Title

Preserving and Utilising an Arctic Research Image Collection: The Making of a New Publishing Platform at the National Institute of Polar Research, Japan

Authors

1. Yasuyuki Minamiyama, National Institute of Polar Research, Japan

2. Hiroshi Kanda, National Institute of Polar Research, Japan

3. Akiko Osaka, National Institute of Polar Research, Japan

Abstract

The National Institute of Polar Research (NIPR) in Tokyo creates and manages a large collection of Arctic and Antarctic images, and also manages a distinct collection of Arctic botanical imagery, called the *Digital Botanical Book*. This chapter focuses on NIPR's efforts to create a functional database for managing and communicating the images in the main collection using the Omeka web-publishing platform. Most of the images in this collection are photographs that originate with NIPR's Antarctic and Arctic research expeditions and activities. The Arctic images, specifically, consist of motifs including Arctic biomes, landscapes, soils, snow, ice, and climatic phenomena collected during various research projects. As of April 2019, the database includes about 14,600 images from both polar regions, of which 1,569 are exclusively Arctic. The chapter introduces NIPR archivists' and

researchers' current practices of collecting Arctic images, the types of images collected, as well as the role of librarians and archivists in operating and managing collection and database processes. Incorporating images into the database involves four stages: registering a Digital Object Identifier (DOI) to each image; granting an open-user license to images; adopting the International Image Interoperability Framework (IIIF) for image sharing; and implementing shared application programming interface (API) and metadata standards. The chapter also describes the expected outcomes for the progress of Arctic research by applying these functions to the database, and outlines the NIPR archives division's hope and expectation that the image database will contribute to a wider use of NIPR's image resources by the general public.

Keywords

Arctic; Image Archive; Image Database Development; Library; Archive; Photographic Repository; Metadata Standards; IIIF

Introduction

The responsibilities of researchers conducting fieldwork in the Arctic are often manifold. While data collection related directly to research projects is usually the main objective, researchers may also engage in the recording of 'other' data during their fieldwork. Often, this other data takes the form of imagery, such as photographs documenting research sites, landscapes, and environmental processes; information about and photographs of fieldwork participants, including local people and partner institutions' staff; and objects found on site, which may be photographed *in situ* or collected and brought back to the researchers' home institutions. Visual records of on-site conditions can offer valuable additional information to researchers upon their return from the field and are often published alongside research results and research data in academic papers and when research is made available to more general audiences in publications and as news features.

While photographs used to be analogue, meaning they were stored as negative film, positive slides, or paper positives, photographic images now taken or collected by researchers exist almost exclusively in a digital format on memory cards, mobile phones, and hard drives. As in other fields of study, the number of photographs produced within the context of Arctic research has increased dramatically, and continues to grow. Expanding collections raise pertinent questions of how image data should be stored and managed long-term, also at the National Institute of Polar Research (NIPR). Until recently, researchers often held on to their

own data. Though used when writing and publishing articles and books, the data and datasets were rarely accessible to anyone except researchers and their assistants (Mauthner, 2013; Tenopir et al., 2011), and this was also the case in the social sciences (Kim and Adler, 2015; Stuart et al., 2018;). Similarly, data in the form of photographs and other image-based materials collected during fieldwork may have been used during research analysis but was rarely published or otherwise made available for future reuse by others. Now, researchers are increasingly asked by their institutions, funders, publishers, and colleagues to share their data (Diekema, Wesolek, and Walters, 2014; Gherghina and Katsanidou, 2013; Zenk-Möltgen and Lepthien, 2014). However, researchers increasingly express concern about not knowing how to share their data (Stuart et al., 2018); that is, the 'best' ways in which to organise and preserve data, including images, for long-term use by others. On the topic of metadata, for example, several studies (e.g., Neumann and Brase, 2014; Tenopir et al., 2011; Whitmire, Boock, and Sutton, 2015) show that while some faculty do assign metadata to their data and datasets, including images, many do not use well-established existing metadata standards such as Dublin Core, DataCite Metadata Schema, Data Documentation Initiative, or VRA Core, choosing instead to use rules created by their own university departments. Currently, there are attempts to address this problem by publishing data journals (Candela et al., 2015; Minamiyama et al., 2017). It is unlikely that researchers themselves can – or, indeed, should – be responsible for managing and preserving data to international standards, given the

