CAPARDUS - Capacity-building in Arctic standardization development

Coordination and Support Action under EC Horizon2020
Grant Agreement no. 869673

Project coordinator: Nansen Environmental and Remote Sensing Center

Deliverable 1.1

Review of existing standards and frameworks relevant to the Arctic

Version 1.0

Type: Report

Start date of project: 01 December 2019	Duration:	36 months
Due date of deliverable: 30 November 2020	Actual submission date:	30.11.2020

Lead beneficiary for preparing the deliverable: NERSC

Authors: Peter Pulsifer, Olivia Lee, Jay Pearlman, Michael Køie Poulsen, Finn Danielsen, Torill Hamre, Lisbeth Iversen, Siri Jodha Khalsa, Stein Sandven

Version	DATE	CHANGE RECORDS	LEAD AUTHOR
1.0	30.11.2020	First version	Peter Pulsifer

Approval	Date: 30 Nov 2020	Sign.

Dissemination Level		
PU	Public, fully open	X
CO	Confidential, restricted under conditions set out in Model Grant Agreement	
CI	Classified, information as referred to in Commission Decision 2001/844/EC	

Executive Summary

This report is the first version of a framework for Arctic standards that is focused on identifying the best standards for a particular context and creating a road map for effective adoption of these standards. The report has focus on observing systems and data systems related to natural resource management, safety of operations, tourism, community planning and decision making and tourism.

We use multi-method and mixed methods approaches to carrying out research in support of establishing a "standards" framework. This includes expert analysis and synthesis by members of CAPARDUS team of standards-related documents (the primary method used as the basis for this report). The Arctic Practices (including standards) will have broader adoption when available online through knowledge representation technology (i.e. ontologies and vocabularies). This technology is used to tag digital resources such as protocols, procedures, manuals and other documents, in order to link related resources and support significantly improved (semantic) search.

The main section of the report is the expert analysis and synthesis based on expert knowledge and experience. The section provides the results of the internal review and survey carried out as part of the process to further develop the CAPARDUS methodology and begin the process of analyzing standards selected as relevant to the process. The survey also collected additional classifications such as document types, themes, and subthemes. Much of the effort in the analysis and synthesis process focused on community-focused themes that draw primarily on the following documents that relate to 1) community-based monitoring of coastal sea ice, 2) community-based monitoring of shoreline change, 3) a roadmap for smart and sustainable cities and communities in Norway, and 4) Manaus Letter: Recommendations for the participatory monitoring of biodiversity.

An updated version is planned later in the project.

Contents

1. Introduction

1.1. Overview of CAPARDUS

CAPARDUS is a Coordination and Support Action with the goal to explore ongoing processes of developing standards in selected topics of importance in the Arctic. The project will develop a Comprehensive Framework Model for development of standards, guidelines and practices related to observing systems and data sharing in the Arctic. Furthermore, the project aims to design an Arctic Practice System (APS), which will be a repository of documents (or other communication media) that is searchable on titles, keywords and content. The ACPS will be a tool for co-production of knowledge between scientists, local communities and other stakeholder groups involved in the case studies of the project. Project activities are focused on natural resource management, safety, community planning and decision making and tourism. The project will be based on regional case studies primarily in Greenland, Svalbard, Alaska and Yakutia in Russia. Local community members will be involved in the case studies after signing an informed consent agreement. Other data related topics of importance for Arctic communities will be addressed when relevant in the cases studies.

1.2. Introductory Remark Regarding Project Schedule

Due to the CORONA virus pandemic decease, the project schedule including dates for deliverables will be changed. The timing workshops, dialogue meetings and research schools planned for 2020 have been postponed because it has not been possible to visit any of the locations in Greenland, Alaska or Svalbard and invite locale community members to the events that were planned. New date for these events will hopefully be decided during the first half of 2021. The impact of the delay is not clear yet. If the pandemic continues in 2021 and planned events are further delayed, it is foreseen that an extension of the project period will be required.

1.3. Overview of CAPARDUS Work Packages

The project is divided into the following work packages:
WP1: Establishing a Comprehensive Framework for Arctic Standards
WP2: Case studies in Greenland
WP3: Case studies in Svalbard
WP4: Case studies in Russia
WP5: Case studies in USA
WP6: Arctic Common Practice System
WP7: Synthesis, requirements and recommendation
WP8: Communication and outreach
WP9: Coordination and management

The present report is the first deliverable from WP1.

2. Establishing a Framework for Arctic Standards

2.1. Defining a Framework

In general, a framework is a real or conceptual scheme or structure intended to serve as a support or guide for the building of something that expands the structure into something useful. In the case of CAPARDUS, we are aiming to establish a framework for Arctic standards that is focused on identifying the best standards for a particular context and creating a road map for effective adoption of these standards. To scope this process, CAPARDUS is guided by primary and secondary themes.

Primary Themes

Observing System: Observing and observing systems are foundational to informed decision making over time and the construction of new kinds of knowledge including scientific, local and Indigenous. The arctic community has established that observing and monitoring the Arctic in various ways and across domains and disciplines and sharing of the data and information resulting from this monitoring will provide significant benefits to society. This has been documented in the International Arctic Observations Assessment Framework (IDA STPI/SAON, 2017) and the Impact assessment study on societal benefits of Arctic observing systems (Dobricic et al., 2018). Standards documents related to the Arctic observing system are a central component of the CAPARDUS analysis and framework development process.

Data System: Data result from observation and, when well managed and curated, provide a long-term record of Arctic observations. Scientists focused on Arctic and polar data management and sharing (henceforth the Polar Data Community) has established that effective data sharing will require a set of "standards" and best practices, while recognizing that there are different types of standards and that the form and methods related to standards and best practices must be adapted based on the needs of actors (see Section 3.3.1)

Community Planning and Decision Making: To develop sustainability of Arctic communities, it is essential that planning and decision-making is based on the best available data. In the Arctic, there is a growing number of CBM programs, including Indigenous and Local Knowledge (ILK), which play an important role in addition to scientific systems to provide environmental, climate and resource data. CBM programs are usually driven by needs in local communities to help in resource management, planning and decision making. A key challenge is to enable data sharing between CBM systems and other Arctic observing and data systems and build services upon them. This calls for development of standardization of observing methods and data management. To go into the future it is important to engage with the youth councils in the different communities.

Natural Resource Management: The way natural resources are managed is essential for the livelihood of communities and the Arctic, and in particular in the case studies of the project. Fisheries, hunting, reindeer herding are examples of key means of livelihood in Greenland, Alaska and in Yakutia, Russia. Oil, gas and mineral resources are explored in many regions and can change the lives of people dramatically in cases where the resources are exploited on large scale with industry plants and transport systems. In Svalbard, the community in Longyearbyen was established because of coal mining more than a century ago. At present this industry is

declining the community is forced to develop other businesses e.g. facilitate research hubs and tourism.

Safety of Operations: The increasing number of people travelling to the Arctic as result of shipping, industrial activities, various expeditions and other tourist traffic represent significant risks for accidents. In most areas there is lack of infrastructure for emergency preparedness, search and rescue operations, medical services and transport systems. This implies that even small accidents, which can be handled easily in populated communities, become challenging in remote Arctic areas. To build up safety of operations, both on land, sea and air, is therefore of high priority in Arctic areas. The Polar Code, which entered into force in 2017, is an example of regulations established by International Maritime Organization (IMO) to ensure that there are minimum requirements for ships operating in Polar regions.

Tourism: Tourism is an evolving and important industry in many Arctic regions involving different the generations and genders. This industry provides several opportunities for individuals and communities, but it also introduces several challenges across the topics addressed in CAPARDUS. Conflicts between local communities and tourism can easily occur e.g. the resource management and cruise ships. It is therefore imperative to find solutions how tourism can develop side by side with the traditional activities for a sustainable development of the Arctic communities. In particular, the increased tourism increases the need for safety and preparedness. It is essential that planning and decision-making concerning development of new businesses such as tourism is based on the best available data both to avoid too restrictive regulations hampering sustaining communities in the Arctic region. CBM will be an important tool for this and the tourism can play an important role in collecting the data through citizen sciences.

Ethics, Norms, Responsible Research etc. The ethics and norms that promote equitable participation and responsible research in the Arctic is an important underlying theme that may support future standardization efforts particularly with respect to community-based monitoring projects. Examples of the range of resources that may encompass this theme include principals for conducting research in the Arctic developed by National agencies, and funding institutions, and workshop reports and guidelines for conducting research with Indigenous Arctic communities that have been developed by Arctic Indigenous organizations. It is important to note that best practices, norms and guidelines for working with Indigenous Arctic communities may also be specific to local, regional, or international research efforts, with some more specific guidelines important to follow for different research disciplines (e.g. biomedical research). While this topic has not yet been addressed in detail, some of the relevant cross-cutting issues are described in the preliminary synthesis of the theme on Community Planning and Decision making.

Health, Clean Food, Water: Many community-based monitoring programs in the Arctic include cross-cutting issues of community health and well-being. This holistic view of the human-environment relationship is well described in a conceptual framework of food security (ICC Alaska, 2015), and includes the following dimensions of food security that overlap with CAPARDUS primary themes: 1) accessibility, 2) availability, 3) decision-making, power and management, and 4) health and wellness. For instance, Arctic common practices that relate to community-based monitoring of sea ice and coastal shoreline change for community climate change adaptation planning are also relevant to human health and wellness if these observations can also be used to document impacts to subsistence hunting activities. Specifically, safety while traveling over sea ice, or changing coastal winds, and storm frequency can affect

accessibility and availability of marine mammals and fish that are essential in the subsistence harvests of Indigenous communities across the Arctic. The ability to monitor standards for clean water, and uncontaminated food are also cross-cutting issues that overlap with themes on natural resource management either directly through management of healthy living resources, or indirectly via management of contaminants in mining, or oil and gas development.

Secondary Themes

A set of secondary themes have been identified by the CAPARDUS team as important: *Infrastructure; Transportation*; *Legal and Regulatory Standards*; *Pollution*. These themes were not addressed in the work done to date. Additional expertise within the community is being sought.

3. Methods

3.1. Introduction

With respect to methods, in general, we are using a multi-method and mixed methods approaches to carrying out research in support of establishing a "standards" framework. This includes expert analysis and synthesis by members of CAPARDUS team of standards-related documents (the primary method used as the basis for this report). As we move forward through population of the Arctic Practices System with more documents, more formal Content Analysis (quantitative/qualitative), surveys, semi-structured interviews, and other grounded theory methods and tools will be used to formalize the research methods and outcomes. This section outlines these methods with recognition that some methods are not yet confirmed due to the delays introduced by COVID-19. Responsible community-based research, including the confirmation of appropriate methods, requires engagement and partnership with community members. This has not been possible to date.

This section provides an overview of the methods already in use or planned within the CAPARDUS project.

3.2. Establishing a Repository – Arctic Practices System

3.2.1. Rationale and background

A foundational component of CAPARDUS is the Arctic Practices System being utilized and refined through WP6. Arctic Practices (including standards) will have broader adoption when available online through knowledge representation technology (i.e. ontologies and vocabularies). This technology is used to tag digital resources such as protocols, procedures, manuals and other documents, in order to link related resources and support significantly improved (semantic) search. Use of these methods in the Arctic Practices System will advance standardization by making information searchable and accessible for a wide range of users. The scope of WP6 will include the co-design of a repository for documents and other material describing common Arctic practices, based on results from WP1-WP5 and will be aligned to with the FAIR and CARE principles. These inputs will form the concept for a fit for purpose Arctic Practices System. The outcome of the co-design process will be documented in a

roadmap. Additionally, the APS' basic functions are being piloted through contributions of Arctic practices to the Ocean Best Practice System (OBPS; www.oceanbestpractices.org), which has been initiated in the AtlantOS project (https://www.atlantos-h2020.eu/) . As part of the framework development, a model will be created that identifies and describes key relationships and creates links between and among different standards and links with other relevant entries (e.g. legislation, academic bodies of knowledge). This model can then be used with identified documents addressing common practices from WP1-WP5, which will be uploaded to an Arctic-focused section of the OBPS during the project period. The lessons learned in this process will be used to develop the roadmap.

