FROM DATA TO PUBLICATIONS: THE POLAR INFORMATION SPECTRUM

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ABSTRACT

Polar information falls into at least six categories: information about researchers, organizations, research facilities, research projects, research datasets, and publications. The management of polar research datasets has been the focus of significant attention in recent years, but it is only one piece of the polar information world. The other information types are needed to provide context to, and extract knowledge from, the raw data. Here, I discuss the possibilities for linking the various types of information categories in Canada to create a truly holistic view of Canadian Arctic research.

Keywords: Polar information, Researchers, Organizations, Research facilities, Research projects, Datasets, Publications, Canada, Arctic Science and Technology Information System, Arctic Institute of North America

1   INTRODUCTION

The Arctic Institute of North America is keenly aware of the need to develop better connections between the polar publications and research project information that its databases contain and the other types of polar information that are held by other organizations. Here, I present an overview of six information types, the ways in which they are used, the importance of ensuring that this information is interconnected, and our vision for the future of connecting polar information in Canada.

2   WHAT IS THE POLAR INFORMATION SPECTRUM?

The polar information spectrum consists of information that describes at least six different entities: researchers, organizations, research facilities, research projects, research datasets, and publications. Escalating interest in polar regions has prompted a great appetite for all six types of polar information and an increasing need to ensure that the six types are interconnected in data management systems.

2.1   Researchers

Researchers, people who collect polar data and write polar publications, are the originators of polar information. Researchers' names are included in metadata and the citations to publications, but these information types usually say little about the researchers themselves. Biographical information about the researchers who produced the data, their research projects, publications, and information about their associated organizations and facilities can give context to how the data was collected, the motivation behind the data collection, and the knowledge level of the team that collected it. Researcher databases can also help people quickly find subject or regional experts, researchers who are associated with specific organizations or facilities, and researchers who are based at specific locations (Canadian Polar Information Network: Researcher's Directory, 2012).

2.2   Organizations

There are hundreds of organizations globally that are focused on polar or cold regions (Scott Polar Research Institute: SPRI Polar Directory, 2013). Organizations include, but are certainly not limited to, government

departments and agencies, educational and research institutions, libraries, museums, non-profits, and industries. These organizations fund researchers and facilities, produce research datasets, edit and publish publications, and issue licenses for research projects. Information about the organizations that are associated with research datasets is useful when considering the motivation behind the data collection and whether or not the data is reputable. Databases of organizations can help determine which organizations are linked with specific areas of interest, which organizations house valuable information or artifacts, which organizations will fund or support specific research initiatives, and which organizations provide scholarships.

2.3   Research facilities

Polar research facilities are often located in remote areas and are designed to house researchers and equipment for studying the surrounding environment (Canadian Polar Information Network: Northern Research Facilities, 2013). Many of these facilities are associated with organizations or specific researchers and form the basis of the study area for research projects and publications. Databases of research facilities, particularly when geospatially mapped, can help researchers determine potential study sites, what types of equipment and amenities are available on site, and which ones are best suited for specific research topics.

2.4   Research projects

Research projects often involve fieldwork and the collection of research data with the permission of organizations that license research for specific regions (Arctic Science and Technology Information System (ASTIS): What's in ASTIS?, 2013). Research licenses are often issued to a researcher or an organization for a specific period of time, and research projects may require more than one license if they extend over more than one fiscal or calendar year. Databases of research project descriptions can help people find information on research being conducted at research facilities or in specific areas, including their own in the case of polar communities. Databases that describe research projects can also aid researchers and students in finding similar research projects to their own or research projects being conducted in the same area, thus promoting collaboration and minimizing duplication of logistics or data collection.

