Canadian Polar Data Workshop
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Canadian and international polar/Arctic research data management – Context and avenues to enhance collaboration

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Canadian Cryospheric Information Network/Polar Data Catalogue
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Note: Audio recordings were made of all presentation and discussion sessions and can be provided upon request.

I. Executive Summary

As the importance of data and their proper management are increasingly recognized, the Canadian polar data community has grown in size, capability, and complexity. Concurrently, the need has grown to identify and connect the various organizations which produce, steward, and support polar data in Canada. In May 2015, a Canadian Polar Data Workshop was held in Ottawa to facilitate conversation between groups and present options for coordination of our activities. The Workshop agenda was crowd-sourced through a six-week national consultation on polar data, in the form of an online survey answered by individuals from 30 organizations. The Workshop was attended by 44 people, and 6 more individuals joined remotely. Presentations were made on data management topics and challenges, including data sharing, access, preservation, interoperability, policy, funding, and partnerships. In addition, national coordination, including the necessity to include all interested stakeholders at the very beginning of the process, and contribution to the international polar data community were discussed at length.

Canadian Polar Data Workshop participants, Ottawa, Ontario, Canada, 26-27 May 2015.

The primary outcomes of the Workshop are new opportunities for collaboration, creation of this comprehensive report on the proceedings of the Workshop and the landscape of polar data activities in Canada, and a position paper representing the views of the community and significant issues. The position paper, to be completed in mid-2016, will be drawn from the information in this report and will be actively shared with government agencies, academia,

northern Canadian organizations, funding bodies, and other stakeholder groups with connections to or responsibility for management of polar data in Canada.

The long-term goal of the Workshop and the coordination initiative is to design and implement, through consensus of the participants in the coordination exercise, a national management plan and structure for coordination of polar data activities and systems in Canada. Through this new structure, links within Canada and internationally will be established to create a robust technical infrastructure and human network for optimal stewardship of Canada's polar data resources. The model to be established will take lessons from the successes of other data communities and will ideally serve as an example of good practice for other sources and repositories of scientific data.

The Canadian Polar Data Workshop was co-hosted by the Canadian Cryospheric Information Network/Polar Data Catalogue (CCIN/PDC), the Polar Data Management Committee (PDMC), Exchange for Local Observations and Knowledge of the Arctic (ELOKA), the Canadian High Arctic Research Station (CHARS), the US National Snow and Ice Data Center (NSIDC), and the US National Science Foundation (NSF). Funding support was provided by the Natural Sciences and Engineering Research Council of Canada and the ArcticNet Network of Centres of Excellence at l'Université Laval. We thank all the speakers and the participants in both the meeting and the pre-Workshop consultation. The response and interest in this initiative have been significant and tell us that the time is right for coordination of the polar data community in Canada.

We look forward to working with NSERC, the Workshop participants, and all interested stakeholders to translate the excitement we felt at the Canadian Polar Data Workshop into actions for the polar data community in Canada. We are indebted to NSERC and to ArcticNet for their generous support of and enthusiasm for this initiative.

II. Data Policy-Relevant Information and Outcomes

As outlined in the detailed record of the Workshop discussions (provided in Sections IV to XIV below), meeting participants clearly felt that we need better data policy in Canada and that it is the federal government's place and obligation to lead and help unify policy development to drive improvements in data access and long-term preservation and to guide researchers on how to manage and archive data. Funding agencies should require formal data management plans for proposals and should work with the polar data community in Canada, as an initial partner, to build a system which can facilitate data archiving and access for future generations. The federal government should also provide leadership to develop an effective long-term funding strategy to support polar and other data management in Canada. These activities may be led by the Assistant Deputy Ministers of the science and technology agencies (S&T ADMs), including the Tri-Agencies, but would surely also include other relevant stakeholders such as universities and international organizations.

The cost of data management should be included in funding agencies' overall budgets, as incremental amounts to individual projects but also as baseline funding for development of data management infrastructure and systems. A funding program for data, similar to the Northern Supplements, was suggested as a way to begin support to individual researchers. Short-term funding of projects and data archives is a major concern, as data are so often lost and portals

go away when projects, or even major programs, come to an end. A detailed list of explicit funding needs is provided in the *Policy and Funding* section of this document.

Open data is considered almost universally to be a public good. Workshop participants felt that the default position of funding agencies and data collectors should be that data should be shared openly, if at all possible, and that exceptions to open sharing should be considered and approved on an individual basis. Notable exceptions to open sharing will almost certainly include traditional knowledge and sensitive data of Indigenous and northern communities and peoples. The appropriate approach to stewardship of sensitive northern and Indigenous data and information is currently under extensive consideration and will need to be a large part of the polar data community's future coordination and management plans. Participants felt that both encouragement ("carrot") and requirement ("stick") approaches would be necessary to achieve open sharing for data that are not determined to be legitimately exempt.

Other notable considerations from the Workshop deliberations included the following: (1) Employers and funding agencies should advocate for professional credit to researchers who archive data, to recognize their effort as a legitimate scholarly contribution; and (2) Participants expressed the desire that Canadian data, even if collected by people from other nations, should be archived in and available from Canadian repositories. Participants in the Canadian Polar Data Workshop were keen to coordinate their work together and are intent on having a follow-on Workshop in 2016 to continue the dialogue.

III. Conclusions and Next Steps

The overarching conclusions of the discussions at the Canadian Polar Data Workshop are summarized below:

- Canada has an obligation to provide easy access to polar data. It is the responsibility of our community to determine how to do that, and then to do it.
- Workshop participants felt the Canadian polar data management system has many strengths, but improvements are still required, including more tools for use and interpretation of the data, more training and support to educate and assist data contributors and users, and more coordination between various stakeholders, especially considering and including Indigenous and northern people and communities.
- The special challenge for preservation of polar data is the variety of our data. Archiving and providing access to varied data (the "long tail" of data) has different challenges than archiving data from massive projects, such as astronomy or genomics ("big data").
- Canada needs better data management policy to drive improvements in data access and long-term preservation, to guide researchers on how to manage and archive data, and to advocate for credit to data providers and support for infrastructure.
- Participants overwhelmingly consider open data to be a public good, and most people support sharing and free release into the public domain (without license conditions) as much as possible. Most participants feel like recent progress toward open data has been good, but the nuances of terms and timing of sharing data, including protecting sensitive data, particularly related to northern and Indigenous people and communities, need to be addressed and resolved so that our community can work together most effectively.

- Open data should be the default in all cases, because people want access to data as quickly as possible. Data producers should more seriously worry about data loss than about others stealing data and publishing them. By sharing data, we are saving data from permanent loss when data producers move or retire, when a computer fails, or other issues.

- If a data producer seeks to protect data, he/she should fully justify the exception and have the justification peer reviewed. The sharing policies and expectations should be defined in a formal data management plan for every project, required by the funding agencies, and funding for data management should be included in the project plan.

- Availability of funding, sustainability of archives and services, and data providers' and users' rights are viewed as the greatest challenges to polar data management. Interoperability of archives and data formats are viewed as the greatest technical challenges, but human interoperability, or the ability for all stakeholders in the Canadian polar data community to understand each other and work together effectively, is also considered to be a challenge. The success of this initiative will depend on improving human interoperability, especially regarding communication and collaboration related to participation and leadership by northern and Indigenous people in managing Canada's polar data.

- Long-term, sustainable funding for data management and for coordination of the polar data community is very constrained. The federal government should provide leadership to develop an effective long-term funding strategy. In the interim, we need to identify funding sources to support this coordination initiative so that we may be more efficient and productive in our work and support to polar research and monitoring in Canada.

- Participants seek a tangible, focused roadmap from the Workshop and related activities that can move polar data management in Canada forward and make a difference by creating a polar community to work together toward a common goal.

- The participants were extremely keen to collaborate and coordinate their activities on polar data management, to benefit Canada and to make our efforts more effective. The group developed a vision statement and agreed that a position paper would be drafted and circulated for community comment, then the final approved message, which would include a short list of policy and funding requests, should be taken in person to the pertinent decision makers.

- It is important to make sure all stakeholders are included and made to feel welcome in this effort, including Inuit and other northern Canadians. It is imperative to have all parties invited and engaged from the beginning as much as possible and to make it easy to join the effort. Special effort will need to be made to facilitate northern participation, keeping in mind the expense and logistics of traveling to and from northern Canada. Links should be made with international groups and with polar data communities in other countries, and the Antarctic community should not be overlooked.

- The Workshop participants agreed that we should form a committee, formal working group, or national secretariat to represent the polar data community in Canada. There may be a central coordinator or "polar secretary" to connect the different groups in Canada and in other countries along with an advisory committee formed of representatives from all sectors to provide guidance and leadership and to ensure proper communication throughout our large network.

- We must work with data contributors to find out what they need in terms of infrastructure, tools, and support for preparing and archiving data and with users to learn what they need

in terms of types of data, how data are presented and made available, and services for facilitating use and understanding of data.

- Our survey results suggest that the data most commonly managed by repositories are not the data most commonly used by people. Repositories and researchers need to recognize this and work together to archive and provide access to the data types that people use more often, to be as applicable as possible to users.

- Participants asked to continue the dialogue begun in the Workshop and are interested in joining another Workshop in 2016. CCIN/PDC staff have been in contact with Polar Knowledge Canada (POLAR, formed from the Canadian High Arctic Research Station and the Canadian Polar Commission in 2015) about co-hosting a 2016 Workshop, and funding support for annual meetings through 2020 has been included in a proposed federally-funded project related to sharing Arctic knowledge among stakeholders.

Specific activities were outlined for next steps:

- Draft the position paper and circulate to the community for comment prior to finalization and wider dissemination and advocacy activities. This should include options for consideration by the community regarding governance and activities for which the community and its advisory group would be responsible.

- Create a governance structure for the polar data community in Canada.

- Create an inventory of stakeholders (we can build on similar efforts of other organizations).

- Create a flow chart of the activities involved in polar data management in Canada, determine which organizations will work on the various parts of the process, and design a collaboration plan to facilitate efficient coordination between all participating stakeholder groups.

- Engage with fields and groups which already have good data management coordination and implement their best practices.

- Create an online communication forum.

- Plan a 2016 Canadian Polar Data Workshop to carry on the momentum of the 2015 meeting as well as the international Polar Data Forum II held in Waterloo in October 2015.

Many other specific activities and suggestions for coordination have been documented in the report below.

IV. Welcome, opening remarks, and expectations for the Workshop - Ellsworth LeDrew, CCIN/PDC Executive Director

Presentation - main points (slides in Appendix 8):
1. Good morning, and welcome!
2. Along with an invitation to this Workshop (Appendix 1), a *Background document for a Canadian Polar Data Workshop* (Appendix 2) on motivation for coordination of polar data management activities in Canada and Internationally, this Workshop, and the Polar Data Forum II was distributed to almost 200 people in mid-April. From the *Background document*:
   1. Canadian scientists and the public must have access to the data and information needed to facilitate their research activities and make informed decisions.
   2. National and global coordination of activities related to polar data management will benefit Canadian society by streamlining data management and access systems, making our work more time- and cost-efficient and putting data and information within easy reach of all stakeholders.
3. Our tasks during this Workshop:
   1. **To coordinate polar data management activities in Canada**
      1. Governance and management
      2. Interoperability: technical, human
      3. Long-term preservation of data and sustainability of archives
      4. Conversion of data to user-focused information and utilization in outreach
   2. **Prepare Canadian positions on issues in polar data management** in preparation for the second Polar Data Forum, the Tri-Agencies, and others.
4. An example of good data management is demonstrated, showing integration of a variety of datasets and effective display - *AirNow*, (http://www.airnow.gov) with air quality data from the US and Canada (managed by the EPA)
5. Logistics of the workshop - plans for breakout sessions today and tomorrow, note-takers and rapporteurs for sessions, using the microphone so that remote attendees can hear you, plans for group dinner tonight
   1. Participants, please let us know if you do not want to have your comments recorded or if you do not want to be photographed.
6. Thank you to all of our sponsors and participants in this initiative, including the Natural Sciences and Engineering Research Council of Canada (NSERC) which has contracted with us to report on the proceedings.

V. Review of Questionnaire Responses - Gabrielle Alix, PDC Data Manager

Presentation - summary (slides in Appendix 8):
1. An online questionnaire, on SurveyMonkey, was distributed in mid-April to individuals who responded with interest to the invitation for this Workshop (Appendix 1).
2. Goals of the questionnaire
   1. Gather information about the current landscape of polar data activities in Canada.
   2. Shape the agenda for this Workshop, based on participants' needs and interests.
3. Thirty-five people completed the questionnaire between 17 April and 25 May (see Appendix 3).

1. The process was very beneficial and we received a variety of perspectives and ideas.
    2. Researchers and data repository staff comprised almost half of the respondents.
    3. Few respondents identified themselves as northerners, but there were some northerners who identified themselves in other categories (e.g., researchers).
4. How do respondents use polar data?
    1. Majority use data for professional research, outreach and education, and professional data management activities.
    2. Three people use them for their daily activities, and seven use them for personal interest (research centre director, program managers, researchers, faculty and policy maker).
5. What category of polar data do you work with or require?
    1. Top three answers: Natural science, Satellite imagery, Ecological knowledge
    2. Traditional Knowledge (TK) data are required for about half of the respondents to do their work.
    3. Less frequently used categories - Political science, Health sciences, and Social sciences
        1. The same people use or require these three types of data - they are all working closely with Northerners and are policy makers, researchers, a research advisor, a faculty member, and a centre director.
        2. This is reasonable given that the three types of data are often sensitive and not as freely shared as natural science data.
6. What types of data do you **manage** or **use**?
    1. All nine categories of data were frequently managed and used, especially reports and publications.
    2. Top **used** data types - Scientific publications, written reports, natural history collections and associated data, and satellite imagery.
    3. Top **managed** data types - Raw data, maps derived from data, information derived from data, custom products derived from data, and processed data.
        1. People who manage data mostly manage raw data and derived information.
    4. **NOTE: There is no overlap between the top used data and the top managed data types!**
        1. Repositories and researchers need to recognize this and work together to archive and provide access to the data types that people use more often, to be as applicable as possible to users.
7. Why do you archive your data?
    1. We were surprised and happy to see that 94% of respondents said "data are a public good"! This is the most important reason why people archive their data.
    2. These results are encouraging and indicate that the culture is changing to be more favourable toward data sharing, ultimately leading to more collaboration.
    3. Lowest percentage responses - "access other people's data" and "funding requirement" which was surprising as we anticipated a higher number.
        1. These responses came from researchers, a faculty member, students (Post-Doc and PhD), and data repository staff.
8. What are the technical challenges of polar data management?
    1. There are many challenges - **interoperability and data formats are viewed as the greatest challenges.**
    2. Moderate challenges - Long-term preservation and internet capacity and bandwidth.
        1. Internet capacity and bandwidth are good in southern Canada but are lacking in the North and on ships (particularly in the Arctic Ocean).
    3. Security was identified as the smallest challenge - this is surprising to us due to the significant security issues discussed in various fora that can threaten repositories.

1. Positive responses on security came mostly from data repository staff, researchers, policy makers, and a faculty member.
9. What are the ethical and political challenges of polar data management?
    1. **Long term funding comes in first with over 80% of the respondents saying this is an issue.**
    2. Providers' and users' rights are the next most popular answer with 77%.
    3. Almost all issues garnered over 50% response which means that most of the challenges listed are issues that will need to be addressed.
10. Which data repositories or archives do you use?
    1. Responses are located on a map - each star represent an archive or repository that was used, in North America, Europe, and Australia.
    2. Repositories listed by more than one respondent, in order of frequency of response:
        1. Polar Data Catalogue (most common response)
        2. National Snow and Ice Data Center, United States
        3. Environment Canada
        4. Arctic Science and Technology Information System, University of Calgary
        5. Canadian Geospatial Data Infrastructure
        6. Geomatics and Cartographic Research Centre, Carleton University
        7. National Oceanic and Atmospheric Administration, United States
        8. ICES Oceanographic Database
        9. Ocean Biogeographic Information System
    3. Access to international data is very important to respondents. It is assumed to be similarly important for other users and stakeholders.
11. What are the strengths and challenges of polar data management in Canada?
    1. Canadian polar data managers and systems have many strengths, but improvements are still required.
    2. Challenges have been covered in the questions before as well as in the six sub-topic presentations later this morning.
    3. All items in the table are viewed as strengths but many also have high levels of respondents indicating they are challenges.
    4. Top strengths
        1. IT and technology (challenge: It can be difficult to keep up with the latest technology)
        2. Data visualization (but we need more!). Users like displays of data and want more.
    5. Minor strengths
        1. Networking and partnerships (but we need more - this Workshop is a good opportunity to enhance those links!)
        2. Protection of sensitive data (but questions remain, so it is important to form strong policy that will help repositories protect data)
        3. Open data (but this is also seen as an ethical and political challenge)
            1. This pattern may be due to lack of a clear definition of open data - we should create a community definition of open data.
        4. Education and training (but again, we need more of this)
            1. People gave many suggestions for communication and outreach - meetings (like this one, plus larger conferences), newsletter, webinars, and others.
                1. We could use communication venues to present groups and organizations, share progress and highlight available datasets, learn about new initiatives and make connections, and provide resources, information, and technical help.

        2.   We need to share the functions and responsibilities for these activities among several participants.
    5.   Data portals (but archives are a challenge - we should strive to understand the difference and how we can address it).
  6.   Other strengths - these are elements that were not in the questionnaire list but emerged from other comments:
        1.   Metadata management
        2.   Ocean data
        3.   Spatial data infrastructure
12. Final questions about coordinating Canadian polar data management and Canadian leadership on the international stage will be addressed next by Professor Warwick Vincent.

Discussion/questions from the audience:
1. Do you think the lack of use of social science data, as described in the questionnaire responses, is a reflection of the interests of the questionnaire participants rather than a generality?
    1.   There were eight respondents who work in social sciences, but it is unclear what percentage of the polar research and data community these respondents represent.

VI. Goals for the Position Paper - Ellsworth LeDrew, CCIN/PDC Executive Director

Presentation - main points (slides in Appendix 8):
1. There are a number of prior summits and initiatives related to polar data and data management in general that can inform this workshop and the development of a position paper. Are there other references for previous work/documents on research data management, including Arctic or polar, which we should consult?
2. Audiences for the position paper are many and include the Tri-Agencies, the Canadian High Arctic Research Station (CHARS[1]), the Canadian Foundation for Innovation (CFI), scientists, northerners, data portal managers, and others.
3. The process to develop the position paper started last year with meetings with key collaborators and stakeholders. Following the questionnaire and this workshop, we will write an initial draft and will request feedback. All perspectives, including dissenting opinions, will be documented.
4. The outcomes of this Workshop will form important input into Polar Data Forum II.
5. The idea of a second questionnaire has been raised, to augment the results from the first one and reach new audiences. We will discuss this more tomorrow afternoon.

Comments from the audience:
1. **We need a tangible, focused outcome or roadmap from this initiative that can move the polar data management agenda forward and make a difference by creating a polar community to work together toward a common goal.**
2. Who is our community? How many people are we talking about? It would be helpful to have a report which provides more information on the polar data management community:

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[1] CHARS is now included in Polar Knowledge Canada, POLAR, which formed from combining CHARS and the Canadian Polar Commission in June 2015.

who are we, how many individuals and groups are involved, activities and future plans of each member.

1. The Geomatics and Cartographic Research Centre at Carleton University has done a scan of who is doing Arctic data management. This initiative listed eighty-five different groups which self-identify as creating data. However, it is not certain that we are actually a community due to our fractured work and relationships.
2. We should mine and report on who is getting funding for northern research and data management.
3. If a second questionnaire is conducted, send it to more than the 200 people from the original invitation list, if possible. The Tri-Agencies, ITK, and others could be surveyed for information on stakeholders and contributors to polar data management.
4. We should be careful about calling our plan a "position" as that can sometimes imply an official Canadian stance in the international sphere. We need to be sensitive to semantics and be clear that this is not the position of the country of Canada.

VII. Introduction to Workshop Question: *How can we coordinate polar data management in Canada and what opportunities should we pursue for Canadian leadership internationally?* Warwick Vincent, Scientific Director of Centre d'études nordiques (CEN), Université Laval

Presentation - main points (slides in Appendix 8):
1. Due to the recent focus on the importance of data and the formation of many relevant partnerships, the time is ripe to capitalize on opportunities for polar data management in Canada. I will list some pertinent programs and initiatives as examples and likely members in our work together.
2. ArcticNet Network of Centres of Excellence, 2004-2018
    1. Northerners want to know what is going on in their own backyard.
    2. Community consultations and outreach required for research permits are not necessarily reaching communities with data or information on research results.
    3. Inuit Research Advisors in each Inuit region are helping to bridge the gap.
    4. The ArcticNet community of young researchers is helping move the culture toward open data sharing.
3. Polar Data Catalogue (PDC)
    1. Initiated by ArcticNet, using metadata as a starting point.
    2. Has a geospatial focus because maps are the desired information sharing mechanism by northerners in Canada.
    3. Standards-based to facilitate interoperability and sharing with other polar data portals.
    4. With the addition of new partners, the PDC now houses data, along with metadata.
    5. In response to feedback from northerners who had difficulty with the PDC Geospatial Search application being slow due to limited bandwidth, the PDC Lite was created.
    6. The PDC has an oversight committee, the Polar Data Management Committee (PDMC), with representation from ArcticNet, northern organizations, government departments, and universities. You may wish to consider enhancing or extending this committee as a part of this current initiative.
4. Activities to coordinate data

1. Each research group and institute has its own data requirements, and strengths - the key is to connect these pieces together. Tools and advancements include:
    1. ArcticConnect - new suite of tools will be available soon
    2. *Nordicana-D* - journal for publishing datasets
    3. Journals are more frequently requiring publication of data.
    4. Inuit Knowledge Centre at Inuit Tapiriit Kanatami (ITK) is a model for data exchange and translation as required by users and stakeholders.
    5. Networks of stations and collaborators (e.g., CEN, Canadian Network of Northern Research Operators [CNNRO], International Network for Terrestrial Research and Monitoring in the Arctic [INTERACT], many others) are developing data policies and best practices, defining expectations and challenges for data management.
5. There is a need for data sharing across disciplines.
6. Increasingly, international players such as South Korea are interested in Arctic data collection and are even collecting in Canada. There is no formal mechanism in place by which we can access some of these data.
7. Questions that must be addressed regarding data coordination - these will be addressed in breakout groups over the next 1.5 days:
    1. Who should take the lead in this initiative, to improve Canadian data management for all stakeholders (northern communities, researchers, governments, industry, policy makers, public, etc.)?
        1. What is the role of CHARS?
    2. How can we connect and build on each other's initiatives?
    3. How would we fund this effort?
    4. How can researchers be encouraged to contribute?

Comments from the audience:
1. For International research, some data sharing is required through the Oceans Act for international researchers. Perhaps we should explore this as an example.
2. The oceanographic community has a culture of open data sharing in some sectors, but this may not be true in academic circles.
3. Efforts should be more closely aligned with the Arctic Spatial Data Infrastructure (ASDI) and the Canadian Geospatial Data Infrastructure.

VIII. Data Sharing - Peter Pulsifer, Research Scientist, US National Snow and Ice Data Center

Presentation - main points (slides in Appendix 8):
1. "Sharing" may have different meanings to different people, but the idea of sharing data being a "common good" is included in most definitions.
2. Sharing data openly is necessary for discovery, and data increase in value when shared and preserved. Data sharing supports reproducible research and is critical for transparency. The benefits of sharing and open data are generally considered to outweigh the risks.
3. The scientific community and society in general are in a transition, moving quickly from private data to sharing and open data, with a desired outcome of sharing being avoidance of conflict.
4. Governments are promoting the concept of open data. Organizations such as the International Arctic Science Committee (IASC) are releasing statements on data sharing which address the concept of open data while allowing ethically-legitimate restrictions.

5. There is competition in research to publish and be recognized. This is a sharing model, but it is one which is restrictive and is being challenged by newer, more open sharing models.
6. Trust is fundamental to sharing. Data sharing policies and clear information and expectations help to build trust, but trust also relies on human relationships and political and historical context. It takes time to earn trust.
7. Practical issues must be addressed in archiving data, such as which archive to use (if there are multiple appropriate options), how to maintain the archive, and how to build data management tools which are easy for both the data producers and data managers to use.
8. Questions for attendees (these questions may be addressed in the Data Sharing breakout session):
   • How can consideration for publication and credit to the data producer be reconciled with open and immediate sharing?
   • Many data producers expect an embargo period of exclusive access to data. How can we encourage early archiving? What timelines are realistic for the embargo period? Should sharing be immediate? Who decides on the timelines - the producers, funders, or users? Can the timeline be different for different types of data?
   • How do we reconcile the expectations of open data with the legal and ethical issues of providers' and users' rights or the potential for data sharing to cause harm?
   • How do we address considerations of intellectual property and "ownership" of data?
   • How do we promote trust?

Questions to be addressed during the breakout session:
1. The majority of participants indicated that "open data" is necessary and valuable. At the same time, there are notable exceptions to the fully open model (i.e., International Polar Year program Data Policy, IASC Data Statement which allow exceptions). What should the allowable exceptions to fully open data sharing be, and who should decide these exceptions?
2. In general, trust is a critical component of sharing data openly. What is required to establish trust between and among data producers, stewards, users, and other stakeholders?

Summary of Ideas Presented During the Data Sharing Breakout Session and Group Discussion

Chair: Peter Pulsifer
Rapporteur: Jeff Saarela
Participants: Marlene Doyle, Jesse Flowers, Ed Kennedy, Virginie Roy, Scott Tomlinson, Cameron Wilson

1. **Open data**
   1. We should assume that open data is a good idea. Data should be collected and released, but there is substantial nuance in this, including consideration of timelines of release and legitimate permanent exceptions.
   2. There are different kinds of data: scientific research data, monitoring data, potentially commercial data that may have proprietary restrictions, local and traditional knowledge, data from sensitive areas or species, others. Public domain is the desired outcome, but some types of data, like images, may have copyright holders who must agree to release the data to the public domain.
   3. Data sharing expectations may be different when dealing with monitoring data, instead of research data. In general, there is no reason to not share monitoring data.

4. Monitoring data should be shared as quickly as possible - immediately/near real-time for sensor data, monthly or annually for analysed data.
5. To encourage open data sharing, it is important to communicate to researchers the value proposition in data sharing and explain what is in it for them.
6. Researchers and funders should be aware that there are costs to **not** making data open. If data are not shared or are not accompanied by high-quality metadata, they will be difficult to find. Sharing data increases the probability of wasted resources and time by duplicating data collection.
7. Where you work may be important to how you feel about the data you produce. For example, if you work for government and manage a long-term monitoring data project, you may not feel great ownership over the data. Your connection to the data may depend on your job function and what you are doing to generate the data.
8. Data sharing is perceived as a part of research, but data sharing can also happen with Elders who share knowledge and information with community members or researchers. In this case, it is the Elders who control how data are shared. The provider and the recipient of the sharing must both be defined, and the roles must be respected. This information may be designed and stated in a data management plan.
9. How shall we define data, information, knowledge, and analysis, and the expectations of sharing which go with each?
10. Do permits or licenses for research in northern Canada require open data? This should be explored and understood.

2. **Exceptions to open data**
   1. There will always be exceptions to the general policy of open sharing, and they are context dependent. The exceptions make it difficult to develop a comprehensive data sharing policy that can be applied to all polar data sets.
   2. Who should decide these exceptions to fully open data? Communities, individual researchers, journals, publishers, employers, funders, shareholders, and courts may all be involved.
   3. The default should be fully open data, but if a data producer plans to deviate, he/she should justify the exception and have the justification peer reviewed. Data producers should not be allowed to just do whatever they like.
   4. Currently, ethics procedures require that much social science data is destroyed. Do we, or does anyone, including ethics boards, have the authority to not destroy sensitive data?

3. **Embargoes**
   1. Immediate access to data is what people, including northerners, want, but this is not happening due to a variety of reasons.
   2. Some data can be made open immediately upon collection, such as most monitoring data, but other data sets will have different timelines for release.
   3. Data may be placed into a repository but not made available until the embargo is over. This is good practice as it protects the data from loss (by archiving) as well as premature release (by not allowing public access).
   4. The polar research data community needs to establish a reasonable expectation and maximum time for embargoes of certain types of data, such as 1 or 2 years.
   5. Embargo periods should be shortened to reduce the risk of data loss.
   6. If guidelines or requirements for embargo periods are enacted, then exceptions will need to be defined and approved.
   7. When does the embargo clock start: When the data are collected, at the end of the project, or after publication? This should be clearly determined and stated.

8. The International Polar Year (IPY) data committee had a policy on embargo times. Should we set up the same kind of body which will set this kind of policy?
9. What are the pros and cons of embargoes? These should be explicitly stated.

4. **Issues with sharing data**
   1. Some data are required to be shared, some even by law, but people are not sharing them. How may we work with data producers and others to address this?
   2. The research agenda is driven by incentives in the research community such as publishing. This is a strong disincentive to releasing data too early. How can our community have any influence or control over this reality?
   3. There is a sense that scooping (stealing data and publishing them as your own) does not happen very often in the real world. For example, a graduate student contributes her data to a large repository because her supervisor told her to do it. There is a perceived risk, but it may not be a very large risk at all.
   4. People are part of different communities. The polar community supports fully open data, but other communities are not requiring fully open data. Some researchers are pulled by multiple sets of expectations.

5. **Trust**
   1. It will take time to establish trust through mutually beneficial relationships.
   2. Trust should be facilitated by funders and other stakeholders.
   3. We should recognize the actions that are required to build trust and follow them.
      1. One such action is always providing data back to anyone who was promised they would receive it.
   4. We should understand that it takes time to establish trust, and we should plan for it.
   5. What is the mechanism for creating or facilitating trust? There should be a clear process resulting in written agreements and or statements of principles which stipulate the relationships between participating individuals and groups. Written agreements require and sometimes can engender a basic level of trust, but there is no magic formula to doing this. It took more than two years to get an international agreement for the ASDI signed, with much time spent building trust and relationships among countries and individuals. The level of work required in the polar community may be similar, due to the great variety in the size, level of experience, and sophistication of the players in our community.
   6. We have a good chance of success if can get the key parties to the table to start the discussion and build trust. However, we need to know that people are prepared to provide the resources to work through a process for developing agreement.
   7. When we talk about "community," we are talking about the polar data community. However, there is also the community of Inuit in Canada who deal with trust all the time. Trust is complicated and difficult to establish but is very much a critical component. The path to establishing trust will be different depending on the types of data and different communities, and it must be based on relationships built over time. Unfortunately, information does not always get back to the community directly: Sometimes it happens indirectly, long after it should have happened, which erodes trust. Developing trust involves and depends on every stakeholder.

6. **Examples related to data sharing**
   1. The Geogratis open data archive at Natural Resources Canada (NRCan, http://www.geogratis.gc.ca) was created because it is less expensive to have open data than to have and manage licenses for use. Also, different licenses complicate and hinder data interoperability.

2. For satellite data, different processing levels are required for different communities (level 0 raw data, level 1 processed data, etc.). Which data and which processing level is shared depends on the context and the community.
3. NRCan and MacDonald, Dettwiler and Associates Ltd. (MDA) partner to manage ground-receiving stations for satellite data. This is a public-private sector arrangement, part of which is a contract that limits what can be shared.
4. For ArcticNet, the embargo extends to three years after the end of the project. This allows time for appropriate analysis and quality control. Other polar programs in Canada, however, have embargo periods as short as one year.
5. In Yukon, there is a project to develop a flow of information for permits, licenses, and projects which presents information for decision making.
6. For the National Science Foundation in the United States, open data is a funding requirement. They have established the capacity and resources and provide archives for many communities.
   1. The NSF requires a mandatory two-page data management plan which is part of the proposal review process. The reviewer must determine if the budget supports the work proposed. Grants can be rejected if this is not justified. People have not felt victimized by this new requirement.
7. The geospatial community in Canada has gone through a five-year process of community building, developing a strategy and governance framework. The community is fragmented as well as overpopulated with organizations relative to its size. They have much in common, but all have discrete interests (cartography, surveying, science, industry, licencing) which need to be coordinated. A new organization, GeoAlliance Canada (http://cgcrt.ca/en/geoalliance-canada/), represents all geospatial organizations in Canada, including corporations, universities, governments, and not-for-profit organizations.
   1. This process has led to success at building trust, which is key to making progress. It takes a long time, and it may be an example for us. We need a structure to work this out for the polar data community. Our community needs a champion, or a few champions.
   2. The process was supported by NRCan. We need funding to support the polar data community if we are to succeed in this effort.
   3. *A Case Study of the Canadian Geomatics Community Round Table* (http://geoscan.nrcan.gc.ca/starweb/geoscan/servlet.starweb?path=geoscan/fulle.web&search1=R=296396) may be an informative document.
8. In human health research, data must be taken to the community before release to the general public. Although this is different from the normal academic research process, it is the policy of the Northern Contaminants Program and perhaps other programs, too. This sharing is very important for the communities. Communities need more recognition as stakeholders in the research process.
   1. For health research, sometimes the community does not want the data to be published. These concerns must be considered and respected.
   2. This requires extra time to publish and may impact students' timing of graduation.
   3. As a community, we can help provide information on this, to make sure people know when this type of consultation is required and how it may impact a project, or a student's career.
9. What other communities are doing well in sharing data? The ocean research community, astronomy, genomics. We can learn from these and others which may have more similar sharing issues to the polar community.

