonio River, four kilometers from Metla main building.

Post Office and Bank

The post office is located inside the grocery store Sale. This makes it possible that the post office services are in use every day. The leaving mail is collected from Sale daily at 15.00 o'clock. The mail is also collected from Metla info desk with the mail-deliverer who drops and picks the mail as he visits.

There can be found two ATM cash dispensers, one from the Sale grocery store and one from the village center. There is also two payment ATMs and bank offices of Nordea and Osuuspankki at the village center.

Grocery and Liquor Store

The nearest grocery store can be found near the railway station half a kilometer south from Metla next to the main road. There is also two other grocery store at the village center. Liquor store Alko is located next to Sale grocery store some two kilometres from south from Metla. In the Swedish side of the border, there is one grocery store next to bridge. Here on the border region the grocery stores are open every day, and it is useful to notice that in the Swedish

side the grocery stores are open until 22.00 o'clock because of the time difference.

Medical Services and Pharmacy

The healthcare center of Kolari and the pharmacy are located in the village center. The healthcare center is on call in turns at Kittilä, Muonio or Enontekiö. This means that sometimes the doctor services can be quite far. Still especially from Ylläs privet doctor services can be found.

- Healthcare center, phone: + 358 40 489 5090
- Pharmacy, phone: +358 40 528 5548
- Medical center of Ylläs (35 km from Metla), phone: +358 40 4112262
- Emergency number: 112

Restaurants

Pub 65 is the nearest pub and restaurant located in the village center. Lunch is served in Pub 65 as well as in Wood Jewel, located beside the main road.

Taxi and Travel connections

There is trains leaving Kolari daily during the tourist season and other times couple times a week. The office hours of the ticket service is varying among the tourist seasons. You can check more detailed information and timetables from www.vri.fi

The airport is in Kittilä, one-hour drive from Kolari.

The buss connection in North-South direction is relevantly active. With the buss, you can go the Ylläs (Äkäslompolo) daily. Check more information and timetables from www.matkahuolto.fi
Taxi is also available if you are tired of walking around. Phone: +358 16 106 422.

Sweden

The access to Sweden across the border is two kilometers south from the village center. From the Swedish side you can find a grocery store. Next village center, Pajala, offering multiple services, is located 25 kilometers from the borderline. There is no customs procedure at the border. Non-EU citizens might need separate visa for Sweden.

In Case of Trouble

when there is no staff in the unit, call: +358 400 350 276 (Alatalo, ISS Services)

Ylläs tourist destinations provides many outdoor activities. www.yllas.fi Photos: Mikko Jokinen.

Appendix 4.4 – Visitor information, Abisko Scientific Research Station

(Large, easy access station reached by road, bus, or train)

Abisko Scientific Research Station (ANS)

SOME PRACTICAL ADVICE FOR RESIDENTS AT THE STATION

SAFETY:

It can be dangerous to work in the mountains and please remember that it will take longer to get emergency help than in a city. Please take extra care.

There is a **medical doctor** at the Björkliden Fjällby (phone 641 00/exch) during the winter tourist season. Outside the winter tourist season you will have to contact the hospital in Kiruna (phone 731 12). Simple first aid can be obtained from laboratory staff/technicians.

In the event of a **SEVERE ACCIDENT/EMERGENCY**, please, use the international emergency **number 112**.

Information on current **routines in the laboratories & workshops** can be found on the notice boards in the main entrance to house A, in your room, and in the laboratories and workshops. To the left of the main entrance door/main building (house A) there is a notice board with the name and telephone number of the **meteorological observer on duty** (+46(0)702589221)**.** He/she should be contacted as a first point if problems arise outside office hours.

LABORATORY SAFETY

Before entering any of the laboratories, study the information package for laboratory routines.

WORKSHOP SAFETY

If you are planning to use any of the workshops alone, please inform the technicians so that we are assured that you are familiar with the use of any machinery. When using the workshop, you also have to sign up in the logbook.

WORKING ENVIRONMENTAL ISSUES: Site Manager, Christer Jonasson, is responsible for the coordination of working environmental issues. If you have questions, complaints, requirements etc. please contact either the Site Manager or some of the safety representatives (‘skyddsombud’).

FIRE:

PLEASE OBSERVE and identify the route to your nearest exit.

PLEASE OBSERVE On a map in the information package, fire extinguishers are clearly marked.

PLEASE OBSERVE When leaving the house in the case of a fire, gather at the entrance road close to the ANS flagpole.

FIELD: When working in the field, please work with a partner. Also, ensure that someone at the Station knows where you are working, your route and expected time of return. ANS helps guests to manage their safety by providing a white board at the reception and will check if you fail to return only if you complete the notice before your field visit. This service operates only until 8pm weekdays, excluding holidays. At other times, other guests operate the service.

Appendix 4.4 – Visitor information, Abisko Scientific Research Station, Sweden

WEATHER: is very variable and unpredictable; NEVER UNDER ESTIMATE IT!
Even during summer it is sensible to bring warm clothing (including headwear and gloves), heavy boots and rainwear in your **RUCKSACK, which** is indispensable during a field tour. A survival blanket is also recommended, food, water, map and compass.

ACCOMMODATION: The swipe-card allows access to the main house (A) and the accommodation building. Please bring it with you at all times before and after office hours (when doors are automatically locked). Please, help us to keep the entrance doors secured.
Your room is furnished with beds including blankets/quilts, sheets and towels. The sheets and towels will be changed approximately every 14 days or on request.
Beds for children are available on request.
To keep the costs of accommodation low, beds are not prepared, and cleaning is only intermittent by agreement with the staff. The residents are requested to take care of the daily cleaning of their rooms. A vacuum cleaner and other cleaning equipment are available in a broom-cupboard (marked 'STÄD') on your floor (or at the place indicated on the plan of the building). There are showers in some rooms and also in the saunas (house A). Please bring your own soap. Please help us to save water, especially hot water that is environmentally costly. There is also a wooden fired sauna at the lake. Bookings are made at the reception.
If you open a window, you are expected to close it before you leave the room. Strong winds can develop in a very short space of time, even during calm days. Our procedure is that if you open a window, you have the responsibility to ensure its closure.

SMOKING is prohibited throughout the Research station, including all laboratory, office and accommodation areas. **Pets** are also prohibited.

BANKS: the nearest Swedish banks are in Kiruna (100 km) and the nearest Norwegian banks are in Narvik (80 km). **TRAVELLERS CHEQUES** for small amounts can be cashed at the tourist hotels (Abisko, Björkliden and Riksgränsen) but non-residents are usually charged extra. A limited number of **CREDIT CARDS** are accepted at hotels (VISA, MASTER CARD).

BIBLIOGRAPHY: Abisko Bibliography 1992 (with supplements) is accessible in the library. This is available free of charge.

LIBRARY: The library is open throughout the day. Guests are free to borrow books and use the library. Journals may NOT be taken out of the library.

CLOGS/SLIPPERS: In northern Scandinavia it is common courtesy to remove shoes before entering a room from outdoors. It is therefore polite to carry a pair of slippers or other light shoes, when visiting. Clogs are popular for indoor wear.

Appendix 4.4 – Visitor information, Abisko Scientific Research Station, Sweden

TRAVEL: BUSES leave for Abisko from the bus station opposite (100 m) the town hall in Kiruna. During the tourist seasons, the bus from Kiruna Airport to Kiruna City continues to Abisko and Riksgränsen. There is a bus stop at the gas station in Abisko Östra. Both long distance and local **TRAINS** stop at the railway station in Abisko Östra 1 km away (closest to the Research Station) but also at the Abisko tourist station. Both train- and bus tickets are bought on board. Timetables for buses and trains are displayed at the reception. The station also has a **BOAT** in Lake Torneträsk, which can be used by prior .The station has a **MINI-BUS** and 2 **Skoda** which can be hired for short periods 30:- SEK (Excl. tax) per 10 km. The car should be booked at least one day in advance. However, during the field season there is a high demand, and the cars are often heavily booked. Should you need a **CAR** for longer periods or frequently during your stay you are advised to hire your own from Hertz, the only car rental company at Abisko, or at Kiruna (Europcar, Hertz, etc.). A **CHAIR LIFT** operates on Mt Njulla (2 km: s distant) during the tourist season from 400 m to 900 m above sea level; crossing the tree line at 650 m. Ticket concessions can be arranged through the Abisko tourist station.

