Flora and *Fonds:* Activating Herbaria as Archives

by

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Abstract:

An herbarium (pl. herbaria) is a collection of botanical specimens, primarily used for identification and classification of species. While herbaria may not be structured as archives traditionally are, I will argue that the concerns of management, preservation, access, and use, can be paralleled. After establishing the herbarium as an archive, I will apply archival theories of societal provenance and total archives to herbarium collections and discuss the possible benefits of an archival lens to herbaria.

Introduction

Archives have long been described as living things. Whether in reference to characteristics such as "naturalness,"[1] the act of "organic" collection, the lifecycles of records, the "weeding" during the function of appraisal, and the classification system as paralleled to those found in biology[2] – archives are replete with references to the living. But where do living things fit into archives?

Archival theorists have debated the meaning of archives, of record-creators, and the roles of archivists in the creation of knowledge. As archivists explored these meanings, a more expansive archival ethos has allowed for the inclusion of a variety of types of records and the sources of information. Tom Nesmith laid out a broad definition of archives as "unpublished recorded documentation of personal and/or institutional activities that is kept indefinitely in public or private institutions or in private hands. The many members of this distinctive type of archives together hold a massive, integral part of the overall human archive of all forms of knowledge transmission and memory institution."[3] Theorists also illustrated archives' paradigm shifts from a "juridical-administrative" nature to ones more focused on "socio-cultural" outcomes,[4] reflecting the differing needs over time of what is demanded of archives. Where records historically served as signs of authority in an administrative or governmental context, social change has encouraged archives to shift towards reflecting "archives from the bottom

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[1] Terry Eastwood, "What is Archival Theory and Why is it Important?" *Archivaria* 37 (1994): 127.
[2] Greg Bak, "Continuous classification: capturing dynamic relationships among information resources," *Archival Science* 12, no. 3 (2012): 287-318.
[3] Tom Nesmith, "Towards the Archival Stage in the History of Knowledge," *Archivaria* 80 (2015): 121.
[4] Terry Cook, "What's Past is Prologue: A History of Archival Ideas Since 1898, and the Future Paradigm Shift," *Archivaria* 43 (1997), 37.

up."[5] Nesmith highlights the "archival stage" of the history of knowledge, wherein the use of archives in the preservation and creation of knowledge has reached an unprecedented high.[6]

This expansion of archival theory has allowed for a greater consideration of scientific information already in archives, and that which is created to be preserved in archives. In his consideration of seedbanks as archives, Marc Kosciejew describes "natureculture documents," advocating for a wider understanding of "material, information, and documentary objects embedded in, entangled with, and co-constituting nature and culture." Building on the idea of nature and culture being contingent on each other rather than as separate and opposite concepts, Kosciejew also places seeds as important parts of human survival.[7]

Botanical specimens could also be considered in a similar light as seedbanks as another kind of natureculture documents. Botanical specimens represent a form of "embodied information."[8] They represent formerly living things, and also act as physical representations of the development of knowledge as interpreted by the science of botany. An herbarium (pl. herbaria) is a collection of botanical specimens, primarily used for identification and classification of species.

It is the intention of this thesis to show that herbaria are a type of archive. The inclusion of herbaria as an archive is important because it contextualizes how knowledge surrounding these records has been created over time. This thesis explores this contextualization through the archival concepts of societal provenance and total archives.

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[5] Tom Nesmith, "Archives from the Bottom Up: Social History and Archival Scholarship," *Archivaria* 14 (January 1982): 5-26.
[6] Nesmith, "Towards the Archival Stage," 120.
[7] Marc Kosciejew, "The Concept of Natureculture Document: A Conceptual Exploration of Seeds, Embodied Information, and Unconventional Records," *Journal of Contemporary Archival Studies* 7 (2020): 2.
[8] Kosciejew, "The Concept of Natureculture Document," 6.

The first chapter of this thesis establishes how herbaria are a form of archive. This largely focuses on a comparison of herbaria and archival standards as they pertain to the functions of appraisal, arrangement and description, preservation, and access. This chapter contemplates traditional perspectives on the roles of archives as opposed to herbaria, and shifts as a result of post-modern archival theory.

The second chapter discusses the contributions of individuals and communities outside of academia to herbaria by applying the concept of societal provenance to herbaria collections. In considering this, there are two separate areas I explore. Early European botanical research was conducted by largely untrained individuals, or what might now be known as citizen scientists. The observations and collections of citizen scientists led to the establishment of herbaria and laid much of the groundwork for the growth of botany as a science. At the same time, the roots of botany are colonial, wherein Europeans collected specimens from around the world for the benefit of European nations and individuals, exploiting Indigenous Knowledge (IK). The undervaluing of IK in the foundations of the science implies that the knowledge lies solely with western scientists, although IK systems are still thriving. It is incumbent on researchers and archivists to consider how contemporary and historic contributions of IK are being preserved, recognized, and utilized within an archival setting, acknowledging that archival spaces are also colonial.

The third chapter is a case study of the total archives concept at the University of Manitoba, discussing the collections of A.H. Reginald Buller, the first professor of Botany at the University of Manitoba. These collections, one housed within the University of Manitoba Vascular Plant herbarium (WIN), and the other at the University of Manitoba Archives & Special Collections (UMA), allow for a unique look at the circumstances of acquisition at each

institution. Due to the herbarium's primary focus on botanical specimens, records such as notes, journals, and other related research information are not always included in the collection. Instead, these are sometimes included in a researcher's personal papers and donated to an archive. While this separation of records by the same creator seems opposed to traditions of provenance and original order, this also opens a discussion around total archives regarding separation based on media. I hope to demonstrate the importance of more inclusive collections in each archival repository and the importance of providing additional historical context to scientific study.

Positionality

The intersection of my identities informs my worldview. I have experienced sexism as a woman, and homophobia as someone who is queer, and in some respects, these compound as they intersect and I have experienced specific discrimination as a bisexual woman. I am privileged as a white, cisgender, able-bodied settler in a middle-class family. I have been able to afford to make it this far in my studies based on my access to resources, such as steady employment, housing, scholarships, and time. These privileges mean that inside and outside of academia, I have largely been accepted and have had opportunities that other people have not.

While I have an interest in the history of science, I am not a trained scientist, let alone a botanist. What I have learned about botany and herbaria has been largely theoretical. Additionally, as this thesis discusses Indigenous Knowledge, exploitation, and colonialism, I want to note that I do not have lived experience with these as a settler in this land. I hope that this project will have an impact on how scientists see their records; how archivists treat records; and will affirm the contributions of Indigenous peoples which have been dismissed or ignored in

institutions. I recognize that the ways in which European knowledge has been created and codified in the past has exploited Indigenous peoples and wish to correct this in my discipline and beyond.

Much of the research and most of the writing for this thesis was undertaken during the coronavirus pandemic, which was declared in March 2020. Up until that point, I had planned on a strict writing schedule, spending more time in different archives and herbaria, and even research trips abroad. In reality, I struggled with motivation to keep myself accountable to my writing schedule, particularly as access to archives and libraries was limited.

Chapter 1: Herbaria as Archives

The herbarium is broadly defined as a facility which stores botanical specimens for study. Characterized as "a great organism,"[1] the herbarium is constantly changing as new specimens are acquired and classifications are adjusted. Traditionally, the primary function of herbaria was to "provide taxonomic and nomenclatural documentation for systemic botany;"[2] now, while herbaria still exist as reference points for classification, they are also sites for novel research within biological and ecological sciences.

Parallels can be drawn between the functions of herbaria and archives. An archive can be defined as a "physical or digital collection of historical records."[3] This chapter discusses what qualifies botanical specimens as records and of herbaria as a type of archive. This involves a comparison of similarities and differences between archival functions to the operations of herbaria, including appraisal, arrangement and description, preservation, and access. In order to consider the functions of each institution, I compare the protocols of herbaria management, as described by Smith and Chinnappa in their chapter "Plant Collection, Identification, and Herbarium Procedures"[4] against the protocols of digital preservation, as described in the Consultative Committee for Space Data Systems (CCSDS)'s *Reference Model for an Open Archival Informational System* (OAIS).[5]

These standards were selected as examples of fulsome, detailed reference models in their respective fields. Smith and Chinnappa's chapter provides step-by-step instructions for best

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[1] F. R. Fosberg, "The Herbarium," *The Scientific Monthly* 63, no. 6 (1946): 429.
[2] Richard K. Rabeler et al., "Herbarium Practices and Ethics, III," *Systemic Botany* 44, vol. 1 (2019): 7.
[3] Society of American Archivists, *Dictionary of Archives Terminology*, "Archive," https://dictionary.archivists.org/entry/archive.html#ucd3e2d74648b2f74.3d32d4e.15a432086a6.-285a
[4] Bonnie Smith and C.C. Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," in *Plant Microtechniques and Protocols,* eds. Edward C. Yeung and Ferhan Ayaydin. (1st ed. Cham, Switzerland: Springer, 2015): 541-573.
[5] The Consultative Committee for Space Data Systems (CCSDS), *Reference Model for an Open Archival Information System (OAIS*), (June 2012).

practices from field to folder with a great amount of specificity. Similarly, OAIS provides incredibly granular details in describing the processes of the archival information system. Both standards were published in the last decade. OAIS has been widely embraced in the archival community as a foundational resource for digital archives.

By considering postmodernist archival theory, one can acknowledge that the shifting definitions in traditional archival theory can accommodate herbaria as a type of archive. It is important to situate herbaria as archives because it is important to manage the records within herbaria for present and future research use. Additionally, the inclusion of an archival perspective within herbaria and botany provides an alternate way of looking at these systems, reflecting on and problematizing the traditional approaches to knowledge creation.

A historical comparison: traditional herbaria, archives, and the progression of the field

Traditional views of the practices and functions of herbaria and archives set the stage for the consideration of the parallels of these repositories. In the early twentieth century, the language used to describe archives and herbaria were similar to one another.

Writing in 1946, F.R. Fosberg situated the herbarium as a collection of primary sources in a field of biology, which at the time, was largely "unexperimental."[6] Where other fields of science may have created data through experimentation, herbaria were originally founded in the pursuit of the collection and classification of species. Fosberg also discussed the importance of herbaria collections in providing taxonomic information, saying that they "will last indefinitely and may always be examined, if they are so cited as to be identifiable."[7] In discussing the specimens, Fosberg stated, "They should be regarded as a part of the general heritage of the

[6] Fosberg, "The Herbarium," 429.
[7] Fosberg, "The Herbarium," 429.

science of botany, rather than the private possessions of any one institution, regardless of their legal status."[8] This alludes to the primary source that botanical specimens provide in botany and scientific study generally.

This sentiment may be familiar to archivists because of the similar position archives hold in the study of history. Hilary Jenkinson's opening statement in his *A Manual of Archive Administration* parallels Fosberg: "It is hardly necessary to say that History, as it is now, has become largely dependent on Archives."[9] Jenkinson defined an archival document as "one which was drawn up or used in the course of an administrative or executive transaction (whether public or private) of which itself formed a part; and subsequently preserved in their own custody for their own information by the person or persons responsible for that transaction and their legitimate successors… not drawn up in the interest for the information of Posterity."[10] Jenkinson encouraged archivists not to place their own value judgments on what could be useful to the study of history and lamented archivists becoming too involved in the making of archives: "the Archivist is not and ought not to be an Historian. He will need of course, some knowledge of History and may be interested in it personally…but his duty is to his Archives, independently of any of the Research subjects…which make use of Archives for their own ends." In this respect, herbaria and archives take a slightly different view, as those who work in herbaria very typically contribute to the holdings through their own collecting.

Fosberg used language which compared herbaria to museums, though this could be based upon the connection to nature sciences and natural history and may speak to the prevalence of herbaria within natural history museums. This connection between natural history museums and

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[8] Fosberg, "The Herbarium," 431.
[9] Hilary Jenkinson, *A Manual of Archive Administration*, New and rev. ed. (London: P. Lund, Humphries, 1937): 1.
[10] Jenkinson, *A Manual of Archive Administration*, 11.

herbaria continues, with Rabeler et. al. recently contending that herbaria are "the botanical equivalent to history museums" while in the same sentence, calling herbaria "archives of plant biodiversity through space and time."[11] Herbaria should be distinguished from other specimen collections in natural history museums, such as zoological or geological specimens that may otherwise be found displayed within a museum. While botanical specimens may be used in exhibitions, the storage methods of dried and pressed specimens are reminiscent of a filing cabinet rather than a curiosity cabinet. Similarly, herbaria should be distinguished from library collections. While botanical specimens are used as reference aids in similar ways as library books, one significant difference is the primary source that botanical specimens act as, in opposition to the secondary source that published materials are.

The definition of what can be constituted as archival has been debated at length. Jenkinson himself likely would not have approved of botanical specimens being stored within an archive, although he may have understood the place of species as traces of an administrative transaction. In his discussion of the place of different media types in archives, he wrote:

> …Supposing, to take a more actual example, that the Government of a Colony presents to the First Commissioner of Works in London a two-hundred-foot spar of Douglas Pine: the question may be imagined to arise: Is the spar 'annexed' to correspondence with the Government of British Columbia?...The answer to those who would put this dilemma to us in the present connexion is that the Administration would be obliged in all such cases to solve the question of housing – to send the spar to Kew Gardens…[12]

While comparing herbaria with traditional archival definitions serves to underline a common evolution in the disciplines, archival thinking has shifted away from traditional definitions and paradigms in favour of a more intersectional view of the archive and the roles of archivists. As

[11] Rabeler et. al., "Herbarium Practices and Ethics," 7.
[12] Jenkinson, *A Manual of Archive Administration*, 7.

described in Terry Cook's influential text, the shifts of *evidence, memory, identity*, and *community* in archives can be applied to herbaria collections as well.

For example, Terry Eastwood's earlier work discussing the values of impartiality, authenticity, naturalness, interrelatedness, and uniqueness[13] can be applied to botanical specimens as a test of their use as *evidence*. In these terms, botanical specimens should be impartial and authentic, in that their collectors should be unbiased and attempting to identify a specimen that will serve the larger collection. If a botanist were to fabricate information about the species, it would be determined to be untruthful by their colleagues, gaining nothing for the science as a whole. Apart from their literal naturalness as plants, botanical specimens have naturalness in Eastwood's sense of the word in that they are a tangible record of the activity of conducting botanical expeditions and documenting taxonomic information. In considering a specimen's place within a genus and family, each specimen is interrelated to its collection. Uniqueness is an interesting aspect of archival quality in regard to botanical specimens. While it can be beneficial to have duplicates of specimens to ensure long-term use and preservation of important species that may be in rotation often, obtaining unique specimens is important to building the collections of herbaria. Each specimen remains unique when considering other aspects of its collection, including the collector, location of collection, and even on a genetic level. One distinction can be made for the "type" specimens, which are "specimens upon which species have been based and which are thus the points of reference for the names given to species," which are highly valued in a collection.[14] Although each specimen can be of possible benefit to the herbarium, type specimens are an asset to both the science of botany and the

[13] Terry Eastwood, "What is Archival Theory and Why is it Important," *Archivaria* 37 (Spring 1994): 122-130.
[14] Fosberg, "The Herbarium," 431.

herbarium that holds it. Herbaria are still important resources for the act of identifying botanical species.

However, as Cook argued, the intention of archives as *evidence* does not encompass the totality of archives. Beginning in the Jenkinsonian era where archives were intended to document the work of those in power, Cook contemplates *evidence* and *memory* as competing forces in the work of archivists. Viewing archives only as evidence, particularly where only one perspective is documented, favours those in power, and perpetuates systems of power. The concept of *memory* also limits the perspectives shared. T.R. Schellenberg's focus on appraisal by archivists trained in history was aimed to respond directly to the research goals of historians, anticipating the needs of historians in a given moment. Cook notes the inherent power that archivists hold in the process of memory creation or deciding what should be remembered.[15] In the context of herbaria, this parallels the creation of knowledge: those trained in science, collecting information to further the pursuit of science, decided what information was worth sharing. In this way, the knowledge preserved in herbaria reflects the worldview of the people within those systems. This also means that the information within has been selected based on its perceived worth to people in power.

The third paradigm Cook describes is *identity*, wherein the field became more professionalized through the introduction of graduate programs, professional associations, and publications dedicated to the work of archivists. This focus on the work of archivists encouraged many to become more self-aware of their impact, which in turn inspired a culture of transparency to reveal the inherent biases within records, archives, and in archivists themselves. This

[15] Terry Cook, "Evidence, memory, identity, and community: four shifting archival paradigms," *Archival Science* 13 (2013): 107.

professionalization of herbaria staff has already occurred. The paradigm of *identity* as it applies to sources of knowledge from which botany is derived will be discussed in the next chapter.

The final paradigm, *community*, is one Cook identifies as underway in archives in his 2013 article. The focus here is on a broadening of what constitutes an archivist or a record, and to slant towards a more open, interrelated, and interconnected mindset. There are already many indications of the paradigm of *community* in the sphere of botany. For example, through citizen science initiatives, science aficionados are solicited for contributions and observations by researchers to aid in resource-heavy data collection. As well, a great number of online resources, including digital surrogates of specimens from herbaria, have been made available to a wider audience. This allows for greater access by other researchers in a variety of disciplines, as well as those outside the academic sphere.