Delays related to COVID-19 have postponed the WP2 – WP5 workshops, which are an integral part of the co-design process for APS. To continue making progress, the CAPARDUS team has been using the Arctic section of the OBPS to store, manage and make available documents that will be included in the review process (where permissible and practical).

3.2.2. The Ocean Best Practices System (OBPS)

The OBPS is a system that includes a repository of methods (Pearlman, et al 2019) with online knowledge representation technologies that support advanced discovery and access to repository content. (Buttigieg, et al 2019) The OBPS acts as the foundation for the APS and there is a symbiotic relationship between the initiatives. The OBPS is an increasingly mature operational system that provides a sound base and test environment for CAPARDUS to evaluate features that may be included in the APS roadmap (Fig. 1, Fig. 2).

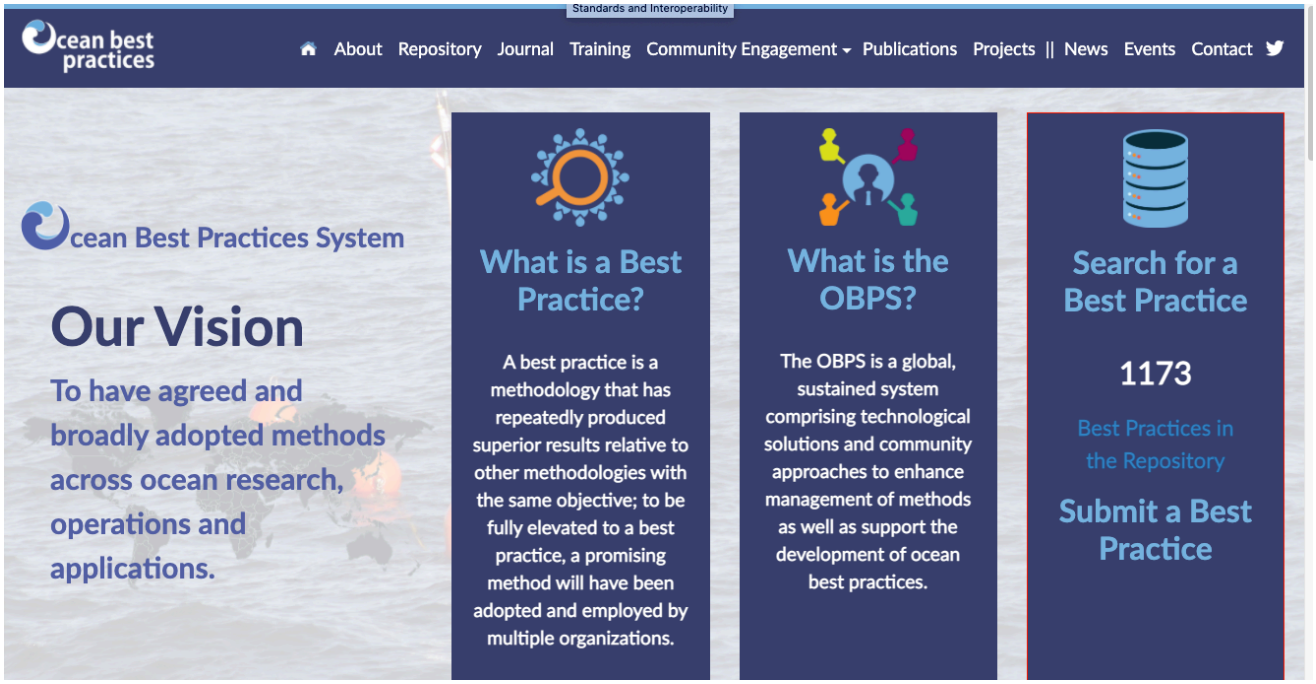

Figure 1. The Ocean Best Practices System (OBPS) provides an established repository and a place to hold reference set of practices for organizing and, ultimately, analyzing standards identified by the CAPARDUS project (https://www.oceanbestpractices.org/).

The CAPARDUS activity will help to improve OBPS through expanded capabilities in non-English language documents and improved the search features for a broader diversity of document types (including indigenous knowledge as well as videos and narratives). At present, the APS is enabled as a community within the OBPS.

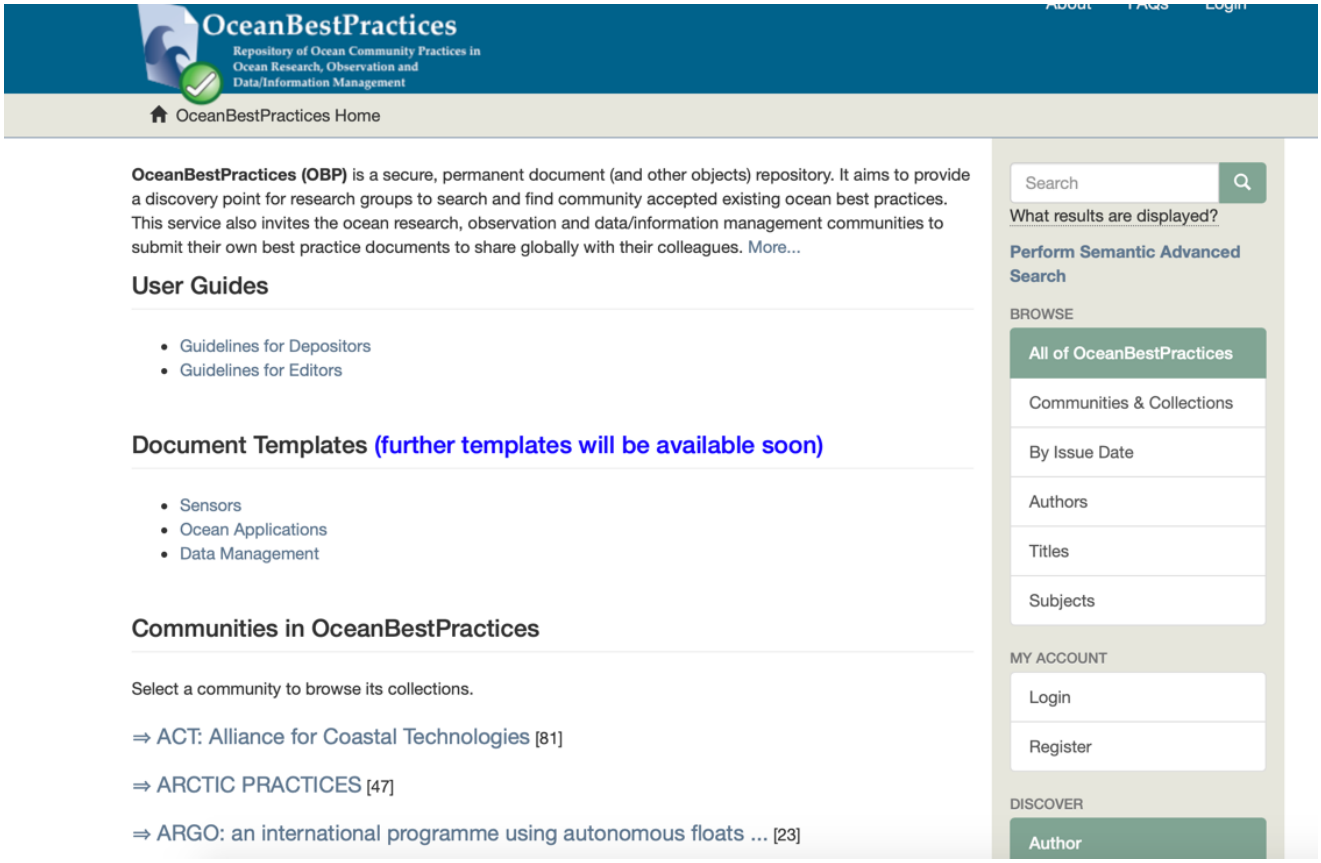

Figure 2. The OBPS acts as a gateway to the Arctic Practices System. Access to Arctic Practices is shown on the lower left with 47 practices from CAPARDUS already included.

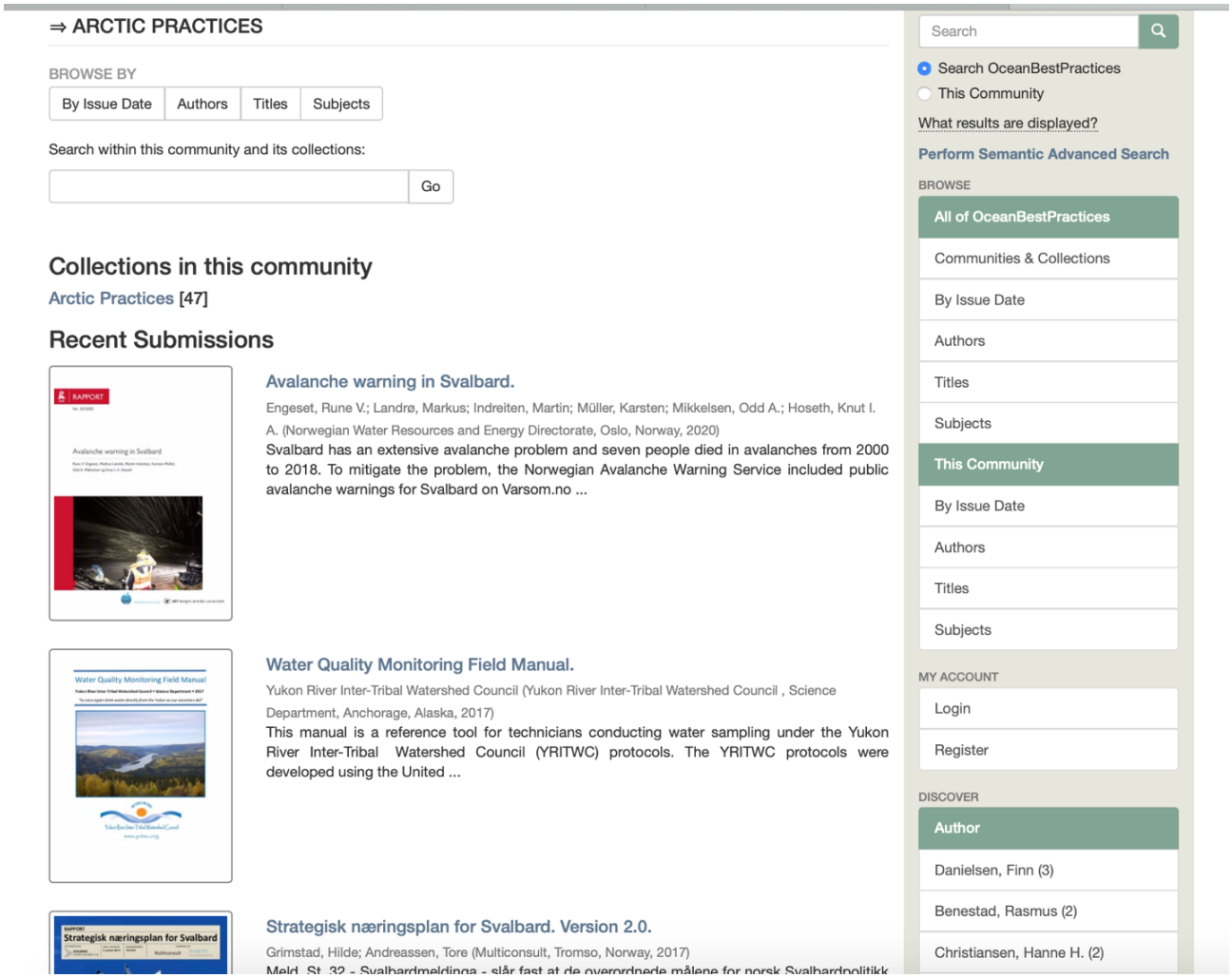

Figure 3. The Arctic Community of OBPS showing the diversity of topics and the introduction of non-English documents.