FOOD: the station has fully equipped kitchens and dining rooms for self-catering. There is a well-equipped grocery store at Abisko Östra (1 km). During tourist seasons groceries are also available at the shop at Abisko tourist station (2 km) and prepared meals can be obtained /self-service restaurants/ at Abisko Mountain Lodge (Abisko Östra village, 1 km), at Abisko tourist station (2 km), at gas station (Abisko Östra village, 1 km) and at Björkliden Hotel (8 km).
By special arrangement the station can refer to a catering company for groups of up to about 40 people (courses, conferences, etc.).
During the field season, many of the visiting scientists are preparing meals together in the main kitchen in the D-building. The single or groups of the members prepare the meals. Anybody can join this group; the only demand is that every member has to be prepared to cook for the entire group now and then. How often depends on the amount of members.
Every weekday between 10.00 and 10.15 coffee/tea is served in the dining room in the main building. This is free of charge for all visiting scientists.

RECYCLING. Visitors are asked to separate glass and metals and to put them in separate small containers sitting in the kitchen.

COMPUTERS: 2 Windows computers are available for guests. Both have Internet connections.

POST: Abisko does not have a Post office. Also post is taken to/from the Station by car Monday to Friday. In-coming mail is delivered to the pigeonholes at reception. Details of delivery times are on the notice board at reception.

Appendix 4.4 – Visitor information, Abisko Scientific Research Station, Sweden

TELEPHONE: +46 – 980 400 39 (during office hours also 400 21)
Telephones for visiting scientists are available at the station
FAX: +46 – 980 401 71(ANS), 401 42 (Guests)
POSTAL ADDRESS: P.O. Box 62, SE-981 07 ABISKO
E-MAIL ADDRESS: ans@ans.polar.se
WEB ADRESS: www.ans.kiruna.se

TOURIST SEASONS: 1/3 – 10/5, 1/6 – 30/9.

MOSQUITOES: an insect repellent is being advised from mid-June to mid-August.

Abisko climate (1961 – 1990)

	Monthly mean temperature (^{o}C)	**precipitation (mm)**
January	-11.9	25
February	-11.0	19
March	-7.9	15
April	-2.8	12
May	+3.1	13
June	+8.4	22
July	+11.0	54
August	+9.7	45
September	+5.2	23
October	+0.3	28
November	-5.0	22
December	-9.1	26
Year	-0.8	304

Lowest minimum temperature ever measured at Abisko: - 38.9^{o}C 28/1/1978.

Highest maximum ever measured at Abisko: +31.3^{o}C 14/7/1954.

Lake Torneträsk is covered with ice between mid-December (mean: December 23) and early June (mean: June 10) 1872-2007.

Riksgränsen/Katterjåkka has a yearly mean temperature of -1.7^{o}C and 848 mm of precipitation (1961- 1990).

Torneträsk weather station had a yearly mean of –1.0^{o}C and 472mm of precipitation (1961-1990)

Appendix 5 – Permit issues

Appendix 5.1 – Application form, Abisko Scientific Research Station

(Large, easy access station reached by road, bus, or train)

Swedish Polar Research Secretariat

Abisko Scientific Research Station

Application/Registration form for visiting scientists and guests

SECTION 1: TO BE COMPLETED BY ALL VISITORS

1 a) Details of Applicant

Surname	First name	Nationality
Academic degree	Profession	
Institution and address	Telephone	
	Telefax	
	E-mail	
☐ Project ☐ Conference ☐ Other	Title of the project or conference or other reason for the visit	
Discipline Choose from list	Specify discipline if other	

1 b) Time period and requirements for the visit at ANS

Arrival	Departure	Requirements (beds/rooms, lab space, field hut, etc.)

Accompanying partners and children names	Arrival	Departure	Requirements

1 c) Project leader/ conference organiser if/ and as appropriate

Surname	First name	Nationality
Academic degree	Profession	
Institution and address	Telephone	
	Telefax	
	E-mail	

1 d) Invoice information

Name and address to were the invoice should be sent	What should the invoice include?	Specify reason why an invoice should not be sent (stipendium, conference pays etc.)
VAT registration number	☐ All costs or ☐ Accommodation ☐ Local transport ☐ Consumables ☐ Other (please specify)	

SECTION 2: FOR OFFICIAL USE ONLY

Date received	Application approved	Date acknowledged	Date notified	Date invoice sent	Date payment received
	☐ Yes ☐ No				
Other notes					

Appendix 5.1 – Application form, Abisko Scientific Research Station, Sweden

SECTION 3: TO BE COMPLETED BY VISITORS ENGAGED IN FIELDWORK

3 a) Other project members

Name and institution

3 b) Details of the project

Description of the project (max 200 words)	
Total number of years for the project	Source of funding
This year is year number	
Links to EU programmes	
Links to other programmes and projects	

3 c) Field activity and investigation area

Planned activities in the field (e.g. non-destructive measuring, removing samples, adding chemicals etc.)		
Investigation area; general location and approximate size	GPS locations (WGS 84 or RT 90) Longitude, x	 Latitude, y
Expected impact on environment		
Plans to restore environment when project ends		

SECTION 4: TO BE COMPLETED BY ALL VISITORS

4 a)

Recent publications arising from your fieldwork in the Lake Torne Area or planned conference proceedings. Please give copies to the ANS library.

4 b)

Do you agree that information on your application form, regarding project abstract, contact person, and institute can be published on the Abisko website and in hard copy.

☒ Yes ☐ No

Appendix 5.2 – Application form, Oulanka Research Station

(Very large, semi-remote station reached by road)

APPLICATION OF RESEARCH LICENSE

Addressed to:
Metsähallitus
Pohjanmaan-Kainuun luontopalvelut
Torangintaival 2
93600 Kuusamo

Date of application:

APPLICANT
Name:
Address:
Phone:
E-mail:

The study: title, objective, timetable, appendix if necessary

Specified need for license: sampling, access, else?

Period:

Assistant(s): number, names if necessary

Special needs: temporary structures?

LICENSED AREA
Protected area:

Location: specify, map if necessary

DATE AND SIGNATURE

Name of applicant

APPENDICES
- Research plan
- Map
- Other

Licenses for research in protected areas – instructions

Applying

In some cases, scientific research, when conducted in protected areas (such as Oulanka National Park), needs a license admitted by the responsible managing authority. The license may be accorded by the Nature Conservation Act and area-specific Codes of Conduct for the following activities:

- access to strict nature reserves or restriction zones
- catching or killing animals or collecting plants or fungi, or parts of them, for scientific purposes
- collecting mineral samples for scientific purposes
- setting up temporary structures (hides, traps, and visibly marked study plots)
- feeding or disturbing of animals
- use of motorised vehicles outside roads

The licenses are to be applied in writing (the application form below) from Metsähallitus, Pohjanmaan-Kainuun luontopalvelut, Torangintaival 2, 93600 Kuusamo. As regards the species protected by law, the license has to be applied also from regional environmental authority, Pohjois-Pohjanmaan mpäristökeskus/Luonnonsuojelu, Isokatu 9, 90100 Oulu. The licenses are a public administrative action, which implies that each license will be served as a note for stakeholders that have the right to lodge an appeal to Oulu Administrative Court. Therefore, the licenses will be legally binding decisions only after the appeal period is over. The length of the period is 30 days, starting from the day of service.