complexity of these issues. Indeed, during informal conversations with us, several NIPR researchers state that they often find it challenging to keep track of and safely store digital images themselves following the conclusion of their research projects. More and more, information professionals such as librarians and data curators now offer assistance to researchers with data management support across all fields of study (Weller and Monroe-Gulick, 2014).

It was these types of considerations that led to the NIPR archive and library sections' decision to establish the Arctic and Antarctic image database that is the main subject of this chapter. Two primary objectives are met by constructing an image database; first, to store valuable data to internationally approved archival standards, and second, to create a means for researchers and the general public to access and utilise the images. While the impetus for developing the NIPR image database to a large degree rests upon internal institutional needs, we expect that larger audiences will, ultimately, benefit from the existence of the database.

An Overview of the History and Contents of the NIPR Image Database

When NIPR was established in 1973, it was framed as a predominantly Antarctic research institute (Ministry of Education, Science, and Culture, 1963). As a nation, Japan had already been engaged in Arctic research before the 1970s, however. In 1957, physicist Ukichiro Nakaya of the Snow, Ice, and Permafrost Research Establishment (SIPRE) expedition travelled to and conducted research in Greenland (Higashi, 1962). Later,

beginning in 1979, the Global Atmospheric Research Program (GARP) and Polar Experiment (POLEX North) carried out larger-scale observations in the Canadian North. In the following decade, from 1983-1988, research was conducted in Svalbard in the fields of upper atmospheric science, geology, biology, and geomorphology (Tatsumi, 1990).

The *Murmansk Declaration* of 1987 was initiated by Mikhail Gorbachev, the then-General Secretary of the Communist Party of the Soviet Union; it aimed at "transforming the northern part of the globe from being a sensitive military theatre to becoming an international 'zone of peace'" (Åtland, 2008, p.289), triggering an interest in and understanding of the importance of Arctic observation by Japan. NIPR researchers at the time successfully argued for official and recognised involvement in observation and research in both polar regions, not just the Antarctic as had originally been the case. As a result, and during the same year, the Japanese Arctic Glaciological Expedition (JAGE) was formed to conduct research in Svalbard, which it did for twelve years, establishing cooperation with the Norwegian Polar Institute in Ny-Ålesund (Watanabe and Fujii, 1988). Since the 1980s, Arctic research by Japan has been focused on Svalbard, though it began to expand slowly but more regularly into Siberia, Greenland, Alaska, and the Canadian North. The first International Arctic Scientific Committee (IASC) Council was held in 1991, with Japan joining the committee alongside France, Germany, Poland, and the United Kingdom, in addition to the eight countries with inclusive Arctic territory. Japan's interest and participation in Arctic research

has grown in the decades since JAGE (International Arctic Environment Research Center, 2017), and in 2013, Japan became an Arctic Council observer nation.

Given its history, the NIPR archive initially collected and preserved field records, photographs, and moving images from expeditions to the Antarctic. Since 2009, the operation division in NIPR is obliged to collect "official photographs" from each expedition team of JARE (the Japanese Antarctic Research Expedition) in order to gather information on Antarctica. Photographs collected and accumulated through this project include black and white film, colour film, and colour slides. The image database developed concurrently with advancements in image digitisation technology, starting in 2006, when the NIPR public relations office developed, and then managed and operated, an ‘image database system’ (slide retrieval system) for slide data mainly relating to official expedition photographs taken by JARE. At the time, the institute’s images were used primarily as illustrations in books and public relations magazine articles. This early database was short-lived for two reasons. First, as the operation to retrieve images from the database was somewhat complicated and restricted to access within the NIPR institution, only a limited number of people were able to use it. Second, as computer technology improved, it became possible to retrieve images in a simpler way without having to navigate the complexities of the database.