7. **Policy**
   1. How can we encourage the willingness to share? The sharing process needs to be defined early in the process of designing the research study, as an expectation and requirement.
   2. The data management details for each dataset should rely on a formal data management plan that is part of the research proposal, and exceptions to sharing should be stated in the metadata.
   3. If data licencing terms are required, they must be very clear.
   4. The community itself may not be able to enforce firm policies about openness - the willingness and ability to share depends on community cultures, funding requirements, employer requirements, and others.
   5. Some people are not optimistic about a community-wide consensus on a carrot or stick policy that applies to the entire polar data community. What may be best is documentation of existing and future required policies.
   6. Journals and publishers are starting to require data to be archived. Once this is more common, it will force authors to archive their data, and this will quickly lead to a culture change.
   7. Policy on intellectual property rights must be resolved before we can have clear definitions or expectations for sharing.
      1. Researchers operate in a world of pooled funding, e.g., NSERC and industry may fund a single project. In this case, who owns the intellectual property in the data?

IX. Data Access - Benoît Pirenne, Director of User Engagement, Ocean Networks Canada

Presentation - main points (slides in Appendix 8):

1. Data access can be defined in terms of expected functionality and qualities of the access system, including data, metadata, portals, sharing services, users, and other components.
2. Everybody has data, but few have well-managed data, and even fewer provide access to their data.
3. Creating a data access system can be confusing and difficult, but one way to start is to design the system according to user-defined requirements for access:
   1. Users want to be able to find data using online portals, select what is interesting, and download relevant data in a usable format.
      1. Users want data access and download to be fast. Access to data in Northern Canada is often slowed due to limited Internet capacity and speed.
      2. Users want access to real-time data whenever possible.
      3. Users want access to international data, not just Canadian data.
      4. Users would like to know whether data are of high quality. Archives should ideally provide quality indicators so users know whether to trust the data.
   2. Portals should be reliable, available, and intuitive, with good user interface design.
   3. If analysis functions or interactive access are available, that is even better.
4. There are a plethora of data portals, with more being built all the time. Should we have a centralized, national facility which would simplify access? This ties in to data preservation and interoperability.

5. If a user downloads data, can they or should they be expected to upload products or analyses which they make from the downloaded data?
6. When discussing open data, remember that a "proprietary period of access" and "privacy protection" are two different aspects.
    1. Perhaps there should be no proprietary period at all for data that do not require privacy protection (no embargoes).
    2. Privacy protection will almost always apply more to social science data than to natural science data.
7. Data access depends on good metadata which describes data observation conditions, data quality assessments, and other characteristics. Data without adequate metadata are not useful and are therefore not accessible.
    1. Metadata should be public, even if the data themselves are not.
    2. Should there be metadata quality enforcement/acceptance criteria for funding agencies?
8. All topics addressed during this Workshop (sharing, access, preservation, interoperability, partnerships and linkages, and policy and funding) are tightly coupled. Decisions in one will influence the others.

Questions to be addressed during the breakout session:
1. What does "Open Data" mean to you?
2. Who are the users, and what are their needs for data access? Is everything covered? What is important?

Summary of Ideas Presented During the Data Access Breakout Session and Group Discussion

Chair: Benoît Pirenne
Rapporteurs: Laura Petrunka and Karen Lauer
Participants: Shannon Asencio, Mathieu Ouellet, Ellsworth LeDrew

1. **Open access**
    1. In the questionnaire responses, numerous people indicated that Canada has an obligation to provide easy access to polar data. It is the responsibility of our community to determine how to do that, and then to do it.
    2. We must improve awareness by increasing education about the benefits and risks of open data. This will address some of the concerns of data producers and will encourage data sharing.
    3. "Open data" means freely available, where the information is put online for anyone to use, without any proprietary period or restrictions.
    4. Instead of worrying about others stealing your data and publishing it, it is perhaps more important to worry about data being lost, especially when data producers move or retire or when a computer fails. By sharing data, we are saving data from permanent loss.
    5. Some people will want to have data ownership. This will be an impediment to open data.
2. **Portals**
    1. Having a centralized location for data may make access easier, but having more than one portal is useful if the different portals provide different views to the same data or different ways to access the data.

2. Different portals can be adapted to specific audiences and designed for specific uses or specific types of data, and customized applications can be built which provide different ways to access data.
3. The Polar Data Catalogue and many other portals in Canada are working on this, to provide different types of access to different communities and users.
4. Too many portals can be confusing for users, so portals should be linked so that data are available across portals.
5. What kinds of portals and tools should be built? Who should build them?

3. **Data reuse**
   1. Providing access does not guarantee reuse of data. Reuse only occurs if others find value in the data, if the access process is easy, and if others have adequate funding support to explore the shared data.
   2. This community should focus more on analysis and reuse, in addition to simplifying the access process. We need to go from data to knowledge!
   3. Universities and the private sector should be a part of improving access and facilitating data reuse, to add value to the data. As an example, the Group on Earth Observations asked for "user engagement proposals" to encourage reuse of shared data.
   4. Download tracking is helpful for funding, as it provides information on what data are being reused.
   5. For data which are not publicly available but are instead available only via password, even temporarily, systems can be designed to track who downloads the data and provide this information to the data producer. This may be welcomed, especially by the social science community.
   6. In environmental monitoring, progress may be made by archiving and making raw datasets available, then converting datasets into a consistent format which may be easily reused.
   7. Enforcing use of controlled vocabularies/keywords facilitates discovery and reuse (and interoperability).

4. **User requirements for data**
   1. The end user must be defined. There are many different users and communities.
   2. For geographic data, it is important to always relate the data to time and space. This is the concept of a data cube, and it facilitates searching and discovery of data.
   3. Being able to view and download sub-sets of large datasets is very valuable.
   4. Raw data are usually the data that are shared, but products derived from raw data may also be useful and should be considered as a valuable dataset which should be made available.
   5. The community would like to have access to Canadian-based data that are collected by other countries. For example, there is a Korean ice breaker that has been operating in Canadian waters. How shall we obtain access to these types of data?
   6. Reports and publications are very commonly used, perhaps even more than the data itself, but this may be changing as data are more available.
   7. We need to serve the needs of the data producers and users and make data access as simple as possible for both groups.

5. **Data licenses**
   1. The Canadian Open Government Action Plan has an open data license. Should the polar community follow this?
      1. The license allows a user to modify the data. There was some concern with this as it may cause data producers to not want to archive their data in a system which allows modification of contributed data. However, the government's understanding of

modification of data may be different from how data producers view it. This should be explored to ensure that data are respected and that data producers are comfortable with the terms of the open data license.
   2. It is important to make sure that the terms of use or license go along with the data. How can this be done?
   3. There are many open data licenses which have differences which actually render them non-interoperable.
   4. There is a move in the data world towards no licenses at all - all data would be available in the public domain. This would dramatically simplify archiving and access.
6. **Limiting access**
   1. Protection of sites and species, including humans, may justify limiting access to data.
   2. Raw data are provided only if privacy protection is not violated.
   3. Data may be protected at the researcher/producer level (not archived and only accessible to the producer), at the portal level (archived but only available to the producer and data repository staff), or at the community level (archived but available only via password).
   4. Data may be archived without providing open access. The data may remain hidden temporarily (until the end of an embargo) or permanently (for sensitive data). Is it likely that data producers will archive data that they do not want released either temporarily or permanently? Is limiting data access acceptable? Is it useful to archive data without making them available?
7. **Metadata and documentation**
   1. Documentation is required for data to be useful. Metadata should be publicly available, even if the data are not. This provides a record of the existence of the data.
   2. There are different types and levels of metadata. Descriptive metadata (ISO 19115 or FGDC standard format) are critical for discoverability, but there are additional levels of metadata which give further details and aid in reuse.
   3. Documentation should include some indication of quality.
8. **Policy**
   1. The community needs to formulate policies related to data access. This will take substantial effort.

X. Data Preservation - Scott Tomlinson, Environmental Scientist, Northern Science and Contaminants Research Directorate, Aboriginal Affairs and Northern Development Canada[2]

Presentation - main points (slides in Appendix 8):

1. Preservation protects data against loss, ideally through reliable and redundant storage systems.
2. We focus here on preservation of digital content, defined by Wikipedia as a formal endeavour to ensure that digital information of continuing value remains accessible and usable, through planning, resource allocation, and application of policies, strategies, and actions to ensure access and accurate rendering of authenticated content over time.

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[2] AANDC is now Indigenous and Northern Affairs Canada, since November 2015.

3. Preservation should be facilitated through a national effort to create and support long-term archives and repositories.
4. Data producers and users should have confidence that the repositories will endure via long-term and stable support, so that users can rely on their existence and producers will feel it is worth the effort to archive their data.
5. Old data can be extremely valuable for climate and environmental change observations. Non-digital content such as paper records, books, and photographs should be located, identified, and rescued by digitizing them and making them available in public portals.
6. Data quality and documentation are critical and are primarily the responsibility of the data producers (researchers).
7. In the case that repositories are performing quality control for certain types of data, data producers and future users must have confidence that control processes are not introducing errors and are well documented.
8. Data should be provided in internationally-accepted formats when possible, to promote long-term access as well as interoperability.
9. Questions for attendees:
   1. Who should lead the effort to coordinate polar data rescue and preservation?
   2. What data should be rescued first? How do we prioritize data for rescue?
   3. Who should pay for data rescue?
   4. What should be expected of researchers with respect to data quality and documentation?
   5. Strict adherence to accepted formats may hinder data archiving. To what degree should producers be expected to provide data in specific formats?

Questions to be addressed during the breakout session:
1. Data documentation is a critical part of the preservation system. What are the best methods, including enforcement or encouragement, to ensure this essential element of the data life-cycle is completed?
2. Data rescue has been a hot topic in recent years. What are the key challenges to overcome when addressing the issue of data rescue? What triage methods can or should be used to prioritize datasets at risk of being lost?

Summary of Ideas Presented During the Data Preservation Breakout Session and Group Discussion

Chair: Scott Tomlinson
Rapporteur: Paula Tozer
Participants: Gabrielle Alix, Claire Austin, Elizabeth Griffin, Helen Halbert, Laura Petrunka

1. **Motivations and challenges of preservation**
   1. Motivations for preservation include community expectations, funding requirements (return on investment), producer credit and citation (formal or personal, for a sense of well-being by contributing to the greater good), extra publications, and assurance that data will live forever.
   2. This community should consider the actions which we can take to simplify archiving, to encourage preservation by streamlining the process for the data producer.
      1. We should use or design specialized applications or tools for data preservation, such as a special software stack for running data through the process. The tool should have processes which check for fixity (avoiding bit rot), produce archival packages

for incoming data, check formats every few years to ensure files are still accessible, and other characteristics.

3. The special challenge for preservation of polar data is the variety of our data. Archiving varied data (the "long tail of data") has different challenges than archiving data from massive projects, such as astronomy or genomics.

4. Communities such as astronomy have a strong record of data management, but it is easier to manage astronomy data because there are fewer types. However, we can learn a lesson from astronomy in particular in that they make plans for data management and preservation even before the telescope is built! We should be similarly proactive.

5. There are many disciplinary portals available, but some communities do not have repositories. There must be a home for data sets before they can be archived, so focus should be on identifying gaps in availability of appropriate repositories for all polar researchers in Canada.
   1. Policy and infrastructure must go hand in hand to make it easy for researchers to comply.

6. For social science research, it is critical to ensure that consent forms are completed properly. If there are mistakes on the form, this can result in loss/destruction of data.

7. Security of archives can be a challenge, to ensure that data are safe for the long term and will not be compromised or corrupted by intrusion.

8. Much social science data simply can not be preserved, due to privacy considerations and other restrictions. Is there any way to save these data, instead of destroying them?
   1. Perhaps we need to think about social science data differently, to acknowledge that the "data" are already being "archived" in the publications and reports that are coming out of the work.

9. The issue of preserving physical samples must be addressed, if not by this community, then by someone appropriate.

2. Data rescue

1. We should, as a polar data community, set out policies for identifying data at risk and prioritizing data for rescue.

2. The idea of data rescue applies to Traditional Knowledge (TK) as well as digital data. Transfer of knowledge from Elders to youth is critical.

3. It may be difficult to provide complete documentation or assess the quality of rescued data. This may help determine whether a particular dataset should be rescued or not.

4. Some data may not be worth rescuing. Criteria for abandoning data should be documented in policy.

5. Data rescue success stories should be identified and highlighted for outreach as well as to justify funding rescue activities.

6. Climate data from the Polar Continental Shelf Program have been compiled and made available on the University of Ottawa website. These data may be considered high priority and should be entered into a permanent repository to ensure long-term access.

7. Related to rescue is data mining, to make archived data more useful.

3. Documentation

1. Documentation should be a mandatory component of data management policies and plans.

2. At the same time, the value of documentation should be emphasized to the data producer.

3. Documentation should itself be of high quality so that future users can fully understand the history of the data.

4. README files are very useful to provide documentation which goes beyond the initial discovery metadata, but standardized machine-readable metadata is even more useful. Requiring a standardized README file may be a good start to obtaining the information that is needed, rather than allowing the README to be completely free-form. The polar data community should define the contents of a standard README file to facilitate conversion to machine-readable metadata in the long-term.
5. It may be useful to have some fields that are not controlled, to allow additional comments and text that are useful for using the data. This information may be targeted in a keyword search.

4. **Data formats**
   1. When translating information into different languages, the original records in the original language should also be preserved, since translation can result in a change of meaning.
      1. Alternatively, if source data may lose meaning when translated or converted to a new format or a different language, then it may be preferable to leave data in its own original format or language.
   2. Data sets that support research publications should be archived in the format that supports the published research results.
   3. Who should be responsible for data format conversion? Should it be done by the data producer or by the data managers or other repository staff? Should there be a separate function for data format conversion and long-term preservation?
      1. Optimal solution would be for producer to provide data in non-proprietary formats for long-term archiving, but if that can not be done, then the repository should do the conversion and confirm accuracy.
   4. Who will pay for conversion, including development of tools and personnel time?
   5. Proprietary software usually outputs data files in proprietary formats. This is discouraged for preservation as it hinders future access to data. It is preferable to output and preserve non-proprietary formats for data files if at all possible, along with the original proprietary files, or to provide software for opening the proprietary data files.

XI. Interoperability - Julie Friddell, Associate Director, CCIN/PDC

Presentation - main points (slides in Appendix 8):

1. Interoperability was identified in the questionnaires as one of the primary challenges for polar data management in Canada.
2. Interoperability may be defined in terms of *technical* as well as *human* and *legal* interoperability.
3. Technical interoperability is defined as linking portals for metadata sharing and data discoverability.
   1. Impediments to technical interoperability include the variety of standards and formats in use for both metadata and data, the lack of use of controlled vocabularies/keyword libraries in metadata, and the variety of sharing protocols available for both metadata and data.
4. Human interoperability is hindered by the lack of interaction between data producers and repositories and the fact that different people have different experiences and views on sharing data, thus it is sometimes difficult to work together due to a lack of familiarity and trust.

5. As with other topics discussed today, limited funding impacts our ability to achieve interoperability.
6. Benefits of interoperability include more visibility for Canadian data, enhanced knowledge of and access to Canadian and international data, reduction of the burden of archiving on the data producer, and reduction of duplication of data.
7. Interoperability can lead to new collaborations with Canadian and international polar data initiatives, including possibilities for co-hosting or ingesting other nations' data.
8. Interoperability can help link data for large-scale studies by providing online tools where researchers can upload and combine their data with others' data.
9. Online data management tools are required to aid interoperability. There are many tools which may be used, such as brokering to aggregate metadata and web services to share data files and metadata. The largest challenge is deciding which tools we want to use.
10. Manual creation of interoperable links is labour intensive. Can we make a "Google for data" to automate interoperability? This should be explored.
11. Canada is contributing to polar data interoperability through a variety of data portals and archives, the Canadian federal geospatial platform and data infrastructure, Research Data Canada (RDC) and other initiatives, and expertise and leadership in metadata formats and web services.
12. Canada is also a leader in making interoperable links with international data portals and organizations. We should use these connections to enhance and strengthen the polar data community in Canada.

Questions to be addressed during the breakout sessions:
1. What are the challenges for interoperability (technical, human, legal)?
2. What specific actions can your group/Canada take to improve linkages between polar data portals within Canada and internationally?

Summary of Ideas Presented During the Interoperability Breakout Sessions and Group Discussions

Note: Since interoperability ranked as one of the top challenges for polar data management, there were two breakout sessions for this topic. The discussions and notes from both sessions have been combined below.

Chairs: Julie Friddell (1) and Shannon Vossepoel (2)
Rapporteurs: Jennifer Sokol (1) and Shannon Vossepoel and Jeff Saarela (2)
Participants: Claire Austin, Tulio Crescuolo, Shirley Mills, Jenn Parrott, Robert Way (1) and Colline Gombault, Mathieu Ouellet (2)

1. **Definition of interoperability**
    1. Interoperability must be clearly defined, to facilitate clear communication. This community should establish definitions of human, legal, and technical interoperability.
    2. Technical interoperability may be defined as the ability to interact with data sets in a flexible way.
    3. There are different levels of interoperability, from bare minimum to optimal/maximal. It may be important to consider what level to strive for in different situations.
    4. Even though it may not be considered true interoperability, providing a link to an external source enhances discoverability and thus meets the goals of interoperability.

5. Both confederated searching for discoverability of data and true interoperability of portals and data are important.

2. **Benefits of interoperability**
   1. Open data and interoperable systems simplify provision of information to various interested parties. For example, rather than having to answer the same question about a project or dataset from multiple people or provide data multiple times, the information can be prepared once, then subsequently provided around Canada and the world for discovery and use.
   2. If a data producer can contribute data and metadata to one repository which then disseminates those resources to other polar data portals or systems which also require archiving of the target data, that saves work for the researcher.
   3. If researchers can discover and access other data through effective interoperable networks, they do not have to collect those data for themselves. This saves money and is a huge motivation for interoperability.

3. **Challenges and barriers to interoperability**
   1. Controlled vocabularies and standard keyword libraries are required for true metadata interoperability. Use of different keyword libraries/controlled vocabularies is a huge impediment to metadata sharing which can only be solved by manually equating keywords in different libraries. This is labour-intensive and is currently one of the largest issues in metadata interoperability.
   2. Interoperability may be hindered if some groups do not have the ability to use or implement favoured or required technology. The community should be sensitive to the fact that not all organizations have the resources or capacity to be interoperable.
   3. In the government, there are many barriers to interoperability such as firewall rules, security clearances, organizational policies, and others. These will result in delays or complete prevention of making interoperability a reality.
   4. Sharing data is more complicated than sharing metadata: There are many formats and many possible sharing protocols.
   5. It is difficult for different types of data (for example, bibliographic data and metadata which do not have a location vs. geospatial metadata and data) to be technically interoperable, just due to the nature of the data.

4. **Requirements and expectations of interoperability**
   1. Interoperability relies on repositories having the expertise and support for setting up and maintaining the interoperable links.
   2. Providing data and metadata via different portals requires data sharing, usually through web services, from the portal which holds the master copy.
   3. The ideal interoperable system would have the following characteristics:
      1. Ingest information from the beginning of a project (preferably at the time of the proposal) and disseminate to other parts of the system, as appropriate, so that it does not have to be entered multiple times.
      2. Assign a Digital Object Identifier (DOI) to the project upon entry of data into the central project database, to enhance citation and credit to the data provider.
      3. Assign additional DOIs as additional metadata and data files are entered for complicated projects which produce a variety of datasets.
   4. If we do create distributed networks for sharing data and metadata, we should ensure that there is still one portal which is always clearly responsible for the data, so that we do not find in the future that critical datasets are gone because no one person was looking after them.

5. We need to ensure protection of sensitive data when setting up interoperable links. It is imperative to not provide access to private data by mistake.
6. Location/geography is a means of linking data, but political, social, and other linkages also need to be made.

5. **Human interoperability**
   1. Factors in human interoperability include personalities, jobs/mandates, backgrounds, experiences, agendas, goals, etc.
      1. One example of potentially conflicting mandates is provincial and territorial jurisdictions which have different systems and different feelings about their responsibilities.
   2. We want to communicate, and we often want the same things, but if we do not use the same words, we may have difficulty understanding each other and finding common ground.
      1. Development of a common language about polar data management will facilitate human interoperability. This can only be accomplished by talking with and understanding each other.
   3. There is some concern with the concept of a "one-stop shop" for polar data in Canada. This does not mean, however, that a variety of archives/portals should not be linked.
      1. For example, there are many different organizations and jurisdictions which want to steward their own data.
      2. There also may be other issues with centralizing data management. For example, making a central group responsible may take responsibility away from the researchers, who are critical to the process.
   4. Challenges of human interoperability may be addressed via targeted partnerships, especially with regard to getting TK to researchers.
   5. Better technology to keep in touch with each other allows us to increase capacity by sharing resources and group knowledge. This helps us to become humanly interoperable.

6. **Choosing standards**
   1. Technical interoperability is not suffering from a lack of standards but from clarity on which standard to choose. There are standards for metadata, for data files, for transfer protocols, and many more.
   2. Currently, our community does not have a set of recommended standards and guiding principles to follow.
   3. Many groups, however, are already making choices of which standards to use.
   4. There are many standards available. It is important to think about what is available and what is currently in use. We do not have to create a new "polar" standard. Use available standards as much as possible, and do new work only to fill actual gaps.
   5. What level of standardization is required for true interoperability? Can we ensure effective discoverability and access without extensive standardization?
   6. To simplify the work, perhaps we should think in terms of transfer formats instead of context transfer.
   7. Popular standards change frequently, so we need to choose standards which are not losing popularity.
   8. How is a standard defined? Is it defined by which information or fields are required or allowed?
   9. When standards are followed, it is important to document which standard is being followed and the level of compliance with the standard.

10. Standards themselves may evolve, making it necessary to accommodate requirements for compatibility in the future. When the portal or the metadata or data standards change, the new system should be designed in such a way that users are not impacted and old ways of linking or accessing are left intact.
11. If a portal or repository does not require a particular standard, users should archive their data using existing standards and should try to conform to standards which are common within their field of research.

7. Examples of existing standards
  1. Internationally, OGC (the Open Geospatial Consortium) is used for maps, and ISO 19115 is used for metadata. They have not changed much over the years and are adaptable.
  2. ISO 19115 is quite extensive and complicated to use, so we may benefit from a definition of minimum elements which should be used to facilitate interoperability.
  3. FGDC-STD-001-1998 (Federal Geographic Data Committee) and GCMD/DIF (Global Change Master Directory/Directory Interchange Format) are also popular metadata standards.
  4. Darwin Core is the usual standard for biodiversity data.
  5. Shapefiles and NetCDF files are not standards, but they are ubiquitous and could be considered "standardized" file formats. Sometimes standards are not decided from the top but are instead simply what everyone is using.

8. Proposed activities
  1. We should create a central, comprehensive database of publicly funded polar research projects which are producing data or a summary of the research (where, when, who?) so that northern community members can know what is happening near them.
      1. Who can provide leadership on creating this database?
          1. ITK may be able to guide development of the system to facilitate use by Inuit.
          2. The Canadian Polar Commission's (CPC[3]) research project map website may be useful.
      2. Research licenses are a huge potential source of information for this. The licenses may be linked to the data.
          1. Research license granting agencies may update their license application forms to require information on where data will be archived.
          2. If license or project information can be imported automatically into a central system, it would be easier than manually entering information.
          3. All sources of polar data in Canada should be included in this database.
      3. Perhaps we could plan an app-a-thon on creating a polar research project database!
  2. We should recommend standards, formats, protocols, and policies which would facilitate interoperability of both metadata and data, without complicating data deposit and curation.
      1. We should produce or contribute to a list(s) of relevant standards that currently exist.
      2. It would be preferable to inventory the community and choose standards and formats which are already in use. If we choose a standard because it appears to be the best one, but it is not in common use, there may be lower adoption rates.
          1. We should consider NRCan's geospatial standards and operational policies when deciding on standards to recommend to the community.
          2. Libraries may provide useful guidance in choosing standards.

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[3] CPC and CHARS became Polar Knowledge Canada in June 2015.

3. The private sector, including OGC, should be involved in deciding on standards for polar data and metadata.
      3. We should capture in the documentation the users' intent for sharing the data. Would it be possible to augment the standard with this type of information?
      4. We should draft a brief document which lays out recommendations for data and metadata standards to the community, and give people a chance to respond to the recommendations and perhaps vote on them.
         1. If we pursue this path, it will be critical to have a formalized process to ensure everyone's engagement.
   3. We should bring together key portals and archives to implement recommended standards to facilitate metadata interoperability.
      1. If we start with the large groups or key portals which have the most experience, then other groups can be brought in afterwards as they have the chance to follow the standards.
   4. We should link groups which have different levels of readiness for interoperability, to share knowledge and enhance progress.
   5. We should provide "smart searching" for keywords in our portals, to facilitate discovery.
   6. We should continue the efforts of linking repositories within Canada and expanding international links, too.
   7. We should link data to the publications and articles which report on the data.
   8. We should investigate options for automating creation of interoperable links.
   9. Can we build the equivalent of Google search for data? What would this look like? Data files would need to be automatically available online and tagged as a data resource.
   10. Interoperability is complex to coordinate. Perhaps we should implement an iterative approach of baby steps to reach the goal.
   11. We should look to successful case studies to guide our activities:
      1. The Aurora Research Institute (ARI) may be a good example for setting up an integrated project database system.
      2. The Australian Antarctic Division (AAD) may be a good example for setting up a comprehensive data management system.
         1. AAD has an excellent system for automating management of project information, metadata, and data. All projects must have a data management plan, and creation and submission of metadata and data are incremental, with deadlines starting at the very beginning of a funded project and continuing throughout the project's life.
         2. This type of structure makes it easier on researchers and encourages their compliance by providing infrastructure and support to researchers and very clearly laying out expectations.
   12. We need to develop a plan to foster and maintain linkages and clear communication between groups, to improve human interoperability.
   13. Can we make an app which publishes data?
9. **Existing Canadian and international activities which may contribute to the proposed tasks above**
   1. Canada is leading the IASC/SAON (Sustaining Arctic Observing Networks) Arctic Data Committee's metadata elements project to define a minimum set of metadata elements required for effective metadata interoperability.
      1. It will be important for the Canadian polar data community to adopt the recommendations from the metadata elements project, once they are published.

2. Canada has a large variety of portals and archives and is connected to polar data portals in other countries through interoperable links.
    1. The Polar Data Catalogue (PDC) metadata are currently being harvested by other polar data portals, and PDC is harvesting metadata from other portals.
    2. PDC and the Arctic Science and Technology Information System (ASTIS) have been discussing options for linking data with publications.
3. GeoGratis at NRCan provides publications, datasets, and maps as a complete package.
    1. This may not be ideal, however, for real-time, time-sensitive, or time-variable data.
4. The Northwest Territories and Nunavut provide basic information about projects online. The information is collected as part of the research permit system.
5. ARI has a well-established system for issuing research licenses.
6. ASTIS at the Arctic Institute of North America (AINA) is working on a licensing and permit record system. These include research project descriptions and translations of the licenses.
7. The CPC had a website of research projects on a map. The project has slowed down recently as it requires a significant effort to maintain.
8. NRCan publishes recommendations on geospatial standards and operational policies (http://www.nrcan.gc.ca/earth-sciences/geomatics/canadas-spatial-data-infrastructure/8902).
9. Research Data Canada's Standards and Interoperability Committee (RDC - SINC) works on standards and interoperability for all data, not just polar. They are in contact with the international Research Data Alliance (RDA) to advocate for generic and flexible use of standards. SINC welcomes new participants.
10. Research Data Canada has produced a list of relevant standards (available on the RDC website).
11. The Scott Polar Research Institute in the UK has a list of Arctic data producers, but it is not comprehensive.

10. Working together to achieve interoperability
   1. We need to develop a plan to keep the conversation going so that human interoperability may improve and our enhanced collaboration can result in increased access to polar data.
       1. We should develop a plan to foster linkages between groups that need tools or resources and organizations which already have built tools or have resources.
           1. For example, Canadensys has an integrated publishing toolkit, developed by the Global Biodiversity Information Facility, that can be used by others to publish biodiversity occurrence data.
   2. We should, as a community, share resources and technological capabilities.
       1. It will be necessary for organizations with more experience to provide guidance and assistance to groups which are just starting out.
   3. The discussion of standards is difficult but we should work as a community on group agreement of where we want to go together. If we choose a path, we can slowly shift our implementations to be compliant with the chosen standards in the long term, which will facilitate interoperability.
       1. We need a formalized process to identify and choose standards which involves the entire community. This is part of building trust. People may not embrace the new standard if they were not involved at the beginning.
           1. Any recommended standards should be flexible and simple to implement, to enhance compliance. The approach to define or recommend standards for our

community may not work if groups are not able to follow or implement the recommended standards.

2. Adopting a minimum set of metadata elements to be applied to all metadata records may be valuable and should facilitate interoperability. However, it may be difficult to find a common set of elements to support a wide variety of stakeholders.

3. Several participants eagerly indicated they would be willing to use and support a standard once it was chosen by and for the community.

4. If we can not achieve the desired interoperability in the short term, can we link, mirror, or host other datasets to enhance access? This will require trust and cooperation.

XII. Partnerships and Linkages - David Arthurs, Managing Director, Polar View Earth Observation Limited

Presentation - main points (slides in Appendix 8):

1. We need to develop a framework for communication between participants in this effort.
2. There are too many organizations to list them all, so perhaps we should focus on "communities."
3. There are many ways to define "community":
   1. As different communities of data managers (polar, geospatial, scientific),
   2. By sector (citizens, government, academia, industry),
   3. By type of data (in situ, cultural, socio-economic, earth observation),
   4. By research interest (marine, atmosphere, land),
   5. By geography (Arctic, Antarctic, nations, international),
   6. Or in other ways.
4. These groups overlap in many ways, and one person may be a member of numerous communities. People and communities work together to collaborate and learn from each other.
5. Canada is only one facet of international data. In the polar regions, nationality is less important than circumpolar linkages.
6. Communication issues result from a variety of logistical difficulties:
   1. There seem to be more organizations than people!
   2. Communities may do a good job of working internally but not at interacting with other communities.
   3. Technical barriers such as standards get in the way of working together.
   4. Social barriers such as languages or cultures can result in a lack of common ways of communicating.
   5. Requirements for privacy of data or information can cause difficulties in even talking about the data or activities required for stewardship.
   6. Limited funding limits resources available for these activities.
7. Many communication pathways are informal. Formalization of communication channels may improve the links.
8. Questions:
   1. What communities should be involved in the "Canadian polar data community"?
   2. How can communication be facilitated between communities and, by extension, with organizations?

3. What does each community or organization have that can be shared, and how can it be shared?
4. What does each community or organization need?

Questions to be addressed during the breakout session:
1. There are too many organizations to establish linkages with every one. Which communities, organizations, groups are a priority for engaging?
    1. Should we consider influence, goals, impact, potential for success, or other criteria in answering this question?
2. How shall we link with industry?