3.2.3. The Arctic Practices System

The Arctic Practices System will address some interesting needs and challenges resulting from the complexity of the Arctic environment. The practices will range from community-based traditions to ecotourist and mineral industry sectors to local and regional governance in the public sector. The system must be structured to suit Arctic thematic areas, including cryosphere, marine, terrestrial, and atmospheric observing activities, as well as community-based monitoring and sustainable use of Arctic ecosystems. Prior to the design of the APS, communities will be consulted to identify their current strategies, needs, and priorities. It is essential to understand how Arctic rightsholders, stakeholders and local communities may interact with and benefit from the APS. Thus, various rightsholders and stakeholder communities will participate in co-design through interviews, surveys and workshops.

Early in the ongoing design process and recognizing the limitations on Arctic access due to COVID, expert members of the CAPARDUS team have been critiquing the approach and the features of the OBPS which can be brought over to the APS. These inputs will be refined

through the stakeholder consultations mentioned above in collaboration with WP 2-5. The inputs will then lead to the roadmap for the APS implementation.

Wherever possible, the current version of the OBPS is being used as a repository for standards documents that are being considered by the CAPARDUS team part of the research supporting the development of a framework. The next section outlines methods used in the preliminary analysis of documents.

3.3. Expert Analysis and Synthesis Based on Expert Knowledge and Experience

3.3.1. Rationale and background

Recalling the CAPARDUS proposal, the term ”standard” can be vague, depending on the context. To some, a standard is a set of technical directives developed by international standards organizations and confirmed and monitored for compliance by governance bodies. Others may consider standards to be a set of rules or agreements established by a “community” that are based on norms and ethical behaviors. In this broad gradation, there is overlap between more formal top down standards and bottom up community developed “conventions” or “best practices”.

Fig. 4 presents our original continuum model that situates different kinds of “standards” ranging from culturally socially negotiated ethics and norms, to formally negotiated laws. A factor in this continuum model is the gradations of time scales for implementation, with the more formal standards taking longer to formulate and be accepted.

Our focus in CAPARDUS is on the range from “convention” (as opposed to Formal Convention) to International Standard, while understanding and drawing from Ethics, Norms and Informal agreements and considering the process of moving into more formal constructs such as Policy and various forms of law. This framework (Fig. 4) was be used in planning document analysis and other CAPARDUS activities (e.g. workshops in the future) to ensure that there is an understanding of the current level or lack of standardization, the appropriateness and ethics of aiming to establish a particular level of standardization, and the process and cost-benefits for moving from less formal to more formal standardization as appropriate. This will be particularly important in relation to local communities and Indigenous Peoples, whose “standards” may be quite different than that of a scientific discipline or engineering community. This may be the result of differences in many things including language, epistemology, culture, customary law, level of community ownership and many others.

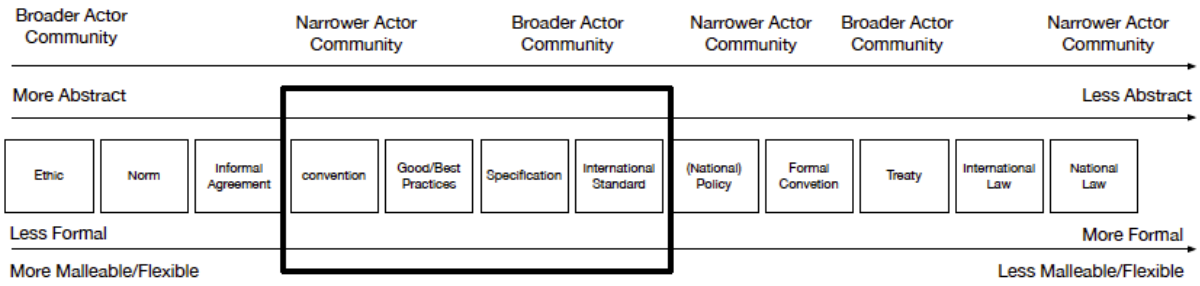

Figure 4. This standardization continuum presented in the CAPARDUS proposal is being refined through discussion and expert analysis and synthesis process.

The initial standardization continuum model has been further developed by the CAPARDUS team. Table 1. presents these terms as a set of document types with definitions as of November 2020. These documents types are a key facet being used for identifying and selecting standards for analysis.

Table 1. CAPARDUS document types based on the standards continuum

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

International Law	(legal instrument) (the body or branch of law concerned with dealings between nations; a law of this kind)
National Law	a binding rule or body of rules prescribed by the government of a sovereign state that holds force throughout the regions and territories within the government's dominion
Research report or paper relevant to CAPARDUS	No formal definition
Concept or framework relevant to CAPARDUS	No formal definition

The analysis process is also identifying and applying other attributes, including CAPARDUS subthemes (Table 2.), and "additional attributes" (Table 3).

Table 2. Emerging CAPARDUS subthemes

CAPARDUS Survey Subthemes (23 November 2020)
Policy
Observing platforms
Data transmission
Observing platform, data, method, program etc. description (metadata)
Data, information or community (of practice) semantics (glossaries, thesauri, ontologies etc.)
Data services (for example OGC Web Services, OPeNDAP etc.)
Community (of practice) consultation
Decision Support Systems
Communications and outreach
Indigenous knowledge, observations or practices
"Western" science best practices
Observing or computing devices

Table 3. Emerging CAPARDUS additional attributes

CAPARDUS Survey Additional Attributes (23 November 2020)
Is the standard performed or implemented by a person?
Is the method a "commonly accepted method" but not formally recognized by a standards organization?
Is systematic conformance evaluation of the standard possible?
Is the evolution to a common method documented (in writing or verbally)?
Does the standard describe the performance of a human-made entity (e.g. observing device, computer system, vehicles etc.)?
Does the standard relate to features or operation of a product/material?
Is the standard readily transferable to other domains?
Is the standard/method likely to be adopted beyond the creator community?

3.3.2. Internal Survey and Document Analysis

To collect preliminary expert analysis and synthesis results from members of the CAPARDUS team, an online survey was established (Figure 5). This provided a mechanism for classifying various aspects of the documents as well as providing a written review based on a review guide. Preliminary results are provided in the next major section of this report.

Figure 5. Internal survey form used to collect standards document reviews from CAPARDUS experts. The survey also collected additional classifications such as document types, themes, and subthemes.

3.3.3. Formal Document Analysis

As the CAPARDUS standards corpus grows, formal document analysis will be applied. This will include quantitative analysis (word/concept frequency), graphic, qualitative and semantic analysis. Qualitative analysis will include thematic coding within recognized approaches such as content analysis and grounded theory using standard tools (Figures 6, 7). Beyond quantitative dimensions, this emergent approach will aim to reveal what the documents tell us in terms of themes, critical concepts, suitability methods, approaches to implementation etc. in a way that is comparable and suitable for evidence-based decisions related to framework development. This approach will be used on standards documents as was as textual outputs from workshops, interviews etc.

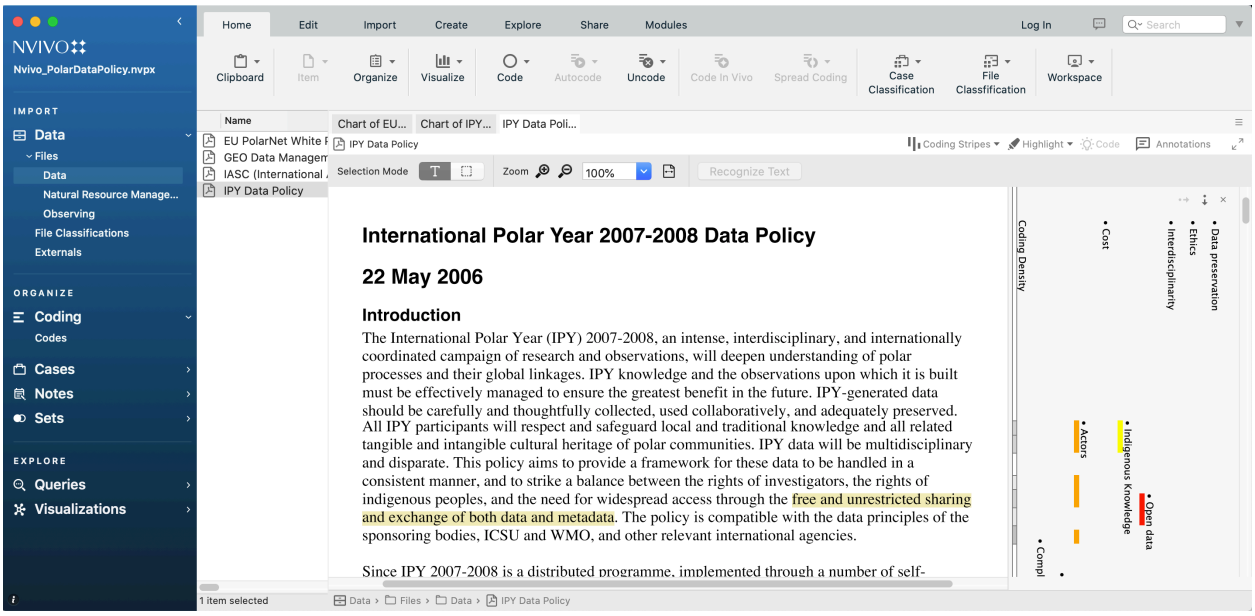

Figure 6. Formal coding of standards documents will be used to analyze themes

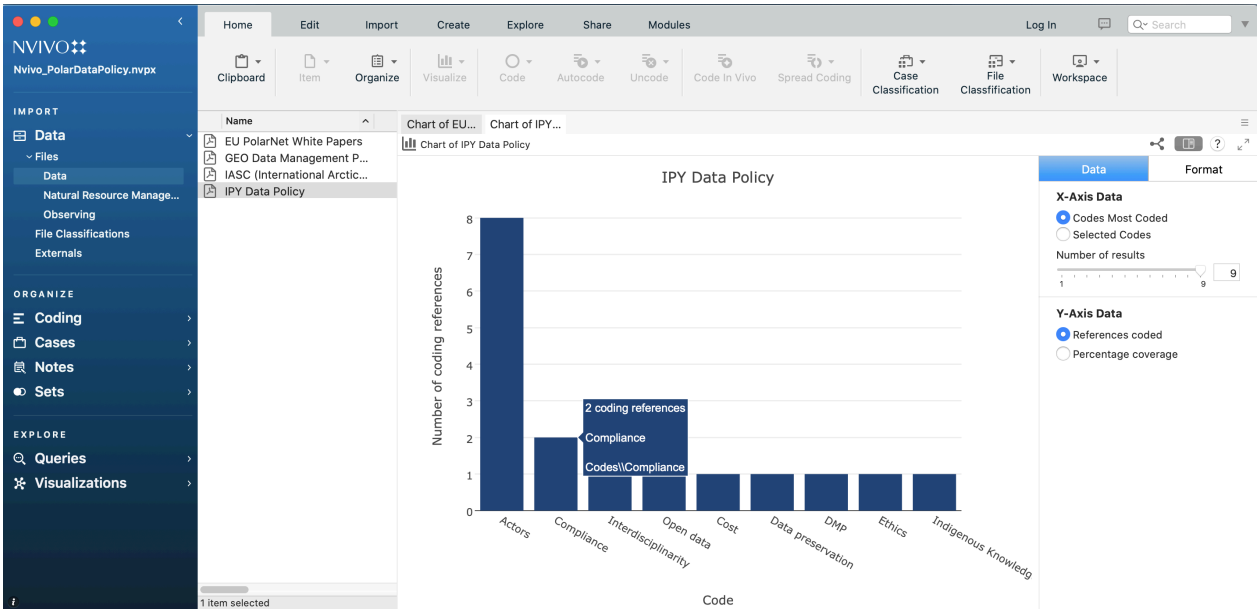

Figure 7. Graphs and other types of visualizations will be used to communicate results (e.g. frequency analysis)

3.4. Community-based methods

CAPARDUS will use a number of other methods when engaging in community-based research. As stated, COVID-19 has delayed these activities, however when they do move forward, the most appropriate quantitative and qualitative methods will be used. This may include surveys, workshops, focus groups, and semi-structured interviews. In many cases, follow up workshops will be held to validate results.