Comparing OAIS archives and herbaria: institutions

In OAIS terms, an Archive is defined as "an organization that intends to preserve information for access and use by a Designated Community," not limited by media.[16] Although OAIS is largely concerned with digital preservation, the reference model itself is broad enough in its descriptions of situations so that it may be applied to a variety of archival collections. By Smith and Chinnappa's definition, the herbarium is "a collection of pressed and dried plant specimens generally organized either in a systematic or alphabetical classification sequence…and will usually include many other diverse materials…including, but not limited to, photographs, drawings, books, reprints, and cone and fruit collections."[17]

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[16] CCSDS, *OAIS*, 1-9. Throughout this discussion, I have followed the OAIS standard in capitalizing terms that are defined in the glossary that accompanies the standard. This indicates that they are being used in the same specialized sense that they are used in the standard.
[17] Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 554.

The OAIS model outlines various roles in an OAIS repository as follows: the Producer, who supplies the information to be preserved; Management, who provides the mandate and resources for the institution, but does not necessarily interact with the operations of the Archive; and the Consumer, who uses the OAIS to access information.[18] These roles sometimes overlap one another – the Producer could also be the Consumer and vice versa – and are not necessarily external to the staff of the Archive. In OAIS, the Designated Community are those users (Consumers and Producers) identified by the Archive as the group "for whom the information is being preserved," who have the Knowledge Base to understand that information without additional mediation.[19] In herbaria, the Designated Community would be botanists, who are either conducting research, teaching, or depositing their own specimens.[20] They have a Knowledge Base, through their training in botany or other biological sciences, which allows them to interact with the specimens. A researcher may deposit specimens with the herbarium and may return to study the specimens themselves. The staff of an herbarium may also contribute to their own holdings or conduct their own research in the collection.

Other users who are not part of the Designated Community may gain access to the materials at the discretion of the OAIS, though they may need mediation or translation. In the OAIS system, this interpreting or translating information is called Representation Information.[21] The herbarium is not limited to granting access to only botanists or biologists outside their Designated Community, and Representation Information can be provided to help interpret information to those who do not have the Knowledge Base to interpret information otherwise.

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[18] CCSDS, *OAIS*, 1.7.2.
[19] CCSDS, *OAIS*, 2.2.1.
[20] Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 554.
[21] CCSDS, *OAIS*, 2.2.1.

Comparing functions: appraisal, submission, ingest

The archival function of appraisal is intended to identify whether records should be acquired based on their value in relation to an archive's mandate. Although some herbaria may specialize in the flora of the regions they are situated in, or by classification orders, the collection mandates of herbaria vary greatly. For example, while the University of Manitoba's Vascular Plant Herbarium focuses largely on building their collection of the flora of Manitoba,[22] other, larger herbaria such as the Kew Herbarium in London collect specimens from around the world.[23] Herbaria staff must be cautious in their acquisitions, ensuring that they acquire specimens which have been ethically collected, that laws around endangered species are adhered to, permission and permits are granted and documented where applicable, and collectors do as little damage to the species population as possible.[24]

In OAIS, an archive's mandate could be based on "subject matter, information source, degree of uniqueness or originality, and the nature of the techniques used to represent the information (e.g. physical media, digital media, format)."[25] In CCSDS's supplementary standard, Producer–Archive Interface Methodology Abstract Standard (PAIMAS), more depth is afforded to the relationships between the Producer and Archive, the requirements of the information being transferred, and the Submission Agreement.

The appraisal begins with the Producer, (in the example of an herbarium, a collector), the OAIS (the herbarium), or Management (the overarching institution controlling the Archive) requesting to preserve the data objects (specimens) created or acquired by the Producer. OAIS

[22] University of Manitoba Vascular Plant Herbarium, "Herbarium Overview," https://winherbarium.weebly.com/history.html
[23] Kew Royal Botanic Gardens, "The Herbarium," https://www.kew.org/science/collections-and-resources/collections/herbarium
[24] Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 541-542.
[25] CCSDS, *OAIS*, 3.2.1.

describes many different relationship dynamics at play in the appraisal process. The first example illustrates a relationship where the Producer and Archive share the same Management, which may be likened to an herbarium staff member submitting specimens. Second, where the Producer and Archive do not share the same management, but the Archive is still mandated to receive information due to legal requirements. Third, a relationship based on a contractual obligation, as in a commercial Archive. Fourth, a voluntary relationship where the Producer has chosen to deposit their information with the Archive – in an herbarium, analogous with an external researcher depositing specimens. Finally, a scenario where there is no relationship between the Producer and the Archive, but the Archive obtains the information. In such a scenario, the Archive would need to prepare the information for submission themselves.[26]

Regardless of the terms of the relationship, PAIMAS outlines a multi-step process to negotiate the needs of the "Producer-Archive Project," or the details of the workflow in accepting a submission to an Archive. These actions also fit into the function of appraisal: verifying the type of information and format;[27] assessing the user access restrictions and the needs of the Designated Community;[28] checking feasibility and possible costs associated with the project; and terms of transfer for the potential acquisition.[29] Ideally, these negotiations begin even before data is created – this way, an agreement can be made before the data is even formatted.[30]

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[26] The Consultative Committee for Space Data Systems (CCSDS), *Producer-Archive Interface Methodology Abstract Standard*, (May 2004), 2.1.3.
[27] CCSDS, *PAIMAS,* 2.2.
[28] CCSDS, *PAIMAS*, 3.1.2.1.
[29] CCSDS, *PAIMAS,* 3.1.
[30] CCSDS, *PAIMAS*, 2.1.4.

After these assessments are made, the project as assessed is formalized, including the collecting specifics of the information being preserved;[31] the drafting of a contract or other legal concerns;[32] and confirming transfer conditions, the plan to validate objects, and the delivery schedule ensuring all information arrives safely and as intended.[33] Finally, the Submission Agreement "is the result of all the preceding negotiations," confirming the specifics of the previous sections.[34] An agreement is set regarding the transfer of the records, what type, and frequency, etc. of the submission.[35]

In the OAIS model, the process of submission is paralleled with acquisition. Once the Submission Agreement is reached, the Producer sends the OAIS a Submission Information Package (SIP), "an Information Package…[used] in the construction or update of one or more [Archival Information Packages] and/or the associated Descriptive Information."[36] There are several parts of the SIP described as follows: the data to be preserved is the Content Information; the data's descriptive metadata is the description of the data used for intellectual control and searching, or package description information; the technical metadata, or Preservation Description Information (PDI), is the information regarding the data itself, including file format, version history, etc. which is used to ensure the information is preserved in accordance to the needs of the Designated Community; and finally, there is metadata called the Packaging Information which translates how the package in its entirety is arranged.[37] These sources of metadata are important in understanding the object.[38]

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[31] CCSDS, *PAIMAS*, 3.2.2.1.
[32] CCSDS, *PAIMAS*, 3.2.2.2.
[33] CCSDS, *PAIMAS*, 3.2.2.3, 3.2.2.4, 3.2.2.5.
[34] CCSDS, *PAIMAS*, 3.2.3.
[35] CCSDS, *OAIS*, 2.3.2.
[36] CCSDS, *OAIS*, 1.72.
[37] Adrian Brown, *Practical Digital Preservation: A How-to Guide for Organizations of Any Size* (London: Facet Publishing, 2013).
[38] Brown, *Practical Digital Preservation,* 137.

In herbaria, the SIP would include the specimen along with the metadata of contextual information for the specimen. The metadata, which is typically retained in the field notes of the collector, is utilized to create the definitive label for the specimen, and should include information such as the person who identified the specimen, and which authority or key was used to make such determination; the date and location the collection was made; and the institution where the specimen will be preserved.[39] Smith and Chinnappa suggest recording the following information in a field notebook, if not used for creating the label then for additional information later:

> 1. the name of the plant, as well as any descriptors (particularly if it cannot be identified in the field);
> 2. the name of the collector, as well as the collection number of the item (a number used to determine the item within the expedition's collection); should be used to reference any associated materials of the specimen or photographs taken);
> 3. the date of the collection;
> 4. the location of the collection, and as exact coordinates as possible (either by Global Positioning System, description from nearest landmark, or other);
> 5. the description of the specimen's habitat, including "associated species…community type, elevation, exposure, slope and aspect, approximate soil type and soil moisture, drainage conditions (wet, submerged, dry), and any disturbances."
> 6. any additional description which can be provided while the specimen is still fresh and unpressed.[40]

These suggestions for collection include to collect an average size specimen in order to better represent the species; to collect only specimens that have a healthy population of twenty or more members present; to include the root, shoot, leaf, flowers, and fruit; to collect enough for at least two sheets if planning to share the specimen with other herbaria or researchers; and to collect

[39] Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 543-4.
[40] Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 544. Note that this is paraphrased, not a block quote.

extra components of the specimen, such as buds, fruit, and flowers, in order to have specimens to dissect or test.[41]

In the OAIS system, the Ingest function takes SIPs and processes them into Archival Information Packages (AIPs), keeping the Content Information and Preservation Description Information and archiving them based on the archive's desired format.[42] In the herbarium, each specimen is prepared to ensure long term preservation and clear identification. This identification must include: a label with a heading, detailing the name of the institution, or the relevant project it is associated with; a title denoting the location it is from (region, province, or country); the scientific name, formatted *Genus species* (Family name and Common name optional), and the Authority the identification was made from; location and district, latitude and longitude, and elevation; a description of the habitat and the population of the species within; any additional notes on the description of the plant; the name of the collector, collection number, and date of collection; and the name of the person who identified the specimen and the date identified.[43]

After plants are identified, the specimens are mounted on an herbarium sheet with a transparent glue, plastic strapping, or linen tape, the latter of which provides the least damage to the specimens.[44] Accession numbers are assigned to ensure materials can be identified and located, and permanent labels are affixed.[45]

Comparing functions: arrangement and storage

[41] Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 545-6.
[42] CCSDS, *OAIS*, 4.1.
[43] Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 562-3.
[44] Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 555-558
[45] Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 564.

While arrangement is not explicitly discussed in the OAIS model, it is an important function to compare between archives and herbaria. The arrangement of herbaria does not adhere to the same types of classification as most archives would. The arrangement of specimens does not reflect their creators, and as such, there is no sense of *respect des fonds* in regard to a human collector. The specimens collected by a single researcher are not usually separated from the herbarium collection unless the creator is of particular importance within the field.[46] Specimens and related materials are inserted constantly or moved to reflect changes in classification. Although one may consider the context given on labels, providing information on what the specimen is, where it was collected, and by who, this information relates more to the context of the record rather than the system of arrangement. Instead, the most commonly used system of arrangement is based on biological classification, then by alphabetical order; alternatively, some herbaria may choose to arrange their collections by geographical region, then by biological classification.[47]

For the purposes of this comparison between archives and herbaria, the system of describing and arranging botanical specimens is taxonomical, which is a form of hierarchal description. In the herbarium, specimens are separated at the highest level by their Family (analogous to fonds-level), Genus (series-level), Species (file-level), then at the lowest level by each specimen (item-level). Within these levels, each category is arranged alphabetically to improve ease of access, although some herbaria choose to utilize a numerical arrangement system that indexes botanical names of specimens.[48] Due to the needs of identification and

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[46] J. S. Womersley, *Plant Collecting and Herbarium Development: A Manual* (Rome: Food and Agriculture Organization of the United Nations, 1981), 79.
[47] Rabeler et. al., "Herbarium Practices and Ethics," 8.
[48] Womersley, *Plant Collecting and Herbarium Development,* 76-7.

classification, having properly classified and arranged specimens directly impacts the abilities of staff and researchers to conduct their work.[49] Often, a ledger will assist the herbarium employees to intellectually arrange the collection. When a specimen is renamed or moved, the ledger can be amended, and a "dummy" sheet of paper is inserted in its original location to direct users to the new location.[50] Specifications for long-term storage include secure, insect-proof cabinets which remain closed unless retrieving specimens to ensure humidity, temperature, and exposure to light and insects is kept to a minimum.[51]

There are often additional subject-specific collections separated from the rest of the herbarium collection. These may be based on geographic separation, showing the same species in different locations; a separation of domestic (cultivated) specimens from wild specimens; the separation of type specimens from the general collection; or sometimes, the collections of notable botanists or other scientists. However, Womersley cautioned against this manner of separation as it can create a disconnect for users in viewing the complete collection of the herbarium.[52] While archives generally do not separate records based on subject, unless using specific items for exhibits or outreach, it is interesting to consider this in regard to the theory of provenance. When considering the use of herbaria, the importance of grounding each specimen in the context of its genus, family, and even in showing comparisons of different varieties of species may overshadow the importance of the collector, for instance. What may assist in providing context to the creation of the botanical specimen may be to supply additional materials on the specimen from the creator or further researchers, such as notes, published research,

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[49] Womersley, *Plant Collecting and Herbarium Development,* 76.
[50] Womersley, *Plant Collecting and Herbarium Development,* 79-80.
[51] Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 565.
[52] Womersley, *Plant Collecting and Herbarium Development,* 78-9.

illustrations, and letters.[53] In cases where researchers have conducted research using an herbarium's specimens, published work is sometimes included. These contributions act as a form of participatory description, allowing past users to be able to share knowledge with future users to consider.

Part of the philosophy of the OAIS model is to encourage standardization across different repositories, so that institutions are better prepared to face "archival challenges, particularly as they relate to digital information."[54] Other archival standards, such as the Rules of Archival Description (RAD) and the General International Standard Archival Description (ISAD(G)) were developed to focus on description. RAD, which was established by Canadian archivists in the 1980s, was largely influenced by bibliographic cataloguing standards, rather than reflecting the specific and unique needs of archives.[55] ISAD(G) reflected more archival influence, and "acknowledged the bibliographic model not by adapting it but by presenting itself as a peer on par with it."[56] RAD has been criticized for its terminology, elements, and its applicability to archival institutions, and some changes were made in 2008; however, both RAD and ISAD(G) do not address the concerns of the future of archives. Standards such as the Records in Context – Conceptual Model (RiC-CM) reflect the movement towards "multidimensional description" and linked data, taking a broader view of records by considering relationships between fonds. RiC-CM encompasses many of the existing standards of the International Council on Archives (creators of ISAD(G) and others but takes description a step further.[57]

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[53] Womersley, *Plant Collecting and Herbarium Development,* 79; Fosberg, "The Herbarium," 430.
[54] CCSDS, *OAIS*, 1.3.
[55] Richard Dancy, "RAD: Past, Present, and Future," *Archivaria* 74 (Fall 2012): 9.
[56] Dancy, "RAD," 16.
[57] International Council on Archives, *Records in Contexts – A Conceptual Model for Archival Description*, (Consultation draft v0.1, September 2016).

Comparing functions: access

Similar to stereotypes of "dusty" archives, herbaria have been cast as irrelevant in the age of modern research. Concerns were raised over herbaria being characterized as "[becoming] decrepit, static, and generally out-dated," as classification and taxonomy grew to be considered antiquarian. Although archivists have traditionally been viewed as record-keepers rather than record creators, postmodern archival theorists have pushed for archivists to be recognized as active agents in record creation.[58] The work of herbaria employees should be recognized in similar ways. Herbaria staff, who typically have training in botany or biology, are often contributors to their collections. Their specializations in different classes or flora of particular regions act as resources to clients.[59] Their daily activities may include assisting researchers of both academic and non-academic backgrounds, ensuring researchers are able to properly identify specimens, and taking steps to keep classifications up to date and revising descriptions when standards are changed.[60] The work of herbaria employees does parallel the reference work conducted by archivists. Whether they are providing access or additional information to researchers or their colleagues, or contributing to the collection itself, they are trained professionals in their field and should be respected as such.

The description of the employees in herbaria is comparable to traditional views of archivists as the "handmaidens of historians," a theme explored in depth by Terry Cook.[61] Fosberg describes employees of herbaria as inhabiting a "position of unappreciated and

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[58] Terry Cook, "The Archive(s) is a Foreign Country: Historians, Archivists, and the Changing Archival Landscape," *Canadian Historical Review*, vol. 90, no. 3 (2009): 503-4. See also: Tom Nesmith, "Archives From the Bottom Up: Social History and Archival Scholarship," *Archivaria* 14 (Summer 1982): 5-26.
[59] Fosberg, "The Herbarium," 430.
[60] J. P. M. Brenan, "The Relevance of the National Herbaria to Modern Taxonomic Research," in *Modern methods in plant taxonomy,* ed. V. H. Heywood (London: Academic Press, 1968): 24-5.
[61] Cook, "The Archive(s) Is a Foreign Country," 506. See also Jessica M. Lapp, "'Handmaidens of history": speculating on the feminization of archival work," *Archival Science* 19, no. 3 (2019): 215-234.

unrespected servant," urging employees to instead become focal points in facilitating biological study for the benefit of all involved. As with archivists, much is expected of herbarium employees. Fosberg characterizes the "ideal administrator" (disregarding the gendered nature of this description) as:

> an outstanding systemic botanist with broad interests extending into many groups of plants, regions of the earth, and types of problems… He would have a long-range viewpoint, realizing that any work, material, or money put into an herbarium is a long-term investment … he would seek out the opinions of all who had experience with a given topic or field…[62]

Although much is already expected of herbarium employees, the benefits of a more active position and the attitudes surrounding the profession encourage growth in the field as well. In the case of archives, "the archive(s) itself is changed from an unquestioned storehouse of a history waiting to be found to itself becoming a contested site for identity and memory formation…the implications of this change for historians, for historical research, and for historical source criticism remain largely unexplored."[63] The recognition of the work of professionals in these fields is important, because it recognizes that their labour is not simply acting as "handmaidens" for the sake of researchers.