Summary of Ideas Presented During the Partnerships and Linkages Breakout Session and Group Discussion

Chair: David Arthurs
Rapporteur: Ed Kennedy
Participants: Jesse Flowers, Jenn Parrott, Jennifer Sokol, Fraser Taylor

1. **High priority groups**
    1. The polar data community in Canada needs to ensure the inclusion of Inuit and northerners. They are integral to decisions on data management in Canada, and their participation is fundamental to designing and implementing a successful leadership and coordination model.
        1. Target organizations include ITK, the National Metis Council, and the Assembly of First Nations.
        2. Northern Canadians should be represented not only as stakeholders in polar data management but also as producers of data.
    2. Intra-Canadian linkages are very important. Past linkages and effective interactions have been limited, but now that this group is forming, there is more potential for effective partnership.
        1. We should engage with CNNRO.
        2. The Canadian Association of Research Libraries (CARL) is currently running a federated pilot on long-term data preservation.
        3. Canada's Department of Fisheries and Oceans has a strong research group in British Columbia to which we should link.
        4. Canada is not heavily involved in the Antarctic (funding for research in Antarctica is very limited), but we need to remember that the Antarctic is part of this process.
            1. We should make sure that CCAR, the Canadian Committee on Antarctic Research, is included.
    3. IASC should be an international partner.
        1. The IASC Arctic Data Committee, with the input of the Arctic countries, is creating an international ontology of data centres, institutes, policies, metadata catalogs, and other components of polar data. This will be a semantic database that provides information on how to connect to data, for example, through web services. Effort is required within Canada to ensure that the polar data management system is well represented.
    4. The Inuit Circumpolar Council (ICC) is a key international organization. It is a permanent member of the Arctic Council.

1. ITK links with the Arctic Council through ICC (ICC sits on the ITK Board) and is forming links with IASC.
5. OGC deals with open standards which facilitate interoperability and, additionally, links with most of the spatial data community's major players, including industry.
6. The CODATA Data at Risk Working Group will be important for data preservation.
7. RDA is involved in the Belmont Forum which has multimillion-dollar funding for Arctic research.
8. Libraries, including the Polar Libraries Colloquy, university libraries, and the federal library and archives, may inform our work. We need to study what libraries do well so that we can benefit from or join their activities.
9. Links to the United States are important.
   1. The US National Snow and Ice Data Center (NSIDC) is a successful case study for good polar data management.
   2. We should engage with the National Science Foundation.
   3. Since the Arctic Council chairmanship has been handed from Canada to the US, there is more awareness in the US about Canadian activity in the Arctic, particularly the focus on local residents, so there is an opportunity to build on that awareness.
   4. Under the US Arctic Council chairmanship, the US State Department is a new player. There is some political discussion between the US and the other strong Arctic nations about activities in and concerning the Arctic.
   5. Changes in the science funding models in the US present some new opportunities, with more focus on diversification and international partnerships, presenting opportunities for the Canadian polar data community to play a stronger role in helping drive the agenda.
10. Links should also be made with Google Scholar

2. International linkages
   1. International partnerships are very important, but they must be done carefully. We must make sure we have the capacity to sustain the relationships once they are made - we do not want to reach out and then be unavailable.
      1. Receptor capacity in Canada is limited. Effective international engagement requires a minimum level of funding, facilities to attract partners, and recognized experts who are aware of the international situation and can work with others to generate world-leading knowledge.
   2. Some international links are successful, some are not, and some which should be made have not been made yet.
      1. The Inuvialuit Regional Corporation's Joint Secretariat has international linkages.
      2. NRCan is formally linked internationally with the Arctic Council and working groups such as the ASDI.
   3. How well positioned is Canada to maintain a dominant role in the Arctic, given other countries' activities?
      1. Canada has a strong presence and reputation as a leader in the Arctic, and we are well respected in polar data management. We can make a great contribution if this expertise is built upon.
      2. Japan has openly stated their interest in Arctic resources and is spending a lot of money on Arctic science and technology. Japan should work with Canada.

3. Industry
   1. For industry linkages, both user and supplier communities should be considered.

2. The World Ocean Council includes industry and is active in polar science initiatives, funding scientific meetings, organizing proposals, and coordinating funding support for the Belmont Forum.
3. The International Oil and Gas Association would be a good partner for this effort.
    1. We should reach out to individual oil companies. The Alaska office was very engaged at the ELOKA (Exchange for Local Observations and Knowledge of the Arctic) workshop a few years ago. The ConocoPhillips Calgary office is interested in forming relationships with northern communities.
4. The International Association of Antarctica Tour Operators (IAATO) and Association of Arctic Expedition Cruise Operators (AECO) run ecotourism trips.

4. Examples of partnerships related to polar data
1. The Inuit atlas project helps Inuit communities spatially enable records from local projects.
2. The Beaufort Sea Online Platform supports contributions from 53 organizations involved in the Beaufort (e.g., industry, community groups, government, etc.) and includes a partnership with the Alaska Ocean Observing System.
3. The Polar Geospatial Center at the University of Minnesota provides data to US scientists and has recently partnered with Google to help task Arctic imaging satellites with capturing imagery over communities of interest. Google has interest in longer-term location-based services (LBS) to these communities.
    1. The remote sensing community is mostly involved in provision rather than use of polar data.
    2. O'Reilly Group's *Where 2.0* is a forum for interfacing with the LBS industry. LBS involves a much broader community than traditional GIS.

5. Role of CHARS
1. CHARS is trying to leverage polar science and polar knowledge.
    1. CHARS is receiving a lot of interest from the international community with respect to research in Canada's north.
    2. CHARS has international connections such as polar science groups in the European Union and individual countries (e.g., UK, China, and the Korean Polar Research Institute) and other countries that are establishing Arctic observatories in Canada.
2. CHARS' partners in Canada include the scientific community and northern Canadians.
    1. These groups are working together to coordinate dissemination of information to northerners.
3. A new organization, Polar Knowledge Canada (POLAR), was created 1 June 2015 to replace CHARS and the CPC. POLAR's three main programs will be (a) the research station, (b) northern science and technology, and (c) knowledge management (outreach, partnerships, and knowledge dissemination).
    1. David Scott has been named President of POLAR, and the Board of Directors, Steering Committee, and working groups are being formed.
    2. POLAR can act as a broker for linking international scientists with Canadian scientists or agencies and can broker a role to connect them with specific programs in Canada.
    3. Future linkages between POLAR and INAC and Environment Canada are not known yet.
    4. POLAR has facilities to share with the international community, but they need to set policies now for data management and other topics to ensure benefit to Canada.

XIII. Policy and Funding - Philippe-Olivier Giroux, Policy Analyst, Natural Science and Engineering Research Council

Presentation - main points (slides in Appendix 8):

1. There are two topics for this presentation: (a) What policies are needed, and (b) what are the needs for funding? The presentation today reports on the responses to the questionnaire and does not necessarily represent the views of NSERC.
2. Policy
    1. We need better data policy in Canada to drive improvements in access and long-term preservation and to guide researchers on how to manage and archive data.
    2. What happens to the data when short-term projects end? We need to avoid data loss.
    3. Labs and researchers need resources to manage data. Should this cost be integrated into grant proposals? Should data management be required in proposals?
    4. Graduate and undergraduate program curricula should include data stewardship.
    5. Data providers need to have professional recognition and credit for publication of data, which should be recognized as a legitimate scholarly contribution.
    6. What should be the role of each stakeholder, including universities, government departments, and funding agencies, in developing and implementing policy for managing polar data in Canada?
3. Funding
    1. Long-term, sustainable funding is very constrained.
    2. The federal government should provide leadership to develop an effective long-term funding strategy.
    3. We should expand the scope of this coordination initiative to include other groups that can provide tools, resources, and funding for our efforts.
    4. We need funding to engage with international groups, so that the expertise and data of Canada are known and shared around the world.
    5. Funding applicants should ensure that the cost of data management is properly represented in proposals.
    6. Where there are common interests, the polar data community should work together to develop joint proposals to fund data management activities.
    7. Who needs funding, to support what activities and expenses? We need to establish a long-term plan which includes tasks and estimated costs for polar data management in Canada.
4. Current work related to policy and funding for data management in Canada
    1. The Tri-Agencies[4] are working on data policy. This group will be helpful to the Tri-Agency effort by helping them understand the needs of the polar data community.
    2. The Open Government Action Plan includes a focus on open science and open data.
    3. A 2014 report, *Seizing Canada's Moment: Moving Forward in Science, Technology and Innovation*, provides information on big data and open science.
    4. There is a variety of groups (including the Leadership Council for Digital Infrastructure, Universities Canada, and CANARIE, among others previously mentioned) dealing with data issues with whom this group should be linked.

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[4] NSERC (the Natural Sciences and Engineering Research Council of Canada), SSHRC (the Social Sciences and Humanities Research Council of Canada), and CIHR (the Canadian Institutes of Health Research). These are the primary scientific research funding bodies in Canada.

Questions to be addressed during the breakout session:
1. What policies are needed? Who should be responsible for them?
2. What are the explicit needs for funding? Who needs funding, for what activities, and what types of expenses?

Summary of Ideas Presented During the Policy and Funding Breakout Sessions (2) and Group Discussions

Note: Since policy and funding were identified as primary challenges for polar data management, there were two breakout sessions for this topic. The discussions and notes from both sessions have been combined below.

Chair: Philippe-Olivier Giroux (1) and Scot Nickels (2)
Rapporteur: David Arthurs (1) and Karen Lauer (2)
Participants: Gabrielle Alix, Colline Gombault, Amos Hayes, Dave Moorman, Fraser Taylor, Scott Tomlinson, Shannon Vossepoel, Warwick Vincent (1) and Julie Friddell, Ellsworth LeDrew, Simon Riopel (2)

1. **Cross-linking comments**
   1. Requirements for new policy and funding models are being driven by the change in culture to new attitudes about data sharing and expectations of instant data access. Both researchers and the public are growing more amenable to sharing. This new perspective applies to all data, not just polar. It is important to build on this momentum.
   2. For both policy and funding, we should build on what is already available. There are so many groups working on data, and they have already addressed many of the issues and questions that we face.
   3. At the federal level, the Assistant Deputy Ministers of the science and technology agencies (S&T ADMs) should make a plan together for data policy and funding. This happened during IPY and was successful.
   4. Northerners are fatigued with researchers coming with numerous requests for help and information. There are benefits to all the attention on the north, and the northern people benefit by more information being available, but it is also a burden. We need to make sure we clearly define the Canadian process for northern research before people from other countries start coming to northern Canada to do their research.
   5. Because of limited funding, our scientists are not driving the polar science agenda, especially in Antarctica, and Canadian interests are not being served.
      1. There is great concern that we may become a landlord in the Arctic but international partners with more money will drive the science agenda. If they do not like Canadian policies and rules, then those investors will go to other Arctic nations. While the location of CHARS can provide some control on what happens in the Arctic, science funding is a more significant factor.
      2. NRCan is trying to set up an international receiving centre for earth observation in Inuvik, but because Canadian funding is limited, others will drive agenda and Canada will obtain limited benefits.
2. **Policy**
   1. Policy development is not just for funding agencies. Universities, international organizations, and others will also need to be involved.

2. Policy, infrastructure, and monitoring/enforcement of compliance must all come together for policy to be effective.
    1. An example of successful data policy was IPY. The IPY policy was simple and clear: it required data management planning and archiving, and both infrastructure and support were available to back up the policy.
        1. This success story should be more clearly communicated to funding agencies and others who could support future polar data management activities.
            1. Sometimes it is difficult because there is no one group to communicate to, and few people or organizations have the power to make changes.
            2. If we have a clear, simple message, then our probability of success with targeted communication is higher.
3. We need to make sure we include all stakeholders when planning policies, especially when it comes to making policy which may impact international projects or partnerships.
    1. Industry Canada is forming a new working group on big data.
4. Make sure that those who have data policies (e.g., Tri-Agencies, CHARS, IPY, etc.) coordinate to ensure that their policies align as much as possible.
5. Federal agencies need to look internationally for guidance on developing policies, should take the lead for the country, and should make policy and enforce it.
    1. The Tri-Agencies are very interested in using the outcomes of this Workshop and national consultation to advance their data policy work.
    2. CHARS is looking for direction and advice on forming their policies.
    3. The Northern Contaminants Program (NCP) may be a good case study of how to make policy, of being flexible while enforcing requirements.
    4. If the polar community makes policy itself and tries to impose it on others, then others are likely not to follow.
6. There could be problems if you try to centralize data management. The onus should be partially on the researchers.
7. When is it better to use encouragement ("carrots"), and when is it better to use requirements ("sticks")?
    1. The Tri-Agencies will probably need to enforce any data policy they produce ("stick").
    2. However, it is critical to provide support to data producers to help them provide the data ("carrot").
    3. Some people do not want to share or collaborate, and they do not even provide enough information or assistance to write metadata for knowing about their data. Some researchers will not respond to e-mail or answer their telephone. What can be done about that?
8. This will not be an easy process, but we should be more afraid of inaction on data policy than of moving forward, even if we are uncertain.

3. **Specific policies**
    1. Having a clear and enforced data policy for specific research initiatives or projects is critical to the effective stewardship of the resulting data.
    2. Users of data need to be providers of data, too: Once someone downloads data, if they make changes to them, they should be expected to provide the data back to the archive.
    3. Funding applications should require data management plans, and review of new proposals should include an evaluation of the applicant's past data management efforts.
    4. A set amount of funding (to be defined) should be used to support data management, either explicitly in each proposal or as a percentage of the national research budget.

5. We need a linked funding program, like the Northern Supplements, which provides targeted funding for data management for polar research proposals. Everybody should use it, but perhaps it could be voluntary at first.
    1. SSHRC already has a supplemental pool of funding for data management. Others should copy the SSHRC program or provide a "global" fund to which anyone could apply.
6. We need to make sure we have Canadian data in a Canadian archive, even if it is collected by other countries.
    1. One issue with this is to make sure that Canada has the capacity to deal with and make use of the data, once they are collected and deposited: If we do not have the correct researchers who have time to engage with the incoming data, then what use are the data?
    2. We need to be effective at reaching out to international groups which are working and doing research in Canada. Think strategically about making sure that Canadian knowledge, data, and expertise benefit Canada and are not just taken back to other countries.
    3. For example, for a foreign ship sailing through the Northwest Passage, should we require as a part of their license to sail that they deposit the data in a Canadian archive?
7. Metadata about all datasets relative to the Arctic could be registered in the Polar Data Catalogue or searchable in the PDC via interoperable links when the data are hosted elsewhere.
8. NCP plans to implement a data policy soon. Recommendations from this group can inform the NCP data policy.
9. We should have some meetings in northern Canada, to more successfully involve northerners.
10. Server farms should be in cold places, to take advantage of natural cooling. Facebook in Sweden has been successful and may be used as a good case study.
    1. Is Compute Canada environmentally friendly?

4. Funding
   1. Support should be in the form of long-term, ongoing, baseline funding, as opposed to the short-term contracts that currently support most Canadian data activities.
   2. The need for "resources" may be a better way to look at the question of funding.
       1. Resources do not only equal funding - there are many other resources which are available, such as people with expertise, infrastructure, etc.
           1. How can we make sure that these resources are leveraged optimally to accomplish our goals?
       2. We should make use of the resources already at our disposal, but we will need new resources for connectivity and forming links.
   3. We need to consider funding with respect to the entire research lifecycle. There are many dimensions and levels of responsibility, with universities receiving funding from the provinces, but research is mostly funded by the federal government, and there are hidden costs such as support for buildings and infrastructure.
   4. Given the size and complexity of our community, how shall we divide the funding and give it to the right people to get the work done, but minimize the effort to distribute the money?
       1. We need to make sure the researcher and the user do not have to pay for each service individually. This applies to all aspects (repositories, data management offices at universities, training, etc.).

5. We need new funding models and should consider innovative funding sources. The ones we have are not sufficient to facilitate collaboration and connection.
    1. As an example, CFI has a multi-source model for funding projects: 40% from the province, 40% CFI, and 20% from other sources. This makes CFI proposals and projects quite complicated, though, which is not efficient.
    2. Should we consider commercialization or monetization of data?
5. **What activities are required for successful data management? How much do they cost?**
    1. Explicit funding needs
        1. Physical infrastructure, including repositories and networks
        2. Support of the entire data lifecycle: ingestion, archiving, maintenance, user interface, outreach, online access and analysis tools
        3. Funds for the researcher, to prepare data to get it into the repository
            1. A major disincentive is the time, cost, and effort to make data open. There are not enough incentives or support for researchers to prepare the data properly for sharing. Funding should be provided for making the data open.
        4. Long-term stewardship of data from short-term projects
            1. For example, IPY is over, but we are still ingesting data from IPY projects, and we are expected to preserve and provide them "forever," theoretically for free (since IPY funding has ended).
        5. Data management offices at universities, to spread the responsibilities by supporting both researchers and archives. This is starting to happen.
        6. Education, on why data management is important
        7. Training, on proper data management procedures
        8. Travel for northerners, plus salary for time to participate (because many northerners do not have jobs which will support them to attend meetings)
        9. Open access publications
        10. Data rescue
        11. A national coordinator or secretariat for polar data management in Canada
        12. Managing northern community knowledge
    2. We should conduct a needs assessment from all community members, including northern communities, to determine additional needs and capacities.
        1. The private sector is driving some of the requirements for data needs, in addition to researchers and the public.
        2. Canadian funding of the Belmont Forum is very limited. There is so little Canadian money that potential Canadian participation in these exciting breakthrough technology programs is limited.

XIV. Coordination and Leadership - all participants

The following questions were given to the participants:
1. How can we coordinate polar data management activities in Canada?
    1. How can we connect and build on the various initiatives and programs (and meet all expectations)?
    2. Who could/should take the lead?
    3. How would such coordination activities be funded and supported?

4. How can researchers be encouraged to contribute to data management and coordination activities?
2. How can we improve Canadian data management for all stakeholders: northern communities, researchers, industry, governments, policy-makers, the public, and others?
3. What opportunities shall we pursue for Canadian leadership internationally?

All breakout groups addressed the questions above independently during their dedicated sessions. Below is a compilation of the responses from the individual breakout groups along with points raised during the subsequent full group discussion:

1. **Why are we not coordinated?**
    1. There are many different groups doing polar data work, with funding coming from different areas. There is a lack of knowledge of data activities going on in different groups, and there are many conversations between various groups. This leads to duplication of effort, fractured progress, detrimental competition, a lack of clarity in organizational roles, and gaps in meeting needs.
    2. This "bottom up" approach leads to individual groups trying to coordinate with others, instead of the entire community working together.
    3. There is currently no coordinating body to set priorities and define the focus for polar data management activities in Canada.
2. **Do we want to coordinate our community?**
    1. Yes. We need to organize ourselves and coordinate our activities to bring the desired benefits to Canada and success to our work.
    2. To be effective for the long term, we will need a formalized structure with clear guidelines for reporting and responsibilities.
    3. We need a theme and set of guidelines which will take us in the same direction.
    4. We need overall coordination to provide outreach and awareness, both among ourselves as well as to others.
    5. We need to determine who we are (who is involved in polar data management in Canada), our strategic objectives, the scope of our issues, and a long-term plan for where we want to be in 5-10 years.
    6. We need to put data management at the forefront of polar research in Canada.
3. **Ok, so we want to self-organize. What will be the end goals of this coordination?**
    1. We need a message, outlining the vision, mission, objectives, future goals, strategy, scope, and needs of the polar data community in Canada, which will be taken to our target audience. This should include a short list of policy and funding requests from our community.
        1. Once we define the goals, then we can break the tasks down into small steps.
    2. We need to identify our target audience(s) - who should receive the message?
        1. We need to make sure we take the message to the right people and speak to them directly and personally, to increase understanding of our work and needs.
        2. The list should include the S&T ADMs and the research granting councils, but we may need to subsequently take the message even higher in government (ministers, etc.).
        3. We should go to university presidents, vice presidents of research, territorial and provincial governments, other levels of government, Inuit, other northern groups, the private sector, and others.
        4. Often, the people who have the power to make policy and provide funding do not have a very good understanding of the issue, and vice versa.

5. We need to coordinate with key stake holders to take information and feed it to other groups.
    3. We need to identify our spokesperson(s) - who takes the message?
        1. There may be different spokespeople for different recipients/audiences.
    4. We need to ensure that we have a group voice and that the message represents the polar data community in Canada.
        1. We need to involve all members of the community, as much as we can, and ensure that all groups are able to contribute to the internal and external communications as well as coordination of our activities together.
        2. We need to ensure that the views of all participants are represented and that there is support and buy-in from all members of our community.
        3. What we do must be identified as Canadian - of Canada, and about Canada.
    5. We need to build trust and credibility, both within our community and with others.
        1. This includes support to researchers, so that we make it easier for them to manage their data.
    6. We shall define the functions of the new organization:
        1. By creating a community of practice for polar data management, we shall establish best practices and guidelines which we should ourselves follow.
        2. We shall create a list of organizational activities and responsibilities and determine who is best fit to lead specific tasks.
        3. We shall choose a coordinator to strengthen connections within the community (including with researchers) and act as a broker for projects and activities. The coordinator may be a member of the community or someone outside the ecosystem of the group.

4. **The Message**
    1. **Background:**
        1. Changes in the polar regions compel us to record observations of all types so that change can be tracked and understood.
        2. Research data in general, and polar data in particular, are difficult and expensive to produce and are thus very valuable.
        3. We acknowledge that data have traditionally not been shared in Canada and have been used largely for publication.
        4. Polar data are unique due to the diversity of types which include traditional environmental observations such as weather and sea ice records but also information on human health and wildlife, physical samples, oral records from Indigenous Elders, and many more. These data are valuable due to their diversity and the effort and expense incurred in collecting them.
        5. At the same time, the polar data community has many commonalities with other research data communities, including challenges of developing policy and infrastructure for managing the data being produced.
        6. In Canada, numerous groups are researching and managing data for the polar region, so coordination between groups is needed. Resources need to be pooled together, and a forum for communicating is required to improve knowledge of others' activities.
    2. **Vision:**
        1. Recognizing that Canada has great potential and an obligation for sharing polar data with the rest of the world, the Canadian polar data community will work together and with others to develop policies and systems for treating research data as a national resource, including polar data as a subset.

2. To promote the emerging national vision for sharing and preserving data, the polar data community in Canada will be a leader and will work with other Canadian and international groups to improve polar data management in Canada, contribute to improved data management across disciplines, and strengthen the international data community. This will increase transparency and inclusion and will reduce duplication of effort, including research as well as data management activities.
    1. We will organize our community and leverage individual resources to coordinate management of the entire data life cycle, from the genesis of the research idea, to planning for data management at the proposal stage, generating and preserving metadata and data, discovering and publishing knowledge, and rescuing data at risk of loss.
    2. We will ensure that stakeholders, including researchers, northern communities, governments at all levels, industry, and the public, have access to the data and resources that are required to meet the final goal, which is gaining knowledge from the data.
    3. We will ensure preservation of the data and unhindered availability on the Internet so that they and their knowledge are accessible for future generations.
    4. We will ensure that the data are accompanied by proper documentation and provenance information to guarantee that they are usable and understandable.
    5. We will ensure that sensitive data are protected and that producers' and users' rights are respected.

3. **Mission:**
    1. To strengthen the connections between the groups involved in polar data management in Canada as well as with groups in other countries.

4. **Strategy:**
    1. Polar change is a popular topic now. We should capitalize on the attention that the Arctic is receiving to take our message to receptive audiences while the interest is high.

5. **Goal:**
    1. To be effective leaders in data management.

6. **Objective:**
    1. Long-term management of polar information, primarily in the Arctic but also encompassing other polar areas, and coordination to ensure preservation.

7. **Benefits of participation** - why should busy people join this effort?
    1. Increased access to polar data for all stakeholders, including contributors who also need access to others' data.
        1. Streamlining the data stewardship life cycle simplifies the work of data management organizations, accelerates progress in academic research, promotes business, provides critical information to northern communities and decision makers at all levels of society, and informs the public.
        2. Formal data management is increasingly expected of researchers. Coordination of data-related tasks simplifies the process and takes work off data contributors by providing clear and unified instructions on how they should manage their data and providing resources and repositories for their use.

8. **Activities:**
    1. It will be our responsibility to do the work to achieve progress.
    2. We should establish best practices and guidelines for data management by others as well as for ourselves.

3. We should collaborate with researchers, northern communities, and decision makers to increase the information they can receive from the data, including participating in the formulation of research questions and projects and in data collection activities.
4. We should provide data support services to scientists, to simplify their work and make data management easier for them.
5. We need to enhance the preservation of data, to guarantee its future accessibility.

9. **Value proposition:**
   1. Our work connects to government, industry, university, research, and northern community priorities. How will our efforts contribute to help them?
   2. The message is not only to add value to research and discovery but also how to enhance the value provided by cooperation between a variety of Canadian organizations.

10. **Future plans:**
    1. Where will we be/where do we want to be in 5-10 years?

11. **Scope:**
    1. Management of data and information created in Canada, but also data about Canada's polar region created outside of the nation.
    2. Advisory function only, not operational.

12. **Title:**
    1. Should specify that it is Canadian, but perhaps First Nations and Inuit would prefer to not have Canada in the title as this may be considered to not be inclusive
    2. "Canadian Polar Data Advisory Council"?
    3. Should use "information" instead of "data"?
    4. Perhaps "Polar Information Management" or "Polar Knowledge Management" or "Polar Data Management Network" may be better titles?

5. **Potential models for coordination**
   1. The most important aspect is for all groups to be involved. The group must be inclusive and accessible to all who are interested, including not only academia and government but also northern communities and industry. This may not be easy to accomplish, but it is critical to ensure inclusion and effectiveness.
      1. To ensure inclusion of Inuit and First Nations communities and voices, we may want to have dedicated seats on any committee or board and not just rely on the outcomes of an election. We need to project the message of inclusivity from the start.
         1. We may want to do the same with industry representation.
      2. Meetings and other communication venues must be easily accessible to all members.
      3. We should endeavour to engage people and organizations who may not be supportive of data management, to educate and inform as many people as possible of the benefits.
   2. Preference seems to be for creating a committee, formal working group, or national secretariat to represent the polar data community in Canada.
      1. There may be a central coordinator or "polar secretary," or perhaps two people to share the job (some other organizations have multi-person Secretariats), to connect the different groups in Canada and in other countries.
      2. There should be a national advisory committee or management council, as with IASC and the Scientific Committee on Antarctic Research (SCAR), to provide credibility to the effort.

1. This advisory committee may either provide direction to the secretariat or actually do the work. We will need to decide on the role of the advisory committee.
        2. It may be possible to have two groups, one advisory and one operational.
        3. There is some concern with providing an operational role as it may not be advantageous to have external people deciding how everyone should manage their data.
    3. To be successful, this group will have to be relevant and useful and will need to be able to maintain the momentum and the connections.
    4. The network will feed information to the secretariat which will liaise with the international community and share expertise. The secretariat will then distribute information back to the network.
    5. The group will need to be made of representatives from all sectors, including government, university, and private members, and representatives who can speak for proper stewardship of TK.
        1. Group should perhaps have representatives from each major organization that manages polar data.
        2. Tri-Agencies would need to be on the advisory committee. They should be involved in creation of data management policy for the country, hopefully being able to use the polar community as a successful example.
    6. Resources will be needed to support the group's work.
    7. Such a group would need to define a clear governance structure, but the structure may need to evolve over time as roles become more clear over time.
    8. Concerns:
        1. Forming a new committee. We should build on existing committees if at all possible.
        2. Secretariat being formed within the federal government (for example, if CHARS or another federal body were to lead this), as it would be subject to government mandate and may not be able to effectively manage competing priorities or respond to the needs of all community members. The Open Government initiative has not been a good example of coordination.
        3. Secretariat being formed at a university, as there may be issues of competition between groups and institutions as to who becomes the host, as this could influence where funding goes.
        4. One person or group which speaks for all - this may not work well. We may need a truly distributed model.
    9. Should this committee or secretariat be given the authority to coordinate polar research in Canada so that data management could be coordinated and mandated uniformly? This could be very useful but would take a great deal of work to arrange.
    10. We need an "honest broker" who can effectively and fairly speak for all.
3. Local or regional chapters which can get together more easily than a full national organization, so that there are multiple levels of governance.
4. Other options
    1. An institute that handles polar data itself
5. Examples of good data management
    1. The Australian system, which has built the national data management policy and infrastructure in increments.
        1. This requires coordination as well as funding to create the organization and system.
6. Examples of successful coordination efforts

1. The Canadian Federal Geospatial Platform, in developing a North American standard for geospatial data
    1. The group held a series of meetings with stakeholders from various countries. It took five years to accomplish the original goal!
    2. Progress was made by developing recommendations and providing options to the community to consider and select which ones to implement.
2. The Canadian Advisory Council for Remote Sensing began as a grass roots movement with community input. It had a flat structure and successful function.
3. The Alberta Library consortium
    1. They make joint purchases and have one person who coordinates the group, but smaller groups are tasked with performing specific functions.
4. DataOne in the US holds annual showcases of their activities. We could attend their events and learn from them.
5. The World Wide Web Consortium (W3C) - how is it coordinated?
7. Challenges
    1. It may be difficult to coordinate between the different groups engaged in polar data activities in Canada, based on the different goals and interests.
    2. Polar data management is complicated by the variety of disciplines, geographic regions, and types of data.

6. **Potential activities**
    1. Create a chart of the activities involved in the different steps of the data life cycle, from research project formulation to planning for data collection, to sharing, publication, preservation, and data rescue.
    2. Determine which organizations will work on the various parts, taking into account individual preferences and expertise and aiming to meet the needs of all contributors and users, from novice to expert.
        1. It will be important to use tools and portals which already exist and not re-create system components which have already been built.
    3. A governance structure and organizational policies or charter would need to be drafted in a form which is acceptable to all.
    4. Ask one or two people to research potential governance models, including the ones cited above, and provide suggestions and options for our community.
        1. Could the private sector lead the coordination function, as they have a vested interest in having access to the data?
    5. Demonstrate the value proposition and make the case for resources.
        1. Create an inventory of requests for data and information across portals to establish the need for data access and services.
        2. Develop case studies to demonstrate the value of increased data access to present successes in research, policy development, industry, northern communities, and the public.
    6. Reach out to fields which already have good data management coordination, and learn and implement their successful actions.
    7. Make a list of groups which have recently had meetings like the Canadian Polar Data Workshop or who have written position papers on related topics, and talk with the people who led these efforts. These people are the ones who want to get things done, and we should engage with them to hear the recommendations and actions from their activities so that we can work together to coordinate in Canada and internationally.
    8. Create an inventory of stakeholders, so we will know who should be involved, the expertise of each group, and who we are missing.

1. Others have been working on this already. The Arctic Data Committee map of organizations may be a good place to start. Data producers should also be included in the inventory.
2. Use the semantic web framework and visualization capacity to build a concept and geolocation map of the entities of the polar data ecosystem.

9. Assess the needs of data users and contributors, including tools, data and information requirements, data-related services, infrastructure, connections within the network, etc.
10. Work with all stakeholders in Canada to create and unify data policies, to simplify data management for researchers and programs.
11. Secretariat/committee would organize teleconferences, webinars, meetings, and workshops of the community, maintain a list of stakeholders, write position papers on our activities and goals, and advocate for support, best practices, and optimal coordination within our community.
12. Create an online communication forum, such as a LinkedIn group for polar data management, in which all stakeholders and interested parties could participate.
13. Organize projects and funding for the community.
14. Arrange for support for data management assistance, ideally as an individual or team of people who have been identified and can work with researchers or other data contributors to understand the requirements and help them prepare their data for archiving.
15. Work with journal publishers to advocate that authors archive the data supporting their published results (as increasingly required by publishers such as PLOS ONE, etc.). This will encourage the culture change toward open data and sharing.
16. Produce a guide on how to navigate the Canadian polar research system, including northern research licenses.
17. Produce a guide on how to effectively participate in the polar data management community in Canada.
18. Seek additional input from the community as we move forward.

7. **Who would be involved?**
   1. We need to incorporate, leverage, and build on existing relationships.
   2. Regional Inuit must be present and engaged so that they bring their ideas and needs as well as take the message back to northern communities.
   3. First Nations must also be involved.
   4. We should partner with Arctic College. They are teaching a course on the research process.
   5. The role of the PDC, PDMC, ARI, Canadian Polar Data Network, POLAR/CHARS, etc. will need to be defined.
   6. We need to coordinate with national and international groups such as IASC and SCAR, to link to, learn from, and contribute to the needs and activities of the polar data community at the international level.
      1. The list of international stakeholders is very large.
      2. The Polar Data Forum II, in Waterloo, Ontario, will be an excellent opportunity for international and Canadian interaction.
   7. We should determine if we can work with international or industry groups who have collected Canadian data, such as the Great Lakes Commission, to obtain data for archiving.
   8. Stakeholders in Canada include government of all levels, the Tri-Agencies, academia, non-governmental organizations, and others.
      1. NRCan should be engaged.

9. Deputy Ministers and the ADM Board should be involved.
10. Libraries have long experience in preserving information and other critical aspects of data management. Hiring librarians into the data management world will help ensure good data management.
11. Research Data Canada engages with many stakeholders and is very interested in coordinating data management in Canada. They may help disseminate information as well as facilitate development of a national infrastructure and policy for data management.
12. What is the role of the private sector? Could they be involved in providing resources, data, or in driving the coordination function, because they have a vested interest in having access to the data? Could the community provide specialized data products for private sector use? Would private industry be interested in working on data preservation?