4. Preliminary Results

This section presents preliminary results from development of the Arctic Practices System and the expert analysis and synthesis process that underpin the development of a standards framework under WP 1.

4.1. Artic Practices System

The early steps for the Arctic Practices System outlined in Section 3.2 of this report were focused on two key attributes of user engagement. These are: (1) the ability of community members to enter their practices in the APS; and (2), the ease with which users can discover and access practices that are in the APS. For the first, members of the CAPARDUS team are identifying multiple practices that include, for example, community-based methods, governance documents and videos for training. Using the Ocean Best Practices System (OBPS) as a test bed, the team members went to the repository and did the submission process that includes creation of metadata to improve search and then uploading of the methods document. Instructions for this are available from the OBPS at: https://repository.oceanbestpractices.org/bitstream/handle/11329/343/OceanBestPractices_Depositor_Guidelines_2017_V.2_20180727.pdf?sequence=4&isAllowed=y.

This CAPARDUS process was instructive as some elements of the metadata, such as those that ask for relevant UN Sustainable Development Goal or Essential Ocean Variable, were not obvious to some of our submitters with reference to the documents they were contributing. To facilitate the contributions, the WP6 lead walked through the submission process with selected team members and a training video was created (https://youtu.be/tusrBa4-_Rk).

Questions of document language were examined. This is significant in two ways. First, broadening access when documents are in Indigenous languages needs to balance the broad access with the need to respect the cultural context contained in the original language document. Second, the semantic search mechanisms in the OBPS have a foundation in English-based ontologies and technology. The use of automated translation was exercised and showed promise. However, for Indigenous languages these capabilities may not exist yet. It was recommended that all submissions in original languages should have a quality abstract in English. The practicality of this decision is now being evaluated. A more detailed discussion of this and other features will be provided in a WP6 deliverable.

For the user looking for a best practices, the OBPS provides alternative discovery patterns. The user can look in the Arctic community collection and would find 47 entries. There are also relevant documents which may not be part of a community collection as the relation may not have been indicated by the submitter. A more general search of the OBPS using the search terms “arctic” and “community” identifies 198 documents. When many practices result from a search, there may be multiple methods that are similar. The OBPS is looking at helping users identify the best practice through either a community endorsement process or convergence among methods. As the requirements for the CAPARDUS APS roadmap evolve, lessons of this type from the OBPS will be examined and assessed for incorporation.

Looking forward to the roadmap, the above work, contributions from the case studies in WP 2-5 as well as the usability considerations from other developments of WP6 will create design

examples of user - specific submission templates and online workspaces to facilitate the submission of Arctic practices.

The roadmap will also address how to handle the broad diversity of users documents and metadata offered to the APS. The roadmap, in its formation, is expected to consider processes necessary to: 1) create the APS as an incubator for increasingly harmonized and standards compliant, ethical and culturally appropriate best/common practices; 2) support community dialogue to identify gaps in standards and best practices for the case study focus areas; and 3) identify the key steps to promote local adoption and sustained involvement in the developing the APS as a day-to-day working tool. The final roadmap formulation is the third step in a three-step evolution and will be completed near the end of the CAPARDUS project.

4.2. Expert Analysis and Synthesis Based on Expert Knowledge and Experience

This section provides the results of the internal review and survey carried out as part of the process to further develop the CAPARDUS methodology and begin the process of analyzing standards selected as relevant to the process. As indicated, this process cannot fully proceed until community-based activities are possible, however documents of initial interest were identified and analyzed. The initial focus was on documents in the categories of "data system", "Community planning and decision making" and "Natural Resource Management".

Analysis of data system document revealed several patterns and conclusions important to establishing a standards framework. Many policies or methods that explicitly refer to or imply more specific standards exist. Some, such as the IPY Data Policy were written some years ago and may be considered obsolete. However, these policies have impacts on current policies as they are used as reference documents. More recent standards documents (4.2.2., 4.2.3) provide well-articulated and detailed visions and plans for standards and system implementation that can build on more general policies (e.g. IPY data policy). However, there is recognition that these visions and plans are complex and cross many disciplines and sub-disciplines, making them more difficult to implement. Program specific policies (4.2.4) that reference detailed technical standards provide a good basis for practical implementation as they are being used in real-world situations. The next iteration of CAPARDUS will focus on analyzing a larger set of these program specific policies and the standards that they reference to build a better picture of a broadly applicable standards framework.

Much of the effort in the analysis and synthesis process focused on community-focused themes that draw primarily on the following documents that relate to 1) community-based monitoring of coastal sea ice, (4.2.5.), 2) community-based monitoring of shoreline change, (4.2.6), 3) a roadmap for smart and sustainable cities and communities in Norway (4.2.8), and 4) Manaus Letter: Recommendations for the participatory monitoring of biodiversity (4.2.12). However, this synthesis also includes information from other submitted documents that mentioned relevance to this theme.

The reviewed documents spanned a range of standards types, including specific methods and standard operating procedures to make observations, through to broader best practices and recommendations that may be applicable outside the Arctic. Although not all efforts described broad stakeholder engagement in the development of any standards or practices that cut across sectors (e.g., governmental and non-governmental agencies, academia, local communities), a common theme was an emphasis on involving local community participation to ensure that

local knowledge was included. Frequently the issue of involving local expertise in the design and implementation of a community-based monitoring program was described as a good practice that could support community decision-making. In the case of monitoring sea ice and Arctic shoreline change, the community interests were especially important in the implementation of the monitoring protocols since resident experts would decide on the best monitoring sites that could be used to support planning for coastal infrastructure risks from coastal flooding and erosion, or decision-making related to safety while hunting or traveling over sea ice. It was noted that some local monitoring efforts that support community decision-making might also be relevant to future natural resource management efforts. Often the overlap between the community planning and decision-making theme and the natural resource management theme made it important to consider the common practices across these themes.

There was an emphasis on co-creation of knowledge with resident communities, and acknowledgement of the importance of Indigenous and local knowledge. The norms and ethics for co-creation of knowledge, and for responsibly conducting research in the Arctic were not investigated at depth in this preliminary assessment, but there were some examples that highlighted the need for different approaches to engage Arctic urban, or rural and Indigenous communities in support of community planning. For instance, the role of technology for monitoring programs and community planning was not uniformly promoted. Instead, use of technology was described in several ways: either emphasizing the value of using low-tech tools that would be robust in Arctic environments, or highlighting that technology is important, but secondary to understanding the needs of the resident population in the development of "smart" urban environments. The specifics of data management to support community planning and decision-making were not explicitly described in the reviewed documents, but in general community based monitoring data of physical environmental change (e.g. sea ice, coastal erosion) were likely to be available to researchers and government agencies to help communities developing climate change adaptation or mitigation plans. However, there were no formal arrangements describing how data from community-based monitoring programs would be archived long-term, used for decision-making outside of community-interests, or used beyond local planning efforts.

Natural Resource Management

This preliminary synthesis is based primarily on two documents related to: 1) Good practices for Environmental Impact Assessment and meaningful engagement in the Arctic, 2) local documentation and management of living resources User Guide that was initially used in PISUNA communities in northwest Greenland and 3) Manaus Letter: Recommendations for the participatory monitoring of biodiversity. However, this synthesis also includes information from other submitted documents that mentioned some relevance to this theme.

Natural resource management involves location-specific management authorities and legislation which can make it challenging to implement a standard that is applicable across the Arctic. However, the documents reviewed here demonstrated either engagement with stakeholders across the Arctic who had experience in Environmental Impact Assessments or community monitoring of biodiversity from different countries or had demonstrated application of the guidelines in other Arctic regions. Most documents developed with international collaborations were translated into several languages.

Management of living resources was a key issue in the preliminary assessment for this theme, with an emphasis on giving local resource users a voice in natural resource management. The guidelines and good practices shared information on how to help resource users collect

observations and interpret changes in living resources, learn from other community-based monitoring programs, and contribute to sustainable management of living resources. Yet, in addition to the guidelines for community partners on collecting data on living resources, an important resource were the guidelines for institutional partnerships that could support natural resource management. In the case of the guidelines developed for NW Greenland, there was also information for Natural Resource Councils on practical issues such as guidance on how to organize and facilitate village meetings. This is an important component to the natural resource management theme with information on opportunities and mechanisms for government agencies and other institutions collaborating on natural resource management to support the inclusion of information from Arctic communities on natural resources. This aspect of including the role of government and management agencies in the guidelines was generally missing in the documents reviewed in the previous theme (community planning and decision making).

Commonly emphasized within this theme was the importance of local engagement in the development of any monitoring program to support natural resource management. However, it was acknowledged that there may not always be adequate training or resources provided to government agencies to implement all of the good practices described. The ability to engage communities over time to improve and implement new monitoring efforts that support natural resource management was also described as a good outcome from sustained community engagement. Environmental Impact Assessments and living resource management also requires good practices that can be applied across domains (e.g., ocean, coastal and terrestrial domains), but doing so may involve developing more domain-specific measurement protocols at a later date. This can be difficult to do with limited resources to keep stakeholders engaged over an extended period. Finally, information reviewed on best practices for management of natural resources using a trans-national cross boundary approach did not specify mechanisms for continued international stakeholder engagement and had limited information on best practices for leveraging technology and sharing community monitoring data for use in managing living resources.

The remainder of this section presents the results of the CAPARDUS expert analysis and synthesis process. The reviews presented are be used to develop synthesis as presented in the previous paragraphs. These syntheses will then be used to guide the next stage of the process that will expand the number of documents and work towards formally coding elements and attributes of existing standards (broadly defined) to identify the characteristics of a comprehensive Arctic standards framework.

4.2.1. International Polar Year 2007-2008 Data Policy, 22 May 2006

PRIMARY THEME: DATA SYSTEM

APS Handle	
Other URL	
CAPARDUS Themes	Observing System; Data System; Ethics, Norms, Responsible Research
CAPARDUS Document Type	Best Practice; Policy
CAPARDUS Subthemes	Data transmission; Data, information or community (of practice) semantics; Data services; Indigenous knowledge, observations or practices; "Western" science best practices

The International Polar Year data policy was confirmed on May 22nd 2006 as the result of a series of international meetings and consultations. The policy aimed to provide a framework for IPY data to "ensure that these data to be handled in a consistent manner, and to strike a balance between the rights of investigators, the rights of Indigenous peoples, and the need for widespread access through the free and unrestricted sharing and exchange of both data and metadata" (i.e.https://nsidc.org/sites/nsidc.org/files/files/Glaciological_Data_33.pdf).