Licenses are temporary, at most for three years.

Reporting

The license-holder is expected to give a report after the study, or when the license has expired. The report may be a short, free-form description of the conducted study. It can be either printed, or electronic (.doc is preferred). The report may include a list of observed species, if the study involves species observations. Observations of rare or threatened species should be provided with coordinates. The report will be delivered to Metsähallitus (address above). If a publication will be prepared, it will be greatly acknowledged by both Metsähallitus and Oulanka Research Station.

Note

Even in those cases, where the study license is not obligatory, the findings of the studies may be shared with Oulanka Research Station and Metsähallitus. Especially observations of rare or threatened species will be of great help in the management of the protected areas.

Appendix 5.3 – Application form, Finse Alpine Research Center

(Small, easy access station accessed by train, van, or snow machine)

Finse Alpine Research Center

User registration and agreement

Instructions:

This form must be filled in by *all* users of the research unit *every season*. All users must fill in sections 1, 2 and 5. Project leaders, including students working on their own student projects, must also fill in sections 3 and 4.

1. **Fill in the requested information by clicking on the fields in the form (or use tab/shift-tab to move between fields)**
2. **Save the form and send it by e-mail to the centre director, torbjorn.ergon@bio.uio.no**
3. **Print the form, sign it, and give it to the manager upon arrival to the field station**

1. Name and affiliation

1.1. Name: Click here to enter your name.
1.2. Date of birth (dd/mm/yy): dd/mm/yy
1.3. Gender: Select 'Female' or 'Male'
1.4. I am a: Click here to enter text.
1.5. Institution: Click here to enter name of institution/employer
1.6. E-mail address: Click here to enter e-mail address
1.7. Mobile phone number: Click here to enter phone number
1.8. Do you want to be added to the mailing list for the research centre: Select 'Yes' or 'No'
1.9. If you are a student, please provide name, email address and affiliation of supervisor:
Name: Click here to enter name of supervisor/project leader
E-mail address: Click here to enter e-mail address
Institution: Click here to enter affiliation of supervisor/project leader

i) 1.10 Are you the project leader (students are considered leaders of their own research project)? Select 'Yes' or 'No'

ii) 1.11 If you are not the project leader, please give name, email address and affiliation of project leader
Name: Click here to enter name of supervisor/project leader
E-mail address: Click here to enter e-mail address
Institution: Click here to enter affiliation of supervisor/project leader

2. Health and safety

2.1 Next of kin:
Name: Click here to enter name and phone number
Phone number: Click here to enter phone number
2.2 Will you work on the glacier (written proof of adequate training is required): Select 'Yes' or 'No'
2.3 Will you use the snowmobile at the centre (you must show a driving licence valid for snow mobiles): Select 'Yes' or 'No'
2.4 Risk assessment:

What are the health and safety risks involved with the field work/lab work and what will you do to minimise the risks (include an attachment if necessary)?

What can happen (describe hazard below)?:	How do you judge the risks (what is the probability of an incidence)?	What will you do to reduce the risks, and what will you do in the event of an accident?
Click here to enter text.	Click here to enter text.	Click here to enter text.
Click here to enter text.	Click here to enter text.	Click here to enter text.
Click here to enter text.	Click here to enter text.	Click here to enter text.

3. Project (project leaders only):

3.1 Project title: Click here to enter Project Title
3.2 Start of project: Click here to enter start date
3.3 End of project: Click here to enter end date.
3.4 During which period(s)/season(s)/month(s) do you need access to the field station: Click here to specify which period(s)/season(s)/month(s) you need access to the field station
3.5 Name(s) of other person(s) working in the project at the field station: Click here to enter name(s)
3.6 Write a short description of your project: Click here to enter project description (or include attachment)
3.7 Publicity on the field station web-pages (select one of the two options): Click here and select one of the two options below.
3.8 You may provide a picture for your project description by clicking on the box below:
3.9 Describe your need for lab-space and what you will do in the lab: Click here to enter text (or include attachment).
3.10. Please give a comprehensive list of chemicals that you will bring to the station: Click here to enter text.
3.11. Do you request the use of the snow mobile or any other equipment owned by the research centre? If so, please specify: Click here to specify equipment

4. Environmental impact and animal welfare (project leaders only):

4.1. Please give a detailed account where you address the following questions: How does your project affect the local natural environment? Are there any environmental risks involved? What will you do to reduce environmental impact and risks? Click here to enter text.
4.2. Does your project have any animal welfare issues? If so, please give details: Click here to enter text.
4.3. If you plan to leave any marking sticks or other material in the field, please provide detailed information about type of material, where the material will be put out and how long it will remain in the field: Click here to enter text.
4.4. Will your project require any permits from local or national authorities? If so, please describe what permits you need to obtain and the status of your application: Click here to enter text.

5. Agreement and signature

Keys given: _____
By signing this document I confirm that I have read thoroughly and agree to the Conditions for using the field station (printed on the front of this form), and I understand that any breach of these conditions may lead to exclusion from the research station.

_____
Place, date and signature

Appendix 5.4 – Application form, Zackenberg Research Station

(Small to medium sized, very remote station reached by chartered plane)

Application form for access to Zackenberg 2013

Any research project planning to implement a scientific activity at Zackenberg Research Station (ZERO-Zackenberg) and/or the branch facility at Daneborg (ZERO-Daneborg) must apply for access. This is done by completing and signing the present form (**one project per application form**) and relevant appendixes, and sending it to: The Zackenberg Secretariat zackenberg@dmu.dk **before 22 February 2013**. The form must be completed on computer – not written in hand.

The Zackenberg Secretariat will take care of all practicalities in relation to your travel to Zackenberg, including the application for a permit to travel into the National Park of North and Northeast Greenland.

Before you complete and submit this form, you must read **ZERO Site Manual**. When signing this form as a principal investigator (PI) you acknowledge and accept the conditions and requirements in the ZERO Site Manual as well as the responsibility to inform all your co-workers of the contents of this manual. We need all the information asked for in the form, and therefore we cannot approve your project without a completed form.

We kindly inform you that staying at Zackenberg is at your own risk. All project participants (including yourself) should be properly insured during their stay at Zackenberg (i.e. having relevant search and rescue insurance (SAR), company injury insurance, medical insurance and other relevant insurances) either by an insurance issued by a commercial insurance company or by self-insurance by their institution. The Department of Bioscience, Aarhus University, takes no responsibility for the safety of users of Zackenberg Research Station.

1. Permit number*

*** To be filled in by the Zackenberg Secretariat**

2. Research site

ZERO - Zackenberg ☐ **ZERO - Daneborg ☐**

Other ☐ If other, please specify:

3. Project title

4. Principal investigator (PI)

5. Institution of PI

Institution:
Address:
Phone:
E-mail:
Institutional VAT/CVR-number:
Contact person (in case of emergency) while PI is in the field (institution):
Phone:
E-mail:

6. Specify all persons going to Zackenberg/Daneborg (including the PI, if he/she participates)

1. Name:
Date of birth:
Institutional address:
Contact (e-mail and phone no):
Nationality:
Proposed field period (start and end date):
Airport (start and end):
Name, phone number and e-mail of the nearest relative:
Short description of the participant's experience working in Greenland/Arctic areas:

2. Name:
Date of birth:
Institutional address:
Contact (e-mail and phone no):
Nationality:
Proposed field period (start and end date):
Airport (start and end):
Name, phone number and e-mail of the nearest relative:
Short description of the participant's experience working in Greenland/Arctic areas:

3. Name:
Date of birth:
Institutional address:
Contact (e-mail and phone no):
Nationality:
Proposed field period (start and end date):
Airport (start and end):
Name, phone number and e-mail of the nearest relative:
Short description of the participant's experience working in Greenland/Arctic areas:

4. Name:
Date of birth:
Institutional address:
Contact (e-mail and phone no):
Nationality:
Proposed field period (start and end date):
Airport (start and end):
Name, phone number and e-mail of the nearest relative:
Short description of the participant's experience working in Greenland/Arctic areas:

…

7. Health problems: Does anyone of your project participants (including yourself) have physical or mental health problems that will require special medication or precautions during your stay at Zackenberg/Daneborg? If so, please provide all pertinent information in **appendix A**. Notice that the Department of Bioscience, Aarhus University, will take no responsibility for problems caused by any of the health problems you list. The information given in appendix A will be treated as confidential between you and the Zackenberg Secretariat.