8. **Involvement of Northerners**
   1. There is a full ecosystem of regional and community Inuit and First Nations organizations concerned with TK and data and ensuring they are well represented.
   2. The First Nations have developed the principles of ownership, control, access, and possession (OCAP). These should be respected in funding agency agreements. OCAP may also be useful for Inuit and Metis.
   3. Proper care of TK enhances northern communities and researchers.
   4. Northern agencies such as ARI and the Nunavut Research Institute should define the metadata and other information that they need for research licenses.
      1. Each region currently handles this differently. Collaboration may simplify the process for everyone.
      2. The licensing process should obtain the information that the community requires for making sound decisions.
      3. The license should be linked to outputs and results of the licensed research project.
      4. A suggestion was made that ongoing research may only require one license, instead of annual renewals, to simplify the process.
      5. Licenses may be used to enforce data management and community involvement in the process of data archiving and stewardship, including feedback and involvement in the community, so that community members benefit from direct access to data and understanding of the research results, rather than just a research article which may not be informative.
      6. Licenses could require data management plans. Compliance with the plan should be required before granting of subsequent licenses.
   5. Communities would like to benefit from the data and information that is collected in their areas. More involvement in the research process and knowledge gained from research provides an opportunity to enable more self-direction and empowerment in northern communities.
   6. We should use this process to build capacity in the north, to train northern people to do polar data management. Northerners must be equal partners in the process. CHARS is trying to address this by planning for data management facilities in northern Canada.
   7. Communities would also like to benefit from some of the funding for research that takes place in their areas.
   8. ITK indicated it is very difficult, and actually not appropriate, for them to act as the sole representative for Inuit. To properly represent Canada's Inuit, ITK needs regional representatives who develop and produce data and who make decisions using data to be involved in this coordination process and ensuing structure.

9. **Role of CHARS**
    1. CHARS should be a partner, and perhaps a leader, in this coordination effort. They have international partners and clear linkages with the government structure, including the CHARS President sitting on the ADM committee, thus they may be a good conduit to reach a wide variety of stakeholders.
    2. CHARS/CPC personnel suggested they may host the secretariat, as knowledge mobilization and coordination are part of their mandate. They have also offered to provide in-kind resources toward this effort.
        1. Could CHARS fund a position to help with coordination and the advisory committee?
    3. CHARS is dedicated to proper data and information management and is currently developing a data policy, thus POLAR would be a natural advocate for and contributor to coordination of polar data management in Canada.
        1. To do this, POLAR would need to have the capacity and resources, and they would need to learn about and develop the necessary linkages with the organizations and stakeholders in the science and data management communities, to receive input from the community, promote community preferences, and facilitate integration of stakeholders.
            1. Some progress is already being made on making linkages through a funding proposal for Arctic data interoperability to the emerging CFI cyberinfrastructure program, between CHARS, ITK, and several universities.
    4. CHARS can help advance the Canadian Arctic scientific research agenda. POLAR should take advantage of its program and location to attract not only international researchers but also resident scientists who live in Cambridge Bay.
    5. There were some concerns with a government organization taking on the role of leadership for this community, as there may be too much bureaucracy, potential interference with academic freedom, instability due to changing government priorities, and insufficient capacity to handle the role.
        1. Most people were more comfortable with CHARS playing a support role but not directing it.
        2. POLAR may play the honest broker role by hosting the secretariat, but they should not handle everything. Other members of the network should lead it and take actions to accomplish joint activities.
        3. POLAR may not be able to take a leadership role in technical issues such as interoperability.
    6. The opening of CHARS in 2017 can give us a goal for making progress.
10. **Role of the Polar Data Management Committee (PDMC)**
    1. The PDMC may be able to form the core of the new national committee or may be the national organization that officially represents and speaks for the polar data community in Canada.
        1. There is general consensus in the room that this may be appropriate. The mandate of the Committee would of course change and be broadened, and new members would be added.
    2. PDMC could perhaps play the leadership role but will still need an advisory function for guidance and direction.
        1. The PDMC has recently discussed splitting its advisory and operational functions, so this may fit well into a dual-role management committee model.
    3. The relationship between PDMC and POLAR will need to be determined.
    4. The PDMC will need to be consulted on this possibility, to confirm that they are open to the idea of expanding their mandate.

5. A new name would likely be needed, and the new mandate would need to be defined. As always, resources would be required to guarantee sustainability and usefulness to the community.
6. We may also choose to just create a new structure, instead of using the PDMC as the base. In this case, there may be overlapping membership, but the mandates would be distinct to serve both the polar data community in Canada as well as the PDC itself.

11. Funding
1. Long-term sustainability of both data management and coordination are critical.
2. We need to ensure that the users find us indispensable so that they will support our continuation.
3. Success of the Canadian polar data management system may be facilitated by international coordination of activities and funding, in addition to coordination within Canada.
4. Data and information management is not prioritized in Canada as it is in some other countries. We should engage foundations and companies to consider taking on the Arctic as a priority issue. For example, Coca Cola may be willing to fund polar bear research and would be willing to support proper stewardship of the resulting data.
5. We should set up a strategic plan for acquiring funding to support secretariat/committee activities.
6. There are some universities which are working on including data management in the university infrastructure. We should make sure to work with these universities to understand and provide guidance on their plans, if applicable, so that they may optimize funding expenditures.
7. In addition to data managers, institutions and researchers need funding for data management, too.
8. One option would be for all of us, the polar data community, to self-fund a central body to coordinate ourselves. Such a grass-roots effort would ensure that we could direct it as we wished. Would this be worthwhile? Could we afford it? We would have to guarantee that the expenditure and effort would be worthwhile and well executed.
9. Alternatively, perhaps researchers or programs could use a percentage of their research funding to support coordination. If the researchers found this useful, then it is possible that they would be willing to support it. However, it is unlikely that it would happen without the funding programs requiring it and providing guidelines on amounts and timing of contributions.
10. This group will need institutional support from one or more organizations.

12. Plans for the position paper and a follow-up survey
1. The position paper should be short. It should include the message and the requests, but it will be supported by the long report which has the details.
2. A few people should be tasked with writing the position paper which should include options that can be discussed within the community.
3. Need to ensure that federal employees can access the document online for review and editing.
4. Once the position paper has been vetted fully by the community, it will be very important to take it directly to the decision makers to share the information and ask for partnership in accomplishing our community's goals.
5. Second questionnaire - should we do it?
   1. After discussion, it was determined that a second questionnaire may be useful but is probably not necessary at this point. It may be better to wait until the position paper

is ready or perhaps run a new survey before the next Workshop, to conduct a stakeholder assessment or environmental scan.
2. Need to ensure it is circulated to all interested and involved stakeholders, including industry.
3. The current participants can help form the next questionnaire!

Appendix 1

Invitation E-mail to Canadian Polar Data Workshop

Good afternoon!

We invite you to participate in a Canada-wide consultation and meeting of scientists, faculty members, program managers, students, and users, including Indigenous people and organizations, policy makers, and other stakeholders with interests in discovery, management, and preservation of polar data and information. We plan to hold a Canadian Polar Data Workshop in Ottawa May 26-27, 2015 which is just prior to the Third International Open Data Conference (http://opendatacon.org, May 28-29). The Workshop will be held at the Albert at Bay Suite Hotel, 435 Albert Street, in downtown Ottawa. The Workshop and consultation are hosted through a partnership between the Canadian Cryospheric Information Network/Polar Data Catalogue, Polar Data Management Committee, ELOKA, CHARS, NSIDC, and NSF. In addition, NSERC and SSHRC are very pleased to see this workshop taking place and will be participating with great interest.

These activities are not just for the people producing or managing data, but also for users of information about Arctic and Antarctic issues. Users may range from the expert user who needs raw data to conduct basic science to the novice user who needs the information derived from data to make decisions about and manage their daily lives.

The objectives of the Workshop are to coordinate polar data management activities in Canada as well as prepare a Canadian position on issues in polar data management in preparation for the Second Polar Data Forum (PDF II, http://www.polar-data-forum.org) that will be held at the University of Waterloo, Ontario, 27-29 October 2015. PDF II will inform future international and Canadian development of data management for the Arctic and Antarctic.

The Canadian Polar Data Workshop will be structured to reach specific outcomes through consensus building. We will be providing all interested parties a short questionnaire to be completed in advance to determine the following, from the perspective of the individual or institution:

1) Scope of your interest and activity in polar data management

2) Current Canadian strengths in polar data management

3) Immediate Canadian issues and opportunities for polar data management

4) Long-term opportunities and challenges for polar data management in Canada

5) Technical challenges for polar data management

6) Role of Canada in international polar data management issues

7) Other issues

The agenda for the two-day workshop will be based on the initial responses, starting with a summary of the responses to date to set the scope of work to do. This will be followed by a series of plenary and break-out sessions with tasks assigned to mediators and scribes to address and provide potential solutions to specific theme issues. We plan to produce a white paper on the outcomes that will provide input to the PDF II and guide future data management policy development in Canada.

In the attached document we provide background information that highlights why such a meeting is important at this time in the evolution of polar science and data management within Canada as well as the context for the Polar Data Forum II to be held in October.

We want this discussion to be as inclusive as possible. We have started with a large distribution list (in bcc: on this e-mail to protect privacy) but welcome information on whether there are others who may be more appropriate within your group. Please advise us if someone else should be contacted in your stead, or in addition to you. If you know of a particular individual or group that should definitely be contacted, please let us know by Monday, 20 April and we will ensure that they are included.

If you are interested in participating in the workshop and/or questionnaire, please respond to Dr. Julie Friddell, Associate Director of the CCIN/PDC at julie.friddell@uwaterloo.ca by **next Monday, 20 April**. We will send the link to the questionnaire which can be answered on-line. We hope to have these completed by the end of April to allow time for evaluation of the results and prioritizing issues to be considered in the workshop. Please note that if you can not attend the Workshop, we encourage and welcome independent completion of the questionnaire.

We appreciate that this is a busy time for all. However, the window of opportunity to prepare for the PDF II is short and we appreciate any effort you or your group can make to help with this initiative. Thank you for your contributions!

Sincerely,

Ellsworth LeDrew, Executive Director, CCIN/PDC

Julie Friddell, Associate Director, CCIN/PDC

Peter Pulsifer, PI, ELOKA

P.S. Apologies if you receive this more than once as our distribution list is long and may have duplicates! :)

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Appendix 2

Background document for a Canadian Polar Data Workshop, April 2015

Background Document for a Canadian Polar Data Workshop
26-27 May 2015, Ottawa

Motivation for Coordination of Polar Data Management Activities, in Canada and Internationally

The importance of data and its proper management are increasingly being recognized by governments, the science community, and society. The leadership of the global polar science community in data management and policy has been strengthened via the International Polar Year (IPY) programs in 2007-2008. Unprecedented opportunities for science based on open, networked, digital, and ubiquitous communication technologies present an urgent need for the polar science community, Arctic residents, and other stakeholders to establish a clear global vision, strategy, and action plan to ensure effective stewardship of and access to valuable Arctic and Antarctic data resources.

To this end, the University of Waterloo will host a Second Polar Data Forum (PDF II) in Waterloo, Ontario, 27-29 October 2015. *Polar Data Forum II: International Collaboration for Advancing Polar Data Access and Preservation*, or PDF II, will build upon successes of the first Polar Data Forum (PDF I) in Tokyo, Japan, October 2013. PDF I and a series of other international and national meetings in various countries have identified priority themes and key challenges in the domain of polar data management (see the PDF I *Communiqué* at http://www.polar-data-forum.org/International_Polar_Data_Forum_Communique.pdf for a brief listing and description of outcomes).

PDF II will be informed by a national consultation and workshop which will seek to coordinate Canadian polar data management activities and provide strong Canadian input to the international polar data management community. The "Canadian Polar Data Workshop" and the PDF II will both ensure that Canadian scientists and the public have access to the data and information needed to facilitate their research activities and make informed decisions. Proper and effective stewardship of the valuable data resources resulting from Tri-Council, government, and private sector investment within Canada as well as across the globe facilitates awareness of and access to datasets and information that provides an advantage to Canadian researchers. We will engage researchers, Indigenous groups, funding agencies, data managers, and other stakeholders who require better systems and services related to archiving and accessing Arctic and Antarctic research data and information. Our expectation is that national and global coordination of activities related to polar data management will benefit Canadian society by streamlining data management and access systems, making our work more time- and cost-

efficient and putting data and information within easy reach of all stakeholders. This vision is shared by international polar data management organizations and is increasingly of interest to Canadian programs producing Arctic and Antarctic data and information.

The Canadian Polar Data Workshop

Since 2012, the Canadian Cryospheric Information Network/Polar Data Catalogue (CCIN/PDC) and the Polar Data Management Committee (PDMC), the guidance and steering body for the Polar Data Catalogue, have engaged the Tri-Council in planning for coordination of polar data management activities in Canada. Discussions with NSERC, SSHRC, and others in the Canadian and international polar data management communities have led to the conclusion that a national workshop would be conducive to creating a strategy and opportunities for coordinating and supporting the growing ecosystem of polar data-related initiatives in the country.

Accordingly, a Canadian Polar Data Workshop has been planned for 26-27 May 2015 in Ottawa at the Albert at Bay Suite Hotel, 435 Albert Street, in downtown Ottawa. The Workshop will be hosted by CCIN/PDC[1], the Polar Data Management Committee, ELOKA[2], CHARS[3], NSIDC[4], and NSF[5]. In addition, NSERC[6] and SSHRC[7] are very pleased to see this workshop taking place and will be participating with great interest. A pre-workshop questionnaire has been created to solicit input on current projects and needs for data and information. The questionnaire will be sent to data managers, researchers, students, northerners, funding agency and industry representatives, policy makers, and other people involved in polar data management in Canada. The results of this questionnaire will be used to construct a landscape of existing activities and future plans and opportunities for supporting researchers and other stakeholders through coordinating our work together as a community, which will guide the final agenda for the Workshop.

A tangible deliverable from the Workshop will be a **position paper** which describes the following:
- Stakeholders in Canada and their respective requirements for and contributions to polar data management;
- Priorities, challenges, and opportunities for future collaboration;
- Funding options for specific projects as well as long-term sustainability of a polar data management system in Canada; and
- Plans for a Canadian contribution to international polar data management through Polar Data Forum II.

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[1] https://ccin.ca/; https://www.polardata.ca
[2] http://eloka-arctic.org
[3] http://www.science.gc.ca/default.asp?lang=En&n=74E65368-1
[4] http://nsidc.org
[5] http://www.nsf.gov
[6] http://www.nserc-crsng.gc.ca
[7] http://www.sshrc-crsh.gc.ca

The Polar Data Forum II

PDF II, 27-29 October 2015 (http://www.polar-data-forum.org), will be hosted by the CCIN/PDC and will be held at the University of Waterloo. PDF II is being organized by an International Advisory Committee (IAC) and a Local Organizing Committee. PDF II will further refine priority themes and will accelerate progress by establishing clear actions to address target issues, primarily

- Meeting the needs of society and science through professional practice and policies to promote open data and effective data stewardship
- Developing trusted data management systems and repositories for long term preservation
- Establishing sharing and interoperability of data at a variety of levels
- Building an international metadata and data sharing network
- Improving the user experience, creating analysis and visualization tools
- Connecting the polar data community through new partnerships

The Forum will be held in conjunction with the scheduled annual meetings of the Arctic Data Committee (ADC) of the International Arctic Science Committee and Sustaining Arctic Observing Networks (IASC/SAON) and the Standing Committee on Antarctic Data Management (SC-ADM) of the Scientific Committee on Antarctic Research (SCAR), effectively creating a Polar Data Week.

PDF II will provide a critically important venue for Canadian and international polar data initiatives to showcase polar data management systems, while learning from global partners and working collaboratively to continue developing a global vision and action plan. In addition to polar data managers, researchers in Arctic and Antarctic science, policy makers and funding agency representatives concerned with polar research and its data assets, student researchers, and Indigenous groups will be an integral part of PDF II. By the end of PDF II, we will have updated status and made progress on polar data management activities and outstanding issues, including international coordination of ongoing and future planned efforts across the Arctic and Antarctic data and scientific research communities.

The Forum will give participants an opportunity to express their requirements for polar data and information. Polar data managers will have a venue for coordinating their activities to better address the expressed needs for service to science and society. By participating together in an international dialogue, polar data managers and the stakeholders of data assets will better understand the requirements, opportunities, and challenges of proper stewardship of polar data and information. Outcomes will include an action plan for international collaboration between polar data funders, producers, managers, and users on standards and procedures for effective polar data stewardship.

The Forum has received endorsement from a variety of international organizations, including the following:

- World Data System (WDS)
- International Council for Science (ICSU)
- Committee on Data for Science and Technology (CODATA, of ICSU)
- International Arctic Science Committee (IASC)
- Sustaining Arctic Observing Networks (SAON)
- Scientific Committee for Antarctic Research (SCAR)
- Association of Polar Early Career Scientists (APECS)
- World Meteorological Organization (WMO) and the Global Cryosphere Watch (GCW)
- Inuit Circumpolar Council (ICC)
- Research Data Alliance (RDA)

Conclusion

PDF II and the Canadian Polar Data Workshop contribute to the success of polar data management activities in Canada by exposing participants to new information and facilitating partnerships and projects which help reach our goals: following best practices in managing data to facilitate access and security, creating a metadata interoperability network to extend access to northern people and to the international polar research community, and establishing funding options which provide long-term sustainability for our community activities. The Canadian Polar Data Workshop and PDF II also benefit polar researchers and other related initiatives in Canada, including Aboriginal Affairs and Northern Development Canada, Environment Canada, and universities with polar research programs, by raising the profile of Arctic and Antarctic research and its contribution to society. Effective management and increased awareness of and access to the data arising from polar research, monitoring, and other activities across Canada provide benefits to the community of scientists and policy makers who focus on the polar regions, particularly the Arctic.

For further information, please contact:

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Appendix 3

List of respondents to the questionnaire

Name:	Organization/Affiliation:	What is your current role/position? (Select a title most relevant to this subject)	
Canadian Polar Data Workshop - May 2015, Ottawa			
Survey respondent list			
Ashley Stasko	University of Waterloo, Fisheries and Oceans Canada	Student	
Benoît Pirenne	Ocean Networks Canada	Program manager	
Canada Centre for Mapping and Earth Observation	Ministry of Natural Resources, Canadian Federal Government	Other stakeholder (please specify)	Data provider and spatial data infrastructures
Carol Perry	OCUL	Data repository staff	
Carolyn DuBois	The Gordon Foundation	Program manager	
Christine Barnard	Centre d'études nordiques (CEN)	Other stakeholder (please specify)	Coordinator - Research Manager
Claire Austin	Environment Canada	Researcher	
Colline Gombault	ArcticNet	Data repository staff	
D.R.F.Taylor	Geomatics and Cartographic Research Centre,Carleton University	Faculty member	
Darlene Langlois	Canadian Ice Service	Program manager	
David Arthurs	Polar View Earth Observation Limited	Program manager	
Dr, Shirley Mills	Carleton University, School of Mathematics and Statistics	Faculty member	
Gita Ljubicic	Carleton University	Faculty member	
Hayley Hung	Environment Canada	Researcher	
Jean Thie	IUCN Arctic Ecosystem Management Specialist Group	Other stakeholder (please specify)	Science Director
Jeff Saarela	Canadian Museum of Nature	Researcher	
Jenn Parrott	Inuvialuit Regional Corporation	Other stakeholder (please specify)	GIS Coordinator
Jeremy Geelen	Social Sciences and Humanities Research Council of Canada	Policy maker	
Julie Friddell	Canadian Cryospheric Information Network/Polar Data Catalogue, University of Waterloo	Data repository staff	
Karen Lauer	Canadian Polar Commission	Policy maker	
Kevin Fitzgibbons	Natural Sciences and Engineering Research Council	Policy maker	
Leah Braithwaite	Environment Canada - Canadian Ice Service	Program manager	
LeeAnn Fishback	Churchill Northern Studies Centre	Researcher	
Lena Schofield	Government of the Northwest Territories, Environment and Natural Resources, Wildlife Division	Data repository staff	
Marlene Doyle	Environment Canada	Researcher	
Mathieu Ouellet	Oceanographic Services, Fisheries and Oceans Canada	Data repository staff	
Paula Tozer	Environment Canada - Business Analysis and Data Management Division	Other stakeholder (please specify)	Data Management Service provider (EC Data Catalogue)
R. Elizabeth Griffin	Dominion Astrophysical Observatory (NRC), Victoria	Researcher	
Reyna Jenkyns	Ocean Networks Canada	Data repository staff	
Robert Way	University of Ottawa	Researcher	
Shannon Vossepoel	Arctic Institute of North America (AINA), University of Calgary	Data repository staff	
Suzanne Carriere	Government of the Northwest Territories	Northerner	
Virginie Roy	Canadian Museum of Nature	Other stakeholder (please specify)	postdoctoral fellow in Arctic Research
***Plus 2 more who preferred not to have their name listed publicly			

Appendix 4

Open-ended questionnaire responses, edited to remove personal content

(remaining questionnaire questions are represented in the Review of Questionnaire responses presentation by G. Alix, in Appendix 8)

Please describe your activities related to management and/or use of polar data and information.	If applicable, please describe your organization's strengths and contributions to polar data management in Canada and goals for the future.	How do you use, or think that you could use, polar data? (Check all that apply)
Open-Ended Response	Open-Ended Response	Other (please specify)
- Manage/oversee the online publication of data and mapping tools of CEN research projects, data and activities - Identify opportunities for collboration and data exchange within Canda and abroad - Identify gaps in geographic scope of projects - Identify knowledge gaps in northern research - Promote CEN research activities - Inform stakeholders and northern communities of CEN and ULaval research activities - Outreach and education for general public and northerners (youth, elders)	- Rigorous application of standards, specifications and architecture from ISO and OGC - Leader in Open Data - Earth observation civilian ground receiving stations and satellites (public private partnerships), eg. Radarsat - Foster development of northern projects, including hard infrastructure, in the North (Inuvik Satellite Station Facility, Fiber Optics - Foster Spatial Data Infrastructure information management practices with Arctic Council Working Groups - Recently published Northern 1:50 000 scale topographic maps series - Canadian Geographical Names Board of Canada - Data published through Web Services (eg. Application Publication Interface (API), Web Mapping Services (WMS), etc.)	As a resource for demonstrating best practice in other fields
- Manager, Arctic Science and Technology Information System (ASTIS), Canada's national northern publications and research project descriptions database (81,000 records: 64,000 publications, 17,000 research project descriptions from licensing information). ASTIS also maintains subset publications databases for IPY, ArcticNet, NCP, BREA, and more. www.aina.ucalgary.ca/astis - Team Leader, ArcticConnect, a network-enabled platform for realizing geospatial referencing of information about the arctic system derived from research, education, and private sector activities in the arctic and subarctic. www.arcticconnect.org - AINA is the PI for the Canadian Consortium of Arctic Data Interoperability (CCADI) initiative	-Museum of Nature houses the largest collection of Canadian Arctic natural history collections, which can be interpreted variously as primary data or sources of data, depending on type of research -our collections data is shared online via our own web portal, and shared internationally via the Global Biodiversity Information Facility and other related databases. However, only about 20% or so of our catalogable units are databased and a much smaller fraction are imaged. This means most of the specimens and their associated data can not be accessed digitally. In other words, most of the data are not mobilized. This is the state of affairs for all museum collections on Canada and elsewhere. The only limitation to getting the job done is $$ to pay people to enter the data. The tools and data standards needed to share the data are well established. Not sure what proportion of our data related material has been digitized.	Awareness of other research activity in the NWT
- topographic mapping - remote sensing - National Air Photo Library - Inuvik Satellite Station - Canadian High Arctic Research Station (Collaboration and Information Management) - Federal Geospatial Portal (FGP) - Research - Remote Sensing methodologies and techniques - National governance mechanisms (Canadian Council on Geomatics CCOG), Federal Committee on Geomatics and Earth Observation (FCGEO), Canadian Geomatics Committee Round Table (GeoAlliance), Northern component of Canadian Geospatial Data Infrastructure (CGDI) Arctic Spatial Data Infrastructure (Arctic SDI) - International: Arctic SDI, United Nations Global Geographic Information Management for the Americas(UNGGIM), Global Spatial Data Infrastructure (GSDI), Arctic Council - Standards Associations (International Organization for Standardization (ISO), Open Geospatial Consortium (OGC), Standards Council of Canada (SCC) - Various projects in the North	Data collection. Long term archiving of our own Departmental data.	For delivering operational services
-collect specimens and related data in the field -generate genetic data from polar organisms in the lab -led development of CMN's Collections Online portal for specimen data -publish research papers using my own and related data of others	I cannot fully comment on the extent of polar data management for Fisheries and Oceans Canada, however with regards to the specific project I am involved in, DFO is responsible for depositing all data acquired through the BREA-MFP onto the PDC. Metadata for each sampling year and sampling component are already available on the PDC. The DFO uses the PDC as a repository for making publicly-funded data publicly available.	For policy and decision making
1. Polar View is delivering the Polar-TEP on behalf of the European Space Agency. The European Space Agency (ESA) and other satellite operators have been at the forefront of collecting, analysing, processing and disseminating new data and information from EO satellites for over four decades. Throughout this time, the volume of data and range of applications has increased dramatically, challenging us to find new methods to fully utilise this capacity. ESA is therefore establishing a series of Thematic Exploitation Platforms (TEP) providing the necessary advanced ICT platform to allow new ways of working. One of the TEPs will focus on the challenges and requirements of the polar user community. The TEP concept aims to provide a working environment where users can bring their algorithms, applications and development activities to the data, avoiding the need to download and store large volumes of data. This represents a new way of working with EO data to encourage and allow easier processing, sharing and wider exploitation of EO data. The Polar TEP (P-TEP) will deliver a rich set of polar themed EO and complimentary datasets, plus functionality to easily establish interfaces to new local or distributed data resources. P-TEP will also include appropriate toolboxes and processing capabilities, allowing deployment of a web portal which will also allow users to setup their own development and processing environments. Use of these resources will be accessed through a web portal which will allow users to setup their own development and processing environments. 2. Polar View delivers operational services covering sea ice, icebergs, river and lake ice, and snow for user communities including indigenous peoples, northern communities, marine shipping, oil and gas platforms, fishing vessels, and policy makers. These services are primarily based on near real time satellite earth observation and weather data, and they cover both poles.	Inuit need to be partner, as data owners.	I personally don't use polar data, but SSHRC-funded researchers would have a variety of uses for it. It isn't polar data itself that informs my work, but rather how it is used, managed, shared, etc.--the standards and practices that the polar data community has developed could serve as best practices for SSHRC to encourage other disciplinary communities to adopt.
Amundsen core data coordinator: - Making sure all collected data are backed-up on several servers and depositories - Making sure the documentation with the data is produced and available - Making sure data are checked and processed (QA/QC) and distributed through the PDC - Distributing the data when they are under limited distribution	Large archive of paper and digital ice information products Goals: - digitise all paper ice information - ensure that it is properly geo-referenced - improve over accessibility - improve use for climate services - improve integration with local and traditional Arctic coastal knowledge	Our own data management
As analyst-level lead on the Tri-Agency data management working group, I lead the group in Tri-Agency data management policy development.	Major strengths: (1) Perennity, our unit and its data archive (at first, digital and paper / film, now mostly digital) was established in 1962 within a Federal department, and has been in existence ever since, preserving both digital and non-digital assets (2) Connections with the appropriate international organisations which provide access to global data, and to bodies which are responsible for proposition and adoption of standards As the National Oceanographic Data Center for Canada under the International Oceanographic Data and Information Exchange (IODE) panel of the Intergovernmental Oceanographic Committee (IOC), we act as a focal point for international exchange of all oceanographic data, including polar oceanographic data. We also play a role in the recommendation and adoption of standards used by the international oceanographic community to facilitate data exchanges and achieve interoperability between data portals, through World Meteorological Organization and IOC organisations. Contributions: Our oceanographic data archives contain data from over 1300 cruises (missions) where at least one oceanographic station was sampled either north of 60 degrees North or in the Hudson Bay system (Canada). The temporal range begins in 1916, with data from the 2nd Thule Expedition. We are responsible for end-to-end management of data collected by Argo Canada profilers. We are also planning to make data from the Barrow Strait Observatory available in real-time on the Global Telecommunication System of WMO. We gather and archive data collected globally (including in the Arctic) and provided to us in real-time from various platforms and instruments such as gliders, Argo floats, surface drifters, CTDs, XBTs, ice-thethered profilers, marine animals tags (Antarctic, Arctic), surface buoys, etc. These data holdings comprise over 300000 profiles of temperature and salinity in real-time, and over 10 million observations (atmospheric, surface water) by surface drifters (International Arctic Buoy Programme) in the Arctic. We have a number of data observations in the Antarctic from Argo profilers, ships, elephant seals and surface drifters as well. We manage over 70 time series of wave and marine atmospheric observations (1970-ongoing) and 160 time series of water level observations (1908-ongoing), all in the Canadian Arctic and sub-Arctic. We have ongoing data exchanges with NOAA (USA), Ifremer (France), Japan and Australia. We provide a global real-time data stream to the in situ thematic assembly center of Copernicus Marine Service (formerly MyOcean), which is going to be used as a backbone for an Integrated Atlantic ocean observing system under a project funded by Horizon 2020. Our goal is to lead Canada's data integration in the upcoming Integrated Atlantic ocean observing system, this system will be bringing data from NOAA and EU oceanographic data centers together.	Resource management
As Canada's primary polar knowledge agency, The Canadian Polar Commission: • is a point of contact with the Canadian and international polar scientific communities; • works with Canadian and international institutions to determine scientific and other priorities; • encourages and facilitates cooperation and collaboration in polar knowledge.	My organization has been submitting air monitoring data to the AMAP database for almost 2 decades and have started to enter metadata into the Polar Data Catalogue since the beginning of the International Polar Year 1997. Environment Canada is now working on the Environment Canada Data Catalogue which would link to the PDC and EBAS.	Successful recovery of heritage data leads to unique evidence of environmental changes, and thus supports relevant research.
As Chair of the CODATA "Data At Risk" Task Group (DAR-TG), and as co-Chair of the embryonic RDA Interest Group for "Data Rescue", I encourage all activities that strive to recover analogue or primitive digital data and information in all the natural sciences. Particular emphasis is placed on data that are old enough to span significant changes. The named Groups are striving to contact all those engaged in such rescue or repurposing tasks, and are endeavouring to broadcast the need for, and the benfits of, Data Rescue by speaking to meetings, by leading special sessions, and by writing articles. I was one of the panel of judges in the recent Elsevier/IEDA international "Data Rescue Award" competition, announced at the EGU in Vienna. (The 2013 Award was won by the National Snow & Ice Data Center, USA). Both the named Groups are voluntary organzations and do not (yet) have salaried staff. In practice they are becoming affiliated to one another.	no contribution from the Canadian Museum of Nature (to my knowledge) but a possible future goal	To develop circumpolar data and map with all circumpolar nations
As Environment Canada is a contributor to polar data and information, the EC Management Service would like to ensure that data submitted to the Polar Data Catalogue by EC researchers is also available in the EC Data Catalogue so we are interested in interoperability issues. Issues around data storage and access are also of interest.	Nordicana series D is a formatted, online, DOI-referenced data report series archived at the Centre d'études nordiques. Nordicana series D ('D' for data or données) was launched by CEN at Laval University in 2013, and has evolved rapidly as a convenient and online-accessible environmental data repository. It is produced only in electronic form and is freely and openly accessible to the user. Each issue is published in the two official languages of Canada (French and English), and is indexed via an assigned digital object identifier (DOI). An issue may be updated, for example with new data or the re-instrumentation of a borehole, as a new version number, but retains the same DOI; all version numbers are accessible, as required by the DOI assignment, but this approach allows the user to see and access additional data that may not have been available at the time of citation, as well as any recalibration history of the data. This feature, as well as its structured journal-like format for citation, has made it an attractive option for individual researchers and for research projects wishing to make core data sets accessible. Each issue contains primary actual data sets and metadata that explain the origin and the format of the data, the history of updates via different version numbers, and the format that must be adopted to cite the data, ensuring that the data user properly acknowledges use of the data, thereby giving credit to the researcher. A peer review process is also being developed. All Nordicana D issues are cross-referenced in the Polar Data Catalogue (www.polardata.ca) to ensure that data sets are catalogued and described according to international metadata standards, and to allow the data sets to be readily discovered using the PDC map and keyword-based search tools. The first datasets published in Nordicana D were long-term time series (up to 25 years) of climate and permafrost monitoring data of the CEN Network. The CEN Network is composed of nine research stations and 85 automated climate stations, and extends across a 3500 km gradient of ecozones (30 degrees of latitude), from northern boreal forest in Subarctic Québec to extreme polar desert environments in the Canadian High Arctic. Data from sites outside the breadth of the CEN Network sites have also been added, including the ADAPT sites of Arviat, Daring Lake, Cape Bounty, Beaver Creek, Churchill, and Illisarvik. In addition to climate data, permafrost temperatures have been recorded in boreholes throughout this region, in any cases down to 20 m, and since 1988. Carbon, nitrogen and water content of the permafrost active layer from sites across the Canadian Arctic are also available. Since its launch, several new types of datasets have been added and are continuing to be incorporated. For instance, lemming monitoring data from Bylot Island, Nunavut, is available as well as data from the groundwater monitoring network from the Umijuaq region in Nunavik, Quebec.	to provide ice information to others
Canadian Ice Service generates and archives environmental Information regarding sea and lake ice conditions as well as ice hazards such as icebergs. This information includes satellite image analyses, ice charts, ice reconnaissance data.	NSERC is primarily a funding organization. It seeks to support research excellence and is exploring ways where it can help in the development of best of class data management practices for Canadian researchers.	
Collection and stewardship of Arctic terrestrial biodiversity monitoring metadata. Developing procedures for terrestrial biodiversity data to be effectively shared, managed, made available and archived.	Ocean Networks Canada operates a community ocean observatory in Cambridge Bay, and provides data hosting & distribution services for Arctic datasets collected by DFO (e.g., ice drifting buoys). The Cambridge Bay observatory will be serviced and extended in September 2015. It is anticipated that our Arctic presence will increase in the coming years. Key strengths of ONC are our staff expertise and Oceans 2.0 digital infrastructure. Coordinated teams dedicated to software engineering, hardware systems, science, data stewardship and data quality ensure an interdisciplinary and holistic approach to our data management. Our Oceans 2.0 digital infrastructure provides: - metadata/data storage, management and processing, - instrument control and monitoring, - tools and web services for data access and visualization.	
Database management, decision making, map development, data analysis, data collection and project support	ONC's contributions in this area are: - natural sciences data management, including acquisition, transmission, quality monitoring, archival and redistribution - an open data policy with no proprietary period - scalability of the system -	
Development of a tri-agency policy on research data management	Other people at Environment Canada are involved.	