2.5   Research datasets

Research datasets and the metadata that describe them are essential building blocks of polar information. For the huge number of data generated by polar researchers during the International Polar Year (IPY 2007–2008), there has been increasing interest in ensuring that these data are properly managed. As stated by the Polar Data Catalogue, 'The wealth of knowledge and data generated by polar research must be managed, to ensure and maximize the exchange and accessibility of relevant data and to leave a lasting legacy' (Polar Data Catalogue: About Us, 2013). Conferences such as the *International Forum on Polar Data Activities in Global Data Systems* have been designed to establish best practices, encourage open access and sharing of data, and determine the best ways to ensure long-term preservation (International Forum on Polar Data Activities in Global Data Systems, 2013).

There is absolutely no question that research datasets are invaluable to polar science, but the other types of polar information are equally invaluable, particularly when considered in context with one another.

2.6   Publications

Publications are the most widely used of any information type, mainly because they encompass so many different forms of printed materials. A broad term, publications can refer to books, journal articles, theses, conference proceedings, or abstracts. These items may be either peer reviewed or what is considered 'grey literature'—that is, not peer reviewed. Publications may also include newspaper and magazine articles, oral histories, audio files, video files, social media output, photographs, artwork, and much more. Essentially, a publication is any material that is made publicly available in printed or electronic form (Oxford English Dictionary, 2013).

For those who do not work directly with raw data, publications are often the first point of contact for obtaining polar information. Publications written by polar researchers extract knowledge from the research datasets they

have collected, and make that knowledge meaningful for others. Furthermore, for subject areas like polar history, documents such as diaries and period photographs may actually be the raw data.

Databases of publications are very common—both in the form of libraries and digital records. Databases of publications can help people learn more about a topic, direct them to further information, and help people interpret research datasets in different ways.

3 POLAR INFORMATION IN CANADA

In Canada, different data management systems (databases) are responsible for maintaining the different types of polar information. The Government of Canada's Canadian Polar Commission is responsible for the management of databases that contain information about polar researchers and polar research facilities (Canadian Polar Commission: Researcher's Toolbox, 2013). The Polar Data Catalogue at the University of Waterloo manages a database that contains metadata describing polar research datasets (Polar Data Catalogue, 2013). The Arctic Science and Technology Information System at the Arctic Institute of North America manages one main database and several subset databases that contain information about polar publications and polar research projects (Arctic Institute of North America: Databases, 2013). At present, to the best of my knowledge, there is no database in Canada that manages information about polar organizations.

3.1 Canadian Polar Commission

The Canadian Polar Commission, founded in 1991, keeps track of information about individual polar researchers in Canada through the Researcher's Directory (Canadian Polar Information Network: Researcher's Directory, 2013). It also keeps track of information about Canadian polar research facilities through the Northern Research Facilities database (Canadian Polar Information Network: Northern Research Facilities, 2013). Both of these databases are available for free online. Although there is no database in Canada to my knowledge that currently manages information about polar organizations, the Canadian Polar Commission does maintain a listing of Canadian Government organizations and Canadian Research institutions (Canadian Polar Commission: Canadian Governmental Organizations, 2013; Canadian Polar Commission: Canadian Research Institutions, 2013).

While the Government of Canada's Canadian Polar Commission is the main organization tracking information about Canadian polar researchers, research facilities, and organizations, there are other organizations that manage this information as well. The Scott Polar Research Institute, in Great Britain, maintains a Directory of Polar and Cold Regions Organizations that is divided by region and includes a section on Canada. This listing includes non-research-based organizations, but it is slightly out of date (Scott Polar Research Institute: SPRI Polar Directory, 2013). Many Canadian universities and organizations also keep internal databases of polar researchers. Researcher indexes that assign researcher identifiers (IDs) such as the International Standard Name Identifier and the Open Researcher and Contributor ID (ORCID) track researchers internationally and in all disciplines, including Canadian polar researchers (International Standard Name Identifier, 2013; ORCID, 2013). Finally, social media sites such as LinkedIn are used by organizations and individuals alike to network and keep track of polar researchers, facilities, and organizations (LinkedIn, 2013).