In 2013, one of us (plant taxonomist, Hiroshi Kanda) began to make digital registrations of predominantly botanical photographs. Kanda’s incentive was the fear that

important images would be lost without a formal structure to house them, as well as a wish to ease access for others who wanted to use the images. The following year, NIPR established its archive section and employed one of us (Akiko Osaka) as a dedicated archivist. The archive was to work closely with both the public relations office and the library, and was tasked with establishing a working image database to function as NIPR's official image archive. To restart the suspended slide retrieval system took about a year, at which point work could begin towards improving it and subsequently build a new system for easier image management and retrieval of digitised photographs and other image materials owned by NIPR. From 2015 onwards, the NIPR library section has also been responsible for the archive section, and both sections have continued to develop the image database together and with involvement from one of us (archivist and librarian, Yasuyuki Minamiyama).

NIPR Image Collection Contents: A Focus on the Arctic

Though our collection contains images from both polar regions, this chapter is concerned only with those that are from the Arctic. While no documents exist to state when and how NIPR decided to preserve records of Arctic data, since the function of the Antarctic operation division of managing 'official photographs' moved to the Archive division, researchers seem to have understood it as their implicit mission to also collect data on the Arctic region as the institution's geographical research area widened. Moreover, in addition

to the official photographs of Antarctica, researchers had accumulated photographs of the Arctic in the decades before the image database was established. Most of the Arctic image material at NIPR stems from research projects and fieldwork conducted by NIPR researchers, including collections donated by now-retired institute researchers. A large part of the images originates from botanical fieldwork, typically as colour slides. Before the advent of cheaper and faster digital technology, botanical researchers preferred to use colour slides which provide excellent colour rendition and image sharpness, and which can be preserved for a long time under appropriate preservation conditions. However, as positive slides deteriorate over time, especially outside of climate-controlled storage, creating digital reproductions is imperative in order to preserve valuable image information. Upon digitisation, images can be colour-corrected and otherwise restored as necessary, however we recognise that the original slides contain important intrinsic information as artefacts and keep them in our archive.

As with many other institutions working on Arctic issues, many of NIPR's photographs originate in natural science fieldwork, meaning that a large percentage of the images in the database focuses on outdoor landscapes and natural phenomena. As more researchers and other types of image providers (for instance engineers, research assistants and other expedition participants) discover the database and contact us to deposit images, the content of the database is constantly growing and becoming more diversified. Presently, the database contains images in a number of categories, including marine life and land animals;

vegetation (tree and forest limits, plants, fungi, etc.); landscape and/or climate types (tundra, high and low latitude, polar and sub-desert, etc.); and phenomena peculiar to the Arctic region such as ecology, topography, permafrost, structural soil, snow and sea ice, aurora borealis, and meteorological phenomena such as polar night and white night.

Of these image categories, the images that illustrate biodiversity and change to Arctic flora and fauna are especially interesting because human activity in the Arctic, including the use of trade routes, various forms of tourism, resource extraction, and scientific research activity, has rapidly increased over the past forty years. Modern culture and the increased mobility of people continue to penetrate the Arctic, resulting in changes to the regional flora and fauna (Forbes et al., 2004). While predictions on the increase of temperature across the Arctic varies, researchers agree that such an increase is taking place. Førland and colleagues (2011) project an annual warming of 5°C towards year 2100, with the largest warming taking place in winter. The environmental changes caused by such remarkable global warming are intensely felt in the Arctic. Images in the NIPR archive, made in different geographical areas and at various points in history, reflect and illustrate these changes. One example is photographs that document the appearance of plant species that are not native to the Arctic, but which now grow there due to effects of the warming climate. When accompanied by detailed metadata such as date and location, such photographs not only constitute useful research material, but are invaluable expressions of environmental

change on a larger scale. The subsequent (re)use of such images is not limited to researchers. While natural scientists often measure and communicate in detailed texts and graphs, images illustrating environmental change may be equally, if not more, interesting to journalists and others working in public relations with a focus on climate change and Arctic development.