In the OAIS system, access to data objects is provided through a Dissemination Information Package (DIP). The DIP is generated after a request for access is made and is based upon part of one or more AIPs. The Packaging Information is included for Consumers to contextualize the DIP.[64] Duplicate specimens are often obtained during field work to act as "access copies" of specimens in the collection or for future exchange with other herbaria. This transfer of materials between herbaria is very common and encourages the sharing of

[62] Fosberg, "The Herbarium," 434.
[63] Cook, "The Archive(s) as a Foreign Country," 533.
[64] CCSDS, *OAIS*, 4.2.2.3.

information between researchers in different locations, not only through the specimen itself, but also the attached information included with the specimen.

Writing in 1970, Beschel and Soper lauded the advancements made with new technology in terms of automation and data collection in Canadian herbaria. Many of the projects they highlighted described the automation of catalogues, labels, information retrieval programs, and even map-plotted data on specimen locations. These advances were aimed at improving processing times, allowing for quicker and easier amendments to descriptions and records, and relieving the workload of the herbarium curator.[65] Not only was this technological advancement a boon for employees, it also meant that researchers could have easier access to the specimens they desired or could corroborate information more effectively.

Beschel and Soper were also forward thinking, proposing a data bank based on label information, and featuring field observations, published materials, and other relevant materials in one place. They encouraged the establishment of this system on a national level, in order to pool resources and ease access in satellite locations.[66] In all, the importance of arrangement and description to the function of access were demonstrated here, facilitated by early computer systems.

One recent tool to improve access to herbaria in Canada is an online platform called Canadensys. Canadensys describes itself as a "network of researchers, collectors, curators, information technologists, students, and educators that shares data on the occurrence and identity of plant, animal, and fungi, and other species in Canada."[67] Its original funding grant came from

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[65] R. E. Beschel and J. H. Soper, "The automation and standardization of certain herbarium procedures," *Canadian Journal of Botany* 48, no. 3 (1970): 547-554.
[66] Beschel and Soper, "The automation and standardization of certain herbarium procedures," 554.
[67] Canadensys, "About Us," https://community.canadensys.net/

the Canada Foundation for Innovation, which allowed several repositories to buy equipment to digitize their records.[68] This network's digitization strategy features images, geo-referencing, and data cleaning for collections of herbaria, botanical gardens, and other natural history repositories.

The platform provides increased access to users by contextualizing repositories and their holdings. Each institution details the usage statistics by listing the number of downloads with number of records downloaded, and for what purposes. These purposes include biosecurity management and planning, citizen science, collection management, education, and scientific research. These metrics not only benefit the institution in showing how their collections are being used, but it may encourage non-traditional users to make use of data as well. Canadensys presents a breakdown of the digitized records that the institution has uploaded, with information of when specimens were collected by month and by decade, by data quality, and by family. The platform also allows users to subscribe to alerts when an institution uploads new records or makes changes to a record.[69]

The Explorer feature allows users to utilize a keyword search, with filters including taxon, location, year collected, and type of record. The system is also searchable by map (repository or boundaries for specimens). Although the database is in most terms very comprehensive, images are not often connected to the record and must be located through a separate search feature. The record itself includes sections on the data set; event information, or the location and date of collection; the taxonomy of the specimen, in detail; a geospatial representation (a map, provided by Google Maps); additional properties of the specimen; and data quality tests, which compares the data input from the institution against what it deems to be completeness.

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[68] Bruce Ford, communication with author, March 11, 2019.
[69] Canadensys, "University of Manitoba," https://data.canadensys.net/collections/public/show/in17

Canadensys supports researchers by providing VASCAN, the definitive Database of Vascular Plants of Canada, which gives all accepted names of the known vascular plants in Canada, Greenland, and Saint Pierre and Miquelon.[70] While this does not connect directly to the Explorer database, it provides an easily searchable system for verifying names in French and English, and scientific names, as well as synonyms and alternative names. It also provides the distribution of the plants and the habit (what type of plant it is). Although it is unclear whether indigenous names of plants are included in the system, including names this way acknowledges that while French and English are official languages in Canada, there are other knowledge systems of the land that should be recognized as well.

The Canadensys platform allows herbaria to enter a realm of, as Cook described, "virtual 'archives without walls,' existing on the Internet to facilitate access by the public to thousands of interlinked record-keeping systems."[71] In seeing specimens as records, and these uploaded photos as digital surrogates, this platform provides a great user interface with participating repositories in Canada.

Many archives are incorporating their collections onto database systems. In a local example, the Manitoba Archival Information Network (MAIN) is an online database system consisting of thirty-six archives. It is an initiative of the Association of Manitoban Archives and allows institutions which would otherwise not be able to host their own databases to upload descriptions of their holdings.[72] Although MAIN primarily exists as an entry point to collections, some digital objects are available for viewing on MAIN. These sorts of databases allow for opportunities in linked data, where connections can be made between archives facilities based on

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[70] Canadensys, "VASCAN," https://data.canadensys.net/vascan/about
[71] Terry Cook, "Archival science and postmodernism: new formulations for old concepts," *Archival Science* 1 (2001): 23.
[72] Manitoba Archival Information Network, "About," https://main.lib.umanitoba.ca/about

expanding how records and their creators are described. As mentioned in the previous section, the multidimensional description put forward by RiC-CM allow for archivists to link between various collections. This allows for greater ease of access, especially for users who may not be familiar with searching in archival collections and prefer a "Google" type of subject searching. The conversion of finding aids into linked data formats, or the addition of metadata in creating linked data, results in the ability to conduct more detailed searching.[73]

Comparing functions: preservation

Due to the fragile nature of physical botanical specimens, there are several important preventative preservation techniques that are employed in herbaria to ensure the specimens are maintained from the field to the repository. Considering that the majority of materials preserved in herbaria would otherwise degrade naturally, it is impressive to consider that some herbaria have specimens which are hundreds of years old.

In considering the types of materials used with the mounting of botanical specimens, experts have encouraged the use of materials that would prevent any issues in degradation. Many of these materials are similar to those used in archival settings. Other important techniques include ensuring that collections are not made during a time of dew or rain;[74] inspecting incoming specimens for signs of insects or mould;[75] using acid-free paper for mounting and specimen labels, and waterproof ink when writing on specimen sheets;[76] covering specimens with a light, thin sheet of paper, also known as a "flimsy" to protect them;[77] and keeping herbaria

[73] Jinfang Niu, "Linked Data for Archives," *Archivaria* 82 (Fall 2016): 94, 105.
[74] Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 546.
[75] Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 565.
[76] Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 563.
[77] Womersley*, Plant Collecting and Herbarium Development*, 76.

at temperatures below 21C and between 30-40% humidity.[78] However, despite preventative efforts, curators must sometimes respond to the threat of insects within the collections. Herbaria no longer typically use chemical treatments like naphthalene or paradichlorobenzene due to concerns about their dangers to humans.[79] Instead, often as a preventative measure, specimens are frozen or heated using extreme temperatures to kill insects and mould; insect-proof containers are used to store specimens, even in the processing stages; and all workstations are kept clean and clear.[80]

Best practices have also been suggested for considering when specimens would need to be destroyed in order to facilitate research. When herbaria specimens are sampled for DNA testing,[81] researchers should document their work, specifying that a sample has been taken of the specimen (the typical sample is about five millimetres in diameter, but this should be clarified as well); the project the sample is used in; the researcher, and the researcher's institution; and the resulting data. It is also common practice to send a copy of the published project to the herbarium for future reference.[82]

The OAIS model was created to lead archives towards a "common framework from which to view archival challenges, particularly as they relate to digital information" with the goal of "[enabling] more organizations to understand the issues and take the proper steps to ensure Long Term information preservation."[83] In this model, whether concerning a Digital Object or a

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[78] Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 565.
[79] Womersley, *Plant Collecting and Herbarium Development,* 74 suggests their use in 1981; Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 565, warn against their use in 2015.
[80] Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 565.
[81] This application of DNA testing can be compared to other projects using archival documents for DNA testing, such as Timothy L. Stinson, "Knowledge of the Flesh: Using DNA Analysis to Unlock Bibliographical Secrets about Medieval Parchment," *The Papers of the Bibliographical Society of America* 103, no. 4 (December 2009): 435-453.
[82] Smith and Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," 567.
[83] CCSDS, *OAIS*, 1.3.

Physical Object, the needs of preservation are described by the Preservation Description Information (PDI). The PDI is a set of Information Objects which include Provenance, Reference, Fixity, Context, and Access Rights Information.[84] These Information Objects qualify records by ensuring that the Content Information is what it says it is, providing context of its creation and information on how to access the formats; and giving a picture of the possible change over time due to loss of information.[85] This constant documentation of change is incredibly important to the OAIS model.

In herbaria, some aspects of PDI are captured through other contextualizing information, such as field notes. The Provenance Information, which is intended to show the origins and custody of the object,[86] is contained within information provided to the Archive such as original habitat and collector. Reference Information, which is used to identify the Content Information,[87] could consist of the identifier provided by the Archive to track the specimen. Context Information, which illustrates how the object is connected to its broader environment, could be compared with the taxonomic description of a specimen. There is less of a comparison to Access Rights Information, which refers to legal restrictions on the Content Information,[88] and to Fixity Information, which refers to the information used to identify if any undocumented changes are made to the Content Information.[89] The lack of an analogous marker for Fixity Information could mean that Content Information in a specimen may be missing between the original preservation and subsequent viewing.

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[84] CCSDS, *OAIS*, 1-13.
[85] CCSDS, *OAIS,* 4.2.1.4.2.
[86] CCSDS, *OAIS*, 1-10.
[87] CCSDS, *OAIS*, 1-14.
[88] CCSDS, *OAIS*, 1-8.
[89] CCSDS, *OAIS*, 1-11.

Another aspect of OAIS preservation that transfers well is the consideration towards preserving additional copies of objects. This chapter has considered the changing state of a single specimen from field to folder as undergoing processes similar to the SIP, AIP, and DIP of OAIS. In OAIS, this involves extracting, repackaging, and duplicating data, all the while documenting the steps taken between processes. In herbaria, there may be duplicate specimens saved for remote access requests, as a copy of a AIP would be made and repackaged as a DIP.[90] However, this does not necessarily meet the same rigour as the OAIS model, where duplicates are made, and often saved in a variety of formats to ensure the preservation of the content. Although herbaria preservation techniques are well-established in terms of preserving a single specimen, the concept as described by OAIS would elevate the function preservation in herbaria by ensuring the changes from field to folder are documented, and that when "originals" are handled, their condition can be closely monitored. While this applies to the physical specimen, it also is pertinent to considering the preservation of digital surrogates of specimens.

Chapter 1: Conclusion

In the consideration of herbaria as archive, it is clear that there are more similarities between practices than may otherwise appear. Using archival definitions, botanical specimens can be rationalized as a type of record that needs to be managed. The translation of archival functions of appraisal, arrangement and description, preservation, and access each apply to the herbaria. Suggestions to improve research capabilities, such as contextualizing records beyond what is included on the label, strengthens the informational value of botanical specimens to

[90] CCSDS, *OAIS,* 4.1.1.2, 4.1.1.7.

researchers in a variety of fields. Further connection between archival repositories of all types benefits their practice and their outcomes.

Chapter 2: Societal Provenance

In accepting herbaria as archives and botanical specimens as records, archival theory can and should be applied within the herbarium in order to have a better understanding of the context of the record. In this chapter, I apply societal provenance to herbaria collections and botany as a discipline. The European archival tradition is one worldview's way of understanding how to preserve information; similarly, the western science known as botany is one worldview's understanding of the natural world. In considering the origins of the records in herbaria, we must also recognize the origins of the knowledge botany was built upon. This chapter begins with a discussion of the colonial nature of archives, the importance of a postmodern archival lens, and the theory of societal provenance. Next, it discusses the history of botany and its colonial roots. Early European botanical researchers based much of their research on exploiting Indigenous Knowledge (IK). To illustrate this, I discuss an early naturalist and Hudson's Bay Company employee, James Isham, an individual existing at an intersection of colonial expansion and burgeoning scientific research. Finally, this chapter explores issues pertaining to IK within colonial institutions, discusses steps currently being taken to decolonize institutions, and the possibility of participatory description as a means to decolonize herbaria.

Colonialism in archives, postmodernism and archival theory

It is important to position the colonialism inherent in archives and archival practice as part of this discussion of the formation of knowledge. The narratives, worldviews, and knowledge retained within archives is dependent on those responsible for choosing what is worthy of preserving. Traditionally, this reflects a Eurocentric, positivist view of the past which

focuses on collecting "objective facts."[1] Western/European traditions consider a certain type of record to be reliable or to be used as a form of evidence, namely those which are written. This places preference over "unwritten and communal cultural testimony – the songs, ceremonies, artwork – of [Indigenous] traditions."[2] By focusing on certain types of records above others, particularly in colonial states such as Canada, archives serve to uphold this power by protecting the "official" records of power. The holdings of archives in Canada are dominated by the records of white settlers, primarily male, and primarily of a higher economic class. The danger here is the implicit impression that because there are no competing narratives available, the dominant narrative is the only narrative.

The inclusion of a postmodern lens upon archival theory and practice has encouraged archivists to problematize records, records creators, and their own profession. Terry Cook's description of the paradigm shifts in how archivists consider records place archivists as "active agents" in the creation of knowledge,[3] undoes the characterization of records creators and archivists as impartial and neutral,[4] and challenges dominant ideas such as "universal truth" and "objective knowledge."[5]

Verne Harris' discussion of the role of archives and archivists in the context of a post-apartheid South Africa resonates to a wide variety of archives, but particularly to those in colonial states. His naming of archivists as "memory-activists"[6] places responsibility on those in the field to see themselves as active participants in the creation of history. While his discussion is

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[1] Raymond Frogner, "'Lord, Save Us from the Et Cetera of the Notary': Archival Appraisal, Local Custom, and Colonial Law," *Archivaria* 79 (2015): 125.
[2] Frogner, "'Lord, Save Us from the Et Cetera of the Notary,'" 126.
[3] Terry Cook, "Archival science and postmodernism: new formulations for old concepts," *Archival Science* 1 (2001): 4.
[4] Cook, "Archival Science and Postmodernism," 7.
[5] Cook, "Archival Science and Postmodernism," 7.
[6] Verne Harris, "Jacques Derrida Meets Nelson Mandela: Archival Ethics at the Endgame," *Archival Science* 11, no. 1-2 (2011): 114.

much more focused on a government or corporate context, as opposed to the collection of an herbarium, Harris still raises questions on how knowledge is kept. In the case of an herbarium, the knowledge of one system (western science) is privileged over others (IK systems). The root of the issue in archives is as Harris describes: "Here, beneath the surface whirl and clatter of information is where the instruments of power are forged. Instruments which in their most fundamental of operations create and destroy, promote and discourage, co-opt and discredit contexts."[7] Herbaria are the places where the primary sources of botany are stored and where the information for the science is drawn from – but the privileging of colonial science has led to the erasure of IK in botany as a discipline.

Societal provenance

Tom Nesmith has described societal provenance as the combinations of multiple factors, such as social, economic, and political context which influence the creation and use of a record. By considering these factors, archivists move beyond "limited, surface level characteristics" to delve into how the societal context of the creator has impacted the record.[8] Instead of seeing provenance as simply "the origin or source of something,"[9] archivists are encouraged to ask how a creator came to make a record; how the record was intended to be used, and how it has been used; why a record has been saved; and what will be seen as "trustworthy, authentic, reliable, worth remembering or forgettable, and how and when such information is used, and by whom."[10]

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[7] Verne Harris, "Jacques Derrida Meets Nelson Mandela," 120.
[8] Tom Nesmith, "The Concept of Societal Provenance and Records of Nineteenth-Century Aboriginal–European Relations in Western Canada: Implications for Archival Theory and Practice," *Archival Science* 6, no. 3 (December 2006): 352.
[9] Society of American Archivists, *Dictionary of Archives Terminology*, "Provenance," https://dictionary.archivists.org/entry/provenance.html
[10] Nesmith, "The Concept of Societal Provenance," 352.

The social position of the creator influences what can be saved, how it is recorded or interpreted, and how it can be accessed.