3.2 Polar Data Catalogue

The Polar Data Catalogue contains metadata for the research datasets created by the Canadian IPY programme, ArcticNet, the Beaufort Regional Environmental Assessment (BREA), the Climate Change Adaptation Programme, and Aboriginal Affairs and Northern Development Canada's Northern Contaminants Programme, and it has also been designated to handle metadata for the planned Canadian High Arctic Research Station (Polar Data Catalogue: About Us, 2013). The Polar Data Catalogue has been in operation since 2007 and can be accessed freely online (Polar Data Catalogue: About Us, 2013).

Many other organizations operate smaller databases of polar research metadata in Canada, but these are often internal or specific to a particular project or discipline. Some of the public examples are the ArcticStat Socioeconomic Circumpolar Database, the Atlas for Community Based Monitoring, the Canadian Antarctic Science Data portal (operated by the Canadian Polar Commission, the Canadian Committee for Antarctic Research, and the United States National Aeronautics and Space Administration), and the Government of Canada's Historical Climate Data portal, which is a large database but covers only climate and weather data and covers this data for all of Canada, not just the Arctic.

3.3   ASTIS: Arctic Science and Technology Information System

The Arctic Science and Technology Information System (ASTIS) is the oldest of the three information management systems. In operation since 1978, the ASTIS database currently contains 79,000 records describing publications and research projects about northern Canada and the circumpolar Arctic (Arctic Institute of North America: Databases, 2013). ASTIS is responsible for the Canadian IPY Publications Database, which is part of the international IPY Publications Database (Arctic Institute of North America: Databases, 2013). ASTIS also covers all publications produced by ArcticNet, BREA, and Aboriginal Affairs and Northern Development Canada's Northern Contaminants Programme as well as publications about northern Canada from many other sources (Arctic Institute of North America: Databases, 2013). ASTIS also contains 17,000 research project descriptions from the three Canadian northern territories based on information collected by the agencies that license all field research (Arctic Science and Technology Information System (ASTIS): What's in ASTIS?, 2013). ASTIS is searchable by author, subject, and geographic area, and one can search both research projects and publications or limit the search to a single information type (Arctic Science and Technology Information System (ASTIS), 2013). The ASTIS database is available for free online, and a full list of ASTIS subset databases is available on the Arctic Institute of North America's website (Arctic Institute of North America: Databases, 2013).

The Aurora Research Institute also has a smaller database of licensing information for research projects conducted in the Northwest Territories (Aurora Research Institute: NWT Research Database, 2013). In terms of publications, several organizations have small databases of publications that are either internal or specific to their own organization or region. There are also several large-scale databases that are discipline specific, such as Medline (a large database of health and medical information), that also contain Canadian polar publications.

4   CONCLUSION

Both in Canada and worldwide, there is a wealth of polar information that is being collected by individuals and organizations. However, much of this information is fragmented. That is, the information is scattered in different areas and not managed as a whole. The different information types are rarely interconnected and the different organizations and individuals that collect the information are not always openly accessible or typically have systems that are interoperable.

Each of these information types is valuable and should be connected in a single platform. Imagine the possibilities inherent in looking up researchers and being able to see which organizations they are associated with, which facilities they have worked at, a list of their publications and research projects, and the various research datasets that they have collected and all of it being interconnected and searchable. Which datasets resulted in which publications? Which researchers have worked together and at which research facilities? It is an exciting prospect, and one that is possible through collaboration.

The Arctic Institute of North America is keenly aware of the need to develop better connections between the polar publications and research project information that its databases contain and the other types of polar information that are held by other organizations, both in Canada and overseas. It is particularly crucial to link publications and research datasets because these are the primary gateways to polar information. In developing data management protocols and best practices, we urge everyone to consider linking data with the other polar information types as a crucial piece of this puzzle.

The Arctic Institute of North America's Arctic Science and Technology Information System is already available for free online. We are currently working towards the goal of geospatially mapping our publications and research project descriptions and of making more of our publications, particularly the items in the Arctic Institute of North America's libraries, available digitally. We support open access and sharing, and we are very happy to collaborate and connect with other institutions and their polar information resources.

5   ACKNOWLEDGEMENTS

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