The IPY data policy includes a number of key elements that are identified in many of the data policy documents reviewed. Notable elements include:

- Full, free, and open access to and sharing of metadata and data
- The need for the complete documentation of data using structured, standards-compliant metadata
- Recognition of Indigenous (traditional) Knowledge and related cultural heritage and resulting data as an entity requiring specific attention * The fundamental importance of long-term preservation (security) of data
- The importance of attribution (acknowledgement) through formal data citation * The need to clearly define the data resources that fall within the scope of a data policy. In this case, there is recognition that IPY data include both data generated (produced) by IPY investigators and data used by IPY investigators
- The recognition of the need for special policy and access considerations for data that have legitimate restrictions (i.e. traditional knowledge, human subjects data, IP issues, where open data release may cause harm)
- The need to harmonize data policy with other relevant policies (e.g. ICSU, WMO)
- The value of data policy to help facilitate interdisciplinary research and help in the management of distributed systems

The policy aimed to apply to all research domains in the physical and social sciences, the humanities, and to be relevant to Artic residents, including Arctic Indigenous Peoples.

Although this can now be considered a historical document, it was and is relevant to many actors operating or living in the Arctic. The policy was used as a reference for the IASC Statement of Principles and Practices for Arctic Data Management (2013), which in turn has been used by data centres and government agencies to develop specific policies that guide the day to day collection, management and use of Arctic data (e.g. https://www.canada.ca/en/polar-knowledge/publications/data-management-principles-and-guidelines-2017-may.html)

Actors explicitly identified as beneficiaries of the standard, potential contributors or potential implementers include scientists, Arctic residents, and Indigenous Peoples of the Arctic. The policy is focused on the research community as the beneficiary of the policy through improved, long-term access to data. However, the policy aimed to contribute to enhancing international collaboration and cooperation through the IPY.

With respect to gaps, the policy would have benefitted from making the important links between the design and implementation of the observing system and the data system clearer. The policy could have explicitly indicated its relevance to many other themes (e.g. Tourism, Safety of Operations etc.), however these links were made through reference to the broader IPY science plan.

The policy was implemented during the IPY and has influenced post-IPY policy development (see above). The primary impact and benefits of implementing this standard are outlined in the key substantive elements listed above and notably include enhanced data discovery, open access to data over time (preservation), and more effective interdisciplinary research for the benefit of all. Relative to other data policies it short, easy to understand with clear definition of policy concepts. It is not overly proscriptive with respected to dictating *how* to implement the policy providing flexibility for researchers, data centres and other users of the policy. The policy is focused on fundamental, relatively easy to implement aspects of data management such as documentation and acknowledgement. At the time of IPY it provided a sound vision to build on.

The main weaknesses of the standard in consideration ease of implementation include the general, high level nature of the policy provides little in the way of specific guidance on how to implement the standard. For example, the policy states the importance of complete metadata without reference to specific metadata standards and profiles. This lack of detail intentional to provide flexibility, however the implementation details are left to data stewards. Additional weaknesses include: Limited resources identified for implementation; the objectives of the policy did not align well with the true requirements of the goal of supporting interdisciplinary research and the communities of practice involved; the overall diversity and complexity of the data ecosystem is not fully recognized; Challenge and cost of community building; The paucity of appropriate skills and training (Parsons 2015).

Many in the polar community would admit that the vision and objectives set out in the IPY Data Management Policy were not fully achieved (Parsons 2015). However, the policy did set out an important vision and key objectives that have inspired and been leveraged by the community in subsequent years. + A list of key concepts, features, or terms that are important to the standard International Polar Year (IPY) Metadata Open data Data management Data preservation Data management plan Traditional knowledge Acknowledgement / attribution / data citation

References to other relevant or complementary standards documents

IASC (International Arctic Science Committee). (2013). Statement of Principles and Practices for Arctic Data Management. Retrieved from http://www.iasc.info/images/pdf/IASC_data_statement.pdf

Reference to other documents that evaluate or provide additional context for the standard

Parsons, M. A. (2006). International Polar Year Data Management Workshop , 3-4 March 2006. (May 2006), 3–4. Parsons, M. A., Godøy, Ø., LeDrew, E., De Bruin, T. F., Danis, B., Tomlinson, S., & Carlson, D. (2011). A conceptual framework for managing very diverse data for complex, interdisciplinary science. Journal of Information Science, 37(6), 555–569.

Pulsifer, P. L., Yarmey, L., Godøy, Ø., Friddell, J., Parsons, M., Vincent, W. F., … Huck, J. (2014). Towards an International Polar Data Coordination Network. Data Science Journal, 13, 94–102. https://doi.org/http://dx.doi.org/10.2481/dsj. IFPDA-16

Parsons, M. (2015). Overarching Lessons from the International Polar Year on How to Create a Functional Data Infrastructure. Presented at the Second Polar Data Forum, Waterloo, Canada. Available online at: https://www.panarcticoptions.org/wp-content/uploads/2014/03/Polar_Data_Forum_Booklet.pdf#page=18

4.2.2. Disrupting data sharing for a healthier ocean

PRIMARY THEME: DATA SYSTEM

APS Handle	
Other URL	ICES Journal of Marine Science (2019), 76(6), 1415–1423. doi:10.1093/icesjms/fsz068
CAPARDUS Themes	Data System; Ethics, Norms, Responsible Research etc.
CAPARDUS Document Type	Guideline, Ethic, Research Report, Concept or Framework
CAPARDUS Subthemes	Data, information or community (of practice) semantics (glossaries, thesauri, ontologies etc.) , Data services (for example OGC Web Services, OPeNDAP etc.)

Ocean Data availability is limited by a number of technical and social factors such as selecting a location which can support general data distribution and a human willingness to have general distribution. This is a concept paper and does not address implementation details or specifications.

The proposed method is focused on improving data flow to address roadblocks that occur due to technical issues and social issues. This paper proposes an Amazon.com structure to act as a central access and distribution capability for ocean data. It recognizes the value of Amazon social media use in facilitating user feedback, etc. The method looks at technical roadblocks

for publishing and openness/traceability and introduces the idea of using block chain and natural language processing to document provenance and support discovery and access.

Providing improved access to ocean data is relevant to operations in the Arctic. The paper argues that multidisciplinary science is essential and looks to lowering the barrier for cross-disciplinary work.

The primary stakeholders or actors who would benefit from this standard (broadly defined) would be primarily users of data. With respect to who would be able to contribute to or enhance the standard, data managers and users who provide feedback on the benefits of the proposed method would be the primary contributors and implementers.

With respect to supporting CAPARDUS themes, increased access to ocean data supports many (and probably all) of the Themes.

In considering what is the potential for this standard to be implemented or used within the target community, the concept method needs to be detailed to understand its implementation and then to address the cultural changes needed for viability. This is a web-based solution and groups without good connectivity may find the cultural changes significant. Ultimately, the impact of implementing this standard be on the target community and others would be improved access to data to support decision making.

The main strengths of the standard in consideration of ease of implementation is it brings new technology (to the ocean community) to address the discovery, access and traceability of data and brings social media approaches to expand the cultural aspects of data sharing and access. However, the method is at the concept stage and implementation is not defined. The social factors may not apply to Indigenous communities (this needs to be discussed).

4.2.3. FAIR Digital Objects for Science: From Data Pieces to Actionable Knowledge Units

PRIMARY THEME: DATA SYSTEM

APS Handle	
Other URL	doi:10.3390/publications8020021
CAPARDUS Themes	Data System
CAPARDUS Document Type	Concept or Framework
CAPARDUS Subthemes	Data, information or community (of practice) semantics (glossaries, thesauri, ontologies etc.) , Data services (for example OGC Web Services, OPeNDAP etc.)

The concept of FAIR Digital Objects has evolved from earlier work on Digital Objects providing access to datasets on the Internet, as a composite of data and metadata with a unique persistent identifier assigned unambiguously quality the dataset. With the evolvement of FAIR,

the Digital Objects are no longer restricted to datasets. Other objects, such as algorithms, software, workflows are also annotated with metadata and assigned a PID.

Key elements of FAIR Digital Objects: metadata and data constitute a unit for research objects, objects are types, a PID is assigned to each object, a FDO is also used for also for algorithms, software, workflows, all identified by a unique identifier (PID). FDOs apply cross-domain and cross-sector.

All actors need access to quality controlled and well documented data, as well as to suitable tools for processing, analysis and visualisation. The ability to reference data through a unique persistent identifier (PID) is crucial to keep track of what data has been used in scientific studies or to make decisions in public and private sector. Since the various tools can also be represented as FAIR Digital Objects, all steps in the processing chains can be tracked and unambiguously identified. These needs apply equally across different environmental disciplines and sectors.

Actors within all targeted themes in CAPARDUS could benefit from FAIR Digital Objects when frameworks and tools are developed. Many repositories that hold Arctic data provide DOIs, one type of PID, and these can provide a starting point for the storage of FDOs. Further development of such and new repositories to fully support FDOs must be developed, e.g. for EOSC and ESFRI infrastructures. All actors can contribute with use cases defining requirements for data to be used and what processing facilities are needed. Data managers and software developers can contribute to the implementation of FDO frameworks, services and tools.

The concept of FAIR Digital Objects are relevant for all CAPARDUS themes. The development of FAIR Digital Objects is supported by a large community, including several RDA working groups, the GO FAIR initiative, EOSC infrastructure and service developers, and research infrastructures such as ICOS. This means there will be many entities contributing to the realisation of the FDO concept. Its relevance across many disciplines and sectors can muster strong support and substantial efforts from a wide range of contributors. On the other hand, the cross-disciplinary nature of FDOs will make it more complex as generic solutions will have to be developed to satisfy all stakeholders. This can make the implementation of the concept harder to accomplish.

Additional References

Lannom, L. Digital Object Architecture Primer. Digital Objects- from RDA Results towards Implementation. RDA Side Meeting, Philadelphia. Available online: https://github.com/GEDE-RDA-Europe/GEDE/blob/master/Digital-Objects/DO-Workshops/Workshop-Philadelphia-2019/lannom-do-p13.pdf

Kahn, R.; Wilensky, R. A Framework for Distributed Digital Object Services; CNRI: Reston, VA, USA, 1995; https://www.cnri.reston.va.us/k-w.html 15.

Kahn, R.; Wilensky, R. A framework for distributed digital object services. Int. J. Digit. Libr. 2006, 6, 115–123; doi:10.1007/s00799-005-0128-x

Mons, B. FAIR science for social machines: Let's share metadata Knowlets in the Internet of FAIR data and services. Data Intell. 2019, 1, 1–15; doi:10.1162/dint_a_00002

4.2.4. SIOS Data Policy

PRIMARY THEME: DATA SYSTEM

APS Handle	
Other URL	https://sios-svalbard.org/sites/sios.metsis.met.no/files/common/SIOS_Data_Policy.pdf
CAPARDUS Themes	Data System, Observing System
CAPARDUS Document Type	Convention, Best Practice, Policy Document
CAPARDUS Subthemes	Observing or computing devices, Observing platform, data, method, program etc. description (metadata), Data, information or community (of practice) semantics (glossaries, thesauri, ontologies etc.), Policy

The Svalbard Integrated Arctic Earth Observing System (SIOS) is "an international partnership of research institutions studying the environment and climate in and around Svalbard to

- Develop an efficient observing system
- Share technology, experience and data
- Close knowledge gaps
- Decrease the environmental footprint of science" (source: https://sios-svalbard.org/About).

SIOS was established as an ESFRI infrastructure during the SIOS Preparatory Phase project (SIOS-PP, 2010-2014). SIOS has since evolved as an international partnership with contributions from international and national research institutes, government agencies and research councils.

The policy document defines the principles for sharing data collected or derived within the framework of SIOS. This includes open exchange of observations and products with associated metadata following international and national regulations and policies. All data are shared through the SIOS Data Management System (SDMS), with minimal time delay, and at not higher cost than the cost of reproduction. The policy recognizes that not all data are open. Valid reasons for restrictions include, among others, confidentiality of (personal) data and risk of damaging endangered species.