Nesmith uses the example of the meeting of two cultures in North America during the Fur Trade, discussing an amalgamation and absorption of cultures which challenges ideas of cultural dominance regarding information. Nesmith raises the point that these early interactions were not one-sided and, in the context of information exchange, this upsets the view that Europeans "imposed their worldview" on Indigenous people.[11] However, as time went on, access to information and communication created a power imbalance between Europeans and Indigenous people which manifested in violent and harmful ways, such as the banning of cultural ceremonies including the potlatch and Sun Dance ceremonies, the creation of residential schools, and the Sixties' Scoop. The ethos of a settler society to place preference on the validity of written word over oral traditions, combined with "interventionist laws and regulations to surveil, control, and direct indigenous lives," allowed settler states such as Canada to impose assimilation tactics on Indigenous people and exert control over them.[12] Nesmith discusses the importance of societal provenance in the context of colonial archives, which hold records based on Indigenous knowledge pertaining to "technological, agricultural, military, cartographic, economic, medicinal, weather and wildlife information."[13]

Societal provenance encourages users to consider the sources of knowledge behind the recording, not just the person who wrote down the ideas. In doing so, the source of the information is recognized and the record itself is contextualized in a more fulsome way. Nesmith encourages archivists to acknowledge the contexts of creation while understanding that

[11] Nesmith, "The Concept of Societal Provenance," 355.
[12] Frogner, "'Lord, Save Us from the Et Cetera of the Notary,'" 128.
[13] Nesmith, "The Concept of Societal Provenance," 353.

provenance is not singular: "All of these people play a role in causing the record we see today to exist. Their actions all have societal drivers, contexts and impacts as well. This overall history of the record is the provenance of the record."[14] Botanical specimens, particularly those collected soon after contact, were identified as useful, located, and named by the Indigenous peoples that early naturalists came in contact with, and this should be appreciated as part of the archival information.

Problematizing natural history

The term "natural history" refers to early botanical, zoological, geographical, and astronomical study during the eighteenth century, with the practitioners of this study dubbed "naturalists." The principles of study were focused on the collection and identification of different species, and due to the informal and nascent field, the distinction between professional and amateur was blurred.[15] While this chapter uses the term natural history broadly in order to describe the applications of it within other frameworks, the majority of the examples will consider studies of plants and animals.

Londa Schiebinger and Claudia Swan characterize colonial botany as "the study, naming, cultivation, and marketing of plants in colonial contexts," resulting from the progression of European imperialism. In order to fund colonial projects, Europeans exploited the natural resources found in their colonies, thereby encouraging further study on the natural history of the region.[16] Much of what science understands about the environment originally came from

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[14] Nesmith, "The Concept of Societal Provenance," 359.
[15] Stuart C. Houston, T. F Ball, and Mary Houston, *Eighteenth-Century Naturalists of Hudson Bay* (Montreal, Que.: McGill-Queen's University Press, 2003), 11-14.
[16] Londa L. Schiebinger and Claudia Swan, *Colonial Botany: Science, Commerce, and Politics in the Early Modern World* (Philadelphia, Pa.: University of Pennsylvania Press, 2007), 2.

Europeans collecting information derived by Indigenous peoples around the world. This is particularly true where it concerns botany, and in this lens, the history of the field has been problematized by historians. The imperial powers of Europe were concerned with exploiting living resources, whether they be flora, fauna, or human. The colonial project of collecting knowledge also led to the collection of species and people as "curiosities" of the world.

As botany was being built as a discipline, much of the field work was conducted by otherwise amateur researchers. While this is not to say that these researchers were not educated – many were doctors, part of religious orders, and/or connected to scientific academies[17] - the novelty of the science meant that many became involved with the science as a hobby. In the early nineteenth century, science was viewed as a "fashionable" hobby, particularly for women.[18] Educational texts were written with targeted groups in mind, including women and people of a lower economic standing, to introduce the science to a broader audience. Despite this broadening, the vast majority of those trained in botany or other sciences were Europeans or of European heritage.

In colonial states such as Canada, the introduction of scientific societies acted as "a mark of the socially cultured, usually associated with the upper classes," elevating the nation from the status of "a mere colonial backwater with no intellectual and scientific interests, activities or aspirations."[19] Women were encouraged to study sciences in order to become well-rounded, engaging individuals, and purportedly, "more successful mothers."[20] Similarly, early historical societies such as the Literary and Historical Society of Quebec, founded in 1824, spoke to

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[17] Londa L. Schiebinger, *Plants and Empire* (Cambridge, MA: Harvard University Press, 2009), 23.
[18] Ann B. Shteir, *Cultivating Women, Cultivating Science* (Baltimore, MD: John Hopkins University Press: 1996), 4.
[19] Kerrie Kennedy, "Science Culture in the Nineteenth Century: Women and the Botanical Society of Canada," *Resources for Feminist Research* 33, no. 3/4 (2010): 51-52.
[20] Shteir, *Cultivating Women, Cultivating Science,* 2.

similar desires of elevating the history of the region, to "raise us in the moral and intellectual scale of nations. It will cherish our noblest feelings of honor and patriotism, by showing that the more men become acquainted with the history of their country, the more they prize and respect their country and themselves."[21]

In all, science was seen as a way to improve society. However, it did not necessarily mean that these hobbyists were welcomed into academic or institutional settings. Scientific societies allowed for public discussion and new information to be shared with a wider audience.[22] Women were not consistently welcomed into scientific societies, and if they were, women were not always afforded the same respect or signifiers as men. For example, in the Royal Botanical Society of Canada, men could be members, subscribers, or Fellows, though the only category that women would fall into was "Lady Members."[23] Although largely excluded from the professional class, women did participate in the advancement of the science as textbook authors, illustrators, and specimen collectors.[24]

Although settlement by Europeans escalated in North America, the majority of botanical specimen collection conducted on the continent prior to the nineteenth century was by visitors, rather than settlers, due to a lack of "wealthy leisured people" in the colonies who would otherwise be able to devote time to such a project.[25] A lack of access to the time and resources needed for botanical research outside of one's own neighbourhood excluded many potential researchers from contributing to the creation of the science. This social stratification also impacted the records created by botanical researchers, as only the people who had time or money

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[21] Literary and Historical Society of Quebec, "Address to the Public," as quoted in Ian E. Wilson, "'A Noble Dream': The Origins of the Public Archives of Canada," *Archivaria* 15 (Winter 1982-1983): 16-17.
[22] Kennedy, "Science Culture in the Nineteenth Century," 49.
[23] Kennedy, "Science Culture in the Nineteenth Century," 55.
[24] Shteir, *Cultivating Women, Cultivating Science,* 4-5.
[25] Ted Binnema, *Enlightened Zeal: The Hudson's Bay Company and Scientific Networks, 1670-1870* (Toronto: University of Toronto Press, 2014): 8.

to travel to European colonies were able to write the foundation of the botanical discipline. As specimens were taken from colonies to colonial powers, they were accompanied by records relaying the expansion of empires.

The ideas of qualifications in the early days of the science were hypocritical, as those who would become part of the professional class began as amateurs themselves and relied on the contributions of those they called amateurs for new specimens.[26] For example, the director of Kew Gardens, Joseph Hooker, strove to keep the amateurs out of professional settings and conversations by suggesting a tax on microscopes.[27] At the same time, Hooker, and those like him, needed the cooperation of those based in outlying areas in order to collect the widest breadth of specimens. The contributions of amateurs have been only seen through the intervention of those "institutionalized scientists," or those who were considered "professionals."[28] Perceptions about power, and the possibility of losing power, contributed to some of this stratification.

In the context of natural history, the ability to name species allowed practitioners an authority over others, to the extent that individuals were able to create systems and consolidate knowledge. An example of this is Carl Linnaeus, an early botanist behind the popularization of binomial nomenclature. Linnaeus saw himself as executing "God's work," casting himself as Adam in the Christian creation story, both in the naming of God's creatures and through the domestication of said creatures in order to return to an Edenic paradise.[29] Although Europeans may have had a philosophy of a world designed by divine intervention wherein each region of

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[26] Kennedy, "Science Culture in the Nineteenth Century," 50.
[27] Jim Endersby, *Imperial Nature: Joseph Hooker and the Practices of Victorian Science* (Chicago: University of Chicago Press, 2010): 77.
[28] Kerrie Kennedy, "Science Culture in the Nineteenth Century," 50.
[29] Lisbet Koerner, *Linnaeus: Nature and Nation*, (Boston: Harvard University Press, 1999): 94.

the Earth received different species, the introduction of the variety of potentially profitable species shifted this thinking.[30] In 1746, Linnaeus advocated for the collection of plants from outside of a nation's territory. While this may have begun as a project to cultivate new, profitable crops, Linnaeus' promotion of economic botany and the transplanting of species from around the world gave rise to the institution of plantations outside of Europe.[31]

Natural history institutions, such as the British Museum, clamoured to hold the most variety of species and used their collections as a tangible display of "British imperialism's brilliance in the post-Napoleonic period."[32] As researchers returned from expeditions abroad, they would be encouraged to donate their specimen collections to such institutions in order to be catalogued and kept. While part of this was for the sake of posterity – a single venue to "keep" the curiosities brought back – it has also been characterized as a political tactic to advertise the success of the British Empire.[33] Due to this centralization, foreign researchers were compelled to conduct their studies within British collections. It also allowed the British Museum to take a leading role in the professionalization of the natural sciences.

In the early-nineteenth century, arguments regarding the acceptable naming and classification standards waged within the British Museum, with many scientists preferring Linnaeus' *binomial nomenclature* and existing classifications over the French-influenced *natural system* imposed by Assistant Keeper William Leach during his tenure.[34] The popular binomial nomenclature used two words: the first word to denote the genus, the second word to denote the

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[30] Alan Bewell, *Natures in Translation: Romanticism and Colonial Natural History* (Baltimore, Maryland: Johns Hopkins University Press, 2016), 102.
[31] Bewell, *Natures in Translation*, 102.
[32] Gordon McOuat, "Cataloguing power: delineating 'competent naturalists' and the meaning of species in the British Museum," *British Journal for the History of Science* 34, no. 1 (2001): 6.
[33] McOuat, "Cataloguing power," 6-7.
[34] McOuat, "Cataloguing power," 9-11, 15-16.

species, and aimed to be a standard for the science. The natural system encouraged cataloguers to group based on closer shared characteristics than what had been identified by Linnaeus.[35]

Regardless of the particular style of naming, it is interesting to consider the impacts which individuals have left on the creation of a science. While his peers may have disagreed with his methods, Leach's work in classifying species within the British Museum's collection rippled through the scientific community because the institution itself provided access to a great variety of specimens. The novelty of objects, based on the names assigned to them, created a sort of value which then imbued the institution with a certain status.[36]

Within this discussion, however, was a glossing over of the traditional names, uses, and Traditional Knowledge of Indigenous peoples. In the cases where researchers collected such information, it was rarely included or considered in the classification of species.

James Isham: a study in colonial botany

The Hudson's Bay Company (HBC, 1670-present) is an example of an entity at an intersection between science, colonialism, Indigenous Knowledge, and archives. As a corporation founded in England, the fur trading company acted as a "fertile knowledge network" to scientific institutions such as the Royal Society of London, many of whose members were investors in HBC.[37] While these two organizations remained distinct and did not have a formal policy of cooperation, regular communication did occur due to the initiative of individuals who shared the same interests.[38] HBC later supported the Royal Society by allowing naturalists to accompany expeditions in order to boost its public image. These naturalists acted as observers,

[35] McOuat, "Cataloguing power," 16, 18.
[36] McOuat, "Cataloguing power," 18.
[37] Binnema, *Enlightened Zeal,* 13.
[38] Binnema, *Enlightened Zeal,* 47.

reporting back to the public to encourage HBC's image as "liberal, generous, enlightened… zealous, and open" for supporting a scientific society, and as benevolent and charitable to the Indigenous peoples HBC relied on for trade.[39]

The Royal Society also relied on botanical aficionados abroad, such as James Isham (1716-1761).[40] Much of what is known about Isham is a result of his personal writings, *Observations on Hudson's Bay, 1743,* and *Notes and Observations on a Book Entitled a Voyage to Hudsons Bay in the Dobbs Galley, 1749,*[41] which revolved around Isham's experiences as a Trader and Factor at HBC posts York Fort and Churchill. While there is some implication he may have met with Dene and Inuit traders, the majority of his contact was with Swampy Cree people. Putting his creative spelling or shorthand aside, Isham's attempts at translating Cree words and phrases, as well as some remarks on their customs, is notable as a source of primary information on Indigenous people in Hudson Bay in this time period. However, his opinions about some cultural practices and personalities are coloured by a paternalistic and prejudiced perspective on the Indigenous people he encountered.[42] The Cree-English dictionary, which may be the first of its kind,[43] seems to be an attempt to facilitate communication between Europeans and Cree people. Critical readings of similar language resources created by agents of colonialism, including other examples from HBC, note the self-interested nature of these records. By supplying a language resource to Europeans, particularly one pertaining to the terms of

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[39] Binnema, *Enlightened Zeal,* 10.
[40] E.E. Rich, "Isham, James," in *Dictionary of Canadian Biography*, vol. 3 (University of Toronto/Universite Laval, 2003).
[41] James Isham, *Observations on Hudson's Bay, 1743, And, Notes and Observations on a Book Entitled a Voyage to Hudsons Bay in the Dobbs Galley, 1749,* The Publications of Hudson's Bay Record Society, vol. 12 (Nendeln, Liechtenstein: Kraus Reprint, 1968). Original archival records found at: Hudson's Bay Company Archives, Archives of Manitoba, Observations and Notes by James Isham submitted to the Governor and Committee.
[42] James Isham, *Observations,* 76, 77, 80, 81, 103.
[43] Houston, Ball, and Houston, *Eighteenth-Century Naturalists of Hudson Bay,* 44.

possible resources for extraction, HBC employees were able to expedite trading and relationships which would benefit HBC activities in North America.[44]

Isham documented many different types of plants and animals local to the region, noting migration patterns and usage by Indigenous peoples.[45] He was particularly interested in documenting birds, and acknowledged the great diversity of species in the area:

> I have made itt my Buisness to gaine the Names of all the Different sorts and Kinds of fowl's in these parts but when I consderd and found by the Long Enquire I had made, that itt was an untertaking almost unpossable for the time I shoud reside in these parts, their being such a perdigious Variety of fowls, I then imagin'd itt wou'd be better to trop such then proceed,—But having had Information and Knowledge of some sorts, I have here given a Small acc't of them, tho I may firmly say not a 10th part of the Sorts and Kinds of fowl's in these parts.[46]

While this interest may have been a hobby for Isham and beyond the interests of HBC, he took it very seriously. Although the level of detail varies, he made a great effort to describe the plumage of birds, making distinctions between similar species; the migratory patterns, including when they could be expected to leave and return to the area in relation to each other; and most interestingly, and perhaps most pertinent to his job, whether the species was edible and how it tasted.[47]

Isham had a working relationship with an ornithologist named George Edwards. Edwards received specimens from individuals around the globe, which he then etched, painted, and published. Edwards is credited with the identification of eighty-six North American bird species, thirty of which were based off the specimens contributed by James Isham, who purportedly

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[44] Samantha Booth, "The Role of Archives in Indigenous Language Maintenance and Resurgence," (Master of Arts Thesis, University of Manitoba, 2020), 18.
[45] Isham, *Observations,* 66, 70-71.
[46] Isham, *Observations,* 119-120.
[47] Isham, *Observations,* 120-126.

delivered them to Edwards personally while visiting London.[48] Edward's publications were used by Carl Linnaeus to create his definitive species list in 1758.[49] Through these networks, information and specimens were transferred across oceans, enshrined in international standards, and held as the standard for their species. What makes this even more impressive is the acknowledgement that James Isham had no formal training in collecting or preserving specimens. In the time Isham was working, natural history as a field was still in its early stages. While perhaps not concerned with the same outcomes as the ornithologists he aided, James Isham, a Factor stationed in North America, was a contemporary of and collaborator with, a notable figure in the history of science.

Isham's inclusion of plant descriptions seems to have come upon the request of HBC's Committee that "Factors should send home the roots of herbs, plants and shrubs, with seeds, berries and kernels, whilst the Surgeons should identify them by their [Indigenous] names and list their qualities."[50] The separation of roles – the Factor as a collector, the Surgeon as a researcher – seems to indicate some division of labour or perception of skills, although Isham took to both tasks. Much of this information was focused on edible or otherwise useful plants, focusing on what might be beneficial to settlers. Isham took effort to describe plants he was familiar with and those he was introduced to, making note of many characteristics of the plants, including the difference in size, shape, colours, growing conditions, and taste. For instance, "A Yellow Berrie Grow's here (alias) Borocatomenuck which is Like unto a Rasberrie for bigness, and tast, but grows on a plant not above 5 inches from the ground, also a Red berrie which in

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[48] Houston, Ball, and Houston, *Eighteenth-Century Naturalists of Hudson Bay,* 17; Binnema, *Enlightened Zeal,* 66.
[49] Houston, Ball, and Houston, *Eighteenth-Century Naturalists of Hudson Bay,* 45.
[50] E.E. Rich, "Introduction," in *Observations on Hudson's Bay, 1743, And, Notes and Observations on a Book Entitled a Voyage to Hudsons Bay in the Dobbs Galley, 1749,* The Publications of Hudson's Bay Record Society, vol. 12 (Nendeln, Liechtenstein: Kraus Reprint, 1968), xxxvi.

taste Like a Rasberry and also Grows Low."[51] The most relevant recording to HBC was the use of the plant - for instance, his own use of wishakapucka tea (also Ojibwe: wish-a-ca-pucca; also Cree: maskêkopakwa;[52] also English: Labrador tea):

> Plants of Physicky Herb's Several are growing in these parts one of Which they styl (wishakapucka) which is us'd as a perge or fomentation, but the English in these parts makes a Drink of it, going by the Name of wishakapucka tea, being of a fine flavour, and Reckon'd Very wholesome,— I was troubled Very much my Self with a Nervious Disorder, but by Constant Drinking 1 pint made strong for three months Entirely cur'd me, &c.[53]

Despite his thoroughness, there are still some questionable identifications. For instance, Isham's conjecture that plum and cherry trees were growing "a Considerable Distance"[54] from the fort. While the term "considerable distance" is subjective, it seems more likely that Isham misidentified a plant, rather than plum trees growing wild along Hudson Bay.