I am from the north and am of Inuit descent. My research projects all relate to the cryosphere and particularly northern environmental change. One research project involved generating gridded climate data for the entire Arctic (and globe). I previously worked as a GIS analyst with my main projects involving reorganization of my employer's data management system.	Strengths: - satellite data - ice, icebergs, and snow analysis - near real time data processing - operational services - knowledge and relationships with operational user communities Mission: Polar View provides efficient and effective operational monitoring services for the Arctic, Antarctic, and other areas affected by snow and ice. Polar View services supply decision makers with critical information pertaining to the environment, the economy, and safety. Polar View is a catalyst for international cooperation and the dissemination of knowledge related to earth observation and polar issues. Objectives: - To make earth observation services more accessible and known to stakeholders interested in the cryosphere; - To influence the development of policy regarding monitoring and forecasting in the cryosphere and the use of earth observation in these activities; - To coordinate and provide integrated monitoring and forecasting services in the cryosphere; and - To develop new services by defining service delivery requirements and conducting trials and demonstrations.	
I am involved directing graduate students with cleaning and analyzing massive data on Canadian air pollution and relating it to health effects and to policy implementation.	The Arctic Institute of North America was created by an Act of Parliament in 1945 as a nonprofit tax-exempt research and educational organization. Our mandate is to advance the study of the North American and circumpolar Arctic through the natural and social sciences, the arts and humanities and to acquire, preserve and disseminate information on physical, environmental and social conditions in the North. AINA: - operates the ASTIS database - operates the ArcticConnect platform - is a PI for the CCADI initiative - operates the Kluane Lake Research Station (KLRS) - is home to the journal ARCTIC - is home to the AINA collection, a large library of books, publications, photographs, artwork, and artefacts - is the program office for the International Study of Arctic Change (ISAC) and, via ISAC, organizes the Arctic Observing Summit, a SAON task - has multiple research associates who work with and contribute to polar data	
I am the Scientific Coordinator for a subarctic field research station and work with researchers who are using the facility to provide logistical and technical support. The Centre also conducts long-term research related activities to be used by other researchers. We have limited data housed at the Centre but access a large network of researchers who have polar data and information.	The development of the Mackenzie Data Management System is a core project of The Gordon Foundation's Mackenzie River Basin Initiative. It will help achieve two key objectives: 1) improve access to data for decision-making and 2) encourage basin-wide collaboration on water management. In the near-term, the system will incorporate western scientific water quality data collected in the Northwest Territories. Over the longer-term, we would like to see more diverse datasets included in the system to provide a more complete picture of freshwater health.	
I direct GCRC which is heavily involved in polar data and information management. In addition I serve on a number of international bodies dealing with geographical information management including GEOSS,OGC, CODATA and the UN expert group on Geographical Information Management and others. I Chair the high level Advisory Group to the Arctic Spatial Data Infrastructure and am a member of the OGC Global Advisory Committee	The PDC has a well-designed and implemented data management system with specialized and purpose-built hardware and software for archiving and serving online polar datasets and their accompanying metadata descriptions, particularly from northern Canada but also from other applicable parts of the world. We share our experiences with building and implementing this system with others in the polar data community and have learned from as well as assisted numerous other organizations in improvement of data management practices. We are currently leading an international effort to standardize metadata for polar data portals around the world, in an effort to facilitate interoperability and linking of archives. In the future, we would like to work on the following tasks, with other partners: Standardizing metadata and data formats to facilitate interoperability; completion of a distributed metadata interoperability network of polar data portals (partially in place now); sharing data via internationally-standardized interfaces; improving access to data via visualization, analysis, and download tools; determining and meeting needs of users, especially northerners and taking into account limitations on Internet bandwidth; exploring options for providing the PDC system in a cloud-based infrastructure; and establishing a structure for long-term sustainability of both the PDC and other Canadian polar data archives via appropriate funding mechanisms.	
I gather data, analyze them, post in our WMIS and publish.	The Task/Interest Groups would be delighted to include international polar data management along with those with which we are already in conversation. Access to the larger community should naturally be through the Canadian arm, so that is the best community to meet first. Sharing success stories, and identifying commonalities with other data rescue efforts, are always constructive ways to start.	
I have created/manage a database of stable isotope values for a variety of marine biota (zooplankton, invertebrates, and fish) for the Beaufort Regional Environmental Assessment Marine Fishes Project. I am responsible for maintaining these data for Fisheries and Oceans Canada, returning all data to them, and eventually depositing them and their metadata on the PDC.	transformation and linking data and knowledge into policy and action	
I have no experience with CPD. I am the Principal Investigator for Canada's National Air Pollution Surveillance (NAPS) program. I would very much like to learn from the CPD management experience.	We are interested in ensuring that Inuit needs, concerns, and perspectives become part of the contributions to the polar data management movement. With our connections to sanctioned Inuit-specific committees and organizations we help ensure Inuit expertise, involvement and context at the community, regional, national and international levels are addressed. This not only helps to build capacity on these issues among Inuit, but also assists Canada to become a leader in this area globally.	
I lead air monitoring activities in the Arctic and thus is the data originator of these data. I enter metadata for my projects in the Arctic into the Polar Data Catalogue (PDC) and submit data to the Arctic Council's Arctic Monitoring and Assessment Programme (AMAP) EBAS database (ebas.nilu.no) housed at the Norwegian Institute for Air Research (NILU). I use related airmass backtrajectories to trace sources of atmospheric transport episodes of chemicals measured in air.	We have many individuals within the OCUL network who provide data management support and expertise to researchers across Canada through: provision of data resources for secondary use; management of data repositories; data management planning support; development of data management tools and resources in partnership with other stakeholders; involvement in Canadian and international data organizations.	
I oversee wildlife research and monitoring data management for the NWT.	We have special strengths in two areas; The integration of Traditional Knowledge and the important legal and ethical issues around data sharing and ownership. We are intersted notonly in technical interoperability but also legal and human interoperability.This latter requires a strong knowledge and appreciation of the policy and implementation challenges relating to data sharing	
Inuit Qaujisarvingat (IQ) is a Resource Centre dedicated to sharing Inuit-specific information (resource's, bibliographies, geographic, land use occupancy mapping data, photos, videos) to Inuit and non-Inuit. IQ also has a number of databases with various datasets, such as the IPY funded CFL project (Team 10, community-based database), Unikkaaqatigiit community and regional data on Inuit knowledge of climate change, Inuit land use occupancy project mapping data. Further, IQ has a number of other databases and resources, namely: 1. Assists in the development of Mapping Resource Tools and Atlas's - Enhancing the Nunaliit/other platforms to provide and collect information to build a much richer atlas/tool and Inuit friendly interface: a. Polar Bear Resource Tool – information on 13 populations b. Food Security Program Resource c. Early Childhood development 2. Naasautit Interactive Information Tool – Aboriginal Peoples Survey, Aboriginal Children's Survey, National Household Survey, Other Inuit specific data. Enhance the interoperability of the tool to accept and display other types of Inuit-specific data from other sources. 3. Request For Information data base/infrastructure/process to share research request information and decision-making on involvement and partnerships between national, regional levels, and with researchers. 4. PDC interoperability with CCIN.	We have the ability to host major data repositories at Carleton University and, through the Institute of Data Science, to engage multi-disciplinary research groups in research programs related to polar data management and analysis. We also have major polar research initiatives at our university.	
Metadata and data curation, interoperability standards, physical samples digital curation, GIS applications, operations support for Arctic ocean observing platforms	We have the largest database on wild species in any northern jurisdiction in NA, includes species lists, species status, ecoregion information, species distribution shapefiles, species distribution references, location data, museum specimen data, autopsy data, survey data, and metadata on study designs and transects. Plans are to collaborate with others, create inter-operability.	
No distinction is made between polar and non-polar data in our data activities. Data management, stewardship and dissemination of all physical oceanographic observations (water properties, currents, waves, etc) and water levels collected across Canada and Canadian waters, including the Arctic and sub-Arctic: -receive, compile, process and preserve oceanographic data collected by Canada as well as foreign data of interest to Canada -acquire, by exchanging, data of scientific value from domestic and foreign sources -run procedures and routines to ensure and document the data quality -prepare and distribute holdings as required to various organisations and stakeholders -prepare summaries and indexes of holdings for public distribution We also provide offsite back up space for the Polar Data Catalogue and play a role in the approval of metadata records. We also played a role in documenting the oceanograhic data collected during IPY 2007-2008 in the DataCite repository.	We store a large amount of polar data.	
NTI is a partner to numerous research projects that are currently, or will be part of the Polar Data catalogue. As an Advisor, I am interested in how community agreements on research data will interface with the PDC.		
Ocean Networks Canada (ONC) performs the acquisition, storage and management of data acquired from observatory systems in the Arctic. ONC's "specialty" is with the provision of near real-time data to users around the world. Data types typically include physical, chemical and biological parameters of the ocean but also on atmospheric and ice/snow coverage.		
recording, storing, managing, sharing qualitative data (audio recordings, photographs, video recordings, transcripts, documents etc.) trying to develop metadata and relational databases for accessing and sharing this information effectively involved in Geomatics and Cartographic Research Centre initiatives developing Cybercartographic Atlases to represent and share this information ways to manage research contacts, events, activities, recordings would also be helpful		
searching and merging datasets for research purpose; metadata and data entry for research purpose and for public access		
Support provided through membership in the CPDN and its activities.		
The Gordon Foundation has commissioned the development of an online tool for access, visualization and interpretation of freshwater quality data that is tailored for public audiences and decision makers. The pilot system is scheduled to be launched in the Fall of 2015. As the Foundation's Water Program Manager, I work closely with software developers and program partners in the North to build the pilot system and plan for future phases of this project.		
The Polar Data Catalogue archives and serves online datasets from Arctic and Antarctic research and monitoring activities, as well as RADARSAT imagery from both polar regions. We have a website for access to datasets and satellite imagery for free download and a separate website for information and data visualizations about snow and ice and life in northern Canada. We link with polar data portals across Canada and around the globe for sharing data and metadata, to increase visibility of the PDC collections and make polar data from Canada and other countries more accessible. We work with Canadian and international data-related organizations to advocate for good data management practices, including support to researchers who are learning about proper stewardship of their data.		
Use, integration, transformation and modelling of environmental, socio-economic arctic data and knowledge for ecosystem based management, policy, business models and sustainable livelihoods		
We collect and store ice charts (satellite image analysis, daily ice charts and regional ice charts). We use the climatology to see how the current situation compares to a 30 year normal.		

What category of polar data do you work with or require? (Check all that apply) / Other (please specify)	What type of data do you manage or use? / Additional comment box	For which reason(s) do you archive your data? (Check all that apply) / Additional comment box	What do you believe are the Canadian strengths and challenges in polar data management? Please choose an option for each of the following items. / Additional comment box	What are the technical challenges for polar data management? (Check all that apply) / Additional comment box
Data published via OGC web services	- Some of these are checked based on work conducted by AINA research associates in collaboration with the Institute	All of the above in addition to any federal policies (e.g., the Open Government Action Plan, Science.gc.ca, open.canada.ca)	Clarification needed for Speed of data transmission: is it the time for the researcher to put their data online ? Or the time to find and download the data when we are on the depository.	Culture change - getting data stewards to use common policies and standards to ensure interoperability. Also, metadata (for cataloguing purposes including search and discovery) tends to be a challenge as well.
Heritage data (pre-electronic) are of greatest interest.	No specific focus on arctic science but as a tool for cross-fertilization		Hard to answer from a National perspective - some of the items are a major strength for certain sectors but a challenge for other sectors	ethical ways of working with "data" shared by Indigenous People, especially potentially sensitive data, and when working with secondary data potential diversity of uses and associated ethical issues for keeping to original consent or research agreements provided
metadata records for various data sets	qualitative data, oral histories, digital recordings	I personally do not conduct research that involves collecting/archiving data, but I believe that funders' motivations for developing data archiving policies generally fall into the following: 1. Publicly-funded data are a public good 2. Supports scientific discovery 3. Supports innovation	I cannot [yet] comment, though would expect to gain information from the Workshop! One major challenge is almost certainly accessing and digitizing correctly heritage [analogue or primitive digital] data.	
Weather data. Marine traffic data.	Some of the management and usage I have checked off is not myself but within the Wildlife Division.	In astronomy, data archiving is usually established automatically by the telescope management. The sharing and repurposing of all such data is an overarching benefit.	Portals are a minor strength and archives are a minor challenge, Internet speed specifically in the north is a major challenge	
	The Canadian Polar Commission is mandated to facilitate knowledge exchange. We both create and disseminate data or knowledge products as well as facilitate the sharing of any or all of the above products.	It is part of our Environment Canada mandate to maintain the archive for climate monitoring purposes	Some challenge items (ease of upload/download, network speed) are particularly bad for Arctic regions. Networking, partnerships, and interoperability - I think there is a willingness, but we have not moved forward in the way some other countries have. Some of our portals and archives are very well established and fantastic resources, but not all of them. We have a lot of them and they are not typically interconnected or interoperable.	Security is of particular concern for traditional knowledge holders and industry - to the point where there is concern in some quarters about even putting it online at all.
video, film		Journal requirement to archive most - but not all - types of genetic data, so this is now routine for anyone working with sequence data. It can be a lot of work but the benefits to science far outweigh the disadvantages. I don't think any researcher would disagree. There are clear standards for archiving sequence data and international repositories (including GenBank). The kinds of data I work with are must more amenable to standardization than other types of data (I think), which is probably why strong standards already exist in my field, for the most part.	The challenges are not particular to Canada, they are international in scope.	The above are only guesses, but all other sciences find these particular challenges daunting. Creating data that are fully interoperable (and thus immediately available for repurposing) requires rigid adherence to standards in data formats.
	While I do not personally use such data, I have marked the categories that could be immediately relevant to non-specialists who support data rescue in general.	ONC is a research infrastructure at the service of science. So data archival is its prime responsibility, carried out on behalf of the community.		There are technical challenges associated with looking at all "polar" data instead of looking at it by discipline. We manage data from an area of disciplines (marine, oceanographic); not by geographical coordinates. This said, the challenges in managing polar data are the same as managing any other data. Part of the challenge is a certain number of short-lived data collecting initiatives (CERC, NCEs, or NSERC funded) that don't have a data management solution that includes preservation, and the fact that funding towards federal departments which are engaged in data preservation is not increasing at the same rate as that of initiatives which collect data.
		Part of our approach through the Circumpolar Biodiversity Monitoring Program and a Departmental Directive.		These apply to all types of data - I can't think of any parameter that would be relevant only to polar data (including access by northerners, who also need access to non-northern data of all sorts)
		Reproducible research is absolutely necessary.		We are particularly interested in challenges associated with limited bandwidth connectivity to ships.
		sharing with community partners		

What are the political and ethical challenges of polar data management? (Check all that apply) Additional comment box	Outline the Canadian and international data portal(s) and archive(s) with whom you collaborate for most of your data management or research activities. Open-Ended Response	Is access to data from non-Canadian repositories important to you? Provide examples. Open-Ended Response	Please describe the role that you think Canada should have in international polar data management in the future. Provide examples of specific activities, if possible. Open-Ended Response	Please provide your suggestions on how we may work together as a community to efficiently steward Canada's polar data resources in regards to: Coordination and leadership
As above none of these restricted only to polar data. In the case of polar data some or all may apply, depending on the subject matter.	- IPY Publications Database - INTERACT - Polar Data Catalogue - Scott Polar Research Institute - American Geological Survey - Arctic Observing Summit - Arctic Council - University of the Arctic - We also manage metadata/archival information for a number of sources including IPY, ArcticNet, NCP, BREA, the energy industry, northern communities, and more: http://arctic.ucalgary.ca/databases	Absolutely. In astronomy we work internationally the whole time. Many projects are trans-national or multinational, including many of the space instruments. From the aspect of Data Rescue, our involvement knows no boundaries.	Annual or every 2 years International meeting where the last development and challenges of data management and data availability are discussed.	`Provide technical help to share databases.
As far as we are involved, challenges are mostly technical.	-our internal collections database, through which data are shared publicly -my arctic collections housed permanently in the museum -GenBank and Barcode of Life Data Systems (BOLD) for DNA sequence data (once published). -numerous institutional databases for collections data (none restricted to polar data) -likely others I can' think of	critically important since our we deal with the whole Arctic	being a leader and innovative with regards to natural, social and health science data, along with strong ethical protocols	A centralize body should coordinate the effort of polar data management to prevent duplication of data and data management work. May be the Canadian Polar Commission can play such a leadership role.
First Nations and other co-management partners have a large role in the sharing of data in the NWT.	Arctic Biodiversity Data Service. Polar Data Catalogue. NWT Discovery Portal.	International Ice Chart Working Group National Snow and Ice Data Center German Space Agency and affiliates	Caches of analogue data (on paper, in books, handwritten, photographic, etc) should be thoroughly transformed into modern-format electronic data, and the results of new scientific information derived from them broadcast to the world. Such a project would become a precedent for other countries and sciences to follow, whether the focus is on polar data or elsewhere.	Agencies and universities should be sharing their data with established, thematic archives when applicable
Long-term funding is the most significant challenge, especially in Canada.	Arctic Council Countries, European Union,	It is essential. Almost all Polar issues are circum-polar in nature; especially with respect to the marine environment. International cooperation is currently excellent in both the Arctic and Antarctic. For example, the International Ice Patrol monitors the iceberg danger near the Grand Banks of Newfoundland and provides the iceberg limit to the maritime community. It is funded by 13 countries, but its services are provided by the United States in cooperation with Canada. International data sharing is vital to the operations of the IIP. Polar View provides earth observation data to the IIP.	Canada can be a leader is the planning, management and stewardship of arctic related data for scientific, policy decision making support and information to a wide range of stakeholders	By speaking out (with examples) to demonstrate the unquestionable value of efficient preservation, long-term stewardship and (where appropriate) rescue of all polar data
Open data is a challenge in that a lot of data is not open, researchers' reluctance to make data open (embargoes are a middle ground), and data being too sensitive to have it open. Long term funding is a serious problem.	Beaufort Sea Online Platform, Inuvialuit Atlas, AOOS	It would be good to access data collected by foreign researchers	Canada has a natural leadership position in polar data management, given that our country covers a great deal of the earth's Arctic landmass. We have many programs and many researchers focused on collecting data in and studying the North. We need to ensure preservation of these valuable data resources and information and make them available to the rest of the world. To do this, we should, as a country, decide that we will build, support, and maintain the best, most easily usable online data and information input and access portals in the world. We have a great deal of momentum in this front with a number of strong archives already in existence. Now we just need to organize ourselves and work with governments at all levels, funding agencies, research institutions, archives, and users to ensure this activity is coordinated and optimized for the future. By building a strong network of archives and websites at home, we can be an example to the rest of the world in how to responsibly preserve the outputs of publicly-funded research. We can work with other capable partners such as Australia and international research data management organizations to share experiences and coordinate activities on a global scale.	communicate on major initiatives and minimize overlap wherever possible
Providing a guaranteed, supported repository for all data, regardless of provenance or age, is a challenge that needs to be addressed globally in the interest of reliable research, particularly across the time domain. Once the importance of reusing heritage data is accepted by governments, managing and storing all data will be accorded the same quality of support as is currently given to [shiny] new projects.	Canadian Geospatial data Infrastructure United Nations portals National Snow and Ice Data Centre ITK	My modelling requires access to data from repositories outside of Canada. Use of EPA and European data sources is fundamental to my work.	Canada has an important leadership role to play in the Arctic Spatial data Infrastructure. CHARS has the potential to be a major coordinator of all arctic data	Data catalog sharing, interoperability (web service protocols, data brokering services, etc)
Traditional Knowledge information (sensitivity vs desire to share)	Canadian Geospatial Data Infrastructure (CGDI) Federal Geospatial Platform (FGP) INSPIRE Arctic Spatial Data Infrastructure	National Snow and Ice data Centre is important for us.	Canada has definitive strengths in IT and data management. So proposing that Canada plays a major role in setting up redundant archive centres for Arctic data would make sense. What I mean here is that we could have agreements with other nations involved in Arctic collection and suggest the co-hosting of each other's data to facilitate access and research and provide protection for the data.	Develop geospatial systems which are coordinated and interoperable
Very concerned about documentation and how the data has been "cleaned".	Environment Canada Open Data Portal Polar Data Catalogue	No but I believe that it is an important issue for Canadian researchers	Canada needs to ensure that it remains engaged internationally. Unfortunately, this is difficult given Canadian funding constraints. For example, significant activity in Europe is funded by Horizon 2020, but there is no mechanism for substantial Canadian participation in that program.	encourage all researchers to make conscientious effort to archive their datasets somewhere in some sort of permanent archive
	For research, I use astronomy data, both recent and heritage. I have repurposed astronomical stellar spectra as a unique source of information on global ozone concentrations, dating back to the 1930s (three papers published).	not at the moment, but can see it being very important to others	Canada should be a leader in the USE of polar data and knowledge; data management should be driven by these needs.	Ensure that groups that are difficult to get information from (e.g., Inuit) have the opportunity and capacity to engage.
	GCRC PDC CBM Atlas (ICC Canada)	not at this time, but could be important in the future	Canada should ensure that there is funding to engage the appropriate stakeholders in bringing Canadian perspectives and expertise to the international fora. Canada should be a leader in Circumpolar data management.	Equal partner in working groups establishing standards and data repositories.
	GCRC Polar Data Catalogue northern Hamlets northern Heritage Centres mostly the rest are ad-hoc internal efforts on very small scale	Not quite yet, but I can see it being very useful. In my line of research, we are investigating large-scale ecological patterns. Access to information from other polar nations would be especially useful in understanding whether ecological phenomena observed in Canadian regions are also observed in other northern regions.	Certainly a hub for data / metadata related to Canadian territory / territorial waters whether it is collected by Canadians or not. Beyond that - difficult to say not knowing the CHARS etc. planning - but if possible, leadership in standardisation of data collection, management and visualisation approaches - particularly for Northerner access?	focus on a use, demand and issue driven approach to leadership; foresee the 2050 needs and perspectives as drivers of todays action
	International Tundra Experiment Environment Canada Polar Data Catalogue ArcticNet	Yes	Cross-disciplinary, cross network interoperability.	For Arctic data - it would be interesting to see the role that CHARS and the CPC will play
	Interoperability partners: Yukon Research Centre, ITK, Scholars Portal/OCUL, UofAlberta Libraries, DFO, Canada government Open Data website, Environment Canada, Nordicana D/CEN, NWT Discovery Portal/CIMP, Québec ministry of environment and climate change (MDDELCC), Ocean Biogeographic Information System (OBIS), ASTIS, Parks Canada, GWNT new WMIS, Alaska Ocean Observing System/CBMP, CBMP/CAFF ABDS, GCRC/Carleton, Norwegian Meteorological Institute/Arctic Data Centre, British Antarctic Survey, ECDS (Sweden), National Institute of Polar Research (Japan), Australian Antarctic Data Centre, US NSIDC, GEO's GEOSS Component and Service Registry, Arctic Portal, GTNP, EU Arctic Information Centre, AWI, Pangaea, Arctic Data Explorer, ADIwg, GCW, GCMD, Finland's national data system, EUDAT, and Arctic Community-based atlas. Also, NSERC, SSHRC, IASC, SAON, SCAR/SC-ADM, WDS, CODATA, RDA, RDC, and others on research data governance and policy.	yes - many specimens are housed in museums outside Canada.	Excellent world class archiving and distribution of Canadian data. Collaborations with relevant international initiatives.	Hold a workshop with major data providers that have been successful in terms of developing user friendly tools (NOAA; KNMI).
	Museum collections, NatureServe, GBIF	Yes for all data that covers the Arctic and North.	Get our data on GBIF. Make data-sharing on species at risk a priority.	International standards. Tools to ensure data interoperability. Templates/forms/controlled vocabularies.

	Data repositories	International data importance	Canada's role	Coordination
	NAPS EPA	Yes, Circumpolar repositories of human health, geographical, biological, and economic are all important.	I believe that Canada has an obligation to provide easy access to polar data. I would like to see additional efforts put into the operationalization of online tools which allow easy access to data sources. I find the Polar Data Catalog to be cumbersome to use. A particular project I would like to see is for there to be an online tool where researchers can upload their climate data so that it can be incorporated into other larger scale studies. Currently, there is a lack of knowledge and data translation from major data providers to smaller data catalogs.	More conferences/workshops like the Canadian Polar Data Workshop to learn about relevant initiatives underway and to ID opportunities for coordination of efforts
	None at present, although open to data sharing opportunities as interoperability frameworks improve. For example, when we have ISO 19115 catalogs we'd like to contribute to the Polar Data Catalog.	Yes, for comparative, inter-site studies and opening up collaborative research opportunities.	I have difficulty envisioning a separate Arctic data portal that reproduces/duplicates existing international data repositories, many of which have been developed for specific research communities, or are more general, such as FigShare, Dryad, Treebase, and I'm sure many others in diverse fields. Many workers would likely not archive their data solely in a national portal when other well-established portals are in place that are recognized internationally. However some people may choose to archive their data in a polar portal, especially if, for whatever reason, that is the best or only suitable place. What would thus be useful is a portal where people could either archive their polar data (metadata about the dataset and the actual dataset) OR archive/document metadata about their existing datasets that are archived and accessible elsewhere. Thus a search of a polar portal would help people find relevant data, wherever they are.	National Data Committee with representatives from leading institutions/organizations/groups
	Nordicana D Polar Data Catalogue ASTIS/AINA GTN-P PANGEA	Yes, for interoperability and sharing metadata now, and data in the near future	I think Canada should be able to coordinate and enhance the linkages of multiple national and international polar data portals to enhance the power of data usage and interpretation while reducing data duplication.	Use CHARS as a coordination mechanism, less competition more collaboration
	North American Ice Service - USA National Ice Center, International Ice Patrol, Canadian Ice Service Canadian Cryosphere Information Network Polar Data Catalogue Environment Canada Data Mart Federal Geospatial Platform National Earth Observation Data Framework (NRCan)	Yes, for the Beaufort Sea and Baffin Bay regions that shared frontiers with USA and Greenland watres, respectively.	I think Canada should work on national collaboration, partnerships, networking, and interoperability so that we can better work as a cohesive group on an international level. I think we could take a leading role on developing data management policy for working with northern residents (TK, CBMP, etc). I think Canada could also eventually take a leading role in developing policy, procedure, and best practices for northern data management in general.	We need a national committee to lead this work. There are several groups in place which are working on research data management in Canada. These efforts need to be linked and coordinated to prevent redundancy of activities and optimize our efforts.
	PDC (of course) ICES :http://www.ices.on.ca/Data-and-Privacy/ICES-data ; When the Amundsen sails in Greenlandic seas Bathymetric Metadata has to be enter in the Danish repositories ICES with a link towards the PDC metadata and data (where the data are planned to be distributed).	Yes, it is. We believe that it is important to connect with and make our data services interoperable with international sources and partners.We operate ISAC and the Arctic Observing Summit and we work or have worked with INTERACT, IASC, SAON, and the International Polar Year Program toward those goals. ASTIS, for example, provides the Canadian IPY publications metadata for the International IPY Publications Database. We also have several research associates who work internationally and require access to international data and information.	I think that Canada should take a greater role in participating in international interoperability strategies being developed by groups like WDS, CODATA, RDA and ESIP, and in their specific domain areas of expertise. In addition, I think Canada has an opportunity to play a leading role in ocean data hosting and distribution services.	Work towards operability and inter-linking all existing systems/databases
	Polar Data Catalog; NOAA Paleoclimate Archive; National Snow and Ice Data Center; USGS Earth Explorer; KNMI Climate Explorer.	Yes, particularly the USGS Earth Explorer, NOAA Paleoclimate Archives and the KNMI Climate Explorer.	Interoperability Development of data visualizatin tools/applications that are visually esthetic, user-friendly, multi-layered Live data access/publication online	
	Polar Data Catalogue	Yes, we have acquired over the years data collected by Japan, Russia/USSR, Germany, Denmark, Iceland, Norway and France that cover important parts of the Arctic where data is otherwise rare. Historical data are especially important in the Arctic given its sensitivity to climate change. Acquiring real-time data from foreign-owned ice tethered profilers, surface drifters and ice buoys, gliders and other instruments helps Canadian scientists tuning their ice-ocean-atmosphere models	Most scientific disciplines have intergovernmental or international oversight bodies, and corresponding science-based federal departments should remain engaged with these bodies. In cases where there aren't such bodies, academic consortia can take on the role to interact with ICSU or other similar bodies on a thematic basis. For instance, as a national oceanographic data center under IODE (IOC), our responsibilities include: Participating in the development of international standards and methods for data management through the IODE and JCOMM; Participating in international oceanographic data and information exchange through the IODE and JCOMM; Assisting with data management aspects of global or regional programmes or pilot projects through IODE and JCOMM and in the framework of, inter alia, the IOC's Strategic Plan for Oceanographic Data and Information Management; Operating as a data assembly and quality control centre for part of an international science experiment and Operating specialized Data Centre on behalf of the international science community.	
	Polar Data Catalogue Arctic Data Explorer Arctic Data Centre Australian Antarctic Data Centre	Yes! In general, other major ocean data providers such as Intergovernmental Oceanographic commission (IODE), Global Ocean Observing System (GOOS), and OOI (Ocean Observing Initiative), PANGAEA, Ocean Tracking Network (OTN), Ocean Biogeographic Information System (OBIS), etc.	OGC and ISO Standards SDI Operational Policies SDI enabled technologies SDI Framework Data SDI Governance	
	polar data catalogue during my PhD with ArcticNet	Yes.	Provision of secure and open data repositories Collaboration in: Development and provision of data management support materials and expertise for researchers; Development of standard metadata protocols to support preservation and sharing of data; Development of international portal to polar data resources	
	World Ocean Database ICES Oceanographic Database IODE Ocean Data Portal (to eventually be interoperable with the WMO Information System and the GEO System of Systems) Copernicus Marine Service	YES. I do not have examples because I don't work with data to do research project BUT I think in such field were collecting data is extremely complicated and expansive sharing the data is very important for the benefit of research and all.	Support international data management initiatives (I.e. NOAA - IARM) Prioritize data management when planning international collaborative initiatives	
		Yes. As a point of contact with the Canadian and international polar scientific communities, the Canadian Polar Commission • works with Canadian and international institutions to determine scientific and other priorities; • encourages and facilitates cooperation and collaboration in polar knowledge.	We need to be an equal partner at the table in setting standards and encouraging collaborative international research teams. Open data is absolutely necessary.	
		Yes. It is important for me to access circumpolar data and data in other countries for contaminants in order to put Canadian data into regional and global context. For instance, I use AMAP data and European Monitoring and Evaluation Programme (EMEP0 data on the EBAS database. I draft arctic regional reports on contaminants for AMAP and global reports for the Global Monitoring Plan of the UNEP Stockholm Convention on POPs. Therefore, I need to have access to contaminant data from the polar regions and from various countries.		
		Yes. Require data for international assessments of change in Arctic species, habitats and ecosystems. Examples: Assessment of muskox distribution and abundance, caribou distribution and abundance. Use of MODIS, NOAA data and others to assess landscape scale changes.		
		Yes. Data related to Alaska and arctic waters west of the Beaufort Sea.		