As the images are made available online, the NIPR expects them to be of value both to natural scientists and to users working within the humanities and social sciences, as well as a more general audience. For example, photographs with Arctic motifs are of great interest to designers and artists working in a range of disciplines, including the visual and performing arts, and product, graphic and textile designers. The images can be used indirectly, as research material and as inspiration, or directly, as part of art works, museum exhibitions or theatre sets. In addition, making images available online may lead to the discovery of or sharing of new information between different research communities. One example is imagery portraying traditional foods, plants and medicinal herbs. An ethnologist or sociologist studying Arctic indigenous cultural practices will know that indigenous peoples collect and process plants and animals, utilizing them as food, medicine, or in other ways. However, in order to determine where these plants and animals are originally found and why, the different biological properties of the plants and animals and so on, further and often interdisciplinary research is necessary. The image database would be a valuable starting point for such research projects.

Both of NIPR's collections – the Arctic and Antarctic database and the *Digital Botanical Book* – contain images taken by NIPR researchers. While the former was, and is, created by and is currently managed by NIPR archivists based on multidisciplinary materials submitted by scientific staff, the latter is a purely botanical collection fully created by scientific researchers whom, until recently, were responsible for maintaining the collection. NIPR now manages the *Digital Botanical Book*, though new additions to it remain dependent on the researchers themselves. The two databases exist separately as they have different purposes: the NIPR image database is responsible for preserving the results of activities under the jurisdiction of NIPR archive section, whereas the *Digital Botanical Book* is used to study Arctic flora. The two collections are catalogued and available in separate digital databases.

The NIPR Image Collection Created by Archivists

The Arctic content of the main image collection at NIPR contains materials collected since the *de facto* start of Japanese Arctic research in the early 1990s. This collection, then, represents a history of NIPR's activities in the Arctic. Most of the collection originates with researchers currently or formerly at NIPR, or with researchers connected to institutions working in partnership with NIPR. Most of the images arrive in the archive on the initiative of individual researchers who contact us in order to start conversations about specific

materials. If and when a researcher wants to register their photographs in the archive collection, they are asked to prepare the image files and any related metadata and information on image provenance before making an offer for us to accept. The archive section conducts a technical check to confirm whether the requisite information has been provided. Once confirmed, we request that the NIPR Archive Committee consider the material for acceptance. This committee is made up of representatives from NIPR's administration and divisions for public relations, archives, and library, with NIPR's Director-in General as an observer. The committee considers whether the images should be preserved based on a range of criteria, including the images' provenance information. Material is accepted into the archive only upon the committee's approval. Following a positive decision, the archivist registers the digital image file and metadata in the NIPR image database. [FIGURE 1a & 1b HERE]

Selection Criteria for Material Entering the Database

While no official selection criteria exist to aid the Archive Committee's work, the group makes use of its subject expertise and experience to consider a number of issues, tentatively expressed in Table 1. When submitted images are accompanied by less information than required by the guidance outlined in Table 1, the archivist may conduct interviews with concerned parties in order to obtain the information necessary to catalogue

the images. Following acceptance into the archive, negative films and positive slides are digitised at once, and the archivist creates a list of image titles and other basic information.

[TABLE 1 HERE]

Digital copies of images and metadata are uploaded into the database. Once completed, NIPR researchers can use the images by browsing the image database. Additional information on the images, whether their motif or provenance, can be added later, through communication between the researcher who submitted the images, the Archive Committee, and the archivist. Currently, the full database is available only within NIPR IP range (NIPR 2019a), though this will change. NIPR's stance on access is that the database should be open to anyone. Unfortunately, the full public release of the database is temporarily delayed but will be officially released in the near future. The database link is operational and some parts of the database, though not all, are already globally accessible.