As with all records made at the posts regarding of the daily life, and encounters or trade with Indigenous people or wildlife, Isham's writings were submitted to HBC's Governor and Committee. *Observations* was prepared specifically for a parliamentary inquest in 1749 regarding "the condition of the Hudson Bay area and the trade occurring there."[55] This consistent flow of information from the colonies to the seats of power meant that the knowledge of Indigenous peoples was being moved across oceans to be stored by people who sought to exploit it. This information, such as fur counts, types of habitat, and other possible resource extractions were considered by colonial powers in order to establish larger presences in this territory.

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[51] Isham, *Observations*, 133.
[52] Miyo Wahkohtowin Education Authority, *Nehiyaw Masinahikan Online Cree Dictionary*, "Maskêkopakwa," https://www.creedictionary.com/search/index.php?q=mask%C3%AAkopakwa&scope=1&cwr=26634
[53] Isham, *Observations*, 134.
[54] Isham, *Observations*, 133.
[55] Hudson's Bay Company Archives, Archives of Manitoba, Observations and Notes by James Isham submitted to the Governor and Committee, Archival Description – Scope and Context, http://pam.minisisinc.com/scripts/mwimain.dll/144/PAM_DESCRIPTION/DESCRIPTION_DET_REP/SISN%203958?sessionsearch

In *Observations*, Isham does not specify who informed him of the names and uses of all the plants and animals he reported to Edwards and HBC, but all the information was derived from knowledge learned from Indigenous people. Later records show that Indigenous people also contributed to specimen collection. Even though references are not consistently given, scientists of the Smithsonian Institution relied on Indigenous people to "[collect] a majority of the natural history specimens submitted to scientists from the HBC territories in [the nineteenth century] - and in previous periods."[56] Officers and naturalists could rely on Indigenous people because of existing relationships and positions related to the fur trade. In some instances where collectors are cited, the people who are named happen to be those of mixed heritage, with European surnames.[57] Whether this speaks to a social stratification based on parentage or whether naturalists were unconcerned with documenting the knowledge provided by Indigenous people, what modern readers can take away is that Indigenous peoples have contributed to scientific knowledge at several stages of its history, and yet have not been credited for that knowledge.

Indigenous Knowledge (IK)

Indigenous Knowledge, also known as Traditional Knowledge or Indigenous Traditional Knowledge, are the systems of information passed down through generations of Indigenous Peoples to present day, regarding a wide variety of technological, cultural, biological, and medical subjects. These are sourced through observation, spiritual teachings, oral traditions, Elders' knowledge, and through other Indigenous theories and methodologies.[58] While the term

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[56] Binnema, *Enlightened Zeal*, 272.
[57] Binnema, *Enlightened Zeal,* 272.
[58] Greg Younging, "The Traditional Knowledge – Intellectual Property Interface," Chapter 5 in *Indigenous Notions of Ownership and Libraries, Archives and Museums*, ed. Camille Callison, Loriene Roy, and Gretchen Alice LeChimant (Berlin, Munich: De Gruyter Saur, 2016): 54.

"Traditional" may suggest something only in the past, IK is "part of a living and evolving culture captured in all forms whether held in archival repositories or by a community…[i]t is inclusive of but not exclusive to pre-invasion knowledge."[59] Greg Younging compares the appropriation of knowledge to the justification of the act of colonizing Turtle Island, *terra nullius*, meaning nobody's land, by coining *gnaritas nullius,* nobody's knowledge.[60] This mentality allows credit for scientific "discoveries" to be claimed by European individuals, without regard for the source.

Younging's consideration of IK in relation to intellectual property rights (IPR) is pertinent to this discussion regarding appropriated knowledge. Younging raises specific concerns about the incongruity of acknowledging IK through IPR. If claims of copyright ownership were to be made, because of the age of the knowledge it would be considered part of the public domain. Additionally, IPR typically puts focus on identifying an individual as the source of the information, whereas in IK, knowledge is shared as a collective and there can be no individual owner. When IK is considered part of the public domain, this means that others could have access to culturally or spiritually sensitive knowledge beyond those specified knowledge-holders in a community.[61] At the same time, under copyright laws, IK and records about Indigenous Peoples could "belong" to non-Indigenous people or organizations.[62] While these concepts may not have been part of early botanists' or archivists' considerations, it falls to the current generation to take steps to correct and adapt behaviours. This includes acknowledging sources of IK and other information provided by Indigenous communities, as well as honouring the wishes of Indigenous communities concerning access to records and research projects.

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[59] Terri Janke and Livia Iacovino, "Keeping cultures alive: archives and Indigenous cultural and intellectual property rights," *Archival Science* 12, no. 2 (2012): 154.
[60] Younging, "The Traditional Knowledge – Intellectual Property Interface," 56.
[61] Younging, "The Traditional Knowledge – Intellectual Property Interface," 55.
[62] Janke and Iacovino, "Keeping cultures alive," 156, 160.

A major concern within this discussion of IK and access to records revolves around the varying degrees of appropriate access to culturally sensitive knowledge, based on culturally determined frameworks. Some may critique these terms of access based upon a misconception that Indigenous communities are trying to control over what ought to be part of the public domain. This goes to the heart of a double standard regarding access and acquisition in colonial archives. Not only do archives contain records pertaining to the lives of Indigenous people, but because these records had been "created" by government or church entities or private individuals, the question of prior, informed consent has not been asked to the Indigenous people or communities captured in the records.[63] For instance, a settler donor may be able to put access restrictions on their own records, preventing researchers from what may be potentially private information. At the same time, the same donor could leave records involving culturally sensitive IK open with no access restriction. The perception that culturally-based control is oppressive speaks to Younging's use of *gnaritas nullius,* nobody's knowledge[64] - suggesting that because there is no single, identified creator, the knowledge is there for the taking. The act of instituting culturally-determined controls is just one way of transmitting knowledge, and should not be viewed as being "oppressive" to those outside the community, because it relies on existing relationships of "obligation and reciprocity" that settlers are not automatically entitled to.[65]

In regards to other records relating to Indigenous people in settler archives, archivist Carmen Miedema suggests that archivists require researchers to ask permission from the communities of origin, as one might do when records are restricted. In addition to building

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[63] Kimberley Christen, "Does information really want to be free? Indigenous knowledge systems and the question of openness," *International Journal of Communication* 6 (2012): 2876.
[64] Younging, "The Traditional Knowledge – Intellectual Property Interface," 56.
[65] Christen, " Does Information Really Want to be Free," 2875.

relationships with those communities, this also encourages researchers to outline research goals and respond to community needs, rather than the exploitative style of research that has harmed Indigenous people in the past.[66]

A commonly used set of research guidelines created in 1998 by the First Nations Information Governance Centre (FNIGC) is OCAP® (Ownership, Control, Access, and Possession).[67] These principles "provide guidance to communities about why, how, and by whom their information is collected, used, or shared."[68] The primary effort is to ensure that any information collected is done with the fully informed consent of the community in question, applied within their own context. The FNIGC created OCAP® as a response to historic and continuing behaviours of non-Indigenous researchers in their conduct with First Nations, where privacy, sensitivity, and ethics have been ignored.[69] While the FNIGC encourages non-First Nations researchers to familiarize themselves with OCAP®, the organization has recognized where there have been issues in fully realizing OCAP® within projects. These barriers include insufficient legislation or policies to safeguard entire communities; overarching legislation, such as the *Access to Information Act* or the *Library and Archives of Canada Act*, which may allow public access into government-held data; or researchers not comprehending OCAP® itself.[70] Another barrier important to this discussion is identified as academic culture, where researchers are encouraged to claim sole ownership over what they may have collected. Researchers are encouraged to present information as their own because citing ones' sources as collaborators is

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[66] Carmen Miedema, "Building bridges: dismantling eurocentrism in archives and respecting Indigenous ways of doing it right" (Master of Arts Thesis, University of Manitoba, 2020), 65.
[67] First Nations Information Governance Centre (FNIGC), "The First Nations Principles of OCAP," https://fnigc.ca/ocap.
[68] FNIGC, "Barriers and Levers for the Implementation of OCAP," *The International Indigenous Policy Journal* vol. 5, issue 2 (April 2014): 1.
[69] FNIGC, "The First Nations Principles of OCAP," https://fnigc.ca/ocap
[70] FNIGC, "Barriers and Levers," 1-4.

not seen as beneficial. In all, it considers Indigenous knowledge, and the data collected, "as a commodity and a source of prestige and academic advancement."[71] This does not reflect a respect for the origins of said data.

The United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) was passed by the international body in 2007 in order to "[establish] a universal framework of minimum standards for the survival dignity and well-being of the indigenous peoples of the world and [elaborate] on existing human rights standards and fundamental freedoms as they apply to the specific situation of indigenous peoples."[72] At the time, Canada voted against the UNDRIP.[73] Although the state has since endorsed the Declaration, at the time of writing, the Government of Canada has failed to pass legislation to enshrine UNDRIP in Canadian law.[74] Several Articles within the UNDRIP pertain to IK, particularly Article 31:

> 1. Indigenous peoples have the right to maintain, control, protect and develop their cultural heritage, traditional knowledge and traditional cultural expressions, as well as the manifestations of their sciences, technologies and cultures, including human and genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs, sports and traditional games and visual and performing arts. They also have the right to maintain, control, protect and develop their intellectual property over such cultural heritage, traditional knowledge, and traditional cultural expressions.[75]

The explicit reference to material found in herbaria, namely, genetic resources, seeds, medicines, and knowledge of the properties of flora, indicate a changing tide regarding botanical research.

While neither of these guidelines are legally binding, they are still important for researchers to internalize. Although OCAP and UNDRIP discuss the ownership of IK, there are

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[71] FNIGC, "Barriers and Levers," 6.
[72] United Nations, "Homepage - United Nations Declaration on the Rights of Indigenous Peoples," https://www.un.org/development/desa/indigenouspeoples/declaration-on-the-rights-of-indigenous-peoples.html
[73] United Nations, "Homepage - United Nations Declaration on the Rights of Indigenous Peoples."
[74] "Canada introduces bill to apply UN Indigenous rights declaration," *Al Jazeera* (3 Dec 2020): https://www.aljazeera.com/news/2020/12/3/canada-introduces-bill-to-apply-un-indigenous-rights-declaration
[75] United Nations, *United Nations Declaration on the Rights of Indigenous Peoples* (13 September 2007): 22-23.

other biases held by non-Indigenous researchers regarding the collection of Indigenous Knowledge. Whereas Indigenous Knowledge was previously excluded as having "no relevance" to science, more recent trends of "cultural exoticism" also contribute to the disregard of Indigenous knowledge.[76] This consideration of Indigenous Peoples as an "Other" to be studied, rather than as an active partner, perpetuate colonial practices of research.[77] Addressing dynamics of power in a research project is an important step in creating trust between the researcher and the community they are working with, and should include a consideration of OCAP® to ensure that the community is able to make their own choices about how information is collected, shared, and kept.

One factor that has been missing from botanical research was identified in Iain Davidson-Hunt, Phyllis Jack, Edward Mandamin, and Brennan Wapioke's 2005 article in the *Journal of Ethnobiology*.[78] Davidson-Hunt begins by writing in the first-person, explaining his original project of identification-based research with the community of Iskatewizaagegan (Shoal Lake). Davidson-Hunt was urged by the community to shift from an identification-based research project to a more holistic understanding of Anishinaabe teachings to better represent the ways in which the community interacted with and identified the plants in that region. This included participation in ceremonies, responding to the requests of Elders and knowledge-keepers, and adherence to harvesting ethics. This reconfiguring of the project responded to Anishinaabe ontology, wherein the relationships of humans, non-human living things, and the land are connected. The

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[76] Margaret Kovach, *Indigenous Methodologies: Characteristics, Conversations, and Contexts* (Toronto: University of Toronto Press, 2010), 78.
[77] Kovach, *Indigenous Methodologies,* 170.
[78] Iain J. Davidson-Hunt, Phyllis Jack, Edward Mandamin, and Brennan Wapioke, "Iskatewizaagegan (Shoal Lake) Plant Knowledge: An Anishinaabe (Ojibway) Ethnobotany of Northwestern Ontario," *Journal of Ethnobiology* 25, vol. 2 (Fall/Winter, 2005): 189-227.

Anishinaabe *izhitwaawin* (ways of life) encourage Anishinaabe people to be responsible for the *Manidoo ogitagan* (Creator's garden), the things provided by the Creator for Anishinaabe people to survive.[79] The plants could not be removed from their relationships with the land, their uses, or other living things. Noting the tendency of western scientists to only consider Indigenous names or uses of plants, harkening back to ideas of economic botany, the researchers move past this to identify different classifications into major plant groupings unique to Anishinaabe. While these sometimes refer to characteristics of a plant, the article also discusses grouping based on use, such as groups of plants that are classified as being medicines.[80] Although this classification system demonstrates non-western science and plant knowledge, the researchers also urge that without the knowledge derived from the place and plants, the creation of such classifications can become "divorced" from the holistic traditions which are part of Anishinaabe ways of life.[81]

This project provided the opportunity for IK to be recognized in the herbarium at the University of Manitoba. As specimens were collected, researchers also provided their scientific and Anishinaabe names, coordinates, habitat, and uses. The specimens are arranged in the herbarium according to western scientific classification, an alphabetical index was also created in order to identify these sources.[82] While this has provided a direct link from Indigenous people to the creation of knowledge in the herbarium, on their terms, there can and should be opportunities for further information to be shared or amended to reflect the IK which helped to create specimens in the first place.

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[79] Davidson-Hunt, Jack, Mandamin, and Wapioke, "Iskatewizaagegan (Shoal Lake) Plant Knowledge," 196.
[80] Davidson-Hunt, Jack, Mandamin, and Wapioke, "Iskatewizaagegan (Shoal Lake) Plant Knowledge," 207-209.
[81] Davidson-Hunt, Jack, Mandamin, and Wapioke, "Iskatewizaagegan (Shoal Lake) Plant Knowledge," 218.
[82] Davidson-Hunt, Jack, Mandamin, and Wapioke, "Iskatewizaagegan (Shoal Lake) Plant Knowledge," note, 221-222.

Another notable feature of this project is the participatory aspect of the research goals and outcomes. While this project could have remained simply an identification project, it was adjusted to suit the requests of the community. The members of the Shoal Lake Resource Institute are included as research associates and authors, and the Elders who shared their knowledge are referenced throughout and specially acknowledged. Unlike the early language resources of colonial agents, this project is not merely translating potentially useful words. It is intended to show a broader relationship and ways of knowing the world. The article also promotes the expansion of cultural programming for Anishinaabe people, particularly those in the community of Iskatewizaagegan, to learn from knowledge keepers/Elders about plant knowledge. This project harkens to the basics of the OCAP principles in action.

Robin Wall Kimmerer of the Citizen Potawatomi Nation has discussed at length her position as an Indigenous woman within academia, and specifically, as a botanist:

> I was born a botanist. Those plants tapped me on the shoulder and said "Pay attention." And so I did become a graduate student and subsequently a professional botanist, but what that really means is that I was privileged to spend my life on my knees in the woods learning from plants. And the whole academic enterprise, the scientific enterprise, in a way forced me in that worldview to objectify plants, to understand that if I couldn't measure it, it didn't exist in the realm of plants. And that was deeply, deeply dissatisfying to me because of everything that I had learned from plants as well as the Potawatomi perspective that recognizes the personhood of those plants. That those plants were my teachers. I had a relationship with them that I somehow had to boil down into a p-value on a table.[83]

Kimmerer speaks to a tendency within western science to objectify the natural world, in the language, research goals, and general attitudes of scientists being "purely rational" and somehow above rather than part of this world.[84] While Kimmerer recognizes that western scientific knowledge is different than IK, the intentions behind each of understanding the land are what can

[83] "Conversations around the Green Fire: Robin Wall Kimmerer," Center for Humans and Nature. Youtube. Jan 27, 2015. HumansandNature.org https://www.youtube.com/watch?v=2WRY3GoKYPc
[84] Robin Wall Kimmerer, *Braiding Sweetgrass* (Minneapolis, Minnesota: Milkweed Editions, 2013): 9.

bring these ways of knowing together.[85] This is not to say that there has always been cooperation between the two, or that the harms of the past will be immediately reconciled. For instance, Kimmerer mourns the fact that her introduction to concepts and ontologies were in a colonial language, under the terms of a dominating culture.[86] Although botanists may have collected IK in the past, what was collected was based on what botanists viewed as important. Even now, when presented with IK sources in efforts to collaborate, some botanists still consider western science as having "the unblinking assumption that science has cornered the market on truth."[87] It is projects like the Iskatewizaagegan Plant Knowledge project and the work of Indigenous researchers like Kimmerer that show the possibilities of meaningful collaboration between western science and IK.