Funding opportunities	Partnership and collaborations	Would you be willing to provide information for a white paper (as described in the Background Document) on the state and vision for polar data management in Canada?			Do you have additional comments or questions related to the workshop, white paper, polar data management in Canada, or any other issues?
		I give permission to use my responses to this questionnaire in the white paper	I would like to participate in the creation of the white paper	I do not give permission to use my responses to this questionnaire in the white paper	Open-Ended Response
		29	18	2	
Apply for funding from ArcticNet and other organizations which can provide a long-term stable source of funding for these projects.	Build and/or host workshops on data management ; Write trimestrial or semestrial newlsetter to follow up on / announce workshop / Gives news on data management development and challenges				As of June 1st, CHARS and the CPC will be merging to create a new organization. These answers are more reflective of the CPC side, but also reflect some of the future data considerations for the new organization.
Band together to apply for e.g., CFI cyber-infrastructure funds	Canada's National Air Pollution Surveillance (NAPS) program				Before to aggree on a potential participation in the creation of the white paper, I would like to have more information on it...maybe this info will be given at the workshop.
Canadian gorverment must be involved - ensure legacy, and logical suite if a funding requirement from its programs	Canadian Polar Data Network, Canadian Polar Institute, and CCADI are great starts to this.				I am very hopeful for a successful Workshop!
Co-fund multidisciplinary research teams	Develop and maintain partnerships between data owners, holders, contributors and stakeholders				I would like to be involved in further discussions around the social science, qualitative data, and ethics related to working with Indigenous peoples and developing appropriate data management efforts aspects of a white paper...I'm not sure how much I can contribute in terms of paper content but would be happy to help with identifying important opportunities, considerations, challenges that would then be dealt with by those with much more data management experience...I'm sorry that I'm not able to make the upcoming workshop at the end of May, and look forward to hearing what comes of that and what the next steps entail
collaborate on grant proposals to support further development of DMP initiatives	Ensure that groups that are difficult to get information from (e.g., Inuit) have the opportunity and capacity to engage.				If the topic of Data Rescue is not presently on the agenda, I believe it should be added. It should certainly feature in the white paper. Canada has such a dominance in the field of polar data, owing to its own vast territorial coverage, that its voice in these matters will have to be heard. It is never to early to start, and to push or prod for leadership where non exists at present.
Create something and don't kill it	in addition to horizontal partnerships between 'data' providers and managers more emphasis should be directed to the value-adding processes and partners which transform data into knowledge, policy , management actions and (adaptive) business models				If there is a need to give an overview of GOC and EC data management activities, I would be happy to do so. Environement Canada is also very involved in the Federal Geospatial Platform initiative. There may be some interest in that initiative as well.
deamd and issue drivers provide the best chance of funding and relevance	Incorporate other organizations at the outset.				It would be useful to have a session on OGC web services and on SDI's at the workshop.
Ensure that the appropriate representative Canadian organizations have adequate funding to organize themselves and bring community, regional, and national expertise and knowledge to the international stage. This will make Canada a leader.	Joint efforts				Look forward to the workshop
Establishing the above will help convince funding agencies of the scientific value of ALL data, not just new ones.	leverage partnerships of like-minded organizations eg. CPDN, RDC, CARL, IASSIST				Metadata seems well managed, however the management of actual data seems a lot trickier.
funds needed to get data into an archivable format should be provided by the usual funders. But many researchers may be sitting on datasets that require work to be archived, and it would be good if there were funds available for that purpose. Without further support, it is certain that many "legacy" datasets are at risk of being lost.	Leverage national SDI governance mechanisms				My sense is that any portal should be kept as simple as possible and should not be too restrictive on specific formats for archived datasets. The enormous scope of types of polar data would make having restricted formats an impossibility. This should be left to disciplines creating relevant data archive for their fields - the importance of data archiving is growing in all fields. But there should obviously be some standard metadata fields about datasets so that the database can be queried, etc. If the portal is able to host datasets, researchers probably should be given the flexibility to provide their data in whatever format they think will be best for their colleagues in the future. Beyond some basic guidelines I think it would be impossible to police - ultimately the community has to take responsibility for the quality of their data.
It might be interesting if implicated federal depts put together a joint plan and I think the ADM S&T committee may have made some progress toward that??	More conferences/workshops like the Canadian Polar Data Workshop to learn about relevant initiatives underway and to ID opportunities for coordination of efforts				Northerners cannot travel to the workshop. Allow Northern Territorial Gov. to have say.
Join together to apply for grant opportunities and corporate funding. It would be great if there were more funding opportunities for interoperability, collaboration, and upgrading/expansion of existing portals and repositories. I also think we should lobby organizations that fund researchers to insist that researchers include data dissemination costs in their funding proposals or provide a budget for it themselves.	NatureServe and GBIF				The people living in the Arctic need to be present in numbers to balance the knowledge, messages, and contexts that come forward. This is generally accepted, but in the end is ignored, mainly because of the real costs of this engagement. Canadian initiatives suffer from this reality, and northerns end up paying the price. It is easier, and cheaper, to ensure northerners are assisting in establishing structures processes than it is to try to dismantle inappropriate processes that are already put in place later.
Joint funding applications	Open and non-competitive collaboration. Clarity on roles and data pathways.				We are very much looking forward to participating in the workshop and white paper and are happy to move forward with collaboration and networking efforts.
Long-term funding is essential in ensuring regular and sustained maintenance of Canada's polar data portals.	Provide opportunities for researchers to meet and form collaborations.				

Middleware software development, metadata/data curation activities	Provision of resources/discussion forums/clear information regarding data sharing policies to ease concerns about sharing				
We should work to make proposals together (like the recent CFI CCADI effort) and should work with the federal government to obtain a commitment to a sufficient national framework and structure for supporting research data management, both polar and non-polar, for the long term.

where overlaps or common interests are identified, develop joint funding applications (or new partnerships/collaborations as below) | Recognizing Canadian data as one facet of international data, and establishing domain-specific Groups to manage and share data across borders.

Stronger institutional models for cooperation | | | | |
	There are so many groups getting into polar (especially Arctic) data management in Canada. We really need to work together to coordinate our activities so that we can streamline and harmonize our work. This will ensure a strong system which serves the most people in the best way.				
	Workshops, Brokering tools, etc				

Appendix 5

Workshop Agenda

Canadian Polar Data Workshop
26-27 May 2015
Albert at Bay Suite Hotel, Ottawa, Ontario
      Fall and Winter Seasons Salons

Agenda

Tuesday, 26 May	
8:00-8:30	Registration

8:30-10:00	• Opening remarks - ***Ellsworth LeDrew***
	   o Logistics of breakout sessions and expectations for Workshop outcomes
	• Review of Questionnaire responses - ***Gabrielle Alix***. To include:
	   o Summary of Canadian strengths in polar data management
	   o Support for sharing data and for education/training
	• Goals for Position Paper, contributions to Polar Data Forum II – ***Ellsworth LeDrew***
	• Introduction to "How can we coordinate polar data management activities in Canada, and what opportunities shall we pursue for Canadian leadership internationally?" ***Warwick Vincent***
	• Discussion

10:00-10:30	Coffee and pastries (catered)
10:30-12:00	Background/Introduction on Issues to be addressed during breakout sessions (* see details below): • Data sharing – ***Peter Pulsifer*** • Data access – ***Benoît Pirenne*** • Data preservation – ***Scott Tomlinson*** • Interoperability – ***Julie Friddell*** • Linkages and partnerships – ***David Arthurs*** • Policy and Funding – ***Philippe-Olivier Giroux***
12:00-13:30	Lunch (catered)
13:30-14:30	**Breakout Session 1** • Interoperability • Policy and Funding • Data sharing • Data access

14:30-15:00	Coffee and tea (catered)
15:00-17:00	Reports from Breakout Session 1 Discussion (on topics from Breakout Session 1 only)
Evening	Group dinner (local restaurant)
Wednesday, 27 May	
8:45-10:00	**Breakout Session 2** • Interoperability • Policy and Funding • Data preservation • Linkages and partnerships
10:00-10:30	Coffee and pastries (catered)
10:30-12:00	Reports from Breakout Session 2 Discussion (on topics from Breakout Session 2 only)
12:00-13:30	Lunch (catered)
13:30-14:30	Initial report on "Coordination" question
14:30-15:00	**Breakout session 3** on "Coordination" question
15:00-15:30	Coffee and tea (catered)
15:30-17:00	• Second report on "Coordination" question • Synthesis/summary of Workshop • Next steps, including plans for the Position Paper and plans for Canadian contribution to Polar Data Forum II
17:00	Departure – thank you!
Evening	Group dinner (local restaurant)

Appendix 6

Questions for breakout sessions

Breakout Session questions

Data Sharing – Peter Pulsifer

1. The majority of participants indicated that "open data" is necessary and valuable. At the same time, there are notable exceptions to the fully open model (i.e. IPY Data Policy, IASC Statement). What should the allowable exceptions to fully open data sharing be, and who should decide these exceptions?
2. In general, trust is a critical component of sharing data openly. What is required to establish trust between and among data producers, stewards, users and other stakeholders?

Data Access – Benoît Pirenne

1. What does "Open Data" mean to you?
2. Who are the users, and what are their needs for data access? Is everything covered? What is important?

Data Preservation – Scott Tomlinson

1. Data documentation is a critical part of the preservation system. What are the best methods to ensure this essential element of the data life-cycle is completed (enforcement or encouragement?)?
2. Data rescue has been a "hot topic" in recent years, what are the key challenges to overcome when addressing the issue of data rescue? What triage methods can or should be used to prioritize at risk datasets?

Interoperability – Julie Friddell and Shannon Vossepoel

1. What are the challenges for interoperability (technical, human, legal)?
2. What specific actions can your group/Canada take to improve linkages between polar data portals within Canada and internationally?

Linkages and Partnerships – David Arthurs

1. Which communities, organizations, groups are a priority to link with?
2. How shall we link with industry?

Policy and Funding – Philippe-Olivier Giroux

1. What policies are needed? And who should be responsible for them?
2. What are the explicit needs for funding? Who needs funding, for what activities, and what types of expenses?

Coordination/Leadership – All

1. How can we coordinate polar data management activities in Canada?
2. What opportunities shall we pursue for Canadian leadership internationally?
   • How can we connect and build on everyone's initiatives (and meet all expectations)?
   • Who could/should take the lead on this?
   • How would this be funded and supported?
   • How can researchers be encouraged to contribute?
   • How can we improve Canadian data management for all stakeholders: northern communities; research communities; industry; governments; policy-makers; the public...?

Appendix 7

Workshop participants and short bios (as available)

Canadian Polar Data Workshop

Participant List with Bios (where available)

Marlene Doyle is a Science Officer with the Wildlife and Landscape Science Directorate of Environment Canada. She is Canada's representative on the Circumpolar Biodiversity Monitoring Program Terrestrial Steering Group.

Julie Friddell is the Associate Director of the Polar Data Catalogue and Canadian Cryospheric Information Network at the University of Waterloo. She is dedicated to support of research and researchers to ensure long-term protection of and access to the valuable data and information resulting from polar research and monitoring activities.

Philippe-Olivier Giroux is a policy analyst at the Natural Sciences and Engineering Research Council of Canada (NSERC). He is responsible for NSERC's policy development and interactions with the Canadian research community and stakeholders on research data management, open access, and open science.

Colline Gombault: ArcticNet administrative and data coordinator for the core data collected on the Amundsen. My main task is to coordinate quality control, archiving and distribution of these data. My team interest is to improve our data management and increase the use and the visibility of the data. Participating to this initiative is part of this objective.

Ed Kennedy, B.SC. Eng., MBA is Director, Business Development for Polar View Earth Observation Limited, an international team providing ice and snow related information to user communities in the Polar Regions. Ed's interest in polar data stems from executive level experience in public, private and not for profit organizations in the geospatial/earth observation sector plus extensive knowledge of data management challenges and opportunities gained from related consulting experience.

Mathieu Ouellet at the Oceanographic Services branch of Fisheries and Oceans (DFO) is leading a team which is responsible for long-term stewardship of oceanographic data collected in Canadian waters and/or by DFO, for the real-time data assembly and delivery of in situ data for ocean services, and acting as the primary contact point for international data exchanges. He is also an active member of data management committees under national DFO programmes and of intergovernmental data management and coordination teams.

Jennifer Parrott, Spatial Projects Coordinator for the Inuvialuit Regional Corporation and Joint Secretariat. Supports the development and management of GIS-related initiatives in the Inuvialuit Settlement Region.

Carol Perry, Associate Librarian. I am responsible for data management services including oversight for our institutional and data repositories at the University of Guelph. I am involved with data management and preservation issues nationally as the Ontario Council of University Libraries representative on both the Canadian Polar Data Network and the Canadian Association of Research Libraries' Portage project as well as being active internationally as Canadian Secretary for the International Association for Social Sciences Information Services & Technology (IASSIST).

Laura Petrunka, Research Officer with Inuit Circumpolar Council (ICC) Canada. My work with Inuit Circumpolar Council (ICC) Canada focuses on Inuit mental health and wellness data in the circumpolar region. I attended the Canadian Polar Data Workshop in order to learn about polar data practices and to relay information back to ICC Canada.

Benoît Pirenne, Ocean Networks Canada Director of User Engagement, responsible for our observatories data management. Previously in charge of data management at the European Southern Observatory.

Virginie Roy (PhD), W. Garfield Weston Postdoctoral Fellow in Arctic Research at the Canadian Museum of Nature. Interest in data sharing, because she collaborates with the museum's experts to produce a comprehensive online database of marine invertebrates from the Canadian Arctic. The database will incorporate the museum's extensive invertebrate collections, which include specimens collected 100 years ago during the first Canadian Arctic Expedition.

Jeffery M. Saarela, PhD, Research Scientist & Director, Centre for Arctic Knowledge and Exploration, Canadian Museum of Nature. I am a botanist, and my research is focused on the taxonomy and systematics of Arctic vascular plants. I generate new data about Arctic plants through extensive field collections in the Arctic, documenting the distribution of biodiversity in time and space. I am also involved in efforts to publish the Canadian Museums of Nature's collections data in all natural history disciplines (botany, mineralogy, palaeobiology, zoology) online – including extensive collections from the Canadian Arctic.

Dr Fraser Taylor is Chancellors Distinguished Research Professor and Director of the Geomatics and Cartographic Research Centre at Carleton University in Ottawa. He has been involved with polar Spatial Data Management initiatives for many years.

Paula Tozer joined Environment Canada's Information Management Directorate in 2009 to work on metadata and data management issues and is currently a member of the Geospatial and Data Management Service Team. She holds a Bachelor of Science in Environmental Studies and Biology (Trent University) and a Master of Library and Information Science (Western University).

Warwick Vincent holds the Canada Research Chair in aquatic ecosystem studies at Université Laval, where he is also the scientific director of Centre d'études nordiques (CEN), an interuniversity centre for northern research and training. Warwick is a past chair of the ArcticNet data management committee and helped found and develop the Polar Data Catalogue.

Cameron Wilson is a manager with Natural Resources Canada responsible for Operational Policies, Standards and Spatial Data Infrastructure Assessments in support of Arctic Spatial Data Infrastructure. A geographer from Carleton University, Mr. Wilson has extensive experience in the geomatics domain.

Remaining participants:

Amos Hayes	Gabrielle Alix	Robert Way
Claire Austin	Jean Thie	Scott Tomlinson
Darlene Langlois	Jennifer Amagoalik	Shannon Ascensio
Dave Bowen	Jennifer Sokol	Shannon Vossepoel
David Arthurs	Karen Lauer	Shirley Mills
David Moorman	Kevin Fitzgibbons	Simon Riopel
Elizabeth Boston	Patrick Henry	Sylvie Boucher
Elizabeth Griffin	Peter Pulsifer	Túlio Criscuolo
Ellsworth LeDrew	Robert Oikle	

Joined Remotely:

Eric Solomon	Michel Adam
LeeAnn Fishback	Suzanne Carriere

***There were four additional people who responded to the questionnaire, attended the Workshop in Ottawa, or joined remotely but who have requested to not have their names listed as participants.

Appendix 8

Presentations

CANADIAN POLAR DATA WORKSHOP

May 26, 27 2015
Ottawa

Ellsworth LeDrew,
Julie Friddell,
University of Waterloo
Many others

BACKGROUND DOCUMENT FOR A CANADIAN POLAR DATA WORKSHOP, MARCH 2015
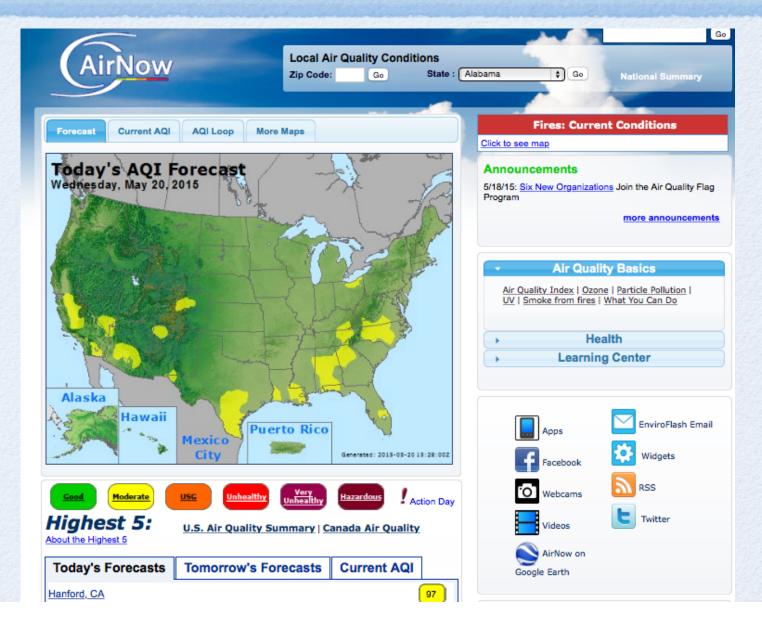
- Canadian scientists and the public must have access to the data and information needed to facilitate their research activities and make informed decisions

- National and global coordination of activities related to polar data management will benefit Canadian society by streamlining data management and access systems, making our work more time- and cost-efficient and putting data and information within easy reach of all stakeholders
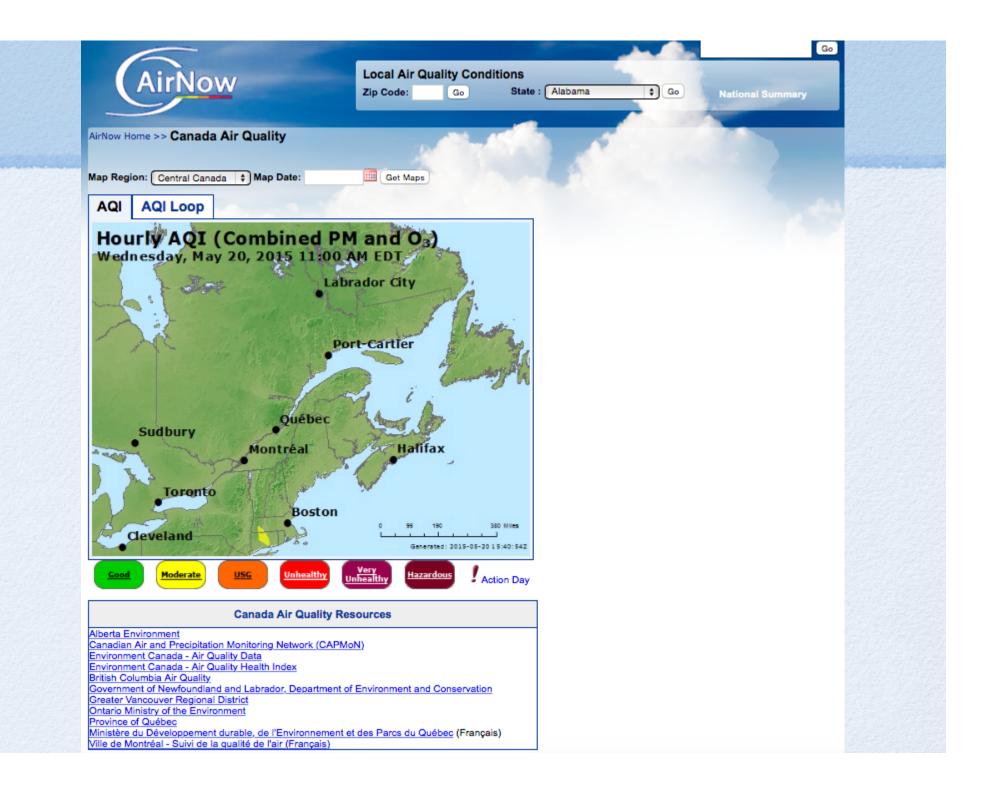
OUR TASKS

1) to coordinate polar data management activities in Canada

   - Governance and management

   - Interoperability: technical, human

   - Long term preservation and sustainability

   - Conversion to user focused information and outreach

2) Prepare Canadian Positions on issues in polar data management in preparation for the Second Polar Data Forum, Tri-Councils and others

EXAMPLE OF GOOD USER VIEW OF DATA MANAGEMENT (GARY FOLEY, EPA)

AirNow

AirNow Home >> **Canada Air Quality**

Map Region: [Central Canada ▼] Map Date: [ ] 🗓 [Get Maps]

AQI | **AQI Loop**

Hourly AQI (Combined PM and O₃)
Wednesday, May 20, 2015 11:00 AM EDT

Labrador City

Port-Cartier

Québec

Sudbury

Montréal

Halifax

Toronto

Boston

Cleveland

0   95   190   380 Miles

Generated: 2015-05-20 15:40:54Z

Good	Moderate	USG	Unhealthy	Very Unhealthy	Hazardous	! Action Day

Canada Air Quality Resources

Alberta Environment
Canadian Air and Precipitation Monitoring Network (CAPMoN)
Environment Canada - Air Quality Data
Environment Canada - Air Quality Health Index
British Columbia Air Quality
Government of Newfoundland and Labrador, Department of Environment and Conservation
Greater Vancouver Regional District
Ontario Ministry of the Environment
Province of Québec
Ministère du Développement durable, de l'Environnement et des Parcs du Québec (Français)
Ville de Montréal - Suivi de la qualité de l'air (Français)

Partners

State and Local Partners | Tribal Partners | Federal Partners | International Partners | Media Partners

State and Local Partners

ALABAMA

Jefferson County Department of Health
Huntsville Natural Resources and Environmental Management
Alabama Department of Environmental Management

ALASKA

Alaska Department of Environmental Conservation

ARIZONA

Pinal County Air Quality Control District
Pima County Department of Environmental Quality
Maricopa County - Air Quality Department
Arizona Department of Environmental Quality

ARKANSAS

Arkansas Department of Environmental Quality

CALIFORNIA

Yolo-Solano Air Quality Management District
Ventura County Air Pollution Control District
South Coast Air Quality Management District
Santa Barbara County Air Pollution Control District

DATA SHARING IS CENTRAL

About the Data

Map and forecast data are collected using federal reference or equivalent monitoring techniques or techniques approved by the state, local or tribal monitoring agencies. To maintain "real-time" maps, the data are displayed after the end of each hour. Although preliminary data quality assessments are performed, the data in AirNow are not fully verified and validated through the quality assurance procedures monitoring organizations used to officially submit and certify data on the EPA Air Quality System (AQS).

This data sharing and centralization creates a one-stop source for real-time and forecast air quality data. The benefits include quality control, national reporting consistency, access to automated mapping methods, and data distribution to the public and other data systems.

The U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration, National Park Service, tribal, state, and local agencies developed the AirNow system to provide the public with easy access to national air quality information. State and local agencies report the air quality index (AQI) for cities across the US and parts of Canada and Mexico.

AirNow data are used only to report the AQI, not to formulate or support regulation, guidance or any other EPA decision or position.

This page was last updated on Wednesday, May 13, 2015.

This data sharing and centralization creates a one-stop source for real-time and forecast air quality data. The benefits include quality control, national reporting consistency, access to automated mapping methods, and data distribution to the public and other data systems.

1) Bathrooms

2) Registration – please make sure you sign in (Julie is at table at back of room)

3) Breakout sessions – 4 this afternoon, 4 tomorrow

   1) Each breakout session will address a specific topic as well as an overarching question which will be asked at each breakout session - **How can we coordinate polar data management activities in Canada, and what opportunities shall we pursue for Canadian leadership internationally? What roles will each group play?**

   2) Sign up for your preferred breakout sessions during coffee break! Lists located around room

   3) Note-takers/rapporteurs are needed for each breakout session, to write on the flip-charts or create PPT (limit of four points) and report back to the group on the main points of the discussion.

4. Expectations for point 3.   We need a note-taker for each session. Please raise your hand now if you are willing to help with notes for this session, and let Julie know if you are willing to help with taking notes for other sessions.

   a.   Please let us know if you do not want to have your comments recorded. We will not be attributing comments to individuals – all ideas and suggestions will be included anonymously.

   b. We will also take some photographs of the meeting. Please let us know if you would prefer not to be photographed.

5/ We have several people joining us remotely via webinar. The podium computer is being broadcast to remote participants, and Colline and Gabrielle are helping make sure remote attendees can hear us and have the opportunity to ask questions and contribute to the discussion. Please speak into machine or microphone so remote attendees can hear.

6/ Workshop – this is the first time we have come together to coordinate our activities. It is the beginning of the conversation, and it is hopefully the beginning of a long road together. We hope to make a good start by understanding the landscape, understanding what people want, and by defining a small set of clear action items that can be led by reliable individuals or groups to make progress in the next 6 months or so.

7. Load ppt for second session this morning at coffee break

8. Dinner: Baton Rouge, Need show of hands

9. Many thanks to Gabrielle for managing the survey! She formed many of the questions and learned SurveyMonkey and has done a great job of synthesizing your input!

Review of Questionnaire Responses
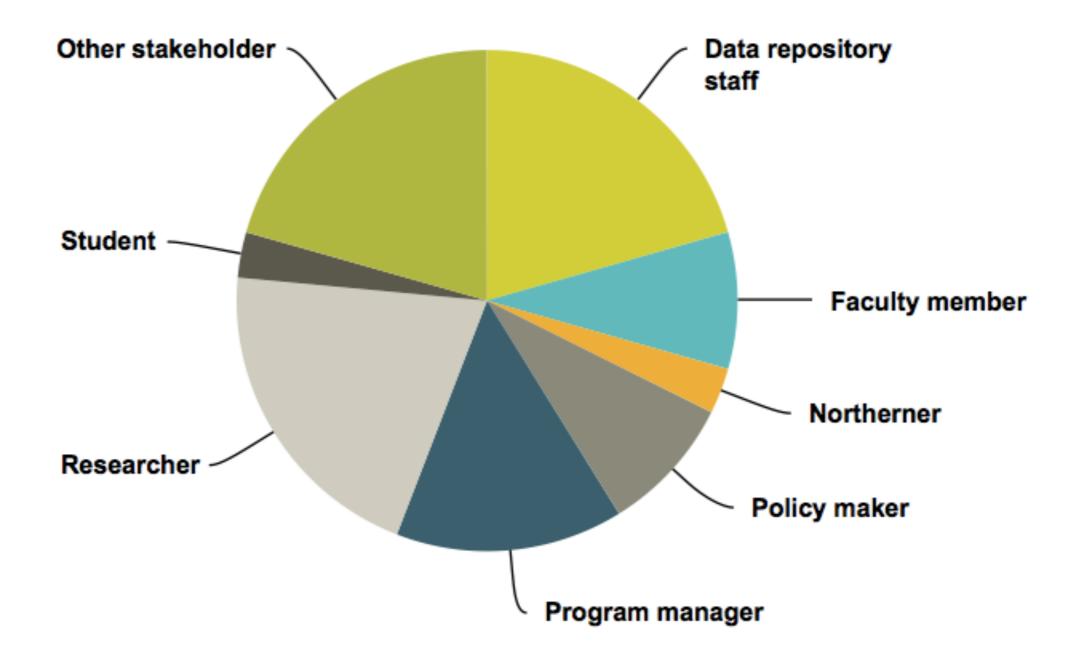
Gabrielle Alix, PDC Data Manager

Canadian Cryospheric Information Network
University of Waterloo

Canadian Polar Data Workshop
26-27 May 2015, Ottawa

Respondents' roles
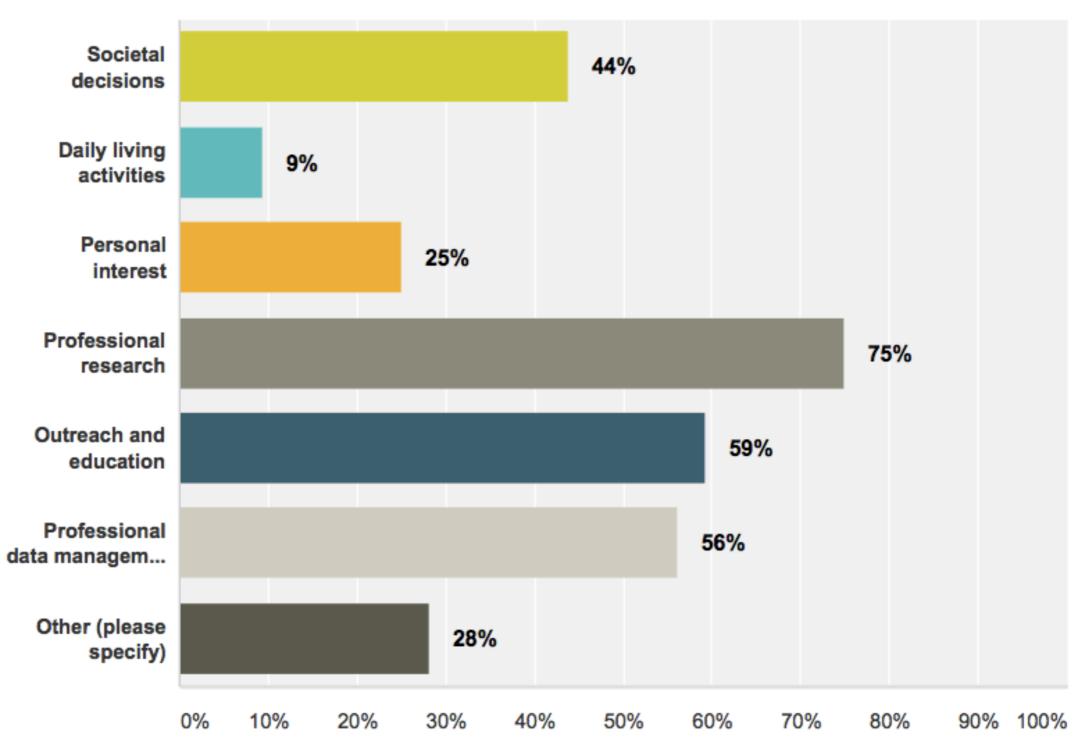
- 34 respondents from 17 April to 25 May 2015

- **Other** : Research centre director
- Data management service provider
- Data provider
- Post-doc fellow

- Research advisor
- Research manager
- Science director
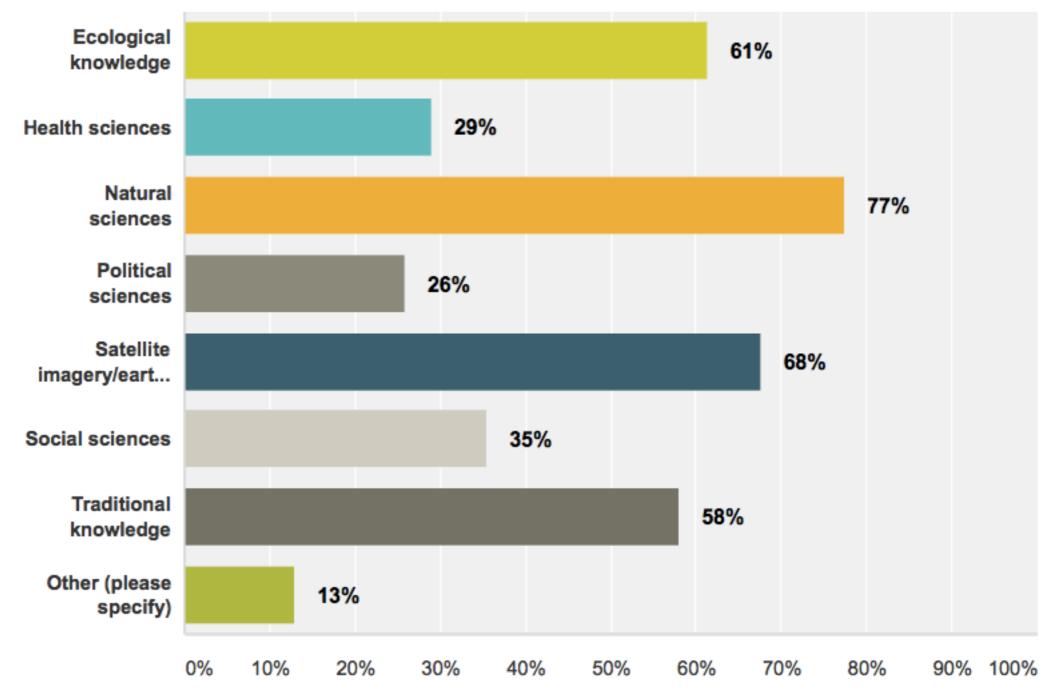
How do you use polar data?