8. Project objectives and abstract of activities for the forthcoming field period (max. 2000 characters at font size 10):

9. Activity area: Indicate on the map(s) (appendix B and/or appendix C) in which zone(s) you anticipate field activity for your project. Specify plans for any item left on the study site

after the field period. If your research positions are located within the Zackenberg Valley (Area 1) then please include a map (1:50 000) indicating your initial placement of these. Note that the specific location of your plots etc. will have to be approved by the scientific leader at Zackenberg. For information about the positions of present and past plots etc., please refer to http://gis.au.dk/ZackenbergGIS/default.aspx.
In case, the project will travel to a location outside these zones, please specify the areas on a map (1: 250.000) and provide UTM positions. Information on possible camp locations and routes between sites/camps outside the Zackenberg Valley must also be provided.

10. Means of transportation within/to-from activity area (check appropriate):

On foot ☐ Ski ☐ Snow mobile ☐ Boat ☐

Other ☐ If other, please specify:

11. Description of any planned habitat or species 'manipulation' or 'destruction':

12. Plans for future field periods: List briefly your plans for continuation of the project as well as personnel and field periods.

13. Insurance: All persons going to Northeast Greenland must have proper insurances/self-insurances including a travel insurance covering costs in relation to a possible search and rescue/evacuation. Please, fill in **appendix D** (research institution) or **E** (insurance company) with relevant information concerning insurance/self-insurance. For researchers employed at Danish research institutions, please state name of insurance company and card number for each participant.

14. Food: Please state if any of the participants in your project have special diet preferences, such as being a vegetarian, not eating fish, allergies etc.

15. Radio permit: Zackenberg Research Station has radio permits pertinent for the different means of communication (HF, VHF, PLB and Satellite) provided by the station. Please indicate whether you need to rent a PLB (Personal Locater Beacon) from the research station. A PLB is demanded if your research area is not covered by the local VHF station. If you or your project wants to bring your own means of communication, you have to apply for a radio permit at

Radioforvaltningen@nanoq.gl and you have to inform the Zackenberg Secretariat about the ID for the PLB. The Secretariat will forward this information to the Greenland Command.

16. Firearm permit: ZERO-Zackenberg and ZERO-Daneborg have firearms with valid firearm permits at the research stations.

17. Activities, which require an additional permit (check appropriate). Please notice that
after your application has been accepted by the Coordination Group for Greenland Ecosystem Monitoring, you will be informed about the additional permit(s) you have applied for. The following might be relevant:

☐ Research on mammals, birds and fish. Send your application to: nnpan@nanoq.gl

☐ Research on biological resources e.g. ice cores, soil, sediment and sea ice. Send your application to: nhlm@nanoq.gl

☐ Research on minerals. Send your application to bmp@nanoq.gl

☐ Area allotment. Send your application to landsplan@nanoq.gl

☐ Research on archaeological artefacts, meteorites or fossils. Send your application to nka@natmus.gl

☐ Archaeological excavations. Send your application to nka@natmus.gl

☐ Other, please specify:

Please notice – all application forms can be downloaded from
http://naalakkersuisut.gl/en/About-government-of-greenland/Travel-activities-in-remote-parts-of-Greenland/Procedure-and-forms

18. Registration of invasive projects: Please acknowledge (yes/no) that you or your co-workers must fill in 'Registration of invasive projects (**Appendix F**) with UTM coordinate of all research sites, plots, pegs etc. before leaving Zackenberg Research Station.

19 Zackenberg Annual Report: Please acknowledge (yes/no) that you must contribute to the Zackenberg Ecological Research Operations Annual Report and that you must deliver a list of the publications coming out of your research at Zackenberg Research Station. (For research projects, the text must be no longer than 3000 characters (i.e. one A4 page) and with a maximum of three tables/figures/photos.

20. Airstrip at Zackenberg/Disclaimer of Liability

Please notice that the airstrips at Zackenberg, Daneborg and Mestersvig are classified as inadequate aerodromes. Any passenger to Zackenberg shall sign a Disclaimer of Liability to the airline company, Norlandair, providing air transport to Zackenberg claiming that he/she has been informed that on the air route to Zackenberg inadequate aerodromes can be used as a landing fields. Inadequate aerodromes can increase the probability of damages and injuries.

The airline company Norlandair bears no additional liability (whether in contract, tort or otherwise) for any loss, damage or injury of any nature beyond the liability of Norlandair insurance policy (regulated by the Danish law, Luftfartsloven) on the base that inadequate aerodrome is used as a landing field.

The PI is responsible for that all participants in project are made aware of, and sign the disclaimer of liability at Akureyri Airport or Constable Point Airport.

With my signature I acknowledge and accept the conditions and requirements for working at ZERO - Zackenberg and/or ZERO - Daneborg, as stated in the ZERO Site Manual and that all participants will be made aware of the contents of the KNNO Expedition Permit, which is issued by the Greenlandic Ministry of Domestic Affairs, Nature and Environment.

The application form must be signed!

Date **Signature**

Appendix 5.4 – Local transport and cargo forms, Zackenberg Research Station, Greenland

Local transportation at ZERO-Zackenberg/ZERO-Daneborg

If your project needs support for local transportation, such as:

Transport by ATV: Cargo transportation in the nearest surrounding of Zackenberg Research Station.

Transport by tractor: Cargo transportation in the surrounding of Zackenberg Research Station or Daneborg.

Transport by boat: Only possible after sea ice has left the fjord, approximately mid-July.

Use of snow mobile: From the opening of the station in spring to approximately mid-June. Not available in Daneborg now.

Airlift or transport by helicopter: Please notice that mobilising a helicopter to Zackenberg is extremely expensive. However, there might be helicopters stationed in the area. The Zackenberg logistics can advise you concerning this.

Please fill in the form and send it to zackenberg@dmu.dk together with your application form.

Form of transport	Zackenberg or Daneborg	App. date	Cargo type	Number of persons

Logistics – Goods and cargo

Notice: In order to optimise the use of aircraft and reduce costs you must in advance inform the logistics about the amount of goods and excess luggage to be flown to Zackenberg and Daneborg. Not notified freight will have low priority and will only be launched when there is available capacity in an aircraft.

Cargo may weigh up to 40 kg per unit. If the weight of the unit is more than 40 kg a special agreement must be made with the logistics.

Dangerous goods: If cargo contains any kind of dangerous items such as: Chemicals, ammunition, weapons, flame bar substances' and liquids, gasses, high pressure containers, medicine, substances containing virus, bacteria or radioactive substances, please contact the Zackenberg logistics before shipping!

Dangerous goods must be delivered in approved containers and not packed with general goods. A data sheet must be provided with the cargo. Shipping of dangerous goods will be billed at current rates.

Freight insurance: Cargo being handled by the Zackenberg logistics is not insured by the Department of Bioscience. It is therefore your own responsibility to have your cargo, properly insured.

Delays: Zackenberg Research Station is situated in a very remote location, and transportation of cargo and passengers is therefore very dependent on weather conditions. The Department of Bioscience takes no responsibility for any costs related to possible delays of your cargo.

Packing and marking of cargo: All cargo must be able to withstand rough handling and wet conditions. We do not accept cargo packed in cardboard boxes. All cargo must be properly marked with Sender, receiver, weight, volume, content, coli number and priority number. Please use marking that can withstand rough handling and wet conditions.