The Archivist's Organisation of the Image Data

When registering an image in the archive collection, the archivist checks the quality and content of the individual images and arranges them in context with similar motifs, providing some basic level of standardisation for screening. In most cases, the donors have already conducted their own screenings with their own methods, and NIPR staff are thus working to determine future screening criteria that best suits the desires of the donors, NIPR

itself, and NIPR users. At this stage, metadata registered by the archivist is confirmed by the owner of the image rights, usually the researcher who made the photograph, and, if needed, other researchers, photographers, and individuals with subject expertise.

While the image database currently does not feature an option for direct feedback from users, such information has and can be shared directly between users and archive staff. As the database becomes more widely known and used, we expect that users may provide feedback on the database itself and its images and metadata. Presently, most feedback received is related to search results, especially where there is a lack of metadata. The archivist responds to such user feedback and makes changes in the database as appropriate. Feedback obtained from research activities where database images have been used is also confirmed and recorded by the archivist.

Arctic Contents of the Database

The bulk of the NIPR Arctic image collection consists of photographs originating with three distinct researchers: Keiji Higuchi, a glaciologist who participated in Japan's first large-scale Arctic research project, the T-3 sea ice and ocean observation team (Yamanouchi, 2016); Yoshiyuki Fujii, who focuses on climate research and participated in JAGE in 1987, 1989 and 1993; and Satoru Kojima, a biologist whose collection is also the main basis of the

Digital Botanical Book. Further details of these collections and their images are provided in Table 2.

[TABLE 2 HERE]

The *Digital Botanical Book*, an Arctic Image Collection Created by Researchers

Based to a large degree on the photographic collection of Dr. Satoru Kojima, the *Digital Botanical Book* (NIPR, 2019b) includes images of and corresponding data for trees, flowering plants and more found in the Arctic region. About 700 species of vascular plants are known to exist in the low-latitude Arctic and 380 species are known in the high-latitude Arctic. Of these, two-thirds are unique to the Arctic regions (Bliss, 1997). At least 168 species of vascular plants are known on the Svalbard archipelago from the 79th parallel northward (Elven and Elvebakk, 1996). The *Digital Botanical Book*'s images and their relevant metadata are collected and organised by a number of botanists, including Hiroshi Kanda, who originally curated and managed Kojima's image collection. Plants representative of Arctic flora are incorporated in both the *Digital Botanical Book* and the Arctic content of the main image collection. The entries in the former consist of an introduction and a research history pertaining to each species, as well as text relating to taxonomy, ecology, geographical distribution, and more, all contributing to further enriching the images. While many of the photographs are duplicated in the two image databases (the *NIPR Image Collection* and the

Digital Botanical Book), information in the *Digital Botanical Book* is more detailed than that in the main image database.

[FIGURE 2 HERE]

NIPR's Omeka Database Technical Specifications and Standards

In November 2017, NIPR approved and published the National Institute of Polar Research Open Access Policy, stating that research output and data as a rule should be available through Open Access (National Institute of Polar Research, 2017). Because image data is no exception, we are following this policy to make the NIPR image database open access.

Essential for us is to adhere to international standardised technologies and procedures as much as possible, both in terms of database sustainability and development and the potential for interoperability with other systems and databases. In order to extend the existing image database functions and make it available for a range of stakeholders, we will continue developing the database using Omeka, an existing open-source platform.

[FIGURE 3 HERE]

After considering other platforms, including DSpace, ERepository and others, we concluded that of the software that meets NIPR's needs, Omeka is the simplest to develop further in-house. One reason is that Omeka has a flourishing development community, which will benefit users such as our image database. The NIPR Omeka platform is being

constructed so that, in the future, the two separately existing databases will be united in one platform. Omeka has many plug-ins that add specific features to the main body of Omeka's software. These plug-ins provide, among other features, image data conforming to the International Image Interoperability Framework (IIIF) and allow for the harvesting of metadata by OAI-PMH. These plug-ins are easily implemented in the database software even with little computer programming experience.