Societal provenance and institutional change

The inclusion of societal provenance in archives allows us to see "many provenances, multiple voices, hundreds of relationships, multiple layers of context, all needing to be documented."[88] Without it, we are not giving an accurate portrayal of the world around us. In institutions where Indigenous peoples are seen as subjects rather than actors, particularly in colonial government or church archives, the impetus of community organizing and international campaigns have pressured institutions towards decolonizing. This has led archives, museums, and art galleries to interrogate the ways in which their collections are represented, described, or

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[85] "Conversations around the Green Fire: Robin Wall Kimmerer," Center for Humans and Nature. Youtube. Jan 27, 2015. HumansandNature.org https://www.youtube.com/watch?v=2WRY3GoKYPc
[86] Kimmerer, *Braiding Sweetgrass*, 50.
[87] Kimmerer, *Braiding Sweetgrass*, 160.
[88] Wendy Duff and Verne Harris, "Stories and Names: Archival Description as Narrating Records and Constructing Meanings," *Archival Science* 2, vol. 3 (2002), 274.

held.[89] Heritage institutions have a gargantuan task in correcting past mistakes, ensuring the narratives put forth are responsible, sensitive, and reflect diverse histories – even when not complimentary to colonial actors. Not only do these interactions with the public influence the way history is perceived, but it also influences the ways Indigenous peoples choose to interact with said institutions.

In a local example, the Manitoba Museum has recognized its role as a colonial institution by publicly addressing several Calls to Action of the Truth and Reconciliation Commission of Canada. This includes a brief statement of purpose which reaffirms their position as "a museum for, and about, Indigenous people." They commit to consult with Indigenous communities regarding "all aspects of museum knowledge, exhibitions, education and programs" and with Elders regarding "the care, storage and exhibition protocols related to Indigenous collections." They also promise to support Indigenous communities by providing space for Indigenous languages, as well as programming, opportunities, and exhibit changes to better reflect Indigenous experiences in Manitoba.[90] In other colonial states, such as New Zealand/Aotearoa, museums have shifted towards better representation of a "bicultural heritage." Moving beyond only including objects in exhibits to represent Māori culture, museum policies have been developed to better reflect *mātauranga* Māori (Māori knowledge) along with the recognition that Māori people are the best people to interpret and care for their *taonga* (treasure).[91]

Archivist Michelle Rydz has described the connections between societal provenance and participatory description as part of decolonizing archives. Participatory description with a

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[89] Bradford Morse, "Indigenous Human Rights and Knowledge in Archives, Museums, and Libraries: Some International Perspectives with Specific Reference to New Zealand and Canada," *Archival Science* 12.2 (2012): 113–140.
[90] Manitoba Museum, "Indigenous Connections," https://manitobamuseum.ca/main/about-us/indigenous-connections/
[91] Janke and Iacovino, "Keeping cultures alive," 166-167.

decolonizing lens has been occurring in archival spaces for decades, endeavouring to represent archival holdings with Indigenous perspectives, narratives, and sensitivity as "creators and collaborators." Rydz highlights the idea of a "community of memory," drawing on the idea of colonial societies as having a shared past, present, and future, albeit one with existing power differentials between settlers and Indigenous peoples in archival institutions. In order to correct this, participatory description is intended to provide further societal provenance on records where only one narrative is presented.[92]

This may present as naming projects, such as the Hudson's Bay Company Archives (HBCA) "Names and Knowledge Initiative," a project which Rydz has worked on. In this initiative, the HBCA has publicly solicited information from northern communities in order to identify unnamed Indigenous people and places in the HBCA's extensive photograph holdings.[93] Not only is this an attempt to properly reference individuals within the photographs, it also references the source of the identification. This can be a way of speaking back to the record, correcting a past mistake, while continuing to acknowledge the person who is making the correction.

In terms of providing control over a collection, Kimberly Christen speaks to the experience of building an extensive digital archive to reflect the needs of the Nyinkka Nyunyu (Art and Culture Centre) of the Warumungu Aboriginal community in Central Australia.[94] Working with community leaders and elders, the challenge was to create a system which would

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[92] Michelle Rydz, "Participatory Archiving: Exploring a Collaborative Approach to Aboriginal Societal Provenance," (Master of Arts Thesis, University of Manitoba, 2010), 45.
[93] Hudson's Bay Company Archives, "The Names and Knowledge Initiative," https://www.gov.mb.ca/chc/archives/hbca/names_knowledge/index.html
[94] Kimberly Christen, "Opening Archives: Respectful Repatriation," *The American Archivist*, Vol. 74 (Spring/Summer 2011): 185-210.

allow for "dynamic cultural protocols" to reflect different areas of access to different types of records and the knowledge they impart. This concern contrasts with the ideas of other "open access" initiatives to share digital materials, and in fact, has the opposite effect.[95] Instead, it speaks to a desire to share on the community's own terms, while still enabling knowledge to be shared.

Herbaria are also moving towards recognizing the role they have played in colonialism. Alexandre Antonelli, the Director of Science at the Royal Botanical Gardens, Kew, recently penned a timely editorial regarding the need for "imperialist views" of the world to be reshaped, by what he characterizes as "sharing knowledge accumulated." This returning of knowledge is intended to empower communities experiencing poverty, food insecurity, and climate instability as a result of colonialism. Antonelli also identifies Kew's goal of increasing diversity among the staff and students at Kew, as well as a digitization project of Kew's holdings to "[examine] and [update] the western-centric labels" in the system.[96] Antonelli's vision harkens to the tenets suggested in the Iskatewizaagegan-University of Manitoba project previously discuses, but endeavours to shift an entire institution towards decolonized thinking.

The focus throughout this chapter of the naming of plants and recognizing Indigenous names and uses is only one aspect to decolonizing botany. As previously mentioned, by using only the name as described by western botanists, it is as though the plants themselves did not exist prior to European contact. The naming of the plant, and the classification system used, are important parts of how the specimen is described. The ability of the "community of memory" to

[95] Christen, "Opening Archives," 189.
[96] Alexandre Antonelli, "Director of science at Kew: it's time to decolonize botanical collections," *The Conversation* (19 June 2020): https://theconversation.com/director-of-science-at-kew-its-time-to-decolonise-botanical-collections-141070

provide additional information on a record in this case helps to illustrate the full provenance of the record.

If institutions make changes in their considerations of IK, starting with terminology, others in the field will follow, as demonstrated at the British Museum in the nineteenth century. This is especially true of such internationally renowned institutions as Kew. Arguments have been put forward to encourage changes to international standards. Although there are cases in which the accepted binomial nomenclature makes some reference to Indigenous peoples or their names for plants,[97] there are also cases where racial stereotypes or actual slurs have been used as part of a species binomial name. Len Norman Gillman and Shane Donald Wright, two scientists in New Zealand/Aotearoa, have suggested that as Indigenous names predate many of the names assigned by colonial botanists, the standard names should be adjusted to reflect the "earliest legitimate name."[98] They propose a debate which would include participation from Indigenous communities, as well as Indigenous scientists, to start a conversation about how taxonomies could be changed to better reflect Indigenous names. Additionally, they propose lobbying organizations such as the International Commission on Zoological Nomenclature and submitting changes to publications.[99] Gillman and Wright characterize the changes as "an important step in the affirmation of Indigenous People's contribution to nomenclature and knowledge."[100]

Chapter 2: Conclusion

[97] Len Norman Gillman and Shane Donald Wright, "Restoring indigenous names in taxonomy," *Communications Biology* 3 (2020): 1-3.
[98] Gillman and Wright, "Restoring indigenous names in taxonomy," 2.
[99] Gillman and Wright, "Restoring indigenous names in taxonomy," 2.
[100] Gillman and Wright, "Restoring indigenous names in taxonomy," 2.

The colonial history of botany produced records which perpetuated the inaccurate myth that Europeans discovered land, species, and knowledge. By applying societal provenance to botanical specimens, greater context is provided to the records at the centre of this issue. Changes are being made to how research is conducted, which will have an impact on the ways records are created. For those records already in archives, participatory description allows for a speaking-back to the record to correct the context of those records. Herbaria are poised to be important institutions in decolonizing botany by challenging the sources of knowledge and bias that exist with collections and representations.

Chapter 3: Total Archives

As sites of primary research, the separation of herbaria and archives can hinder possible research avenues. Although records such as field notes, diagrams, research findings, and personal correspondence created by botanists have been welcomed in archival collections, botanical specimens have not been included in collection mandates, even when these materials are interrelated. When the collections of an individual are separated into different repositories, the context of the collection is lost, and along with it, the opportunity to see a collection and its creator fully.

Total archives is an archival concept largely popular in Canada, which encourages archives to "facilitate the management of current records of their sponsoring institution or level of government and acquire a small portion of these as permanent historical records, and acquire as well the records of private individuals, groups, and organizations that complement these institutional holdings, in both cases for all recording media."[1] By applying the concept of total archives to the collections of botanists and making the connection between repositories, researchers of different disciplines would have a more fulsome picture of collections and creators. This chapter discusses the history of total archives in Canada, the application of total archives as it pertains to herbaria collections, and the issues of scientific data in the archives. The chapter culminates with a case study at the University of Manitoba campus, where the collections of Dr. Arthur Henry Reginald Buller can be found in the University of Manitoba Vascular Herbarium (call sign WIN) and the University of Manitoba Archives & Special Collections (UMA). This connection was marked in the recent exhibit on Dr. Buller, "He was the

[1] Terry Cook, "Total Archives," in *Encyclopedia of Archival Science*, ed. Luciana Duranti and Patricia C. Franks (Lanham, MD: Rowman & Littlefield, 2015): 397.

Very Model of a Modern Research Scientist: Reginald Buller and the Founding of the University of Manitoba" at UMA, featuring specimens from WIN and holdings from UMA.

Total archives concept

Historically, European archival institutions were established to preserve government records, while records created by individuals or private organizations were relegated to other heritage institutions and dubbed "manuscripts." Much of the focus of archivists' work was on the preservation of ancient records (those deemed to be of historical significance) over more recently created records.[2]

In the Canadian context, the early iterations of national archives[3] revolved around capturing the colonial origins of the new country after Confederation.[4] This included collecting and copying a range of historical documents, both government records and manuscripts, to speak to the creation of Canada and its colonial powers. This grasping towards records which demonstrated a larger history was an impetus towards total archives.

Douglas Brymner was appointed Dominion Archivist in 1872 and was tasked with creating a collection geared towards records of "Canadian history," rather than those created by the government records of the nascent country. In 1873, the first Keeper of government records was appointed. Although Brymner suggested that both government and private records should be stored in the same institution, a call which was echoed by historians and organizations such as

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[2] Wilfrid Smith, *'Total Archives': the Canadian Experience* (Brussel: Archives et bibliotheques de Belgique, 1987). See also *Archives: Mirror of Canada Past / Miroir Du Passé Du Canada*. Toronto: University of Toronto Press, 1972.

[3] The choice of "national archives" is meant to simplify the various name changes of the Canadian institution now called Library and Archives Canada – at other times, the Dominion Archives, National Archives of Canada, Public Archives of Canada.

[4] Cook, "Total Archives," 397.

the Literary and Historical Society of Quebec, this change was slow to occur. The 1897 Commission on governmental records recommended the "centralization of public office" which would encompass both the Dominion Archivist and the Keeper of the Records. It was not until 1903 that the two departments were amalgamated under one title and one institution.[5]

The amalgamation elevated the importance of a variety of narratives in the national institution and went on to encourage the inclusion of records representing a spectrum of ethnicities, subjects, and regions in Canada. This inclusion was an effort to capture what was seen as "uniquely Canadian" experiences and histories.[6] Arthur Doughty, the British-born Dominion Archivist and Keeper of the Records appointed in 1904, aggressively made acquisitions from private sources, especially those considered to be influential figures in Canadian history. This was in part due to Doughty's view that the national archives were a resource to be utilized by historians, and as such, Doughty moulded the collection strategy of the archives to reflect its users.[7] Doughty also pushed for the acquisition of non-textual records, such as portraits, trophies, and artifacts. These collections were separated from others in the institution through the creation of a museum, a Manuscript Division, a Library, and a Map and Picture Section.[8] What was born of necessity developed into the total archives concept as it is known today. However, this history of total archives in Canada also demonstrates an effort by early archivists to seek out records which would illustrate an origin story of the nation, derived from European archives and private collections. At the same time, these records reflect the process of removing Indigenous people from their territories and establishing systems to enact cultural

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[5] Smith, *Total Archives*, 328-329.
[6] Laura Millar, "Discharging our Debt: The Evolution of the Total Archives Concept in English Canada," *Archivaria* 46 (Fall 1998): 106.
[7] Smith, *Total Archives,* 332.
[8] Smith, *Total Archives,* 332.

genocide. In creating a narrative around the formation of Canada, it erased the existing First Nations, Inuit, and Métis in these lands and in the historical record.[9]

Former Dominion Archivist Wilfrid Smith popularized the term "total archives" in reference to the practice of collecting "all types of archival material from any source," particularly in the Canadian context.[10] Drawing upon the remarks made by Robert-Henri Bautier in 1970, Smith highlighted the importance of a fulsome, diverse collecting strategy to encompass the "documentary history of the country."[11] Smith characterized four elements of acquisition within the total archives concept. First, that all sources of records, created by private entities - such as individuals, families, or organizations - or public entities – such as municipal, provincial, or federal governments - be considered for acquisition. Second, that all types of record formats and media be acquired, and that "all records originating from the same source should be acquired and preserved in their totality rather than being divided among several repositories."[12] Third, that all subjects should be welcome within a regional archive, rather than being siloed by subject elsewhere. Fourth, that the life cycle of a record should be monitored by an archival repository so that relevant archival records are preserved.[13] Smith argued that the total archives concept had many benefits, including increasing ease of access to researchers; applying archival theory as opposed to other systems of collection management; and allowing for institutions to be centralized, rather than dispersed.[14]

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[9] J.J. Ghaddar, "Total archives for land, law and sovereignty in settler Canada," *Archival Science* 21, no. 1 (2021): 63.
[10] Smith, *Total Archives,* 323.
[11] Smith, *Total Archives*, 325
[12] Smith, *Total Archives,* 341.
[13] Smith, *Total Archives,* 341.
[14] Smith, *Total Archives*, 342-343.

One aspect of the total archives concept to consider here is the collection of a variety of media formats in an archive. This strategy was initially intended to capture records, regardless of format, for a more holistic view of history. Different media formats allow for different information to be communicated in different ways and contribute to the overall understanding of how records were made.[15] Canadian archives developed divisions of collections by media for better control of the unique access and preservation needs that different media had. While this started in Doughty's time with the introduction of the Map and Picture Section, at Smith's writing in 1987, these media-specific divisions and collections had continued.

The total archives concept was not without its critics, particularly as it pertained to media formats. In a passionate debate in *Archivaria* in the late 1970s, archivists sparred on the issues of provenance within the separation of media. Cook shared his concerns about different media formats being removed from fonds and siloed in separate departments, thereby jeopardizing the provenance of the records;[16] Birrell argued that this separation is not an issue as long as proper intellectual control is maintained.[17] Smith had similar perspectives:

> It is true that there is danger of a breach of provenance unless great care is exercised in intellectual control. A record should be kept of an entire collection so that its origins are clear even when elements have been removed. It is true, however that there is no alternative to the advantages of special treatment for different media. The care, arrangement, description and conservation for photographs, for example, is different from textual records or maps. So too, in most cases, is the clientele. What is required is close liaison between different media divisions in an archives and a refinement of finding aids.[18]

While Cook does not seem to disagree with Smith, Cook was speaking to trends which removed or obscured this intellectual control. Cook did not advocate for archivists to stop collecting a

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[15] Cook, "Total Archives," 398.
[16] Terry Cook, "The Tyranny of the Medium," *Archivaria* 9 (January 1979): 141-149.
[17] Andrew Birrell, "The Tyranny of Tradition," *Archivaria* 10 (July 1, 1980): 251.
[18] Smith, *Total Archives,* 344.

variety of media, only that records should not be removed from their provenance for the sake of thematic or media based collections.[19] At the same time, Birrell defended single media collections, such as fire insurance maps, whose "existence in archives is the result of division according to medium."[20] Without these specific collections, these records may not have been preserved. However, if donations of a single medium are donated by a single source, presumably there is no issue of being removed from provenance.

Another issue with Birrell's argument is his flippancy towards historical researchers, who he claimed to be too reliant on text-based media or "are quite simply at a loss to know how to use non-textual records as primary resources."[21] While Birrell was writing at a different time, and working with researchers who may have had different interests, this view seems narrow minded and does not seem to be a good enough reason to separate different media. Similar issues have been raised regarding researchers relying on photographs for their visible content rather than reading into the context of their creation, and the ability of photographs "not simply to document reality, but to evoke it."[22] Additionally, the prevalence of researchers to rely on familiar sources such as "hard copy transcripts of digital files," rather than the born-digital files which could be available to them[23] could be a sign that archivists with specialized knowledge in a variety of media are an important aspect of interfacing with researchers. Ostensibly, providing access to a wider variety of media types should be positive for researchers, but creating artificial collections

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[19] Cook, "Total Archives," 398.
[20] Birrell, "The Tyranny of Tradition," 251.
[21] Birrell, "The Tyranny of Tradition," 251.
[22] Joan Schwartz, "Photographic Reflections: Nature, Landscape, and Environment," *Environmental History* 12, no. 4 (October 1, 2007): 977.
[23] Trevor Owens, "What's a Nice English Professor Like You Doing in a Place Like this: An Interview With Matthew Kirshenbaum," *Library of Congress Blogs*, (August 12, 2013): https://blogs.loc.gov/thesignal/2013/08/whats-a-nice-english-professor-like-you-doing-in-a-place-like-this-an-interview-matthew-kirschenbaum/

removed from their context of creation does not equate to easier access. Maintaining intellectual and physical control over records should be the priority.