Other requirements

Camp: Logistics at Zackenberg can provide full equipment for a field camp of up to 10 persons. If your project need to camp in the surroundings area of Zackenberg/Daneborg please contact the logistic department.

Support: If your project needs support of a logistician or you need special tools or equipment please contact the logistic department.

Cargo to Zackenberg/Daneborg

A: Ship freight from Denmark to Daneborg. The cargo will have to leave Denmark mid-July and will arrive in Daneborg in early August. The cargo will be airlifted to Zackenberg some days later. This is the cheapest way to send cargo to Zackenberg/Daneborg. However, you should not expect your cargo to be in Zackenberg before 15 August.

B: Ship freight from Copenhagen to Akureyri (Iceland) combined with airfreight from Akureyri to Northeast Greenland. Cargo has to leave Copenhagen three to five weeks before the time; you want it to arrive in Northeast Greenland.
C: Airfreight from Copenhagen/Europe to Northeast Greenland. Cargo will go from Copenhagen/Europe via Akureyri to Northeast Greenland. Cargo has to leave Copenhagen/Europe approximately two weeks before the expected time of arrival in Northeast Greenland. This is the most expensive way of sending cargo to Zackenberg.

Mean of transport (A, B, or C)	**Content**	**Size (h x l x w) in cm**	**Weight**	**Priority**	**Latest time of arrival**

Cargo from Zackenberg/Daneborg

D: Ship freight from Daneborg/Zackenberg to Europe: Cargo will leave Daneborg in early August and will arrive in Europe, at an address of your choice, four to six weeks later. Cargo needs to be in Daneborg one to two weeks before shipping. Cargo from Zackenberg will be airlifted to Daneborg. This is the cheapest way to send cargo from Daneborg/Zackenberg.

E: Airfreight from Northeast Greenland to Akureyri combined with ship freight from Akureyri (Iceland) to Copenhagen. Cargo will arrive in Europe, at an address of your choice, three to five weeks later.

F: Airfreight from Northeast Greenland to Europe. Cargo will arrive in Europe, at an address of your choice, three to ten days later. This is the most expensive way to send cargo.

G: Airfreight from Northeast Greenland to Constable Point combined with ship freight from Constable Point to Europe. Cargo will arrive in Europe, at an address of your choice, six to eight weeks later. Cargo needs to be in Constable Point in late August.

Mean of transport (D, E, F or G)	**Content**	**Size (h x l x w) in cm**	**Weigh t**	**Priorit y**	**Latest time of arrival**

Appendix 5.5 - Generalised application form based on best practice examples

The generalised form below is meant as inspiration for station management. Stations need to develop application forms that suit their specific needs. A station may choose to use some of the elements below, but can also add additional items relevant for their specific station.

Generalised model of a station access application form:

1. **Application submission address or e-mail (not needed for fully web-based application systems).**

2. **Information on applicants, including:**
   - Name.
   - Nationality.
   - Academic degree (student may be asked to add supervisor).
   - Current profession.
   - Contact details.
   - Institution (incl. contact details).
   - Billing address.
   - Next of kin (incl. contact details).

3. **Project description, including:**
   - Project title.
   - Project description.
   - Activity area.
   - Duration of the project (years).
   - Start and end dates of current visit.
   - Links to other programmes and projects.
   - Expected impact on environment.
     - Sampling and export of specimens, rocks, soils, genetic resources, etc.
     - Manipulative studies (shading, treatments, etc.).
     - Handling of live animals.
     - Use of non-indigenous species/genes.
     - Setting up infrastructure.
     - Damages to the environment from transport.
     - Use of chemicals.
     - Etc.
   - Mitigation measures and plans to restore environmental conditions if needed.
   - Activities which require an additional permit from authorities (list all possible permits applicable to activities carried out at the station. For example, permits related to:
     - Handling of live animals.
     - Collection and research on genetic resources.
     - Collection and research on minerals.
     - Archaeological investigations.
     - Installation of infrastructure (area allotment).
     - Other type of permits.
   - Health and safety risks associated with fieldwork.
     - Work on glaciers, sea ice, sea, lakes, rivers, cliffs.
     - Years of experiences working in similar areas or similar activities.
   - Logistical requirements.
     - Means of transport to and from field station.
     - Means of transport in field (e.g. need for vehicle or boat).

- Need for lab space and instrumentation.
- Specific food requirements (vegetarian diet, food allergies).
- Freight needs.
- Other support requirements.

4. **Health and safety issues**
   - Health status of applicants.
     - Medical conditions.
     - Chronic deceases.
     - Handicaps.
     - Medication.
     - Etc.
   - Medical statement from doctor (if needed).
   - Documentation of valid insurance (if needed).
   - Documentation of valid radio permit (if needed).
   - Documentation of valid fire arm permit (if needed).
   - Disclaimer to be accepted by applicant (if needed).

5. **Conditional requirements (that station management want applicants to be aware of)**
   - Principal investigator responsible for making all participants:
     - Having read relevant station information documents.
     - Being aware of permit contents and conditional requirements (both station access and authority permits).
   - Provide end of project report (every year for multiple year projects).

6. **Date and Signature by applicant**

7. **Possible appendices**
   - Research plan.
   - Map of research area and transport routes.
   - Required documentation.
   - Authority permits (if required).

Appendix 6 – Health and safety

Appendix 6.1 – Insurance statement, independent groups

Government of Greenland

INSURANCE STATEMENT

For expeditions in Greenland

TO THE DANISH STATE:

Expedition number:

Title of expedition:

Name of all expedition members:

Period(s) of field activity in Greenland:

Activity area(s) in Greenland:

It is hereby acknowledged that the Danish State will be reimbursed by the undersigned insurance company for any expense paid by Danish authorities and derived from implementing Search and Rescue (SAR) operations for the expedition as a whole, irrespective of any limitation in policy clauses, for the amount of:

DKK 1.000.000, - (one million)

Furthermore, the Danish State will be reimbursed for any expense derived from evacuation (ambulance) transport for each individual participant of the expedition, irrespective of any limitation in policy clauses, for the amount of:

DKK 280.000, - (two hundred eighty thousand)

Name of insurance company: **Name of contact person:**	**Company Stamp**
Address of insurance company:	
Phone number: **Fax number:**	
Date and signature of responsible insurance agent:	

Deadline:

The completed and signed original Insurance Statement must be received by the Ministry of Domestic Affairs, Nature and Environment no later than 8 weeks prior to expedition departure:

Department for Domestic Affairs, Nature and Environment (NNPAN)

Indaleqqap Aqqutaa 3
Postboks 1614, 3900 Nuuk
TEL.: (+299) 34 50 00, FAX: (+299) 32 52 86, E-mail: exp@nanoq.gl

Appendix 6.2 – Insurance statement, self-insured institutions

Government of Greenland

INSURANCE STATEMENT

For research expeditions/projects in Greenland

TO THE DANISH STATE:

Expedition number:

Title of expedition/ research project:

Name of all expedition members:

Period(s) of field activity in Greenland:

Activity area(s) in Greenland:

It is hereby acknowledged that the Danish State will be reimbursed by the undersigned insurance company for any expense paid by Danish authorities and derived from implementing Search and Rescue (SAR) operations for the expedition as a whole, irrespective of any limitation in policy clauses, for the amount of:

DKK 1.000.000, - (one million)

Furthermore, the Danish State will be reimbursed for any expense derived from evacuation (ambulance) transport for each individual participant of the expedition, irrespective of any limitation in policy clauses, for the amount of:

DKK 280.000, - (two hundred eighty thousand)

Name of research institution: **Name of contact person:**	**Institution Stamp**
Address of research institution:	
Phone number: **Fax number:**	
Date and signature of responsible research institution:	

Deadline:

The completed and signed original Insurance Statement must be received by the Ministry of Domestic Affairs, Nature and Environment no later than 8 weeks prior to expedition departure:

Department for Domestic Affairs, Nature and Environment (NNPAN)

Indaleqqap Aqqutaa 3
Postboks 1614, 3900 Nuuk
TEL.: (+299) 34 50 00, FAX: (+299) 32 52 86, E-mail: exp@nanoq.gl

Appendix 6.3 – Risk assessment, Sermilik Research Station

(Unmanned, small and remote station reached by helicopter or boat)

Risk analysis and safety procedure for the Sermilik Research Station, Greenland

Analysis of risks:

1. **Location of the station and camps**
   - 1.1 Piteraq, Storms
     In the area of Ammassalik, wind speed close to a hurricane can occur. These are known as Piteraqs. Less powerful storms, known as Naqajak, can also occur. Buildings and tents can be damaged or blow away.
   - 1.2 Avalanche or landslides
     On steep slopes with snow, avalanches can occur. Steep cliff sides and slopes with loose rocks can cause landslides. Both can be deadly. Icebergs can also break or tip and cause waves or small tsunamis.
   - 1.3 Fire risks
     Using open fire can cause risks. Burning buildings or tents can cause danger to yourself and the environment. Also vital supply of food, equipment and fuel can be lost.
   - 1.4 Polar Bears
     Polar bears are observed close to the station.

2. **Residential and service**
   - 2.1 Fire risk
     - 2.1.1 Cooking
     - 2.1.2 Heating
     - 2.1.3 Service on motors/generators (220 volt/12 volt)
     - 2.1.4 Smoking
   - 2.2 Explosion hazards
     - 2.2.1 Pouring and storing of fuel
     - 2.2.2 Recharging of batteries used for the generator
     - 2.2.3 Gas cooker
     - 2.2.4 Storing and use of ammunition
   - 2.3 Carbon monoxide (CO) toxicity
     - 2.3.1 Heating, especially during night
     - 2.3.2 Gas cooker
     - 2.3.3 Operation of motors/generators
     - 2.3.4 Smoking
   - 2.4 Electric shock
     - 2.4.1 Operation of electrical installations
     - 2.4.2 Physical contact of electrical installations

3. **Fieldwork**
   - 3.1 Mechanical damages

Walking in the mountains and on glaciers can result in bone fractures and sprains. Transportation and handling of goods can also result in mechanical damages.

3.2 Drowning
Larger rivers, lakes and the sea imply the risk of drowning. Wearing waders and sailing in boats without life west and proper clothing can be fatal.

3.3 Polar bears
Polar bears have been seen close to the station, both in summer and winter time.

3.4 Frost and cold injuries
Poor clothing can be fatal.

3.5 Glaciers
Walking on glaciers can be fatal due to crevasses and falling snow, ice and rocks.

3.6 Accidental shots
The use of weapons can cause accidental shots.

3.7 Chemicals
The use of chemicals for analysis can cause danger.

3.8 Electrical shocks
The use of electrical equipment and generators can give shocks.

4. Communication

4.1 Radio communication
All kinds of radio communication can fail due to atmospheric disturbances or poor signal behind a mountain.

4.2 Transport
All kind of transportation in the area can be dangerous due to sudden weather changes, specially rain, snow, strong winds and fog.

How to avoid risks:

1. Location of the station and camp

1.1 Buildings and tents should be placed under sheltered conditions or close to something which can give shelter, see 1.2 below.

1.2 Buildings and tents should NOT be placed below gorges or along slopes with accumulations of snow and rocks. Sailing close to icebergs should be avoided. Campsite and buildings should be placed a safe distance away from the sea, to avoid the high tide and waves.

1.3 Keep distance between buildings and tents. Only use fire in an open and non-flammable area. Keep firefighting equipment close and ready for use. Think of evacuation routes.

1.4 Observe the terrain frequently. Install an alarm system.

2. Residential and Service

2.1 Fire risks

2.1.1 One person is responsible for supervision of cooking stove, oven and field cookware when at use. Fire equipment should be easy accessible. Turn off the gas bottles after use.

2.1.2 Only use the oven when persons are in or near the house. Remember to turn off the oven during nights or arrange watching shifts.

2.1.3 As for 2.1.2

2.1.4 Smoking is not allowed inside the buildings, only outside.

2.2 Explosion hazards

2.2.1 Mark fuel containers with type of fuel. The fuel containers should be stored safely, far away from campsite, open fires, electrical installations and generators or motors in use. Refuelling should be done outside.

2.2.2 Batteries should be recharged as the instructions for charging equipment. Make sure of good ventilation of the battery.

2.2.3 Gas cooker should be installed, following regulations. Only use gas under supervision. Turn off the gas when leaving the house.

2.2.4 Ammunition should be stored dry and cool and away from open fires and electrical installations. The use of it should be recorded. Make sure of durability.

2.3 Carbon monoxide (CO) toxicity

Same regulation as for 2.1.1-2.1.4

2.4 Electric shock

2.4.1 Read and follow the instructions carefully when using the power plant and other electrical installations. See also the regulations against Fire risk and Carbon monoxide (CO) toxicity. Do not turn off fire with water!

2.4.2 Make sure that the installation is turned off before touching.

3. Fieldwork

3.1 Mechanical damage

Walking carefully in the area is advised. Always carry personal safety equipment: bandages, weather protection, signal equipment, food and water. Always make agreements on transportation route and time of returning to the camp.

3.2 Drowning

ALWAYS use life jacket. It is required not to be alone. Always make sure of adequate clothing. If available, use clothing that protects against cold water.

3.3 Polar bears

Minimum 1 firearm/weapon pr. group. Observe the terrain frequently. Try to avoid encounters with polar bears. If possible call the police in Tasiilaq and ask for advice if a bear is observed. Shooting is only allowed in case of emergency. Shooting should be done by the person with the best knowledge about weapon handling.

3.4 Frost and cold injuries

Be properly clothed. Always bring extra clothing and clothes which is wind- and waterproof.

3.5 Glaciers

Only people who have sufficient knowledge about glaciers should walk on them. Others should bring someone who is experienced with walking on glaciers.

3.6 Accidental shots

Shooting instructions should be followed carefully. One person, experienced in handling weapon, from each group should be responsible for the weapon. Be careful when cleaning weapon.

3.7 Chemicals

Common instructions for use of chemicals should be followed carefully. Protect eyes when pouring and handling chemicals.

3.8 Electrical shock

As for 2.4, always be careful when using a mobile generator.

4. **Communication**
   - 4.1 Make agreements about communication within each group. Respect those agreements. Arrange procedure upon failure.
   - 4.2 As for 3.1, 3.2, 3.4 and 3.5

Responsibilities:

The owner of the Station (Institute of Geography and Geology, University of Copenhagen) has the responsibility that the installations of the Station are safe and legal.

The expedition leader has the responsibility for instruction of safety regulations and compliance with these while staying at the Station.

The group leader for a project has the responsibility for safety instructions and safety equipment related to the project.

Participants of the expedition and users of the station, who are not part the University of Copenhagen, **must be** insured. Implicating that no claims can be made against the Institute of Geography and Geology, University of Copenhagen, Denmark.

Morten Pejrup/ Bent Hasholt Station manager of Sermilik Research Station, Greenland

Appendix 6.4 – Declaration of indemnity, Samoylov Research Station/AWI

(Small very remote station reached by helicopter or boat)

DECLARATION OF INDEMNITY

- for participants of expeditions with
- ALFRED-WEGENER-INSTITUTE FOR POLAR AND MARINE RESEARCH
Federal Republic of Germany

As far as permitted by the laws valid in the Federal Republic of Germany, I waive any claims against the Alfred Wegener Institute for Polar and Marine Research (AWI) and the persons employed in performing an obligation of the AWI with respect to any physical injury, property damage and property loss that I may incur while I participate in the Expedition of the AWI as far as those are not caused intentionally or by gross negligence.