Open access to quality controlled and well documented data at low cost (free or cost of reproduction) is critical to advance environmental sciences and to support authorities and private sectors in utilising new data in their work. Scientists are the primary users of the observational data and derived products, but some products are developed with public or private sector in mind (e.g. avalanche maps, SST maps).

Open access to data in standard formats (including metadata) is relevant for all CAPARDUS themes. The SIOS data policy builds on a series of internationally acknowledged policies and

agreements (see references). It is thus well aligned with ongoing initiatives and observational programmes in the Svalbard (Spitzbergen) region. Key concepts of the SIOS data policy include, data sharing principles, open access to data, data access free of charge or no more than cost of reproductions, criteria for data access restrictions.

References

Aarhus Convention, 1998. CONVENTION ON ACCESS TO INFORMATION, PUBLIC PARTICIPATION IN DECISION-MAKING AND ACCESS TO JUSTICE IN ENVIRONMENTAL MATTERS. Online at https://www.unece.org/fileadmin/DAM/env/pp/documents/cep43e.pdf (accessed 24 Nov 2020)

EC, 2003 Directive 2003/98/EC of the European Parliament and of the Council of 17 November 2003 on the re-use of public sector information. http://data.europa.eu/eli/dir/2003/98/oj (accessed 24 Nov 2020)

EC, 2007. Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) http://data.europa.eu/eli/dir/2007/2/oj

GEO, 2015. GEOSS Data Management Principles. Prepared by the GEO Data Management Principles Task Force.

International Arctic Social Science Association. Principles for the Conduct of Research in the Arctic. Online https://www.iarpccollaborations.org/uploads/cms/documents/1990-_principles_for_the_conduct_of_research_in_the_arctic.pdf (Accessed 24 Nov 2020)

OECD, 2007. OECD Principles and Guidelines for Access to Research Data from Public Funding. Online https://www.oecd.org/sti/inno/38500813.pdf (accessed 24 Nov 2020)

UNESCO and ICSU, 1999. Declaration on Science and the Use of Scientific Knowledge. https://unesdoc.unesco.org/ark:/48223/pf0000116994 (accessed 24 Nov 2020)

4.2.5. Handbook for community-based sea ice monitoring

PRIMARY THEME: Community Planning and Decision Making

APS Handle	https://repository.oceanbestpractices.org/handle/11329/1349
Other URL	http://dx.doi.org/10.25607/OBP-855
CAPARDUS Themes	Community decision-making; Safety of operations
CAPARDUS Document Type	Method, Common Practice
CAPARDUS Subtheme	Local knowledge, Data collection, Coastal hazards

This document was created as a reference for local observers carrying out sea ice measurements as part of a community-based sea ice observation network for the Siku-Inuit-Hila project, an NSF-funded project (2006-2010) examining sea ice, sea ice use, and sea ice change at the Arctic communities of Qaanaaq, Greenland, Barrow, Alaska, and Clyde River, Nunavut. In response to interest from other communities and researchers, the authors of this manual made the handbook available as a resource for anyone wishing to establish a local sea ice monitoring program. Author Mahoney has mentioned recently that there are plans to update the manual in the near future based on existing work for community sea ice observations in the northern Alaska coast.

The standard relates to ocean/ coastal observations, and snow (atmosphere precipitation?) using relatively low-cost observing equipment and tools available to Arctic coastal communities.

The methods were developed specifically to be used by Arctic communities, with tested implementation of the observing techniques that would provide data that could be ingested by scientist collaborators. Providing some level of standardization on the interval of measurements for snow and sea ice (e.g. stakes marked every 10 cm and 2 cm) thickness provides information on the relative scale of field measurement precision that is important to know if using these observations data to verify satellite data measurements or other technical instrumentation (e.g. LIDAR)

The standard was developed to support Arctic community-based monitoring of sea ice and snow at sites of interest to local Arctic resident communities. Iterative improvements to the standard would be best achieved by joint discussions among community observers and scientists on how the implementation of these standards might be improved (e.g. with new tools, or better equipment, or if there are significant challenges faced in making measurements, such as difficulty measuring ice thickness with substantial surface snow melt ponds on the surface of the ice)

The changes in coastal sea ice and snow would be relevant to community decision-making (e.g. responsive to how coastal communities travel safely on the sea ice, or when coastal boating activity might be anticipated to begin), as well as safety of operations. Although snow and multi-year ice can be an important source of freshwater for Arctic communities, this is not a managed natural resource in this form.

As described above, snow and sea ice are not a managed natural resource, but it may become an increasingly important resource for coastal communities to track in the future. It may be important for CAPARDUS to highlight that while a standard for observing is currently only useful for local scale decision-making, there is the potential for it to inform natural resource management in the future as the un-managed resource becomes more critical.

This method has wide potential application to be used in coastal communities with interest in tracking sea ice and snow at low cost. At the moment there are not a large number of Alaska communities implementing this standard for observations. If this were to be more broadly applied across Alaska and other Arctic communities, there would be extensive additional observation data to support ground-truthing of satellite observations, and may even be useful as coastal earth system models become more sophisticated and could use these data for model verification. The main strengths of the standard include, ease of obtaining and trouble-shooting equipment. Relatively low cost to setup and sustain observations over many years. The main

weaknesses of the standard is that there may be some concerns about accuracy of measurements later in the melt season, or questions about range of accuracy or precision in measurements taken by different observers. Noting that coming from a non-geophysical background, the reviewer may not have fully grasped the limitations of using this measurement standard, and any more in-depth critique of this standard's limitation should come from the document authors or a sea ice/ snow physical scientist.

References to other relevant or complementary standards documents

http://www.climate-cryosphere.org/activities/groups/164-arctic-sea-ice-wg

4.2.6. Community-based methods for monitoring coastal erosion: a step-by-step guide for documenting shoreline change in your community.

PRIMARY THEME: Community Planning and Decision Making

APS Handle	https://repository.oceanbestpractices.org/handle/11329/1360
Other URL	
CAPARDUS Themes	Community decision-making; infrastructure; safety of operations.
CAPARDUS Document Type	Method, Standard Operating Procedure
CAPARDUS Subthemes	Observing platform, data, method, program etc. description (metadata), Indigenous knowledge, observations or practices, "Western" science best practices

This document provides comprehensive instructions for implementing three community-based shoreline monitoring systems, with all instructions designed to be completed by local residents. Tips for selecting monitoring sites, instructions for site installation and data collection, and all necessary materials are explained in a step-by-step format. By building an understanding of long-term shoreline change, Alaskans will be better prepared to respond and adapt to impacts to their public health, safety, infrastructure, and well-being.

The standard relates to ocean/ coastal observations, emphasizing coastal erosion. It provides specific instructions on equipment, methods to carry out observations and data collection sheets that specify information to be recorded.

Coastal erosion is a major threat to infrastructure, safety of operations and transportation in Arctic Alaska. The ability to monitor rates of erosion at sites that are of importance to coastal communities is key for community planning and decision-making, and may support their development or implementation of climate change adaptation plans. The standard was developed to support Arctic coastal communities with their planning and decision-making, as well as the State of Alaska Coastal Hazards Program, who co-developed the methodology and helps to keep archived records of the observations. There is a potential that the standard could

be useful for Natural Resource Management but this has not been explored in the implementation.

Currently there is fairly good community adoption of the standard practices in Alaska, with support from the State of Alaska for training to community observers. There have also been graduate student involvement in this standards implementation, helping to build capacity with future researchers and expanding the use of this erosion monitoring standards across more Arctic Alaska communities. As described above, the implementation of this standard is expected to help communities improve their community decision making in planning responses to coastal erosion. This may assist communities to seek more governmental funding to mitigate losses to infrastructure damaged from coastal erosion, or to provide locally relevant information for community level climate change adaptation planning.

Main strengths include, ease of conducting observations by community observers, relatively low cost equipment use, and developing relationships with State of Alaska Coastal Hazards Program managers who help to manage data across communities. Although the standard observing methodology document provides detailed description on how to implement the standard, along with video (YouTube) instructions for implementing the protocols, it is likely that some in-person training may still be required initially to start building capacity within a community. Also, the accessibility of data across communities is not clear, nor is there the expectation that all data will be freely available.

The reviewer notes that coming from a non-geophysical background, they may not have fully grasped the limitations of using this measurement standard, and any more in-depth critique of this standard's limitation should come from the document authors. Also, the standard does not describe the availability of data or plans for long-term sustained access to archived records in a centralized repository.

4.2.7. Good Practices for Environmental Impact Assessment and Meaningful Engagement in the Arctic – Including Good Practice Recommendations

Original document: https://oaarchive.arctic-council.org/handle/11374/2377

PRIMARY THEME: Natural Resource Management

APS Handle	
Other URL	https://oaarchive.arctic-council.org/handle/11374/2377
CAPARDUS Themes	Natural Resource Management, Safety of Operations, Tourism, Ethics, Health, Legal
CAPARDUS Document Type	Method, Guideline, Good Practice
CAPARDUS Subthemes	Community (of practice) consultation, Indigenous knowledge, observations or practices, "Western" science best practices, Policy

The Arctic is undergoing rapid environmental and economic change. The growing interest in the north and its resources is evidenced through an increase in the number of large-scale development projects. Planning and design of such projects should be done in a competent

way, where Arctic ecosystems and their people are respected and engagement is meaningful. EIA is an important planning tool that can help to balance environmental and economic considerations and facilitate making sustainable development decisions in the context of the changing Arctic. All eight Arctic states have EIA legislation. Each legislative process is unique, but a common EIA framework can be identified across the Arctic.

Increasing economic activity in the Arctic, including a growing number of large-scale projects, provides the rationale for the Arctic Environmental Impact Assessment (EIA) project. How to plan and design large-scale projects in a way that gives consideration and value to the voice and knowledge of Arctic inhabitants is a driving force behind the project. In detail, the project identified three current topics needing specific attention to improve EIAs in the Arctic: 1) Meaningful engagement 2) Utilization of Indigenous knowledge and local knowledge as complementary to scientific knowledge and 3) Transboundary impact assessments. The first two themes appeared consistently throughout the workshops of the Arctic EIA project with about 180 participants total. The third theme was valued as important by the Editorial Group of the project.

This report is intended for all actors involved in environmental impact assessments: authorities, including regulators, proponents, consultants, financers, and those who are most directly affected by the projects themselves, namely Arctic inhabitants and stakeholders. The recommendations (chapter 4) specifically target proponents from outside the Arctic, as they may be unfamiliar with the Arctic context and need a deeper understanding of the issues to be considered when aiming to work in the unique Arctic environment, and in particular, with Arctic Indigenous and other local residents.

The report has been prepared by the Ministry of the Environment of Finland assisted by the Arctic Centre, University of Lapland. Essential input has come from the Editorial Group of the project, which consists of representatives from all eight Arctic states, six Permanent Participants of the Arctic Council and a representative from the Arctic Economic Council. The Sustainable Development Working Group has prepared a number of documents related to management of natural resources, adaptation to climate change and socio-economic issues in the Arctic (www.sdwg.org)

4.2.8. Roadmap for smart and sustainable cities and communities in Norway

PRIMARY THEME: Community Planning and Decision Making

APS Handle	
Other URL	https://doga.no/globalassets/pdf/smartby-veikart-19x23cm-eng-v1_delt.pdf
CAPARDUS Themes	Natural Resource Management, Tourism, Ethics, Infrastructure, Transportation, Legal and Regulatory Standards, Pollution
CAPARDUS Document Type	Best Practice and many others
CAPARDUS Subtheme	Decision Support Systems, Communications and Outreach, Policy

The Roadmap is providing a comprehensive guide for Norway's local and regional authorities on how to create a smart city. The "Roadmap for smart and sustainable cities and communities in Norway" was launched in August 2019 by Design and Architecture Norway (DOGA), the Norwegian Smart City Network and Nordic Edge, with input from more than 150 actors in different sectors, disciplines and levels of government from all over the country. The document is relevant and beneficial as it serves as a guidebook, bridge builder, value creator and platform, promoting collaboration and co-creation. The document is contributing in building a common understanding of a smart city in a Norwegian context, but also for other cities around the world.