For those archivists who engage with the total archives concept, it seems that each tends to gravitate towards a different focus of the concept – the variety of media,[24] the centralized system,[25] or the representative cultural heritage.[26] Inevitably, each archivist is impacted by their own worldview and circumstances. I believe that the total archives concept has had a bigger impact in the ethos of Canadian archivists, encouraging us to ask ourselves existential questions: Why do we keep archives? What do we keep, and where is it kept? Whose stories are being told? How do researchers access these archives?[27] Given the past, the answer is: to preserve a shared history, we must keep as much as practicable, to be as inclusive as possible, and as accessible as appropriate.

Herbaria in total archives

Although there were many drivers to each stage of the total archives concept, it is relevant to raise the concept here because of the possibilities of herbaria as sites of primary source materials for study, consisting of a variety of media. As previously established, botanical specimens are a primary source. Specimens can be read as a sort of hybrid document, containing both textual elements (the label) and visual elements (the plant itself). Other supplemental materials, whether textual (published data or research, notes on the specimen by researchers) or

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[24] For example, Dorothy M. Ahlgren and John McDonald, "The archival management of a Geographic Information System," *Archivaria* 13 (Winter 1981): 59-65.
[25] For example, Jane Turner, "Working Cooperatively for a Sustainable Future: Total Archives in Nanaimo," *Archivaria* 39 (Spring 1995): 177-183.
[26] For example, Laura Millar, "Discharging our Debt: The Evolution of the Total Archives Concept in English Canada," *Archivaria* 46 (Fall 1998): 103-146.
[27] For an example of participatory total archives, a system built from the ground up, please see Jane Turner "Working Cooperatively for a Sustainable Future: Total Archives in Nanaimo," *Archivaria* 39 (Spring 1995): 177-183.

visual (photographs, drawings, maps), contribute to the users' overall experience with the specimen. Herbaria management protocols in the past have acknowledged, deliberately or not, that incorporating several different sources contributes to a more fulsome collection overall. For instance, Womersley noted that "…it is customary to file relevant notes, copies of literature, illustrations of particular species and even letters relating to either a species or a particular specimen. With modern copying facilities it is easy and inexpensive to make a copy of the material from a library collection and include this in the species folder."[28] Similarly, Fosberg saw herbaria as "…a great filing system for information about plants, both primary in the form of actual specimens of the plants and secondary in the form of published information, pictures, and recorded notes,"[29] envisioning a repository of knowledge of various sources. While this seems to parallel a library system of subject-based entry into a collection, it is important to highlight the space that is being given to textual records within the physical storage of the specimens. This practice of supplying contextual information with the specimens fits what Chris Hurley has described as crossing the "archival boundary."[30] The action of making a label, containing information such as names, location and date collected, transforms the specimen into a "metadata encapsulated object" which serves as a physical and intellectual connection to the creation of the record.[31]

Additional sources that may be overlooked in considering the totality of an herbarium collection are the field notes of the collector. Although these notes may be classified as transitory because they are the basis of the final label preserved with the specimen, it is also possible that

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[28] J.S. Womersley, *Plant Collecting and Herbarium Development: a Manual* (Rome: Food and Agriculture Organization of the United Nations, 1981).
[29] F. R. Fosberg, "The Herbarium." *The Scientific Monthly* 63, no. 6 (1946): 429-34.
[30] Chris Hurley, "The making and keeping of records: What are finding aids for?" *Archives & Manuscripts* 21, no. 1 (1998): 58-77.
[31] Hurley, "The making and keeping of records," 60-61.

they contain additional information that may not fit into the standard label descriptions. Smith and Chinnappa advise specimen collectors to include their field notes with their collections in order to retain important information. As part of that retention, Smith and Chinnappa encourage collectors to write in notebooks with "…pages of acid-free, long-lasting paper written in permanent ink."[32] Other modes of collecting field notes include smartphone applications, such as ColectoR, which were developed to make the process of inputting and exporting data more efficient. This includes features such as GPS or location services, automatic tasks such as auto-completing naming, and creating spreadsheets for easy access after the field work is finished.[33] These precautions and proactive considerations encourage researchers to think of their work as having long-lasting importance, and as something which should be preserved.

Considering traditional definitions of the principle of *respect des fonds*, wherein records of a single creator (whether that is an individual, family, or organization) are kept separate from the records of other creators, the total archives concept also encourages archivists to collect a creator's records in a variety of formats. To reiterate Smith, one of the primary elements of total archives is to acquire records of all types, and that "all records originating from the same sources should be acquired and preserved in their totality rather than being divided among several repositories."[34] These field notes, as records of the same creator and regarding the same specimen, would also fit into the herbarium's collection. This is one example where additional materials regarding an individual specimen could give more context about the record in question.

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[32] Bonnie Smith and C.C. Chinnappa, "Plant Collection, Identification, and Herbarium Procedures," Chapter 30 in *Plant Microtechniques and Protocols,* eds. Edward C. Yeung and Ferhan Ayaydin, 1st ed. (Cham, Switzerland: Springer, 2015): 54.
[33] Carlos A. Maya-Lastra, "ColectoR, a digital field notebook for voucher specimen collection for smartphones," *Applications in Plant Sciences* vol. 4, no. 7 (July 2016): 1-4.
[34] Smith, *Total Archives,* 341.

This follows a view of provenance within the total archives concept offered by Terry Cook in 1979, who warned about damages to the "functional unity of the record" when records are separated based upon media type.[35]

Although the concerns of preservation are very similar between archives and herbaria, the incorporation of one into the other is not a simple movement of records; both institutions lack the space, financial resources, and staff training to adapt immediately to integration. As it stands, the separation of media ensures the preservation needs of all records are met. Cook acknowledges this difficulty bluntly: "[w]hile the physical and handling control of a series of functionally related records in various media can be separated, the intellectual control must not be."[36] Without some form of information utopia where all different types of institutions could exist under one roof, one more feasible option may be to encourage linked data between herbaria and traditional archives. While institutions are connecting to each other homogenously, with herbaria linking to herbaria and archives linking to archives, making the connection between herbaria and relevant collections in archives may encourage new routes to information. While these collections have been separated into different institutions and have been used for different purposes, collaboration between institutions allows collections to be better preserved and accessed, particularly in cases where a creator's collections are split between multiple institutions.[37]

An example of an existing database may be through the Global Biodiversity Information Facility (GBIF), an open access "network and research infrastructure," which hosts a database with search capacity for specimen types, occurrences and sightings; publishers and institutions;

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[35] Cook, "Tyranny of the Medium," 142.
[36] Cook, "Tyranny of the Medium," 144.
[37] Laura Millar, "The Spirit of Total Archives: Seeking a Sustainable Archival System," *Archivaria* 47 (Spring 1999): 55-59.

datasets and projects; and resources and literature.[38] This allows for a variety of entry points into available information, and also opens the door to adding a connection to archival series relevant to different data, for instance, the collections of private papers of scientists or research groups.

Linked open data technology is a way of building connections on the internet by adding additional layers and relationships to metadata in order to link between different pieces of data.[39] This has been used by heritage institutions to make collections more easily searchable by creating additional relationships between metadata in their systems, in more specific ways than traditional description might.[40] In archives, this linked data has centred on archival descriptions, authority files, controlled vocabularies for subject indexing, and content annotations, and often rely on the conversion of existing formats of metadata.[41] This allows for the creation of a complex web which is "machine understandable…[allowing] software agents to integrate data from different sources, infer hidden facts, and respond to complex queries easily."[42]

Science in the archives

In this discussion of linking archives and herbaria collections, it is important to note that some barriers do exist between the disciplines. While this is not to say research in archives by scientists or in herbaria by historians has been hindered, the issue of note is incorporating scientific data into archival collections. While archives have had collecting mandates geared to records reflecting political, historical, and cultural relevance, collecting based solely on a

[38] Global Biodiversity Information Facility (GBIF), "What is GBIF," https://www.gbif.org/what-is-gbif
[39] Sherif Sakr et. al., *Linked Data: Storing, Querying, and Reasoning* (Springer, 2018), 9.
[40] Jinfang Niu, "Linked Data for Archives," *Archivaria* 82 (Fall 2016): 84.
[41] Niu, "Linked Data for Archives," 88.
[42] Sakr et. al, *Linked Data*, 1.

scientific basis has been less prevalent.[43] This issue is compounded by the difficulty which archivists, whose background training might be focused on humanities and social sciences, could have in identifying records with scientific references. As such, records such as those created in the course of research projects, particularly data sets, have been relegated to the care of their creators.[44]

Even if archives were to welcome records of a more scientific bent, it may not mean that scientists are willing to deposit their records somewhere they could be accessed by the public. In the past, some researchers were hesitant to share their work with others for fear that their work may be overshadowed or co-opted; that they would be seen as "incompetent" for not using every shred of information; or that their funders or backers would perceive the sharing as a waste of their support.[45] However, in the Canadian context, particularly for those receiving federal funding through the Tri-Council agencies, all data produced should be "…preserved in a publicly accessible, secure and curated repository or other platform for discovery and reuse by others…researchers should consider the data needed to validate research findings and results, and support replication and reuse."[46] In this way, researchers have a stronger impetus to properly preserve their own data.

Creators' preferences and working styles can impact the production of data sets. In the data collection stage, a researcher's daily notes could be indecipherable to another person because of the idiosyncrasies of an individual's shorthand. Additionally, individual researchers

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[43] Jill Delaney, "An Inconvenient Truth? Scientific Photography and Archival Ambivalence," *Archivaria* 65 (Spring 2008): 93.
[44] Delaney, "An Inconvenient Truth?" 92-93.
[45] Stacy Kowalczyk and Kalpana Shankar, "Data sharing in the sciences," *Annual Review of Information Science and Technology* 45, no. 1 (2011): 248.
[46] Government of Canada, "Tri-Agency Statement of Principles on Digital Data Management," https://www.ic.gc.ca/eic/site/063.nsf/eng/h_83F7624E.html

may not hold the production of data to a set standard, which can impact whether the data can be interpreted by others.[47] There are benefits to proper recording within scientific disciplines, largely relating to the importance of scientific discovery and allowing a researcher to stake a claim to legal rights.[48] Kalpana Shankar has identified the process of "synthesis and selection" of data and other research notes as transforming data into records.[49]

In order for datasets to be useful over time, creators will usually need to provide contextualizing information by way of metadata to translate the information. This is particularly useful between different disciplines, where pedagogies vary. Although inputting metadata can be resource-heavy, it can prevent data- or science-friction, where the interactions between conflicting systems could lead to misinterpretation.[50] The inclusion of metadata helps to facilitate the sharing of data, particularly when utilizing standards such as Open Archival Information System (OAIS). OAIS was developed by and for scientific disciplines, and when applied properly, has already identified designated users (users identified by the Archive as the group "for whom the information is being preserved," who have the Knowledge Base to understand that information without additional mediation)[51], and can provide additional Representation Information (the translating or mediating information required by those outside the Designated Community)[52] when necessary.

Dr. A.H.R. Buller: a study in total archives

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[47] Kalpana Shankar, "Order from Chaos: The poetics and pragmatics of scientific recordkeeping," *Journal of the Association for Information Science and Technology* 58, no. 10 (2007): 1463-1464.
[48] Shankar, "Order from Chaos," 1457.
[49] Shankar, "Order from Chaos," 1461.
[50] Paul N. Edwards, et. al, "Science friction: Data, metadata, and collaboration," *Social Studies of Science* 41, no. 5 (2011): 669.
[51] The Consultative Committee for Space Data Systems (CCSDS), *Reference Model for an Open Archival Information System (OAIS*), (June 2012), 2.2.1.
[52] CCSDS, *OAIS*, 2.2.1.

A notable figure whose collections allow for the consideration of the total archives concept is Arthur Henry Reginald Buller, the first professor of botany at the University of Manitoba. Buller's creation, use, and eventual disposition of records in two different repositories demonstrates the importance of connecting collections by creator, even across physical restraints.

Arthur Henry Reginald Buller was born in 1874 to barrister Alban Gardner Buller and Mary Jane (nee Huggins) of Moseley, Birmingham, England.[53] After his primary and secondary education at a local boarding school, Buller attended several universities including Queen's College, Tauton; Mason College, Birmingham; and the University of London, from which he received his Bachelor of Science degree in 1896.[54] The progress of "New Botany," a shift in teaching and studying botany to focus on observation over lectures,[55] brought Buller to Germany in 1897. Buller completed his PhD in Leipzig under a well-known fern specialist, Wilhelm Pfeffer, in 1899.[56] The impact of German New Botany influenced Buller's research and teaching styles, encouraging a focus on hands-on, experimental science.

The University of Manitoba was first granted its charter under the Government of Manitoba in 1877. The university was founded by three original colleges, all operated by different churches: Manitoba College (Presbyterian), St. Boniface College (Catholic), and St. John's College (Anglican),[57] with Wesley College (Methodist)[58] rounding out the coalition in

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[53] Gordon Goldsborough, "Reginald Buller: The Poet-Scientist of Mushroom City," *Manitoba History* 47 (Spring/Summer 2004), para. 2. Accessed online: http://www.mhs.mb.ca/docs/mb_history/47/poetscientist.shtml
[54] Goldsborough, "Reginald Buller," para. 3.
[55] Nicole Fletcher, "Botany on the prairies: Dr. Reginald Buller's botanical wall charts at the University of Manitoba," (Master of Arts Thesis, University of Manitoba, 2017): 20.
[56] Fletcher, "Botany on the prairies," 36.
[57] Gordon Goldsborough, "Manitoba Organization: St. Boniface College / University of St. Boniface," *Manitoba Historical Society, http://www.mhs.mb.ca/docs/organization/stbonifacecollege.shtml*
[58] Gordon Goldsborough, "Historic Sites of Manitoba: Wesley College / United College / University of Winnipeg (505 Portage Avenue, Winnipeg," *Manitoba Historical Society*, http://www.mhs.mb.ca/docs/sites/wesleycollege.shtml

1888.[59] In part because of their religious connections, the first professors of science were untrained clergymen, who provided incomplete and sometimes inadequate teaching, decidedly deficient compared to the academic rigour of European universities. After fundraising for salaries and constructing new buildings for the sciences, the University of Manitoba hired six new science professors in 1904, including Buller.[60] Drawn from his position as a lecturer at Mason College, Buller's move across the Atlantic may have been prompted by a salary increase, a position of authority as a professor and department head, and the opportunity to mould a botany department to his vision. Additionally, Buller had heard of Winnipeg's reputation as a "Mushroom City," based on the population and economic boom around the turn of the century. As a mycologist, or fungi expert, Buller once pithily remarked that it was a "logical destination for someone wishing to pursue studies on fungi;" other benefits included a five month summer holiday, which allowed for his cross-Atlantic travel to visit family and research at the British Royal Botanic Gardens, Kew, in London.[61]

Buller never married, and despite the fact that he purchased real estate properties in the city, Buller lived out of various hotels during his time in Winnipeg.[62] His obituary in the Memoirs of the Royal Society described his life in Winnipeg as being "completely unharassed by domestic duties."[63] While working on his various manuscripts, he described his schedule as very structured:

> I still very often get up before daylight, at five or six o'clock, and do a few hours' work before the rest of the University have arrived; but, to make up, I go to bed early, at 9 or 10

[59] Fletcher, "Botany on the Prairies," 30.
[60] Fletcher, "Botany on the Prairies," 31.
[61] Goldsborough, "Reginald Buller," para. 4-5.
[62] Fletcher, "Botany on the Prairies," 44-45.
[63] Frederick Brooks, "Obituary: Arthur Henry Reginald Buller, 1874-1945," *Biographical Memoirs of the Royal Society* (1945): 50-59.