Registration of Digital Object Identifiers (DOIs)

When considering long-term preservation of data, migration of platforms is always a problem that can occur. One major issue is related to URLs (Uniform Resource Locators); prior URLs created on an older platform may need to be changed to reflect the new platform. Thus, 'old' URLs become inactive, creating possible access issues for internet users. In research, this causes particular problems when citing web sources that may 'disappear' as a result of changing URLs. Using Digital Object Identifiers (DOIs) solves the URL problem because unique, persistent, and stable DOIs are registered to "any entity – physical, digital, or abstract" (International DOI Foundation, n.d., para.1) and are related to entity content rather than online location, meaning that even when URLs change, DOIs remain constant. We try to avoid URL changes as much as possible, but some are inevitable.

To deal with the issue of URL changes, we decided to adopt the DOI system, typically used for published journal articles, as a method also for image materials. Although image material occasionally forms the core element of a scientific paper and its arguments (and more often so in the humanities and social sciences), there is currently no agreed and established method to indicate an image source or to credit an image to a creator and/or rights owner. A DOI is "a system for persistent and actionable identification and interoperable exchange of managed information on digital networks" (International DOI Foundation, n.d., para.1). The DOI system is implemented by registration agencies (e.g., publishers, universities, etc.) who provide domain-specific identifiers for various applications using the underlying DOI framework. NIPR are not the first Japanese research institution to attach DOI numbers to their image data. For example, from 2017, the National Institute of Japanese Literature (n.d.) have adopted DOI to their digital images in their *Database of Pre-Modern Japanese Works* (Okada, Yamamoto, and Matsuda, 2018). By giving DOIs, proper citation becomes possible, access persistence is secured, and the reliability of data is improved. At present, Omeka currently has no function or plug-ins allowing the attachment of DOIs, thus we are in the process of developing a plug-in that allows for this function.

Granting Open Licenses

To grant licenses is important for a smooth utilisation of images and image metadata. When using found images, we must confirm the specific terms for legal use, whether for private, research, or publication use. Looking for and deciding upon appropriate images becomes easier if the search engine can be used to narrow down options based on machine-readable rights statements. The standardisation of licensing for data is a current topic of discussion by the Research Data Alliance (RDA-CODATA Legal Interoperability Interest Group, 2016), and related efforts have also started in Japan. Because copyright is an issue with all the image data currently in the NIPR image database (meaning that none of our data is out of copyright), we use the Creative Commons (CC) license which is the *de facto* standard in academic publishing as determined by sheer volume alone. According to the Creative Commons website (n.d.-a), 1.1 billion works have been published using CC licenses. Specifically, we adopt their CC0, CC Attribution 4.0 International and CC Attribution-ShareAlike 4.0 International licenses. The CC0 license "enables scientists, educators, artists, and other creators and owners of copyright- or database-protected content to waive those interests in their works and thereby place them as completely as possible in the public domain, so that others may freely build upon, enhance and reuse the works for any purposes without restriction under copyright or database law" (Creative Commons, n.d.-b, para.1). The CC Attribution 4.0 International license allows for the open sharing and adaption of works as long as proper credit is given to the copyright holder when used (Creative

Commons, n.d.-c). The CC Attribution-ShareAlike 4.0 International license requires works to be shared “under the same license as the original” when distributed (Creative Commons, n.d.-d).

In most instances, image copyright is held by NIPR because most images come from NIPR researchers or affiliates; consequently, there is no copyright problem in granting an open license. However, this issue is slightly more complicated when the images in question are portraits or when image donors are not employed by or affiliated with NIPR. We have, therefore, established the policy that any images that might be problematic are not made publicly available until all individual permissions have been sought and granted. Although in most cases there is no need to consider portrait rights, NIPR, as a public institution, is required take reasonable precaution.