- **Other**: For policy and decision making
- To provide ice information
- To develop circumpolar data and map

- To raise awareness of research activity
- For delivering operational services
- As a resource for demonstrating best practices in other fields

What category of polar data do you work with or require?

Horizontal bar chart:

- Ecological knowledge: 61%
- Health sciences: 29%
- Natural sciences: 77%
- Political sciences: 26%
- Satellite imagery/eart...: 68%
- Social sciences: 35%
- Traditional knowledge: 58%
- Other (please specify): 13%

X-axis: 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

- **Other**: Heritage data (pre-electronic)
- Data published via OGC web services
- Weather and marine traffic data
- Metadata records for various data sets

What type of data do you manage or use?

Manage

1. Raw data

2. Maps derived from data

3. Information derived from data

4. Custom products derived from data

5. Processed data

Use

1. Scientific publications
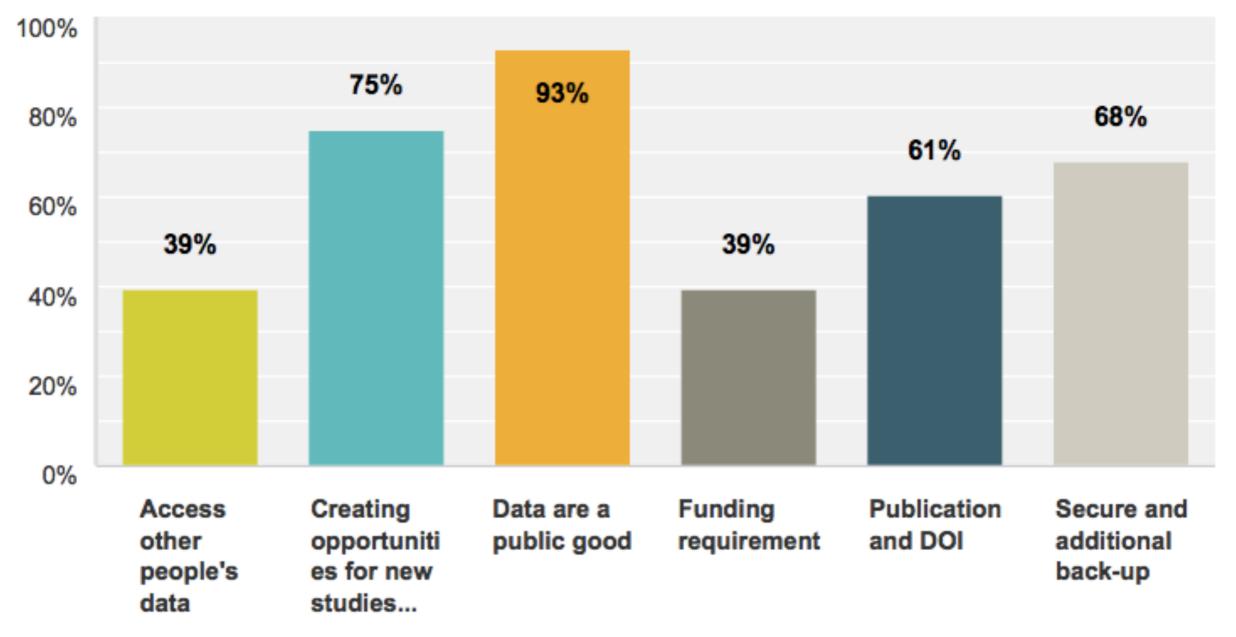
2. Written Reports

3. Natural history collections and associated data

4. Satellite imagery

- **Other**: Video; film; qualitative data; oral histories; digital recordings
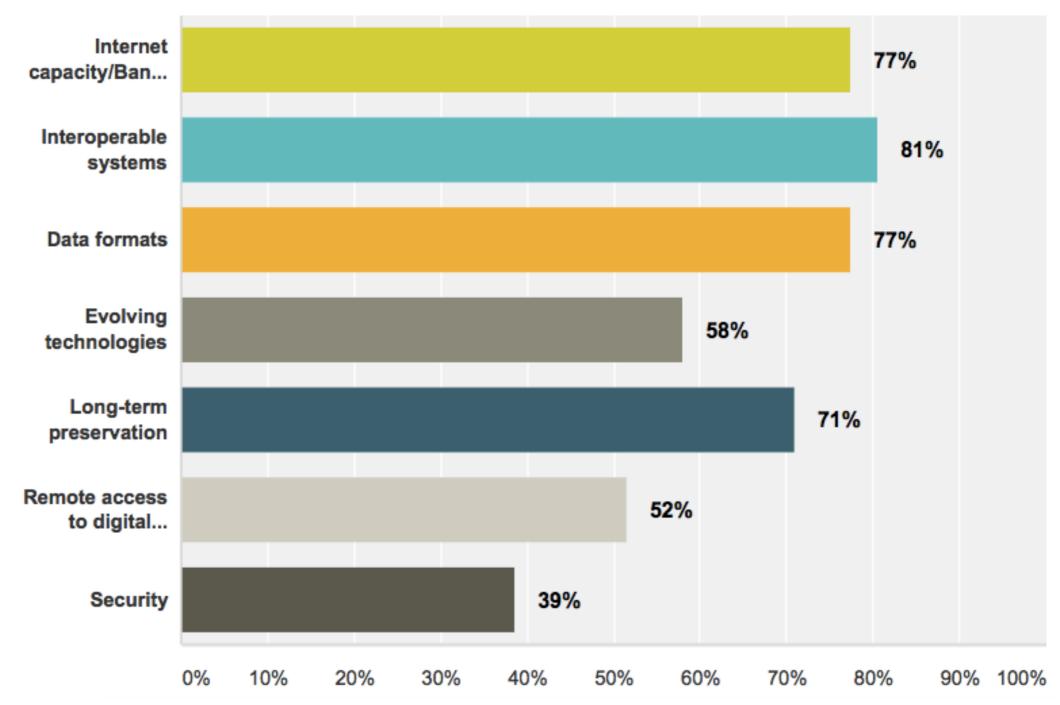
For which reason(s) do you archive your data?

- **Comments**: Sharing with community partners
- Support innovation
- Support scientific discovery
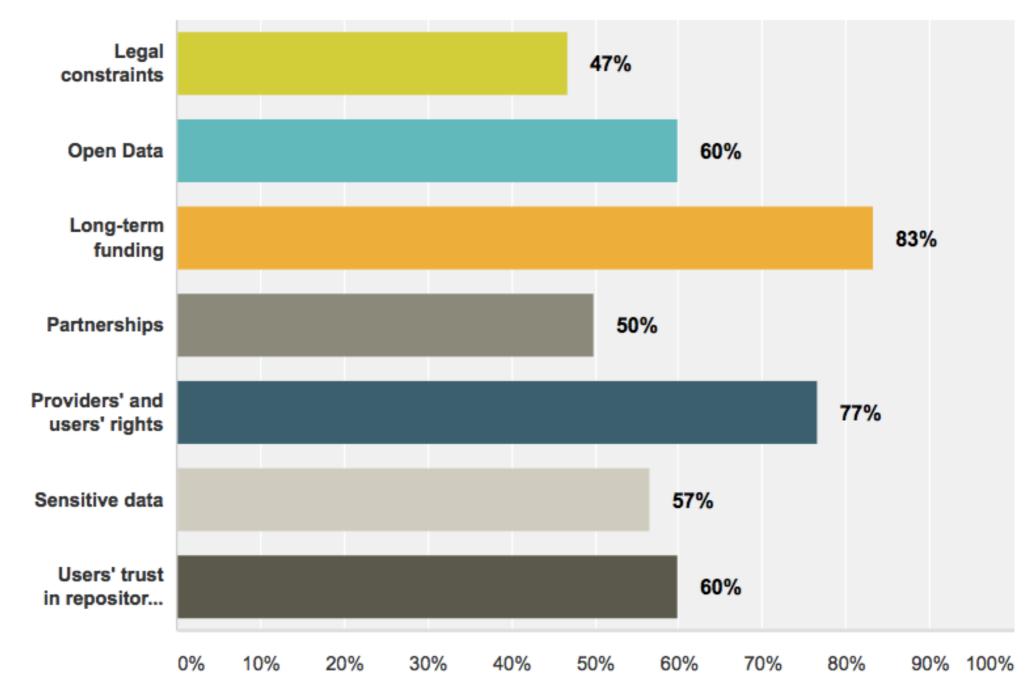
- Journal requirement
- Time series analysis
- Overarching benefit
- Reproductible research is necessary

What are the technical challenges for polar data management?

- **Comments**: Not restricted to polar data
- Limited bandwidth connectivity to ships
- Creating data that are fully interoperable
- Security is of particular concern for TK holders and industry - concerned about even putting it online at all

What are the political and ethical challenges of polar data management?

- **Comments**: TK (sensitivity vs desire to share)
- Not restricted to polar data
- First Nations have a large role in the sharing of data

- Repository for all data, regardless of provenance or age
- Very concerned about how the data are « cleaned »
- Secondary data and associated ethical issues

Canadian and International data portals and archives

Polar Data Catalogue
National Snow and Ice Data Centre
Environment Canada
Arctic Science and Technology Information System
Canadian Geospatial Data Infrastructure
Geomatics and Cartographic Research Centre
National Oceanic and Atmospheric Administration
ICES Oceanographic Database
Ocean Biogeographic Information System

map credit: http://www.6188.com/

Canadian strengths of polar data management

Major Strengths	Minor Strengths	Other
IT and technology*	Networking and partnerships*	Metadata management
Data visualization and display*	Well-established portals and archives* (portal vs archives?)	Security
Bandwidth* (in the South)	Open data* (What is Open Data?)	Ocean data
	Protecting sensitive data*	Spatial data infrastructure
	Education and training*	

Education and training

- Meetings

  - International meeting every 1 or 2 years

- Workshops

  - Present groups and organizations

  - Share progress and highlight available dataset

  - Learn about new initiatives and make connections

  - Provide resources, information, technical help

- Newsletters, information, news on data management

- Webinars, online discussion forum and tutorials

Additional questions

- Describe the role that you think Canada should have in international data management in the future

- Provide your suggestion on how we may work together as a community to efficiently steward Canada's polar data resources in regards to:

  - Coordination and leadership

  - Funding opportunities

  - Partnership and collaborations

Thank you!

Photo by Luke Copland

CANADIAN POLAR DATA POSITION PAPER

PRIOR INFORMATION

- National Consultation on Access to Scientific Research Data, David F. Strong and Peter B. Leach, 2005, NRC

- Mapping the Data Landscape: Report of the 2011 Canadian Research Data Summit, Research Data Strategy Working Group, 2011, http://rds-sdr.cisti-icist.nrc-cnrc.gc.ca

- Summary Report –Digital Infrastructure Summit 2014,Leadership Council for Digital Infrastructure, http://digitalleadership.ca/wp-content/uploads/2014/02/Summary-Report-of-Summit-2014-Final-March-2014.pdf

- Scientific Data and Information, Report of the Committee on Scientific Planning and Review Assessment Panel, ICSU, 2004

- ARL/DLF E-Science Institute Update Webinar for Sponsors, Association of Research Libraries, Digital Library Federation, 2011

- Statement of Principles and Practices for Arctic Data Management, IASC, 2013

- IPY, CHARS etc data policies.

THE AUDIENCE

- Tri-Councils

- CHARS

- CFI – Cyberinfrastructure CFP

- Scientists and citizens in the North

  - Transformative process

- Data and Portal managers

- OTHERS?

THE PROCESS

- Last year, discussions with ArcticNet, SCAR, NSF, NSERC, SSHRC

- Questionnaire sent out for this meeting

  - Questions posed for each breakout.

- Follow-on Questionnaire (next slide)

- Writing over the summer,

  - INPUT, review and comment by this audience (inclusive process),

  - If not a consensus, we will document all perspectives

  - submission to NSERC

- October, 2015, Polar Data Forum II, International Forum – report to NSERC

FOLLOW-UP QUESTIONNAIRE?

- Capture any change and/or evolution of thinking from this meeting

- Recalibrate previous questionnaire and add new questions that may arise

- Embrace additional contributors

- Inform the writing process

- Is this a good idea? Would anyone respond?

Canada Polar Data Workshop
Coordination & Leadership

Warwick F. Vincent, Université Laval; Ottawa Workshop, 26 May 2015

How to Achieve Coordination and Leadership?
Expectations, Examples and Opportunities

- Northern stakeholders
- Research community
- Funding agencies
- Other participants
- Opportunities and questions

ArcticNet
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Établissements et membres partenaires

Nunavut
AANDC-CHARS
Canada Nunavut Geoscience Office
Government of Nunavut
Igloolik Research Centre
Natural Resources Canada-PCSP
Nunavut Arctic College
Nunavut Department of Education
Nunavut Implementation Fund
Nunavut Research Institute
Nunavut Tunngavik Incorporated
Nunavut Wildlife Management Board
Nunavut Wildlife Research Trust
Parks Canada

Québec
Défense nationale
Environnement Canada-CWS
FRQNT
Hydro-Québec
INRS-ÉTE
INSPQ
MAMROT
McGill
MDDEP
MRNF
Garde côtière
MPO-Institut
Ressources
Transport Québec
Université de Montréal
Université du Québec à Chicoutimi
Université du Québec à Montréal
Université du Québec à Rimouski
Université du Québec à Trois-Rivières
Université de Sherbrooke
Université Laval
(CEN, Québec-Océan, CIÉRA, Nasivvik)

Ontario
AANDC
• IPY Federal Program Office
• Northern Contaminants Program
Baffinland Iron Mines Corporation
CCIN
Canadian Institute of Planners
Canadian Museum of Nature
Canadian Polar Commission
Canadian Space Agency
Carleton University
CNIT
Environment Canada
Canada Centre for Inland Waters
Canadian Ice Service
Canadian Wildlife Federation
Canadian Research Institute
Delivery Branch
Lakehead
National Aboriginal Organization
National Defence
Natural Resources
• Canada Centre for Remote Sensing
• Geological Survey of Canada
Ontario Ministry of Natural Resources
Queen's University
Royal Military College
Ryerson University
St. Jerome's University
Transport Canada
Trent University

Northern stakeholders
Expectations and challenges for data management

Inuvialuit
Aurora College
Aurora Research Institute
FJMC
Inuvialuit Joint Secretariat
Inuvialuit Regional Corporation

Yukon
Environment Canada-CWS
Yukon Government

Territoires du Nord-Ouest
AANDC
Canadian North
Diavik Diamond Mines Inc.
Environment Canada
• CWS
• CIMP
Golder Associate

Nunatsiavut
Nunatsiavut Government
Parks Canada
Torngat Joint Fisheries Board
Vale Inco

Colombie-Britannique
CCCMA – MSC
Environment Canada
Natural Resources Canada-GSC
DFO-Institute of Ocean Science
The AXYS Group
University of British Columbia
University of Northern British Columbia
University of Victoria

Saskatchewan
Environment Canada
National Hydrology Resource Centre
University of Saskatchewan

Nunavik
Xstrata Nickel-Mine Raglan
Centre de recherche du Nunavik
Administration régionale Kativik

Terre-Neuve-et-Labrador
Memorial University
Sikumiiut Environmental Consulting

Ile-du-Prince-Edouard
University of Prince Edward Island

Manitoba
Churchill Northern Studies Centre
DFO-Freshwater Institute
Manitoba Hydro
Parks Canada
Port of Churchill
University of Manitoba

Nouvelle-Écosse
Dalhousie University
Environment Canada-CWS
DFO-Bedford Institute of Oceanography
Natural Resources Canada-GSC

Alberta
Arctic Institute of North America
BP Exploration Operating Company
Canadian Association of Petroleum Producers
Environment Canada
Imperial Oil
University of Alberta
University of Calgary

Nouveau-Brunswick
New Brunswick Innovation Foundation
University of New Brunswick

Welcome to the Polar Data Catalogue Metadata and Data Entry

The Polar Data Catalogue is an online database of metadata that describes, indexes and provides access points to diverse data sets generated by Arctic and Antarctic researchers. The records are in an international format (FGDC) to allow exchange among databases, and they cover a wide range of disciplines, from natural sciences to policy to health and social sciences. The catalogue includes a geospatial search tool that is available to the public, and that allows searching for spatial data using a web-based mapping interface. It also allows combining spatial referencing with keywords, categories and date.

Please sign in to contribute metadata to the catalogue, or **click on the map below to start searching** for datasets.

Leave Feedback

NOTE: This website times out after 15 minutes of inactivity. TO AVOID LOSS OF DATA WHEN LOGGED IN, please save your work within the 15 minute window.

Supported browsers include Firefox 27, IE 11, Opera 19, Google Chrome 33 and Safari 6.

Please avoid use of your browser's BACK button when using the PDC.

Navigation

- Home
- About Us
- Maintenance Notice
- Keywords Library
- Help

PDC Sign In

Email:

Password:

Sign In

Forgot Password

Register for PDC

FIRST TIME ENTERING METADATA?
If you already have a log-in account for the PDC RADARSAT Search, please enter your E-Mail and Password above to register for the PDC Metadata/Data Entry site

Arctic   Antar...   GIS

Collections   Results   Metadata   Data

Data Collection: Polar Data Catalogue

The Polar Data Catalogue is an online database of metadata and data that describes, indexes and provides access to diverse data sets generated by Arctic and Antarctic researchers. Since its online launch in 2007, the PDC has rapidly gained popularity, and other programs such as the Government of Canada Program for IPY 2007-2008 and the Northern Contaminants Program have decided to use the PDC to archive their metadata and datasets. The records cover a wide range of disciplines from natural sciences and policy, to health and social sciences. In addition to its focus on the Canadian Arctic, the PDC serves research products from other locations in the circumpolar Arctic as well as the Antarctic. As the PDC collection grows, it forms a solid foundation for national and international data sharing and advancement of cryospheric science and knowledge. Through consultations with partners and users, it is clear that residents in northern Canada want to know more about research conducted in the Arctic. The PDC search capability has thus been developed to help meet the needs of northern communities.

UNIVERSITY OF Waterloo

CCIN CANADIAN CRYOSPHERIC INFORMATION NETWORK

ArcticNet
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CENTRE D'ÉTUDES NORDIQUES
CEN Centre for Northern Studies

Environment Canada   Environnement Canada

Affaires autochtones et Développement du Nord Canada   Aboriginal Affairs and Northern Development Canada

IPY-API 2007-2008
International Polar Year
Année polaire internationa
ᐆᒻᒪᑎ ᐆᒻᒪ ᐅᑭᐅᖅᑕᖅᑐᒥ ᐅᑭᐅᖅ

Fisheries and Oceans Canada   Pêches et Océans Canada

Search   View Other

Map courtesy of the NSIDC

1.67521, 33.15487

CCIN CANADIAN CRYOSPHERIC INFORMATION NETWORK

Links of Interest to Northerners | Canadian IPY Publications | Canadian NCP Publications
Contact Us | Privacy Policy

Polar Data Catalogue @ Canadian Cryospheric Information Network 2015

ArcticNet
ᐅᑭᐅᖅᑕᖅᑐᒥ ᑐᑭᓯᓂᐊᖅᑎᑦ

POLAR DATA CATALOGUE

Polar Data Catalogue Lite

Welcome to the Polar Data Catalogue Lite!

Do you want to know what research is taking place around your community? You can search the PDCLite by (1) selecting a Region or Community on the map at right, (2) selecting a Region and Community from the menus below, or (3) manually entering Longitude and Latitude. The Search Distance tells how far around a community to search.

Searches can also be done with Research Program and/or Keyword.

Region:

Select a Region

Community:

Select a Community

Search Distance (km):

100

Longitude: **Latitude:**

Research Program:

-- CHOOSE ONE --

Keyword:

SEARCH   CLEAR

Alert

Eureka

Grise Fiord

Resolute

Pond Inlet

Arctic Bay

Clyde River

Toloyoak

Cambridge Bay   Hall Beach   Qikiqtarjuaq

Kugluktuk   Kugaaruk   Pangnirtung

Gjoa Haven

Repulse Bay   Iqaluit

Cape Dorset

Coral Harbour   Kimmirut

Baker Lake

Rankin Inlet

Arviat

Sanikiluaq

CCIN CANADIAN CRYOSPHERIC INFORMATION NETWORK

ArcticNet

PolarData CATALOGUE

Welcome to the Polar Data Catalogue Lite!

Do you want to know what research is taking place around your community? You can search the PDCLite by (1) selecting a Region or Community on the map at right, (2) selecting a Region and Community from the menus below, or (3) manually entering Longitude and Latitude. The Search Distance tells how far around a community to search.

Searches can also be done with Research Program and/or Keyword.

Region:
Nunavut

Community:
Cambridge Bay (Iqaluktuutia

Search Distance (km):
100

Longitude: **Latitude:**

Research Program:
-- CHOOSE ONE --

Keyword:

[SEARCH]   [CLEAR]

Global Results

Global Results show metadata that cover the larger region around the Search Community, excluding the Local Results. If you want to view metadata that lie completely within the Search Distance, click on Local Results.

[Local Results]

	Title	Creator	Field Site	Start Date
+	Ocean Tracking Network Arctic Metadat...	Robert Branton	Arctic Ocean	2008-07-21
+	Arctic Commercial Shipping Developm...	Frederic Lasserre	Arctic marine...	2008-07-01
+	International Oceanographic Data and I...	Amundsen's Core ...	Global	2008-05-12
+	Irnisuksiiniq - Inuit Midwifery Network	Amundsen's Core ...	Canadian Ar...	2008-05-12
+	Nunavut Wildlife Resource Centres Co...	Amundsen's Core ...	Nunavut	2008-05-12
+	SCANNET - A Circum-Arctic Network of ...	Amundsen's Core ...	Circumpolar ...	2008-05-12
+	Arctic Research Mapping Application (A...	Amundsen's Core ...	Circumpolar ...	2008-05-08
+	Canadian Polar Information Network (C...	Amundsen's Core ...	Polar Region...	2008-05-08
+	Circumarctic Environmental Observato...	Amundsen's Core ...	Circumpolar ...	2008-05-08
+	Developing Arctic Modeling and Obser...	Amundsen's Core ...	Circumpolar ...	2008-05-08
+	Government of Northwest Territories (G...	Amundsen's Core ...	Northwest Te...	2008-04-18
+	Inuit history and culture: A Select Bibli...	Amundsen's Core ...	Canadian Ar...	2008-04-03
+	Adaptation in a Changing Arctic: Ecosy...	Mark Andrachuk	Northwest Te...	2008-04-01
+	Addressing Climate Change Adaptation...	Martin Tremblay - ...	Communities...	2008-04-01
+	Addressing Climate Change Adaptation...	Martin Tremblay - ...	Communities...	2008-04-01
+	Assessing the Impacts of Climate Chan...	Martin Tremblay - ...	Canadian Ar...	2008-04-01
+	Climate Change Communication to Inu...	Martin Tremblay - ...	Canadian Ar...	2008-04-01
+	Climate Change Risk Management Wor...	Martin Tremblay - ...	Canadian Ar...	2008-04-01
+	Climate Change Vulnerability and Adap...	Martin Tremblay - ...	Inuvialuit, N...	2008-04-01
+	Improved Screening for New Arctic Co...	Frank Wania	Entire Arctic ...	2008-04-01
+	Supporting Northwest Territory Comm...	Martin Tremblay - ...	Northwest Te...	2008-04-01
+	Functioning of benthic hotspots versu...	Philippe Archambault	Canada - Be...	2008-03-01
+	Airborne passive microwave surveys ov...	Peter Toose	Puvirnituq, N...	2008-02-18
+	Sub-arctic tundra snow cover and lake ...	Peter Toose	Puvirnituq, N...	2008-02-18
+	Arctic Peoples, Culture, Resilience and...	International Polar ...	Yukon; Nort...	2008-01-01

Page 5 of 14   Displaying results 101 - 125 of 326

Polar Data Management Committee

Polar Data Catalogue/CCIN

Polar Data Catalogue/ ArcticNet

Universities

Government representatives

       -Canadian Space Agency

       -Fisheries and Oceans Canada

       -Canadian Ice Service

       -CHARS-CPC

Inuit Tapiriit Kanatami

Centre for Northern Studies (CEN)

SAON- Canada

Arctic Scholar

Arctic WebMap

Arctic BioMap →

Arctic SensorWeb

Arctic Institute of North America
Advancing Knowledge for a Changing North

Research Community

Expectations and challenges for data management

CENTRE D'ÉTUDES NORDIQUES
CEN Centre for Northern Studies

Stations de recherche
QAUJISARVIK
Field stations

Réseau météorologique
SILA
Monitoring network

QAUJISARVIK
SILA

CEN : un centre d'excellence en recherche sur les environnements nordiques
A centre of excellence for research on northern environments

Dernières parutions

20 mai 2015 — Allard, M., Sarrazin, D., L'Hérault, E. 2015. Températures du sol dans des forages et près de la surface dans le nord-est du Canada, v. 1.3 (1988-2014). Nordicana D8, doi: 10.5885/45291SL-34F28A9491014AFD.

7 janvier 2015 — Gauthier, G. 2015. Suivi des populations de lemmings de l'Île Bylot, Nunavut, Canada, v. 1.0 (2004-2014). Nordicana D22, doi: 10.5885/45400AW-9891BD76704C4CE2.

4 décembre 2014 — ADAPT (Arctic Development and Adaptation to Permafrost in Transition) 2014. Teneur en carbone, en azote et en eau de la couche active de sites situés dans l'Arctique canadien, v. 1.0. Nordicana D21, doi: 10.5885/45327AD-5245D08606AB4F52.

4 décembre 2014 — Arsenault, D., Vézina, F., Sirois L., Buffin-Bélanger L., Hétu, B. 2014. Données environnementales de la Forêt d'enseignement et de recherche de Macpès dans la région de Rimouski, Québec, Canada, v. 1.0 (2006-2014). Nordicana D20, doi: 10.5885/45318SL-F1C26EB4D6C54F3A.

24 novembre 2014 — Fortier, R. 2014. Réseau de surveillance des eaux souterraines dans la région d'Umiujaq au Nunavik, Québec, Canada, v. 1.1 (2012-2014). Nordicana D19, doi: 10.5885/45309SL-15611D6EC6D34E23.

24 novembre 2014 — Sarrazin, D., Allard, M. 2014. Données environnementales de la région de Quaqtaq au Nunavik, Québec, Canada, v. 1.2 (2004-2014). Nordicana D18, doi: 10.5885/45201SL-6428B371C345424A.

La mission de Nordicana D

Publiée par le Centre d'études nordiques (CEN) depuis 1964, la collection Nordicana, permet la diffusion de travaux d'intérêt nordique tels des actes colloques, des lexiques, monographies, essais ou thèses.

Face à l'augmentation de la quantité de données générées par les travaux du CEN et aussi parce que les demandes pour avoir accès à celles-ci sont en augmentation, le CEN a décidé de mettre en place la collection Nordicana D.

Cette collection produite uniquement sous forme électronique est librement accessible, via internet, aux chercheurs du CEN ainsi qu'à tous les autres utilisateurs intéressés par les travaux du CEN. Elle facilite la gestion des ensembles de données et en garantie l'accessibilité via ce site web. Elle permet aussi de laisser en héritage les résultats des travaux de recherche et de collecte de données du CEN.

Comment fonctionne Nordicana D

Des données brutes concernant des travaux dont les résultats sont déjà publiés sont disponibles dans cette collection. On y retrouve aussi des données qui n'ont pas fait l'objet de publication.

Chaque numéro est publié en français et en anglais, et est associé à un *Digital Object Identifier* (DOI). Il contient des données et des métadonnées qui expliquent l'origine des données, leurs format, l'histoire de mises à jour via différents numéros de version et le format qui devrait être adoptée pour citer les données. Un numéro peut être mis à jour avec de nouvelles données, mais seul le numéro de version sera modifié et conservera le même DOI.

Vous trouverez sur ce site, les métadonnées complètes, les liens pour télécharger les données ainsi que la façon de citer correctement les données disponibles sur Nordicana D. Nous vous suggérons fortement d'utiliser la version des données la plus récente.

Polar Data Catalogue archives the high level Metadata File for each **Nordicana D** volume.

Nordicana D

Données disponibles   **Liste des numéros**

Liens rapides

- Liste des numéros
- Carte des données disponibles

Dernières parutions

Earth System Science Data Discussions — Open Access

The Global Terrestrial Network for Permafrost Database: metadata statistics and prospective analysis on future permafrost temperature and active layer depth monitoring site distribution

B. K. Biskaborn[1], J.-P. Lanckman[2], H. Lantuit[1,3], K. Elger[4], D. A. Streletskiy[5], W. L. Cable[6], and V. E. Romanovsky[6]

[1]Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Potsdam, Germany
[2]Arctic Portal, Akureyri, Iceland
[3]Institute for Earth and Environmental Sciences, University of Potsdam, Potsdam, Germany
[4]Helmholtz Zentrum Potsdam Deutsches Geoforschungszentrum GFZ, Germany
[5]Department of Geography, George Washington University, Washington, USA
[6]Geophysical Institute, University of Alaska Fairbanks, USA

References

ACIA: Impacts of a Warming Arctic – Arctic Climate Impact Assessment, Cambridge University Press, Cambridge, 2004.

Allard, M., Sarrazin, D., and L'Hérault, E.: Borehole monitoring temperatures in northeastern Canada, v. 1.2 (1988–2014), Nordicana, D8, doi:10.5885/45291SL-34F28A9491014AFD, 2014.

Bartsch, A. and Seifert, F. M.: The ESA DUE Permafrost project – a service for high latitude research, Geoscience and Remote Sensing Symposium (IGARSS), 2012 IEEE International

ESSDD

8, 279–315, 2015

The Global Terrestrial Network for Permafrost Database

B. K. Biskaborn et al.

Title Page

Abstract | Instruments

Data Provenance & Structure

Tables | Figures

|◄ | ►|
◄ | ►

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Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Nordicana D

Données disponibles   **Liste des numéros**

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Earth System Science Data Discussions

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[2]Arctic Portal, Akureyri, Iceland
[3]Institute for Earth and Environmental Sciences, University of Potsdam, Potsdam, Germany
[4]Helmholtz Zentrum Potsdam Deutsches Geoforschungszentrum GFZ, Germany
[5]Department of Geography, George Washington University, Washington, USA
[6]Geophysical Institute, University of Alaska Fairbanks, USA

References

ACIA: Impacts of a Warming Arctic – Arctic Climate Impact Assessment, Cambridge University Press, Cambridge, 2004.

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B. K. Biskaborn et al.

Title Page

Abstract | Instruments

Data Provenance & Structure

Tables | Figures

|◄ | ►|

◄ | ►

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Interactive Discussion

Discussion Paper | Discussion Paper | Discussion Paper | Discussion Paper

15 January 2015

Committing to Publishing Data in the Earth and Space Sciences

A new initiative joins together publishers and data... data stewardship.

Will work with stakeholders to direct data to **appropriate repositories**

Statement of Commitment
from Earth and Space Science Publishers and Data Facilities

- Include in research papers concise statements indicating where data reside and clarifying availability.

- Promote and implement links to data sets in publications and corresponding links to journals in data facilities via persistent identifiers. Data sets should ideally be referenced using registered DOI's.