I will be liable within the scope of statutory provisions for the loss, damage or injury caused culpably by me in the course of the Expedition. In respect of such loss, damage or injury I will release the AWI from third party claims.

Expedition: _____

Name: _____

Address: _____
_____
_____
_____

Date / Signature

_____

This declaration has to be signed by every expedition member except AWI employees.

Mail the original of this Declaration of Indemnity together with the Personal Questionnaire to the following address:
Alfred Wegener Institute for Polar and Marine Research - Logistics
Postfach 12 01 61
D-27515 Bremerhaven / Germany

Appendix 7 – Environmental management

Appendix 7.1 – Example of generalised contents from Environmental Impact Assessment

Appendix 7.2 – EU EIA Screening Checklist with thought example (in blue text)

EU Environmental Impact Assessment

- SCREENING CHECKLIST to assess the need for EIAs for proposed activities

INSTRUCTIONS

This checklist is designed to help users decide whether an EIA is required based on the characteristics of a project and its environment.

Start by providing a brief description of the project.

Then using available information about the project, answer each question in Column 2:

- Yes - if the answer is yes
- No - if the answer is no
- ? - if the answer is don't know

If you are not sure what might be important use the more detailed lists of questions in the Scoping Guidance to help answer the question (see http://ec.europa.eu/environment/eia/eia-support.htm).

Briefly describe the relevant characteristic of the project or its environment and then consider whether any effect that is likely to result is likely to be significant and enter the response in Column 3 with a note of the reasons why. Use the next Checklist on Criteria for Evaluating Significance to help answer the question 'Is this likely to result in a significant effect?'.

THE SCREENING CHECKLIST (blue text below is an example)

Questions to be Considered For further guidance on factors to be considered see the more detailed questions listed in the Scoping Guidance	**Yes / No /? Briefly describe**	**Is this likely to result in a significant effect? Yes/No/? – Why?**
Brief Project Description: Establishing a bridge across river. Steel bridge anchored in permafrost and spanning 45 meters. Stones protecting against flooding.		
1. Will construction, operation or decommissioning of the Project involve actions which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.)?	Yes - Increase use of land on the other side of the river.	No - is not likely to have significant impact (no presence of vulnerable/sensitive species /habitats.
2. Will construction or operation of the Project use natural resources such as land, water, materials or energy, especially any resources which are non-renewable or in short supply?	No – stones are abundant.	No.
3. Will the Project involve use, storage, transport, handling or production of substances or materials which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health?	No – drilling machines only used by trained and skilled personnel.	No.
4. Will the Project produce solid wastes during construction or operation or decommissioning?	Yes – Steel construction will have to be decommissioned	No – plan for decommissioning exist, export from area.
5. Will the Project release pollutants or any hazardous, toxic or noxious substances to air?	No.	No.

Questions to be Considered For further guidance on factors to be considered see the more detailed questions listed in the Scoping Guidance	**Yes / No /? Briefly describe**	**Is this likely to result in a significant effect? Yes/No/? – Why?**
6. Will the Project cause noise and vibration or release of light, heat energy or electromagnetic radiation?	Yes - in construction phase.	No – temporary effect.
7. Will the Project lead to risks of contamination of land or water from releases of pollutants onto the ground or into surface waters, groundwater, coastal wasters or the sea?	No.	No.
8. Will there be any risk of accidents during construction or operation of the Project which could affect human health or the environment?	Yes – Use of drilling machine and slinging of heavy steel constructions.	No – using only trained and experienced personnel.
9. Will the Project result in social changes, for example, in demography, traditional lifestyles, employment?	No.	No.
10. Are there any other factors which should be considered such as consequential development which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality?	See point 1.	
11. Are there any areas on or around the location which are protected under international or national or local legislation for their ecological, landscape, cultural or other value, which could be affected by the project?	Yes – Bridge is inside National Park.	No – area allotment granted by authorities.
12. Are there any other areas on or around the location which are important or sensitive for reasons of their ecology e.g. wetlands, watercourses or other water bodies, the coastal zone, mountains, forests or woodlands, which could be affected by the project?	No.	No.
13. Are there any areas on or around the location which are used by protected, important or sensitive species of fauna or flora e.g. for breeding, nesting, foraging, resting, overwintering, migration, which could be affected by the project?	Yes – Pink footed goose moulting area.	No – use of area regulated.
14. Are there any inland, coastal, marine or underground waters on or around the location which could be affected by the project?	Yes – river flow.	No - very limited impact and only during very high floods.
15. Are there any areas or features of high landscape or scenic value on or around the location which could be affected by the project?	No.	No.
16. Are there any routes or facilities on or around the location which are used by the public for access to recreation or other facilities, which could be affected by the project?	No.	No.
17. Are there any transport routes on or around the location which are susceptible to congestion or which cause environmental problems, which could be affected by the project?	No.	No.
18. Is the project in a location where it is likely to be highly visible to many people?	No – No human settlements nearby.	No.
19. Are there any areas or features of historic or cultural importance on or around the location which could be affected by the project?	No.	No – area influenced by erosion.

Appendix 7.2 – EU EIA Screening Checklist (with thought example)

Questions to be Considered For further guidance on factors to be considered see the more detailed questions listed in the Scoping Guidance	**Yes / No /? Briefly describe**	**Is this likely to result in a significant effect? Yes/No/? – Why?**
20. Is the project located in a previously undeveloped area where there will be loss of greenfield land?	No – located in river bed influenced by floods.	No.
21. Are there existing land uses on or around the location e.g. homes, gardens, other private property, industry, commerce, recreation, public open space, community facilities, agriculture, forestry, tourism, mining or quarrying which could be affected by the project?	No.	No.
22. Are there any plans for future land uses on or around the location which could be affected by the project?	No.	No.
23. Are there any areas on or around the location which are densely populated or built-up, which could be affected by the project?	No.	No.
24. Are there any areas, on or around the location, which are occupied by sensitive land uses e.g. hospitals, schools, places of worship, community facilities, which could be affected by the project?	No.	No.
25. Are there any areas on or around the location which contain important, high quality or scarce resources e.g. groundwater, surface waters, forestry, agriculture, fisheries, tourism, minerals, which could be affected by the project?	No.	No.
26. Are there any areas on or around the location which are already subject to pollution or environmental damage e.g. where existing legal environmental standards are exceeded, which could be affected by the project?	No.	No.
27. Is the project location susceptible to earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions e.g. temperature inversions, fogs, severe winds, which could cause the project to present environmental problems?	Yes – flooding, severe winds and permafrost.	No – Has been addressed in the design of the bridge.
Summary of features of project and of its location indicating the need for EIA Limited impacts (energy during transport and construction, use of new land areas, decommissioning of steel construction). Activities in more easily available land areas regulated in relation to sensitivity. Robustness of construction, anchoring in permafrost and stones used for protection around foundation ensures resistance to flooding and extreme winds. Plan for decommissioning exist. Environmental impacts are considered low and therefore no need for EIA.		

Appendix 7.3 - Environmental impacts and mitigation measures for research station operations (based on Zackenberg Research Station, Greenland).