CAPARDUS themes covered: community planning, tourism, natural resource management and safety/planning and development prioritising climate and environment. The document is providing specific advices on the following topics: People centered sustainable planning and development, Attractiveness, Productivity and Resilience.

The roadmap constitutes a common set of values, where new technology and data are tools, not means, for smart cities, and includes a set of principles that municipalities and other actors can work according to. The principles are:

- Put the inhabitants in the center
- Think holistically
- Prioritize climate and environment
- Emphasis on inclusion and co-creation
- Focus on the next generation of business
- Share and use open data
- Focus on competence development, restructuring and innovation
- Start locally, but think globally

The Roadmap defines what a smart city should be in a Norwegian context: "Smart cities and communities put the population at the center, and adopt new technology, innovative methods, collaboration and co-creation to become more sustainable, attractive, productive and adaptable. "The Norwegian smart city work is rooted in the Norwegian model where values such as trust, transparency and credibility provide a favorable breeding ground for building good, future-oriented societies. The UN's sustainability goals are also central to the work.

Strengths of the document include direct, easy to read, practical guidelines, broad topics, experienced based advices building on local and co-created knowledge, and formal rules. Suggests implementation of UN SDGs on local level. Weakness of the document include that it is made for a Norwegian context, where the living conditions are good and the economy is strong. No local/ place-specific guidelines for different areas.

4.2.9. Welcome to the Arctic

PRIMARY THEME: Tourism

APS Handle	

Other URL	
CAPARDUS Themes	Natural Resource Management, Ethics, Safety of Operations, Legal and Regulatory Standards, Pollution
CAPARDUS Document Type	Good Practice and many others
CAPARDUS Subtheme	Community consultation, Communications and outreach

This document is the visitor guidelines provided by The Association of Arctic Expedition Cruise Operators (AECO). This document provides ethical guideline for tourists (especially those joining expedition cruises) in the Arctic. It explains how visitors should behave to be safe and prevent damage to the environment, local cultures and cultural remains. Relevant domains: ocean, terrestrial, social. The standards are relevant to any visitor to the Arctic and especially tour operators and tourists. Tour operators may be able to contribute to enhance and implement the standard. Relevant themes are: natural resource management, community planning and safety. The document goes through the following basic principles

1. Leave no lasting signs of your visit 2.
2. Do not pick flowers
3. Do not take anything with you
4. Do not disturb animals and birds
5. Leave cultural remains alone
6. Take the polar bear danger seriously
7. Respect local culture and local people
8. Be safe

Main strengths: build on long experience, short, comprehensive, broad coverage of basic rules, presented in plain language. Main weaknesses: few details. Key concepts: sustainability, leave no lasting signs of your visit, respect local culture, be safe.

2nd Review from Lisbeth Iversen:

This document provides ethical guidelines for tourists and cruise tourists visiting the Arctic, provided by Arctic Expedition Cruise Operators, AECO. It is guiding the tourist in precaution and safety during the stay, without harming the environment, local communities, culture and cultural heritage. The guidelines are relevant for both tour operators and individual tourists, and can easily be implemented in the routines of cruise-operators and guides. The document is relevant and beneficial for tourists, operators, local authorities and local communities. CAPARDUS themes covered: community planning, tourism, natural resource management and safety. The document is providing specific advices on the following topics:

Strengths of the document: Direct, easy to read, practical advises, broad topics, experienced based advices building on local knowledge and formal rules.

Weakness of the document: No local/ place-specific guidelines for different areas.
Key concepts. General tourism policy, Sustainable tourism, Responsible tourism, safety, respect for local communities and nature, protection of biodiversity. Protection of the environment.

4.2.10. Avalanche warning in Svalbard

PRIMARY THEME: Safety of operations

APS Handle	https://repository.oceanbestpractices.org/handle/11329/1430
Other URL	http://hdl.handle.net/11329/1430. http://dx.doi.org/10.25607/OBP-933
CAPARDUS Themes	Safety of Operations, Tourism, Infrastructure, Transportation
CAPARDUS Document Type	Method, Research Report
CAPARDUS Subtheme	Decision support systems, Indigenous knowledge, "Western" science best practices

Svalbard has an extensive avalanche problem and seven people died in avalanches from 2000 to 2018. To mitigate the problem, the Norwegian Avalanche Warning Service included public avalanche warnings for Svalbard on Varsom.no in February 2016. To assist evacuations by local authorities, local warnings for Longyearbyen were started as a temporary measure days after the fatal accident in December 2015, when an avalanche hit ten buildings. This report presents the methods, organisation, and results associated with establishing the two avalanche warning services on Svalbard.

We discuss lessons learned in terms of collaboration, risk management, specific challenges in the Arctic, due to climate changes and the event of an avalanche hitting two buildings in February 2017 (copy of summary in Arctic Practices).

The methods and practices for snow avalanche warning in Svalbard is under development, related to terrestrial, cryosphere, atmosphere and social domain.

The methods/practices are highly relevant for people living and operating in Svalbard. These are the stakeholders who benefit from and contribute to the development and implementation of the methods/practices. The methods/practices depend on observing systems and data systems. They are important for Community Planning and Decision Making, Safety of Operations, Tourism, Infrastructure, Transportation and Legal and Regulatory Standards. They are not addressing natural resource management directly.

Implementation of the methods/practices is very important. In fact they are established in response to requirements from the local community. The impact will be significant, because the safety of the people living and working in Svalbard will be improved. The main strength of the methods/practices is that the development of the warning system is driven by the needs of the local community and supported by the Government through the Norwegian Water and Resource and Energy Directorate, which is agency responsible for flood and avalanche warning.

The weakness of the methods/practices is that it is in an early stage of development, and it is expected to be improved significantly as a result of better observing systems and forecasting models. It is not a standard yet, it is methods/practices under development.

Key concepts for the methods/practices are implementation of adequate observing systems leading to improved knowledge of the risks for avalanches on local scale.

Other relevant documents are listed in the references.

4.2.11. Local documentation and management of living resources: User Guide

PRIMARY THEME: Natural Resource Management

APS Handle	https://repository.oceanbestpractices.org/handle/11329/1329
Other URL	
CAPARDUS Themes	Observing System; Data System; Community Planning and Decision Making; Natural Resource Management; Ethics, Norms, Responsible Research etc.
CAPARDUS Document Type	Method, Good Practice, Specification, Others
CAPARDUS Subtheme	Observing Platforms, Data Transmission, Indigenous Knowledge

The guidelines are intended to help citizens in Greenland document and interpret changes in living resources. The guidelines have been written especially for fishermen, hunters and others with an interest in the natural environment who want to contribute to strengthening the management of living resources and to promote sustainable use of those resources. The guidelines were originally prepared in Danish and Greenlandic, but an English translation was made in 2018.

The guidelines are focused on the ocean, coastal and terrestrial domains. Notable elements include: A description of the key steps to be taken when establishing local documentation and management of living resources; the rationale for documenting the status of the living resources; the field methods used; how to facilitate meetings of the community. For Natural Resource Councils, the guidelines include: how to complete summary forms; how to get from field data to results and management proposals; how to organize and facilitate village meetings to discuss and validate the findings.

The guidelines are relevant to community members in the Arctic because many community members live close to, and use, natural resources. Many community members are interested in spending time and efforts on natural resource monitoring. Access to natural resources is often a core component in the lives, livelihoods and survival of the communities. Engagement in the resource management process (including monitoring) is key to them. The guidelines were developed for use in Greenland but they have also been introduced and are beginning to be used in other Arctic countries (Finland, and Yakutia, Russia)

Actors explicitly identified include fishermen, hunters and other community members in Greenland with an environment interest. The guidelines are focused on the users of living resources as the beneficiaries. They will benefit by being able to systematically collect and

communicate information about the status of the living resources and management proposals, and through providing the participants with a 'voice' in the natural resource management process. The resource users will also be able to contribute to enhance the guidelines over time and, together with staff of the municipal and central government agencies, they will contribute to implement the guidelines.

The guidelines would have benefitted from further describing the data management system and the data storage system at Pisuna.org (the observations in their original language and format) and PISUNA-net (English version, available at a searchable, web-based database). However, these systems were established after the guidelines were developed.

Since 2014, the guidelines have been used in PISUNA communities along the NW coast of Greenland. The PISUNA guidelines have been introduced to Finland and Arctic Russia and they have also influenced the development of similar guidelines for community-based monitoring in other areas of the Arctic and beyond. In 2018, the PISUNA program was awarded the Nordic Council Environment Prize.

The communities using the guidelines get a better understanding of the status of the living resources and possible management interventions, and they begin to obtain a 'voice' in the management of the living resources. Overall, the guidelines contribute to enhance the capacity of the communities, both socially, politically and economically.

Main strengths of the standard in consideration of ease of implementation

- Relative to other environmental monitoring guidelines they are very simple and very easy to understand
- They were developed with a view to enable fishermen, hunters and other people with an interest in the environment to document trends in living resources and to propose management decisions THEMSELVES
- Designed to build upon existing informal (community-based) observing methods
- They can be considered a "minimum starting point" for community-based observing of the status of the living resources and for proposing management interventions

Main weaknesses of the standard in consideration ease of implementation

- Sometimes the government is slow at listening and responding to the management proposals from the community members who are using the guidelines.
- As of today, Greenland's Government at central level does not have a policy that sets aside government staff time and resources for implementing the guidelines. The central government has an important role in:
    - (1) supervising the community monitors and municipal staff in their use of the guidelines,
    - (2) using the findings for natural resource management interventions, and
    - (3) providing regular feedback to the community monitors on how the findings have been used.
- At the municipal level, one municipality in Disko Bay has set aside funds and staff time for implementing the guidelines (Qeqertalik Municipality, annually, since 2017).
- Public resource managers (municipal and central government) need further training in facilitating the use of the guidelines and in how to interpret and use the findings made by the community members.

A detailed evaluation of the use of an earlier version of the guidelines was undertaken in 2013. The evaluation is available in Danish:
http://www.pisuna.org/documents/Evaluering%20PISUNA%206Dec,%20revNov14.docx

References

Johnson, N., Behe, C., Danielsen, F., Krümmel, E. M., Nickels, S., & Pulsifer, P. L. 2016. Community-based monitoring and indigenous knowledge in a changing Arctic. Inuit Circumpolar Council, Ottawa.

Danielsen, F., Topp-Jørgensen, E., Levermann, N., Løvstrøm, P., Schiøtz, M., Enghoff, M., & Jakobsen, P. 2014. Counting what counts: using local knowledge to improve Arctic resource management. Polar Geography, 37(1), 69-91. This document describes the theoretical framework of the guidelines and the first three years of using the provisional version of the guidelines.

Danielsen, F., Burgess, N.D., Jensen, P.M. and Pirhofer-Walzl, K. 2010. Environmental monitoring: the scale and speed of implementation varies according to the degree of people's involvement. Journal of Applied Ecology 47: 1166–1168 (with cover page and podcast; http://bdown.astream.com/jpe/danielsen.mp3).

Huntington, H.P., Danielsen, F., Enghoff, M., Levermann, N., Løvstrøm, P., Schiøtz, M., Svoboda, M. and Topp-Jørgensen, E. 2013. Conservation through community involvement. Pp. 644–647 in: Arctic Biodiversity Assessment. Status and trends in Arctic biodiversity (Ed. H. Meltofte). Conservation of Arctic Flora and Fauna, Akureyi, Iceland.