Adoption of International Image Interoperability Framework (IIIF)

Processing image data and disseminating images requires specialised technologies and techniques. Because of the variety of file formats in use, even in simple comparisons of images, pre-treatment is often required. To solve these problems, we follow the International Image Interoperability Framework (IIIF) (n.d.-a, para.1), “a set of shared application programming interface (API) specifications for interoperable functionality in digital image repositories.” IIIF is a framework that is rapidly becoming an international standard for

digitised images in the field of digital humanities as evidenced by uptake in large, prestigious institutions internationally, such as the Smithsonian Institution in the U.S. (International Image Interoperability Framework, n.d.-b, para.1). By providing images and metadata that conform with IIIF, autonomous interface-to-interface communication by way of APIs improves processing, functionality, and use of images. Compliant with IIIF, we can process our images for use by others using international standard technology. For example, via IIIF and API, our images are compatible with Mirador, a "configurable, extensible, and easy-to-integrate image viewer, which enables image annotation and comparison of images from repositories dispersed around the world." (Project Mirador, n.d., para.1). Mirador users can, for instance, pull an image from our database and compare it side-by-side with other images from our database, as well as with images from other worldwide image repositories that also are Mirador-compliant. As a result, comparative and analytical research from humanities and social sciences using our images is possible, providing opportunities for new interpretation and discovery in the history of polar observation in Japan and elsewhere.

[FIGURE 4 HERE]

Implementing Metadata Standards

The provision of abundant metadata and mutual compatibility is useful as a means for urging the discovery of electronic contents. With this understanding, the metadata attached to our images conform to the international standard of Dublin Core Metadata

Schema. To enhance discoverability and accessibility by external search engines, our metadata are harvestable in accordance with Open Archives Initiative, OAI-PMH, who "develops and promotes interoperability standards that aim to facilitate the efficient dissemination of content" (Open Archives Initiative, n.d., para.1).

Best Practices and Lessons Learned

By creating and operating our image database, we have learned how Arctic images are utilised in current research activities. By storing archive images to the database, not only comparison of similar images and creating time series becomes possible; the potential for application in other areas than research also opens. From our experience working on the database, we believe that image preservation and public disclosure services have a certain degree of demand. These activities, however, must be thought of in a long-term planning perspective, while actual use of images by users is an immediate, day-to-day need which needs to be considered from a short-term perspective. Thus, it is important to provide services necessary for daily research activities while at the same time looking ahead to future needs.

Our new image pubishing platform based on Omeka went live in March 2018; thus, at the time of writing it has been operational for about one year. Therefore, at present, we have little empirical data to judge whether Omeka has worked as well as we intend. Nonetheless, in our opinion, because this is a technologically new approach, we assume that

it will take time for researchers to become proficient using the platform. We will continue improving the interface while incorporating standard website evaluation methods such as analysing access-logs or conversion rates (i.e., the percentage of visitors that complete a desired goal out of the total number of visitors to the site).

Also, because Omeka is open-source software, future trends of use, including updates, will depend on the activity of the Omeka community. Although we are convinced that implementing Omeka is the most appropriate choice for NIPR at the present time, from the viewpoint of sustainability and interoperability we must watch how the open-source Omeka community develops over time.

Conclusion

This chapter began with outlining the position of Arctic images in the context of published scientific papers. Through working with Arctic images in the NIPR collection, we have come to understand that collecting, making available and utilising images is essential to developing research and research methods. Next, we introduced how the two image databases (*NIPR Image Collection* and *Digital Botanical Book*) at NIPR were built, who uses it, and how they are operated. Then, based on the experience of managing these two databases which have different purposes and characteristics, we noted our plan to develop an integrated image

publishing platform (Omeka) that meets the needs of both. A particular emphasis on integration is platform sustainability and interoperability. We discussed specific requirements to meet these two points, evaluate the implemented functions, and the possibility of future updates. Importantly, Arctic images discussed here are not only used in the natural sciences, but also in social science research. Because different disciplines have varied and specialised viewpoints, it is not easy to provide sufficient metadata to satisfy all demands. We collect metadata from the owner(s) of images, but it is crucial also to the continuing enrichment of metadata to collect feedback from users coming from various backgrounds and disciplines. Of course, archivists and librarians will need to continuously maintain the database metadata in the future. We hope that the NIPR Arctic image database will be widely used, especially by the broader scientific and social scientific community.

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