Coalition on Publishing Data in the Earth and Space Sciences

www.copdess.org/statement-of-commitment/

ArcticNet
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API - Recherches ▾ | Au sujet de l'API | Liens/Ressources | Contact | Vie privée | Recherche | English

http://www.canadiangeographic.ca/ipy-api/map-carte/default.aspx?Lang=fr

ADAPT

Arctique en Développement et Adaptation au Pergélisol en Transition

Arctic Development and Adaptation to Permafrost in Transition

CRSNG
NSERC
Discovery Frontiers

Canadian High Arctic Research Station
CALL FOR PROPOSALS – 2015 – 2016

nks | Science News | Educational Resources ▾

12. Data Management Plan:

Describe your data management plan

Canadian High Arctic Research Station

CHARS - Respecting the Past to Build the Future

Inuit qaujisarvingat
knowledge centre

Member Login

HOME | ABOUT US | WHAT W

INUIT 101 | CLIMATE CHANGE LITERATURE REVIEW | NILLIAJUT | TUKITA

Nilliajut - Inuit Perspectives on Arctic Security

"It is well known that the Arctic is an important global player, and soon the Canadian government will take over as Chair of the Arctic Council. Issues of Arctic sovereignty, security, and militarization have attracted surging interest in the Arctic, creating increasing demands for the best available information. There is a need to understand and include the diverse and unique perspectives of Inuit, as citizens of Canada and stewards of the Arctic."
-Scot Nickels, Director of *Inuit Qaujisarvingat*

"What does security mean to Inuit? Security doesn't come from the comfort that some find in icebreakers, sonar detectors and Arctic military capabilities. Security from our societal perspective comes from access to the basic essentials of life — food, shelter and water."

-Udloriak Hanson, Co-Chair of the Arctic Peoples and Security Research Pillar, Munk-Gordon Arctic Security Program

Inuit Qaujisarvingat, along with the Walter Duncan Gordon Foundation and the Munk School of Global Affairs, have worked to produce a paper series and also a series of video documentaries which capture the Inuit Perspectives of Arctic Security, Sovereignty, and Patriotism.

Read the full edited compendium, or download a copy of the .pdf.

Along with the paper series, Inuit Qaujisarvingat has worked to produce a documentary called Nilliajut: Inuit Voices on Arctic Security. Watch the 20 minute video here.

Nilliajut: Inuit Voices on Arctic Security

Other participants

Expectations and challenges for data management

Territorial Research Institutes

Community Science Centres

CEN Community Science Centre
Kuujjuarapik-Whapmagoostui

All community members are invited at the Premiere of the movie

Eeyu Cheschaaydamowin
The Plant Gathering Project

Wednesday December 4th
@ 8h00 pm
@ the Centre d'études nordiques (U Laval)
Community Science Center

SUIVI ENVIRONNEMENTAL DU NUNAVIK ENVIRONMENTAL MONITORING

La science au Nunavik
Avativut
Science in Nunavik
Berrie and snow, Ice, Permafrost, Remote sensing

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Commission Scolaire **Kativik** School Board

PAR LES ÉLÈVES DE KATIVIK
BY KATIVIK STUDENTS
2014

UQTR Université du Québec à Trois-Rivières

INRS Université d'avant-garde

Centre d'études nordiques

UNIVERSITÉ LAVAL

PETITS FRUITS / BERRIES
LES ÉCOLES PARTICIPANTES DE 2014
2014 PARTICIPATING SCHOOLS
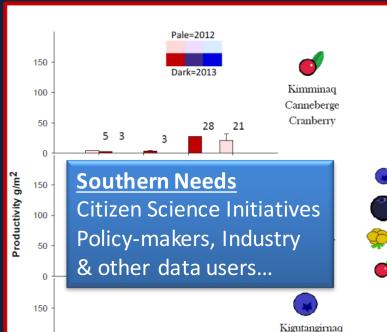
PRODUCTIVITÉ DES PETITS FRUITS PAR VILLAGE / BERRY PRODUCTIVITY BY VILLAGE

Pale=2012
Dark=2013

Kimminaq
Canneberge
Cranberry

5 3   3   28   21

Productivity g/m²

Southern Needs
Citizen Science Initiatives
Policy-makers, Industry
& other data users…

Kigutangirnaq

NOUVEAU PROJET/ NEW PROJECT
GLACE / ICE

PROJETS PILOTE / PILOT PROJECTS
Kuujjuaq 2013 + Kuujjuaraapik 2014

ENTREVUE AVEC UN AÎNÉ / INTERVIEW WITH AN ELDER

« Ice has been changing for two years now: it's going back and forth, sometimes the ice comes early, sometimes late and sometimes it's not coming on the right month. That's the big difference I see for 2 years. »

«ᒪᖓᑦᑐᓂᒃ ᐊᕐᕌᒍᓕᕆᑦᑐᓂᒃ ᓯᑯ ᐊᔾᔨᒋᑦᑐᓂᖃᖃᑦᑕᕆᓕᕐᑐᖅ; ᐅᒪᒐᓇᓕᖅᑳᖅᑕᕋ, ᐃᓚᖏᓐᓂ ᓯᑯᕕᐊᖅᑳᖅᑕᕐᓂ ᑭᒍᒻᒻᒥᕆᑐᓗᐱᕐᑖᕐᑦ, ᐃᓚᖏᓐᓂᓗ ᑕᑦᓗᓂᓗᐊᖅ ᑕᑦᑭᕐᒥ ᓯᑦᑐᕐᓯᓂ. ᑕᒪᐃᓐᓇ ᐊᑦᕿᕐᑕᑦᖙᖠᓐᖡᖃᑦᕿᕐᑦ ᐊᕐᕌᒍᒃᓄ ᒪᖓᓯᓂ ᑕᑯᕐᓯᓕᕿᑦᕿᕐ. »

Samwillie Kuavaq

MESURES DE TERRAIN / FIELD MEASUREMENTS
26 Février 2014 - Kuujjuaraapik – February 26th 2014

NEIGE / SNOW

11,5 cm   12,5 cm
       2 m.
113 cm   112 cm
2 m.
14 cm   17 cm

GLACE / ICE

Kuujjuaraapik 0.25g
Quebec 0.10g
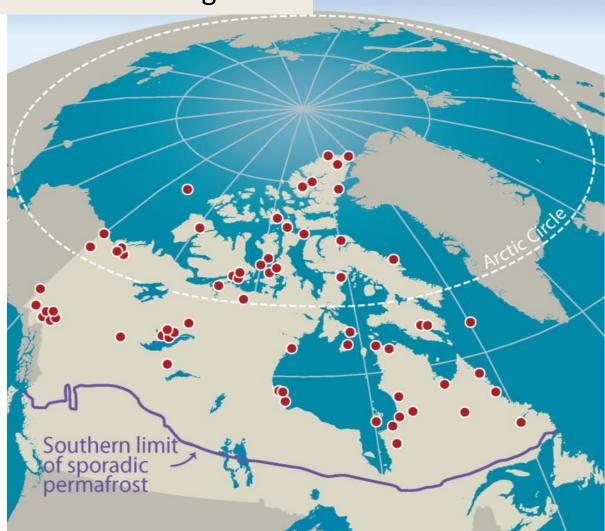
Opportunities to meet the expectations and challenges for Canadian Arctic data management

CANADIAN NETWORK OF NORTHERN RESEARCH OPERATORS

www.cnnro.ca

Some of our members

Arctic Institute of Community-Based Research
Arctic Institute of North America
ArcticNet
Aurora Research Institute
Canadian High Arctic Research Station
Canadian Polar Commission
Centre d'études nordiques (CEN)
Université Laval
Churchill Northern Studies Centre
Dalhousie University
Dechinta Center for Research and Learning
Environment Canada
Government of NWT
Government of Nunavut
Government of Yukon
Institute for Circumpolar Health Research
Inuit Tapiriit Kamatami
Memorial University
Makivik Corporation
McGill University
NWT Literacy Council
Nunatsiavut Government
Nunavik Research Centre
Nunavut Research Institute
Nunavut Literacy Council
Ocean Networks Canada
Parks Canada Agency
Polar Continental Shelf Program
Qaujigiartiit Health Research Centre
Queen's University
ReSDA
University of British Columbia
Vuntut Gwitchin Government
Wilfrid Laurier University
Yukon College
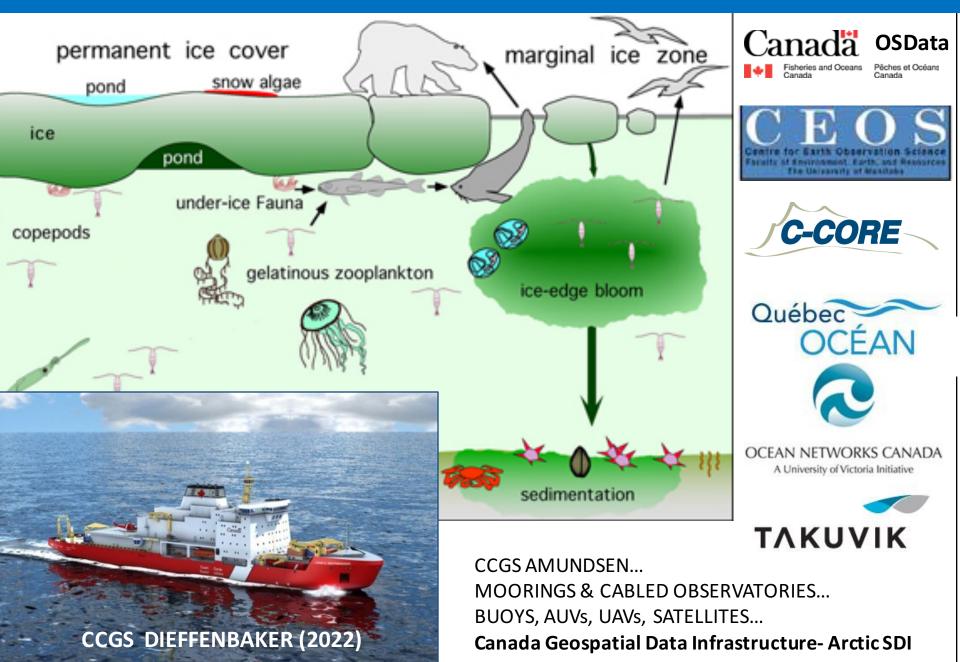
Arctic Circle

Southern limit of sporadic permafrost

Réalisation: Département de géographie, Université Laval, 2014.

Canadian Arctic Ocean Research

CCGS DIEFFENBAKER (2022)

CCGS AMUNDSEN...
MOORINGS & CABLED OBSERVATORIES...
BUOYS, AUVs, UAVs, SATELLITES...
Canada Geospatial Data Infrastructure- Arctic SDI

Arctic Ice Melt Seen Freeing Way for South Korean Oil Hub

By Ann Koh and Heesu Lee | Jul 23, 2014 3:00 PM GMT-0400 | 701 Comments ✉ Email 🖨 Print

The Economist — World politics — Business & f

China and the Arctic

Polar bearings

China pursues its interest in the frozen no

Updated: September 13, 2014 16:16 IST

India's Arctic observatory to aid climate change studies

T. NANDAKUMAR

COMMENT · PRINT · T T

PROPOLAR
Programa Polar Português
FUNDAÇÃO PARA A CIÊNCIA E A TECNOLOGIA I MEC
WWW.PROPOLAR.ORG

APECS
Association of Polar
Early Career Scientists
Portugal

APECS PORTUGAL
Um site para os jovens cientistas e dos jovens cientistas para o Mundo

Canadian Arctic Health Sciences Research

Développement Durable Du Nord

Santé des populations nordiques

Sociaux

Culturels

Économiques

Environnementaux

http://circhob.circumpolarhealth.org

ArcticNet
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Établissements et membres partenaires

Nunavut
AANDC-CHARS
Canada Nunavut Geoscience Office
Government of Nunavut
Igloolik Research Centre
Natural Resources Canada-PCSP
Nunavut Arctic College
Nunavut Department of Education
Nunavut Implementation Fund
Nunavut Research Institute
Nunavut Tunngavik Incorporated
Nunavut Wildlife Management Board
Nunavut Wildlife Research Trust
Parks Canada

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Défense nationale
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Ontario
AANDC
• IPY Federal Program Office
• Northern Contaminants Program
Baffinland Iron Mines Corporation
CCIN
Canadian Institute of Planners
Canadian Museum of Nature
Canadian Polar Commission
Canadian Space Agency
Carleton University
DFAIT
Environment Canada
• Canada Centre for Inland Waters
• Canadian Ice Service
• Canadian Wildlife Federation
• National Water Research Institute
• Science and Technology Branch
First Air
Fisheries and Oceans Canada
• Canadian Coast Guard
• Canadian Hydrographic Services
Garfield Weston Foundation
Health Canada-FNIHB
Inuit Circumpolar Conference – Canada
Inuit Tapiriit Kanatami
Lakehead University
National Aboriginal Health Organization
National Defence
Natural Resources Canada
• Canada Centre for Remote Sensing
• Geological Survey of Canada
Ontario Ministry of Natural Resources
Queen's University
Royal Military College
Ryerson University
St. Jerome's University
Transport Canada
Trent University

Inuvialuit
Aurora College
Aurora Research Institute
FJMC
Inuvialuit Joint Secretariat
Inuvialuit Regional Corporation

Yukon
Environment Canada-CWS
Yukon Government

Territoires du Nord-Ouest
AANDC
Canadian North
Diavik Diamond Mines Inc.
Environment Canada
• CWS
• CIMP
Golder Associate

Nunatsiavut
Nunatsiavut Government
Parks Canada
Torngat Joint Fisheries Board
Vale Inco

Colombie-Britannique
CCCMA – MSC
Environment Canada
Natural Resources Canada-GSC
DFO-Institute of Ocean Science
The AXYS Group
University of British Columbia
University of Northern British Columbia
University of Victoria

Saskatchewan
Environment Canada
National Hydrology Resource Centre
University of Saskatchewan

Nunavik
Xstrata Nickel-Mine Raglan
Centre de recherche du Nunavik
Administration régionale Kativik

Terre-Neuve-et-Labrador
Memorial University
Sikumiiut Environmental Consulting

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Churchill Northern Studies Centre
DFO-Freshwater Institute
Manitoba Hydro
Parks Canada
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University of Manitoba

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Dalhousie University
Environment Canada-CWS
DFO-Bedford Institute of Oceanography
Natural Resources Canada-GSC

Alberta
Arctic Institute of North America
BP Exploration Operating Company
Canadian Association of Petroleum Producers
Environment Canada
Imperial Oil
University of Alberta
University of Calgary

Nouveau-Brunswick
New Brunswick Innovation Foundation
University of New Brunswick

Institut Canadien de Recherche Arctique
Canadian Arctic Research Institute

Nœuds/Nodes

Membres et partenaires

CCGS *Diefenbaker*

Nunavut
CHARS

Alberta
Université de Calgary
Université de l'Alberta

Manitoba
Université du Manitoba

Colombie-Britannique
Université de la Colombie-Britannique
Université de Victoria

Terre-Neuve-et-Labrador
Université Memorial

Québec
Université Laval

Ontario
Université de Toronto

Institut
nordique
du Québec

INRS   UNIVERSITÉ LAVAL   UNIVERSITÉ McGill

Canadian Consortium for Arctic Data Interoperability (CCADI):
LOI to the Canada Foundation for Innovation – Maribeth Murray et al. 2015

Data Coordination: Connecting the Dots

- How can we connect and build on everyone's initiatives?
- Who could/should take the lead on this?
- How would this be funded and supported?
- How can researchers be encouraged to contribute?
- How can we improve Canadian data management for all stakeholders: northern communities; research communities; industry; governments; policy-makers; the public…?

Kuujjuarapik-Whapmagoostui – ArcticNet/INQ

The Simplicity and Complexity of Data Sharing

Peter L. Pulsifer

IASC-SAON Arctic Data Committee
Geomatics and Cartographic Research Centre
Inuit Quajisarvingat
National Snow and Ice Data Center, University of Colorado

Canadian Polar Data Workshop
Ottawa, Canada
Date: 26-27 May 2015

Sharing

- *Sharing: Use, occupy, or enjoy (something) with another or others ;*

- *Common good: a specific "good" that is shared and beneficial for all or most members of a given community*

- We are in transition: data as a private good to a common good through sharing (e.g. "open data")

- As with many transitions, there are associated opportunities and challenges

Outcomes

How do we promote one and avoid the other?

Sharing is a major component that underpins many other aspects of collective data management.

Data as a Public Good for the Public Good

Every person who responded said sharing data is a public good:

- Open data is absolutely necessary
- Polar data are valuable and should be shared and preserved
- There are risks with sharing data, but the benefits outweigh the risks

- What about?
  - Competition in research
  - Publish or perish (... data citation)
  - Potential for data sharing to cause harm

https://explorable.com/competition-in-science

Sound Research

- Data sharing supports reproducible research

  - Sharing is critical for research and transparency/accountability

- What about?

  - ...

Timing of Data Release

- Data sharing supports reproducible research
  - immediate vs. holding on to data until publication
  - What timelines are realistic?
  - How can we encourage earlier archiving?
- But...
  - Who gets to decide a "realistic" timeline?
  - Realistic for whom?
  - Can the same timeline be applied to all data?

Legal and Ethical Issues

- Important facet of data management

- In Arctic, especially relevant to traditional knowledge and community-based monitoring

    - Providers' vs. users' rights and responsibilities

    - Prior, informed consent; ethics protocols

    - Cultural sensitivity

- How do we?

    - Reconcile with "open data" –> "ethically open data"?

    - Deal with intellectual property? "Sweat of the brow"

Statement of Principles and Practices for Arctic Data Management
April 16, 2013

All IASC-endorsed scientific results shall be verifiable and reproducible through ethically open access to all data necessary to produce those results. Data shall be preserved, accessible, and used in accordance with scientific norms of fair attribution and use.

To this end, IASC Council approves the following actions:

1. Endorsement of the Statement of Principles and Practices for Arctic Data Management;

2. Establishment of an IASC Data Standing Committee;

3. To undertake measures towards adoption of national data policies consistent with

Trust

- Trust is fundamental to sharing

- How do we promote trust?

  - Data sharing policies

  - Clear information to ease concerns about sharing data

- We must recognize:

  - The importance of relationships in building trust

  - That trust is earned, not enforced

  - Historical and political context of desired trust relationship

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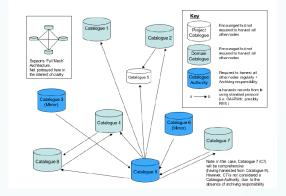
  - Historical and political context of desired trust relationship

Practical Issues

- Where should I share my data?

  - "The" archive

  - Multiple appropriate archives can exist

- Where do I enter metadata?

  - Multiple locations
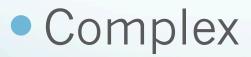
  - Single location... with sharing across locations

- Creating tools that are easy to use: simple entry, interaction, mutliple formats, standardized discovery...

- Solutions... must be practical

Data Sharing

- Simple

- ....

- Complex

DATA ACCESS

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DATA ACCESS

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❖ Data Access in context

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DATA ACCESS

- ❖ Data Access in context
- ❖ Define data access using expected:

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DATA ACCESS

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DATA ACCESS

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DATA ACCESS

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❖ The question of open data

DATA ACCESS

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❖ If you think this was confusing, it's because it is!

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- Everybody has data, few have well curated metadata (including data quality indicators), fewer have search and access services

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- ❖ Let's start from the basic principles

DATA ACCESS FUNCTIONALITY

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❖ As a user, I want to be able to...

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DATA ACCESS FUNCTIONALITY

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- find out what there is (—> portals)

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DATA ACCESS FUNCTIONALITY

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- access data interactively and programmatically

DATA ACCESS QUALITIES

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- Real-time access to real-time data?

DATA ACCESS QUALITIES

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- How about access to non-CDN data?

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DATA ACCESS QUALITIES

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  - Data flow: should it be one-way only?
    - How about pushing metadata, data back? (see data sharing)
  - How about access to non-CDN data?
  - Data curation, whether data quality indicators are available
* As a user, I expect data to be open…

OPEN DATA

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OPEN DATA

❖ What is 'open data'?

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- Metadata:

  - Data without metadata (observation conditions, data quality assessments, …) are not useful, therefore not accessible.

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  - Data without metadata (observation conditions, data quality assessments, …) are not useful, therefore not accessible.

  - Metadata quality enforcement/acceptance criteria for funding agencies?

CONCLUSIONS

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CONCLUSIONS

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❖ Questions for break-out:

- Open data?

- User needs for data access? Is everything covered? What is important?

Data Preservation

Outline

- 3 focal points

- Long term preservation of data
- Data rescue
- Data quality and documentation

Long term preservation of Data

There needs to be data redundancy/protection against loss

There should be a national effort to create long standing, supported repositories

Once established, repositories should be supported so that people can rely on the archives, so that it is worth their effort to archive

Provocation

- How do we go about this?

- Who should be responsible for this effort? Federal? Provincial? NGO?

- This is linked to the break out session on Policy and Funding, and, Data Access.

Data Rescue

Need to have access to heritage/analogue/primitive/physical specimen data

Old data is very valuable – paper, books, photos – for climate and environmental change observations

Very important for polar regions – provides unique evidence of environmental changes, thus supporting research

Need to coordinate our activities to do this as a community

Need funding for people to enter the data

Provocation

- What do we save first?

- Do/can we rescue it all?

- Who's going to pay for this?

Data quality and documentation

Researchers have responsibility for their data quality and documentation

What is expected of researchers with respect to their data quality?

Data Quality Control- there must be confidence it is being done correctly by the researchers and at the archives, if applicable

Data formats can be problematic

Need rigid adherence to international data formatting standards, to promote interoperability

Provocation

- How do we ensure data documentation is taking place? Encouragement or Enforcement?

- Formats are important....sort of. Rigid adherence to formats can actually hinder data flow.

INTEROPERABILITY

of Polar Data in Canada
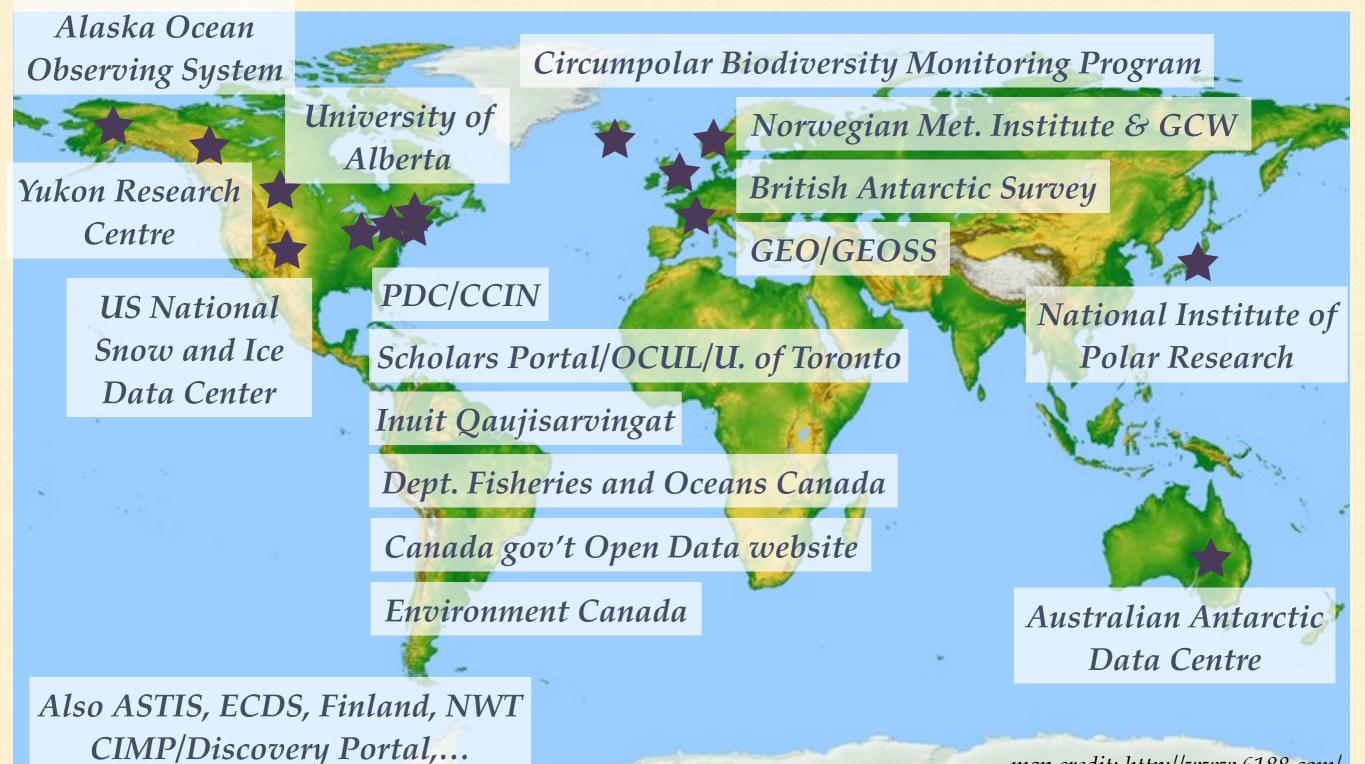
Julie Friddell

Polar Data Catalogue/Canadian Cryospheric Information Network, University of Waterloo

Canadian Polar Data Workshop, Ottawa, 26-27 May 2015

- **"Interoperability" was identified in the questionnaires as one of the primary challenges for polar data management in Canada**

Interoperability = Linking portals for metadata sharing and data discoverability

Alaska Ocean Observing System

Circumpolar Biodiversity Monitoring Program

University of Alberta

Norwegian Met. Institute & GCW

Yukon Research Centre

British Antarctic Survey

GEO/GEOSS

US National Snow and Ice Data Center

PDC/CCIN

Scholars Portal/OCUL/U. of Toronto

National Institute of Polar Research

Inuit Qaujisarvingat

Dept. Fisheries and Oceans Canada

Canada gov't Open Data website

Environment Canada

Australian Antarctic Data Centre

Also ASTIS, ECDS, Finland, NWT CIMP/Discovery Portal,...

map credit: http://www.6188.com/

ISSUES

- Metadata

  - Standards - ISO, FGDC, Canadian federal requirements,…

  - Controlled vocabularies - keyword libraries, smart searching

- Data

  - Formats - need to be standardized and followed…or not?

  - Standards for sharing - OGC,…?

MORE ISSUES

- Technical as well as **human** and **legal** interoperability

  - Different organizations may have difficulty communicating, working under different assumptions

  - People have different definitions of access to data and interoperable linkages, different terms of use on sharing, etc.

  - Lack of interaction between data providers and catalogues

  - Protecting sensitive or proprietary information

- Funding…!

BENEFITS

- More visibility for Canadian data

- More knowledge of and access to Canadian and international data

- To reduce burden on researcher/data contributor – only enter data/metadata in one place

- To reduce data duplication

    - Saves money - if researchers can know about and access other data, they don't have to collect data again

OPPORTUNITIES

- Current and new collaborations and partnerships with relevant Canadian and international initiatives

- Linking data for large scale studies – providing online tools where researchers can upload and combine their data with others

- Co-hosting or ingesting other nations' data

AUTOMATION

- Need online data management tools to aid interoperability

  - Can't just do it all manually - "Google for Data"?

  - Web services to share data files and metadata

  - "Brokering" tools to aggregate metadata

  - Etc.

  - Need to decide which tools we want to use!

CANADIAN CONTRIBUTIONS

- Variety of polar data portals and archives

- Federal geospatial platform/data infrastructure

- Research Data Canada and other initiatives

- Current links to international data portals and initiatives

- Expertise/leadership in metadata formats, web services, etc.

QUESTIONS

- What are the challenges for interoperability (technical, human, legal)?

- What **specific actions** can your group/Canada take to improve linkages between polar data portals within Canada and internationally?

Linkages and Partnerships

- Communications among Communities
- Communities
  - Who are they?
  - With which should be cooperate?
- Communications
  - What can we share?
  - How can we share?
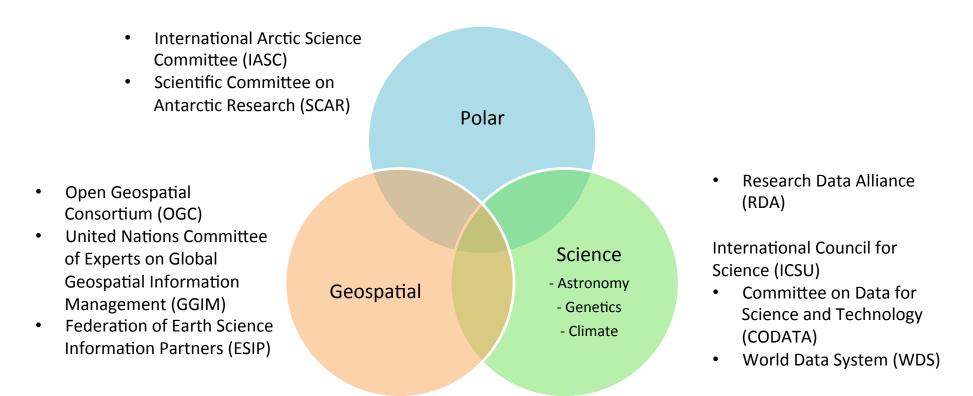
Data Management Communities

- International Arctic Science Committee (IASC)
- Scientific Committee on Antarctic Research (SCAR)

- Open Geospatial Consortium (OGC)
- United Nations Committee of Experts on Global Geospatial Information Management (GGIM)
- Federation of Earth Science Information Partners (ESIP)

Polar

Geospatial

Science
- Astronomy
- Genetics
- Climate

- Research Data Alliance (RDA)

International Council for Science (ICSU)

- Committee on Data for Science and Technology (CODATA)
- World Data System (WDS)

Polar View

Data Type Communities

- Canadian Space Agency
- European Space Agency
- Group on Earth Observations (GEO)

- Organization for Economic Cooperation and Development (OECD)

Earth Observation

Socio-Economic

Cultural

In-Situ

- Sustaining Arctic Observing Networks (SAON)

Research Communities

Atmosphere

- ESA Cloud Climate Change Initiative (CCI)

- MyOcean – Copernicus Marine Environment Monitoring Service

Marine

Land

- CryoLand - Copernicus Snow and Land Ice Service

Geographic Communities

- Access to International data is very important to survey respondents.
- Canadian data is one facet of international data.

Arctic

National | International

Antarctic

Communication Issues

- More organizations than people?

- Inter-community
- Intra-community

- Technical
  - Standards
- Social
  - Language
  - Cultures

- Formal
- Informal

- Sensitivities
  - Confidentiality

- Need for Funding

Linkages and Partnerships Questions

- Which communities/organizations should be given priority?
  - There are too many organizations to establish linkages with all. Consider influence, goals, impact, potential for success, etc.

- In particular, how should we link with industry?

POLICY AND FUNDING
of Polar Data in Canada

Philippe-Olivier Giroux, Policy analyst, NSERC

Canadian Polar Data Workshop | Ottawa, May 26-27, 2015

QUESTIONS TO ADDRESS

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1. What policies are needed?

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1. What policies are needed?

2. What are the needs for funding?

(e.g. who needs it? To support what activities? What type of expenses? Etc.)

WHAT YOU SAID

Policy

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6

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8

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- Short-term projects/programs that do not have data management solutions... **what happens with the data?**

- Resources for labs to manage data

- Curriculum development for graduate programs

- Professional recognition to researchers and data contributors for their activities

WHAT YOU SAID (cont'd)

Funding

- Long-term funding is a significant challenge; very constrained

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12

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- Funding to engage with international stakeholders

- Resources to do the work need to be properly budgeted in projects

Context

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- Tri-agency policy on data management

Context

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- Open Government Action Plan: Open Science

Context

- Tri-agency policy on data management

- Open Government Action Plan: Open Science

- Seizing Canada's Moment: Moving Forward in Science, Technology and Innovation 2014

Collaboration in the Research Ecosystem

- Leadership Council for Digital Infrastructure
  - DI Summits - 2012 and 2014
- Universities Canada (formerly AUCC)
  - Working group to examine issues related to data and digital infrastructure
- Research Data Canada
  - "Federated pilot" to assess infrastructure requirements for data management (in conjunction with CARL's Portage project)
- Canadian Association of Research Libraries
  - "Portage" project to develop a national preservation service and centre of expertise in data management
- CANARIE
  - Funding to Research Data Canada; consultations on mandate renewal include role in data management
- Canada Foundation for Innovation
  - Cyber-infrastructure funding program
- Research Data Alliance
  - International organization to facilitate data sharing across borders; 2300 members in 96 countries

Questions?