Danielsen, F. 2016. Expanding the scientific basis for how the world can monitor and manage natural resources. Copenhagen: University of Copenhagen and NORDECO. 477pp. Available at: https://plen.ku.dk/arrangementer/2016/finndanielsen/Danielsen.pdf

Presentation Naalakkersuisut. 2017. United Nations General Assembly. 16th Session of the Permanent Forum on Indigenous Issues, New York. April 2017.

Danielsen, F., Enghoff, M., Magnussen, E., Mustonen, T., Degteva, A., Hansen, K. K., ... & Slettemark, Ø. 2017. Citizen science tools for engaging local stakeholders and promoting local and traditional knowledge in landscape stewardship. The science and practice of landscape stewardship. Cambridge University Press, Cambridge, 80-89. Available at: https://docs.wixstatic.com/ugd/9ce758_ec68fdf13ab94b40bbb411540c5f2b6d.pdf

Frederiksen, P. O. 2018. The Government should make further use of the knowledge of local resource users. Press release from Attu Natural Resource Council. Available at: http://www.pisuna.org/documents/Media,%20G%C3%B8r%20bedre%20brug%20af%20fangerviden,%20UK.pdf

Mustonen, T. et al. 2018. Deepening Voices. eXchanging Knowledge of Monitoring Practices between Finland and Greenland. SnowChange. Available at: http://www.snowchange.org/pages/wp-content/uploads/2018/01/gronlanti.pdf

Cuyler, C., Daniel, C. J., Enghoff, M., Levermann, N., Møller-Lund, N., Hansen, P. N., ... & Danielsen, F. 2020. Using local ecological knowledge as evidence to guide management: A

community-led harvest calculator for muskoxen in Greenland. Conservation Science and Practice, 2(3), e159.

Danielsen, F. et al. 2020. Community-Based Monitoring in the Arctic. Fairbanks: University of Alaska Press.

4.2.12. Manaus Letter: Recommendations for the Participatory Monitoring of Biodiversity

APS Handle	
Other URL	http://www.monitoringmatters.org/publications/Carta%20de%20Manaus%20ENG.pdf
CAPARDUS Themes	Observing System Data System Community Planning and Decision Making Natural Resource Management Ethics, Norms, Responsible Research etc.
CAPARDUS Document Type	Best Practice, International Standard, Others
CAPARDUS Subtheme	Observing platforms, Data transmission, Observing platform, data, method, program etc. description (metadata), Data services (for example OGC Web Services, OPeNDAP etc.), Community (of practice) consultation, Decision Support Systems, Communications and outreach, Indigenous knowledge, "Western" science best practices Policy

A large group of stakeholders from 18 countries committed to participatory monitoring to manage biodiversity and natural resources gathered in Manaus, Brazil, on 22-26 September 2014 to debate, discuss, and share experiences regarding opportunities, challenges, best practices, and lessons learned. The participants included representatives from indigenous and local communities, academia, organized civil society, practitioners from governmental and non-governmental organizations, and government decision makers. Everyone shared a common objective of improving the practice of participatory monitoring and accelerating its uptake by government, academic, and civil society stakeholders for use in diverse settings and contexts as appropriate. At the invitation of the Director of the Convention on Biological Diversity (CBD), the participants discussed and agreed upon a series of 40 key recommendations regarding best practices for participatory, community-based monitoring of biodiversity and natural resource use (the Manaus Letter). The recommendations were prepared in English, Spanish and Portuguese. They were officially submitted to the Director of the CBD in 2015.

The recommendations are focused on both the terrestrial, limnic, coastal and ocean domains. Notable elements include:

- How to design monitoring initiatives
- How to ensure community participation
- Suitable institutional arrangements
- Partnerships with other institutions
- How to secure data quality and proper data management
- Relationship between monitoring initiatives and public policy
- How to encourage recognition of community involvement
- Institutional and community strengthening
- Capacity-building
- Systematization, dissemination and communication

* Why is the methods/standard/practice relevant to one or more actors living or operating in the Arctic?

The recommendations are relevant to community members, civil society associations, non-governmental organisations, government agencies and scientists in the Arctic who are interested in starting community-based monitoring of the environment, or who are engaged in community-based monitoring already and who would like to learn from the experiences of other community monitors and monitoring programs.

The recommendations were developed from experiences with community-based monitoring programs in many countries, from the tropics to the poles. Community monitors from Greenland, Scandinavia and Alaska participated in developing the recommendations.

Actors explicitly identified include “indigenous and other traditional, natural resource dependent peoples throughout the world”. The recommendations are focused on community monitors, organizers of community-based environmental monitoring programs and other people interested in this field of environmental monitoring. The community members engaged in monitoring the environment will benefit from the recommendations by being better able 1) to collect and communicate information about the status of the living resources and management proposals, 2) to defend their approach to observing the environment, and 3) obtain a 'voice' in the natural resource management process.

The recommendations would have benefitted from further describing the links to the use of technologies such as digital platforms and smart phones. However, most of these technologies were established after the recommendations were developed.

The reviewer believes that the recommendations are very suitable to community-based monitoring initiatives in the Arctic and sub-Arctic regions. It would be an advantage if the recommendations could become officially acknowledged by the CBD as ‘good practice’ recommendations. This would help disseminate the recommendations to the many programs that can benefit from using them. At the same time, it would help increase the recognition of community-based monitoring approaches among scientists, NGOs and government agencies.

The communities using the recommendations would be able to substantially improve their community-based environment monitoring efforts. For instance, they would be able to strengthen the links to decision-makers, to reduce fatigue among the participating community

members, and to increase the abilities of sustaining their monitoring efforts over time, beyond the lifetime of individual projects.

With respect to strengths, relative to other sets of environmental monitoring recommendations, these recommendations are short, very simple, straightforward to understand and use, and have clear definitions of the concepts:

- Focused on fundamental aspects
- Provide a sound vision to build on
- This document with recommendations for community-based environmental monitoring is to our knowledge the first of its kind

We have not yet come across any significant weaknesses in consideration to ease of implementation of the recommendations. It is however a weakness that few organizers of community-based environmental monitoring programs are familiar with the recommendations.

References

Johnson, N., Behe, C., Danielsen, F., Krümmel, E. M., Nickels, S., & Pulsifer, P. L. 2016. Community-based monitoring and indigenous knowledge in a changing Arctic. Inuit Circumpolar Council, Ottawa.

Danielsen, F., Johnson, N, Lee, O., Fidel, M., Iversen, L. Poulsen, M.K., Eicken, H., Albin, A., Hansen, S.G., Pulsifer, P.L, Thorne, P., & Enghoff, M. 2020. Community-Based Monitoring in the Arctic. Fairbanks: University of Alaska Press.

There are many documents that provide additional context. We have been involved in preparing some, for instance:

Danielsen, F., Burgess, N. D., Balmford, A., Donald, P. F., Funder, M., Jones, J. P., ... & Child, B. 2009. Local participation in natural resource monitoring: a characterization of approaches. Conservation Biology, 23(1), 31-42.

Danielsen, F., Burgess, N.D., Jensen, P.M. & Pirhofer-Walzl, K. 2010. Environmental monitoring: the scale and speed of implementation varies according to the degree of people's involvement. Journal of Applied Ecology 47: 1166–1168.

Danielsen, F., Topp-Jørgensen, E., Levermann, N., Løvstrøm, P., Schiøtz, M., Enghoff, M., & Jakobsen, P. 2014. Counting what counts: using local knowledge to improve Arctic resource management. Polar Geography, 37(1), 69-91.

5. Next Steps

The CAPARDUS team will continue with regular team synthesis meetings to discuss the current results of the analysis and synthesis process while refining and expanding the methodology used. This will include further identification and acquisition of relevant documents based on the preliminary results. Where appropriate, documents will be submitted to the OPBS/APS. As indicated, the analysis process will be formalized to ensure reliability,

reproducibility and adequate management of what will be a large corpus of documents and related analyses.

Although scheduling is still uncertain, as soon as possible and appropriate, the community workshops proposed under WPs 2-5 will be planned and carried out. This will provide substantial, and necessary input into the WP 1 process.

6. References for section 1 – 3

Alaska, I.C.C., (2015). Alaskan Inuit food security conceptual framework: how to assess the arctic from an Inuit perspective. *ICC Alaska, Anchorage*. Retrieved 11/27/2020 from https://iccalaska.org/wp-icc/wp-content/uploads/2016/03/Food-Security-Summary-and-Recommendations-Report.pdf

Buttigieg, et al. (2019) "The Ocean Best Practices System - Supporting a Transparent and Accessible Ocean," *OCEANS 2019 MTS/IEEE SEATTLE*, Seattle, WA, USA, 2019, pp. 1-5. doi: 10.23919/OCEANS40490.2019.8962680

Dobricic S., et al. 2018, Impact assessment study on societal benefits of Arctic observing systems - IMOBAR, EUR 29400 EN, doi:10.2760/713084, JRC113327.

IDA-STPI and SAON. 2017. International Arctic Observations Assessment Framework. IDA Science and Technology Policy Institute, Washington, DC, U.S.A., and Sustaining Arctic Observing Networks, Oslo, Norway, 73 pp.

Pearlman J, Bushnell M, Coppola L, Karstensen J, Buttigieg PL, Pearlman F, Simpson P, Barbier M, Muller-Karger FE, Munoz-Mas C, Pissierssens P, Chandler C, Hermes J, Heslop E, Jenkyns R, Achterberg EP, Bensi M, Bittig HC, Blandin J, Bosch J, Bourles B, Bozzano R, Buck JJH, Burger EF, Cano D, Cardin V, Llorens MC, Cianca A, hen H, Cusack C, Delory E, Garello R, Giovanetti G, Harscoat V, Hartman S, Heitsenrether R, Jirka S, Lara-Lopez A, Lantéri N, Leadbetter A, Manzella G, Maso J, McCurdy A, Moussat E, Ntoumas M, Pensieri S, Petihakis G, Pinardi N, Pouliquen S, Przeslawski R, Roden NP, Silke J, Tamburri MN, Tang H, Tanhua T, Telszewski M, Testor P, Thomas J, Waldmann C and Whoriskey F, "Evolving and Sustaining Ocean Best Practices and Standards for the Next Decade", (2019) Front. Mar. Sci. 6:277.doi: 10.3389/fmars.2019.00277

---------- END of DOCUMENT----------

This report is made under the project

Capacity-building in Arctic standardization development (CAPARDUS)

funded by the European Commission Horizon 2020 program

Grant Agreement no. 869673.

Project partners:

No	Acronym	Participant Legal Name	Country
1	NERSC	STIFTELSEN NANSEN SENTER FOR MILJO OG FJERNMALING	NO
2	NORDECO	NORDISK FOND FOR MILJØ OG UDVIKLING	DK
3	Ilisimatusarfik	Ilisimatusarfik, Grønlands Universitet, University of Greenland	GL
4	AWI	Alfred-Wegener-Institut Helmholtz-Zentrum fur Polar- und Meeresforschung	DE
5	IEEE	IEEE France Section	FR
6	NINA	STIFTELSEN NORSK INSTITUTT FOR NATURFORSKNING NINA	NO
7	UCPH	KOBENHAVNS UNIVERSITET	DK
8	NIERSC	Scientific foundation Nansen International Environmental and Remote Sensing Centre	RU
9	ARC-HU	Arctic Research Centre, Hokkaido University	JP

Subcontractors

	ELOKA	Exchange for Local Observations and Knowledge of the Arctic	USA
	UAF/IARC	University of Alaska Fairbanks/ International Arctic Research Center	USA
	CSIPN	Center for Support of Indigenous Peoples of the North	Russia
	E84	Element 84	USA