Resource/Activity	Impact	Mitigation
Water	Drainage	Minimise use - Restrictions on showers, laundry. - Water saving kitchen routine and equipment. - Influence staff and user behaviour – information materials.
	Emission of waste water adding nutrients and other substances to the environment	Minimise emission - Minimise use (see above). - Remove pollutants before emission to the environment. - Emission of spill water with non-hazardous contaminants to the sea or large fast flowing river ending up in the sea. - Transport wastewater to treatment plant.
Energy (fuel based) – whether for heating, electricity, transport, equipment, etc.	Emission of CO_2 and other air polluting particles	Reduce consumption - Use sustainable energy solutions where practical and economical possible. - Use energy efficient equipment (best available and affordable). - Reduce heat loss from building (proper insulation). - Optimise transport (use all seats, plan ahead to limit the need for emergency supply runs).
	Spills - contamination of environment	Minimise risk - Ensure safe transport of fuel. - Ensure proper storage. - Use spill trays. Minimise impact - Establish a station fuel spill contingency and clean-up plan.
	Fuel barrels/containers	Minimise emissions - Burn fuel remains. - Export empty fuel barrels/containers to treatment facility.
	Explosion/fire	Minimise risk

Appendix 7.3 – Environmental impact and mitigation measures (based on Zackenberg Research Station, Greenland)

		- Infrastructure plan preventing or minimizing risk of ignition, injuries and spreading of fire. - Ensure proper storage. Minimise impact - Establish a station fire contingency and clean-up plan.
Garbage	Pollution and contamination of environment.	Minimise production - Limit resource use (e.g. ask suppliers to minimise packaging, buy quality products that last longer, use electronic documents where possible, order only what is needed at the station, order not more than can be consumed at the station (food, medicine or other products with an expiry date, etc.). - Re-use and recycle at station (by products that can be re-used or recycled at the station). - Regulate use of polluting and hazardous substances or find less polluting and dangerous alternatives.
		Minimise emission (see also minimise production above). - Use compressor to minimise shipment volume (not for hazardous materials) Paper, cardboard, wood and natural fabrics: - Re-use and recycle at station. - Export to treatment facility. - Burn. Plastic: - Export to treatment facility. - Burn at high temperatures (certain types of plastic emit almost exclusively CO_2 if burned at high temperatures). Metal: - Re-use and recycle at station. - Export to treatment facility. Glass: - Re-use and recycle at station.

		- Export to treatment facility. Food: - Emit to sea or large fast flowing river terminating at sea (grind to speed up turnover rate). - Export to treatment facility. - (Use for bio-fuel is often not feasible due to low temperatures and limited amounts of leftovers). Medicine: - Export to treatment facility. Chemicals, oil and hazardous substances (incl. radioactive material): - Export to treatment facility. Electronic equipment and batteries: - Export to treatment facility. Other materials (e.g. Styrofoam, glass fibre, artificial fabrics, etc.): - Export to treatment facility.
	Visual contamination	- Influence staff and user behaviour (no littering) – information materials - Field equipment to be removed after use.
Human waste	Adding nutrients to the environment	- Emit to sea or large fast flowing river terminating at sea (grind to speed up turnover rate). - Export to treatment facility.
Transport (walking, skiing, cars, snowmobiles, airplanes, drones, etc.)	Fuel use (see Energy above)	(See Energy above)
	Damaged to vegetation and ground, and disturbance of wildlife	Restrictions on transport: - Protect species or areas. - Designate specific transport routes to minimise risk of erosion, impact on vulnerable species and disturbance of wildlife. - Guidelines for driver behaviour (adjust speed to the circumstances, no fast turns, no rapid acceleration, avoid driving through vegetation, etc.). - Surface conditions (minimum snow depth for snow mobiles, frozen ground or designates routes for ATVs). - Avoid disturbance in sensitive periods and areas (e.g. breeding, nesting,

Appendix 7.3 – Environmental impact and mitigation measures (based on Zackenberg Research Station, Greenland)

		raising young)
Field equipment	Contamination of the environment and visual contamination	Field equipment to be removed after use
Handling of wildlife	Cause disturbance, stress or injuries while handling (e.g. taking samples)	Identify ways of handling animals that minimise risk of stress and injuries
	Taking specimens	Use efficient means for killing animals - Identify appropriate means for specific groups of animals

Appendix 9 – Research and monitoring

Appendix 9.1 - Example of research and monitoring strategy and working programme contents - Zackenberg Ecological Research Operations and Nuuk Ecological Research Operations

Greenland Ecosystem Monitoring – Strategy and working programme 2011 – 2015

http://www.zackenberg.dk/fileadmin/Resources/DMU/GEM/Zackenberg/Nye_Zac_files/GEM_01.pdf

Contents

7 References

Appendix 9.2 - Example of monitored variables at the Abisko Scientific Research Station, Sweden

Responsible organisation in brackets:

ANS	= Abisko Scientific Research Station
SMHI	= Sweden Meteorological and Hydrological Institute
SGU	= Geological Survey of Sweden
IVL	= Swedish Environmental Research Institute
CGB	= Center for GeoBiosphere Science
CALM	= Circumpolar Active Layer Monitoring Network
IRF	= Swedish Institute of space physics

Climate

- Temperature (ANS, SMHI).
- Precipitation (ANS, SMHI).
- Precipitation chemistry (IVL).
- Atmospheric pressure (ANS).
- Relative humidity (ANS).
- Wind speed and direction (ANS).

- Hours of sunshine (SMHI).
- Cloud cover (ANS).
- Global and longwave radiation (ANS).
- UV-A, UV-B (ANS).
- Photosynthetic active radiation PAR (ANS).

- Soil temperature in peat and till (SMHI).
- Active layer of permafrost (CGB at Lund University, CALM).

- Dry downfall (ANS).
- Evaporation (ANS).

- Ice freeze and break up Torneträsk (SMHI).
- Ice thickness (SMHI).

- Snow cover (SMHI, ANS).
- Snow depth (SMHI, ANS)
- Snow profile (ANS).

- Northern lights (IRF).
- Polar stratospheric clouds (IRF).

- $^{14}C/CO_2$ (Ångström laboratory, Uppsala).

Hydrology

- Ground water chemistry of wells in the area of Abisko (SGU).

- Ground water levels of wells in the area of Abisko (SGU).
- Water chemistry of Abiskojokk (SMHI).
- Water level of Abiskojokk (SMHI).
- Water level of Kärkejokk (ANS).
- Water level of Lake Torneträsk (SMHI).

Flora

- Phenology of birch (ANS).
- Phenology of selected species at a mire, Abiskojokk delta, birch forest (ANS) .
- Pollen (Palynological Laboratory, Naturhistoriska Riksmuseet, Stockholm).

Fauna

- Birds (ANS).
- Insects (ANS).
- Reindeers (Länstyrelse).
- Small mammals (ANS).

Physical Environment

- Geomagnetism (SGU).

Appendix 11 – Knowledge capture and data management

Appendix 11.1 – Development of local data capture and storing mechanism

As circumstances differ between stations in the INTERACT network, individual stations may want to take different approaches to developing local data capture and storage mechanisms at their station.

Below are some important issues to consider when developing a local data capture and storage mechanism (e.g. database or simply an excel/access file). It is not a complete list, but meant as inspiration for station management that are developing data handling tools that suit the specific needs of their station.

Important issues to consider when developing data handling mechanism at research stations:

- Identify stakeholder needs.
  - Identify users' needs by talking to relevant stakeholders (e.g. researchers, programme managers, funding agencies, users of the data, etc.).
  - Identify owner institution/national/regional/international databases that can host data or subsets of data generated at the station.
  - Identify international data standards that should be complied with.
- Identify data handling processes, including roles and responsibilities, and data requirements), e.g.:
  - Roles and responsibilities related to data management (e.g. database owner, database manager, data providers, data users, advisory boards and external experts).
  - Data storage platform and technology management (e.g. SQL-server, Access, Excel, etc.).
  - Data backup and recovery strategy (where, when and how?).
  - Data security (database access for managers and users. Who have access to what data and how?).
  - Data delivery deadline (for in-house and external projects).
  - Data delivery agreement (format and time of delivery).
  - Data quality requirements.
  - Data access requirements (user-friendly, intuitive web interphase).
  - Data owners (and citation).
- Design the database (and if relevant the web interface) and test the product.
- Ensure upload of old and new data
  a. Upload existing data into database.
  b. Capture new data through standard data capture and storage procedures.
- Regularly consult all stakeholders to evaluate the data management protocols, and modify as necessary.

Index