> o'clock. I do not consider myself at all virtuous. The hours I keep simply provide me with hours when I can work without disturbance.[64]

Although Buller had a wide variety of interests in life, he once described himself as "first of all a scientific man, then a biologist, then a botanist, then a mycologist and then a phytopathologist. My interests, therefore, are not solely mycological…"[65] His interests led him to one of his most notable research projects on wheat rust, a type of fungus detrimental to agriculture. Over the course of his career, he authored a seven volume text, *Researches on Fungi,* as well as numerous articles and informational pamphlets. Beyond his writing, Buller also frequently gave public talks on a variety of scientific topics, travelled abroad to present his research at conferences, and held membership in several professional associations. Due to his engagement, Buller acted as a promoter of science and the University of Manitoba to the broader public in Winnipeg, Manitoba, and beyond. Some of Buller's interests also included debunked pseudoscience, including his sympathy towards eugenics and belief in telepathy and mediums.[66]

Buller's relationship with the University became more strained as time went on, largely based upon the dire financial situation the University found itself in during the Great Depression in the 1930s. In the early days of the Depression, Buller predicted rough times ahead at the University: "What is going to happen at the University next session remains to be seen…I expect that our grant will receive a further cut and there is a possibility that we may lose certain Departments altogether. Our salaries have been cut drastically and the fees have been much raised."[67] Although the University's operating grant was impacted by cuts from the provincial

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[64] UMA, A.H. Reginald Buller fonds, MSS184, A2004-025, Box 0002, File 0020, "Copy of a letter from A.H.R.B. to Miss Margaret Dudley, 21 Nov. 1932."
[65] Goldsborough, "Reginald Buller," para. 37.
[66] Fletcher, "Botany on the Prairies," 40-42, 47, 54.
[67] UMA, A.H. Reginald Buller fonds, MSS184, A2004-0025, Box 0002, File 0020, "Copy of letter from AHRB to Miss Margaret Dudley, 21 Nov. 1932."

government, this was nothing compared to the mismanagement on behalf of the financial officer, John A. Machray, who defalcated and lost over $800,000 of the university's funds,[68] which led to cuts to salaries, departments, and supplies, and also led, for those like Buller who volunteered, to staff taking leaves of absence. Upon his return, the development of the Fort Garry campus and the related "frustration and fatigue" of maintaining appearances both at Fort Garry and Broadway campuses led to his retirement in 1936. However, he remained a fixture at the University of Manitoba campuses, using his old office and the Dominion Rust Research Laboratory for further research and writing.[69] As the University grew, his former friends in the administration were replaced by newcomers. In 1942, Buller found his place at the University in jeopardy when he was informed that he must evacuate his long-time office space. His response was indignant:

> I have now decided to leave the University of Manitoba – the University that I have served as a teacher and research worker for so many years – and seek accommodation in some other institution in which productive scholarship is more sympathetically regarded than it is here…I shall leave my room with much regret, but with the hope that it will not be occupied by a non-entity, but by someone who will spread the fame of the University around the world to a degree at least equal to that accomplished by myself…[70]

Although he was able to find storage space on campus with some colleagues, Buller's difficulties increased. He was unable to find a new position, which left him lingering in Winnipeg. During an attack on London in 1940, the entirety of his unsold copies of *Researches on Fungi* were lost, "symbolically wiping clean the record of his long career."[71] His health took a turn for the worse in 1943 with "headaches…a giddy feeling, dizziness, and general weakness on the left side,"

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[68] James J. Blanchard, "Machray scandal," *Manitoba History* 33 (1997): 11.
[69] Goldsborough, "Reginald Buller," para. 52.
[70] UMA, A.H. Reginald Buller fonds, MSS 184, A2004-0025, Box 13, File 0026, "Letter from AHRB to F.W. Crawford, Dec. 1, 1942."
[71] Goldsborough, "Reginald Buller," para. 55.

which were diagnosed as a brain tumour. Although he rushed to finish his unpublished works, he was admitted to the hospital, lost his vision, fell into a coma, and eventually died on July 3, 1944.[72]

The "fragmentation"[73] of archival collections by media type describes the fate which befell Arthur Henry Reginald Buller's collections at the University of Manitoba Vascular Plant Herbarium (call sign WIN) and the University of Manitoba Archives & Special Collections (UMA). These two collections are housed in separate institutions on the Fort Garry campus where the creator worked in the latter part of his career.

The A.H. Reginald Buller fonds consists of a wide variety of media, including over two metres of lantern slides, 356 wall charts and posters, 11 maps, 4.73m of textual records, several collector's display cabinets and other assorted furniture, as well as the remains of the collector himself, in the form of an urn of ashes. While much of the collection could be classified as personal ephemera and personal correspondence, a great deal of the records pertain to Buller's teaching, particularly in terms of his teaching aids in the form of wall posters and glass slides. Notably, Buller's own research notes and lecture scripts are missing from the collection.[74]

The fonds was deposited in several accruals over a twenty-year period, from a variety of donors. These donors included the University of Manitoba Department of Biological Sciences; Agriculture and Agri-Food Canada, Cereal Research Centre via Library and Archives Canada (LAC); and an individual named Linda LaBlanc of undetermined connection to Buller. The transfer of materials from Library and Archives Canada occurred in 2009; these materials were

[72] Goldsborough, "Reginald Buller," para. 55.
[73] Cook, "The Tyranny of the Medium," 144.
[74] UMA, Finding Aid, Fonds MSS 184 – A.H. Reginald Buller fonds.

originally donated to LAC because of the Cereal Research Centre was operated by the federal government's Department of Agriculture and Agri-Food.

One of the most important considerations in the case of Buller's collections is the course in which they arrived at their various institutions. A key piece to understanding the donation of these records is that apart from Buller's office on the campus (the University's property), Buller kept all his possessions in the hotel rooms where he lived during his time in Winnipeg.

Anecdotally, a relative who is a graduate of the University of Manitoba Faculty of Agriculture's Master's program was shocked that I was researching such a "weird guy" as Buller. He was equally surprised that Buller's records were even available, considering that Buller had been "kicked off" campus. According to another rumour, "Buller decreed, late in his life, that his papers should not be given to the University of Manitoba but no corroborating evidence is contained in his probate Will at the Provincial Archives of Manitoba."[75] In his own letter of resignation, Buller complains about the time allotted for him to clear out his office, saying that it will be insufficient to "pack up my 1400 lantern slides, my [manuscripts], scientific notes, correspondence, original drawings and photographs, pamphlets, books, unbound numbers of numerous journals, models, and other academic possessions, and dispose of my table, chair, and filing cabinet."[76] This reads closely to the finding aid as prepared by UMA, albeit without the scientific notes.

The research notes are strikingly absent from the fonds, especially as he had mentioned these being part of his office before it was vacated. As someone trained in by the philosophies of New Botany, which emphasized field and lab work, Buller would have strived to capture his

[75] Goldsborough, "Reginald Buller," endnote 2.
[76] UMA, A.H. Reginald Buller fonds, MSS 184, A2004-025, Box 0013, File 0026, "Letter from AHRB to FW Crawford, Dec. 1, 1942."

observations, experiments, and findings. Although there are a handful of records concerning research and field observations, much of his notable work including that regarding mycology is missing. Some examples in the fonds are lists of local flora with marginalia denoting species Buller observed;[77] and a few notebooks of observations and future research ideas.[78] Buller's draft manuscripts for several texts, including a *History of Mycology*[79] and volumes of his *Researches on Fungi*,[80] while showing interesting notation and editing by Buller and his colleagues, are available in their final form. These examples are a small portion of the rest of the fonds. While there is much to be gleaned from the fonds, the fact that these research notes are missing from the archival collection leaves a gap in Buller's work which could otherwise connect the herbarium and archives.

In terms of modern notions of consent, some of the University's acquisitions of Buller's personal effects seem suspect. In a particularly gruesome example, a specimen of necrotic tissue from Buller's brain tumour was taken during his autopsy, then "mounted in a watch glass and placed in the Department of Pathology Museum, University of Manitoba."[81] The autopsy report does not provide a reason to explain why this sample was taken, and there was no indication in his will or within the autopsy report to show Buller giving his consent. While the current standards around medical ethics and consent are much more stringent than those at the time of Buller's death, the retention of this sample seems grievously emblematic of the relationship between Buller and the University in his time. Buller's brain, the sum of knowledge learned over

[77] UMA, A.H. Reginald Buller fonds, MSS 184, A2013-143 (SC), Box A2013-140 to A2014-51 File 0004.
[78] UMA, A.H. Reginald Buller fonds, MSS 184, A2007-062, Box 0001, File 0005, Item 0001.
[79] UMA, A.H. Reginald Buller fonds, MSS 184, A2007-062, Box 0001, Item 0001.
[80] UMA, A.H. Reginald Buller fonds, MSS 184, A2013-143 (SC), Box A2013-140 to A2014-51 File 005.
[81] UMA, A.H. Reginald Buller fonds, MSS 184, A2007-062, Box 0012, File 0001.

a lifetime, was picked apart and a piece was given to the entity Buller had felt so exploited by. There is no indication that this sample is now included in the UMA collection.

The very separation of the collections speaks to the Buller's use of the various types of records. Logically, it makes sense that the records intended for use within the herbarium are still there, while his personal papers were likely in his office or home at the hotel where he had last used them. While the specimens he collected for the establishment of the WIN herbarium were donated by Buller himself and intended to be preserved there, the same cannot be said for his personal papers, writings, and other personal effects. Despite the separation of Buller's specimens and his other records, his own collecting practices are evident in his records. In several of his undergraduate notebooks, reflecting his studies in Zoology, Geology, and German grammar,[82] pressed flowers and leaves are interspersed in the pages. While this is not captured in the finding aid of the fonds, it provides a unique look into what he deemed important to keep – it was not collected with the same intention or use as those which are found in herbaria, but Buller's intention to keep the flower remains. The specimens which are included in the fonds seem to be on loan from other institutions and may have arrived at UMA accidentally. For instance, the specimen of *Arthopyrenia sublitoralis* included a notecard with the taxonomic name, the location collected, and the name of the collector, headed with the title "Herbarium of the University of California." The envelope the specimen was enclosed in features an expansion on the taxonomy in one hand; below, Buller's own observations on the specimen, signed and dated by him.[83] In another example, the enclosing envelope was labelled with a note, "Portion of [University of California] Herbarium" while another note designates the specimen as a gift to

[82] UMA, A.H. Reginald Buller fonds, MSS 184, A2007-062, Box 0006.
[83] UMA, A.H. Reginald Buller fonds, MSS 184, A2007-062, Box 0021, File 21.

Buller.[84] In either case, the specimens likely should have been located in the herbarium, rather than in his personal items.

Buller's contributions to the University of Manitoba's Herbarium cannot be overstated, as he was the founder of the herbarium itself. Although only a portion of the herbarium's collection is currently accessible on the database, a GBIF search turned up ninety-nine results attributed to Buller.[85] Additionally, forty-seven unique specimens of Buller's fungi collection are catalogued on MyCoPortal.[86] Buller saw field work as one of the most important parts of his work as a scientist. His collecting, and eventual donation of specimens, would have been a natural part of his work, ensuring that students had reliable, accessible specimens to study for years to come.

Throughout his career, Buller regularly returned to England, conducting research at the University of Birmingham and Kew Gardens in London. It came as some surprise to me to find that several records created by Buller have been acquired at Kew. This includes four original botanical drawings, such as "Drawing, inscribed 'Puccinia malvacearum on Holly-hock (Althaea rosea)…from microtome section and study of living material. A.H.R. Buller 12/3/16'." The provenance of these items were described as "Found in Travels Room, February 2006."[87] This suggests that items had been left behind by Buller, only to be uncovered and accessioned ninety years after they had been created. Another record was titled "Miscellaneous correspondence,"[88]

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[84] UMA, A.H. Reginald Buller fonds, MSS 184, A2007-62, Box 0021, File 7.
[85] GBIF, WIN. Accessed November 19, 2020. N.B.: Search terms "Recorded By" and searched based on variations of A.R.H. Buller/A.R.H.B/Buller.
[86] MyCoPortal. Dataset: WIN, Search Criteria: buller. My thanks to Diana Sawatzky of the WIN Herbarium for sharing this catalogue with me.
[87] Kew Gardens Library, Art, and Archives catalogue, Illustrations, ILLUS-GEN, 154803-1001, "Drawing, inscribed 'Puccinia malvacearum on Holly-hock (Althaea rosea)...from microtome section and study of living material. A.H.R. Buller 12/4/16'." Accessed March 2020.
[88] Kew Gardens Library, Art, and Archives catalogue, Archives, L-BUL, 136917-1001, "Miscellaneous correspondence." Accessed March 2020. Unable to receive more information due to COVID-19 restrictions and archivists under work-from-home orders.

which unfortunately featured no provenance description. The Kew Library section features several of his published essays and texts. The Library also features information denoting the books Buller had owned – this is noted in the author note, with "(Former owner)," and the provenance description, "From Prof. A.H.R. Buller's collection"[89] though it is not clear how these texts came to be at Kew, whether they had been left behind or if they had been formally donated. While these records provide another layer to understanding Buller's works, the types of records here, as well as the impression given by the term "Found," suggests that these records were not intentionally donated by Buller, or arguably, intentionally acquired by Kew.

A final collection which may be mentioned is the Buller Memorial Library. Buller's own interest in forming a library upon his arrival in Manitoba had much to do with the importance he saw in providing up-to-date literature on scientific issues, both for himself and his students. Over the course of his career, he grew what he called his "Mycological Library," housed within his Broadway campus offices.[90] Prior to his eviction from the campus, Buller had allegedly intended to donate his library to the University. After his death, his executors passed his collection of books and other records to the Dominion Rust Research Laboratory (which eventually became the Cereal Research Centre) where the Buller Memorial Library was established in 1958.[91] When the Centre was closed by the federal government in 2012, the catalogue of books was disseminated to institutions which agreed to take them, including the UMA.[92]

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[89] Kew Gardens Library, Item Description, "Weeds of New York," Walter Conrad Leopold Muenscher (1891-1963) A.H. Reginald (Arthur Henry Reginald) (1874-1944) (Former owner).
[90] Goldsborough, "Reginald Buller," para. 21.
[91] UMA, A.H. Reginald Buller acquisition files, Buller, A.H.R.: General, "Reginald Buller CRC Information – Extracted from Johnson's Dominion Rust Laboratory History Document 1925-1952."
[92] Nicole Courrier, UMA Reference and Discovery Archivist, correspondence with author.

Although Buller expressly wished to be cremated, his will did not leave specific instructions regarding burial or dispersion.[93] However, there was no crematorium in Winnipeg at the time. Dr. J.H. Craigie, a friend of Buller's, accompanied Buller's body to Minneapolis and originally stored in the remains in his own office. When the Dominion Rust Research Laboratory's library facilities were completed, Buller's remains were interred in a specially constructed wall feature, the focal point to the Buller Memorial Library. As part of the shutdown of the Cereal Research Centre, the Library was transferred to the University of Manitoba. The University of Manitoba Libraries later lobbied federal officials with Agriculture and Agrifoods Canada to transfer Buller's remains to his memorial cairn, located in front of the Buller Building on the Fort Garry campus.[94]

In all, the impression taken of the variety of Buller's collections show a life ended abruptly. As his illness was sudden and his condition worsened quickly, the transfer of his possessions was likely not a priority or a possibility from his final months in the hospital. Buller had indicated in a will dated 26 August, 1939 - approximately three years prior to his eviction from campus, and five years prior to his death – his desire to donate all "scientific drawings, photographs, and other scientific illustrations and all [his] manuscripts" to the Herbarium at the Royal Botanic Gardens, Kew.[95] It is unclear why these records were not transferred to Kew, whether relating to logistics, accessibility, or Kew's collection mandate.

Given that he did not have any family in the city and that his property resided on borrowed space, by way of his home in hotels and encroachment on his colleagues' offices in the

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[93] UMA, A.H. Reginald Buller acquisition files, Buller, A.H.R.: General, "Last Will and Testament of Arthur Henry Reginal Buller – 26 August, 1939."
[94] UMA, A.H. Reginald Buller acquisition files, Buller, A.H.R.: A2013-134, "Letter, Karen Adams, University Librarian, to Dr. David Wall, Director of Operations, Agriculture and Agri-Food Canada, Cereal Research Centre, 24 October, 2013."
[95] UMA, A.H. Reginald Buller acquisition files, Buller, A.H.R.: General, "Last Will and Testament of Arthur Henry Reginal Buller – 26 August, 1939."

Department of Biological Sciences or at the Dominion Rust Research Laboratory, it comes as little surprise that his possessions were donated to the UMA in fragments. The UMA's advocacy regarding the transfer of the records previously in LAC's holdings has allowed for a more complete view of Buller's work at the University of Manitoba. In a letter to National Archivist Ian Wilson, former University President Dr. Emöke J.E. Szathmáry even spoke in terms harkening to the total archives concept:

> Reginald Buller's contributions to this institution have been commemorated by a building named in his honour. Having all of his papers and related archival materials in one place would encourage research on his place in the University's history and would be a fitting complement to the honour bestowed on him by the naming of the Buller Building.[96]

It is undeniable that the UMA's guardianship over Buller's records has meant that much of his collection remains on his campus, allowing for researchers such as myself to make use of his collection.

"He was the Very Model of a Modern Research Scientist"

The UMA hosted an exhibit October 15, 2019 through August 31, 2020 entitled "He was the Very Model of a Modern Research Scientist: Reginald Buller and the Founding of the University of Manitoba."[97] The exhibit was curated by Nicole Fletcher, Katherine Pettipas, and Shelley Sweeney, and situated the Buller fonds alongside Buller's contributions to the University of Manitoba herbarium collection. While the botanical specimens are not the focus of the exhibit, it is an interesting connection between the two institutions.

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[96] UMA, A.H. Reginald Buller acquisition files, Buller, A.H.R.: A2004-025, "Letter from Dr. Emöke J.E. Szathmáry, President of the University of Manitoba, to Ian Wilson, National Archivist, Library and Archives Canada, 19 January, 2004."

[97] "He was the Very Model of a Modern Research Scientist," University of Manitoba Libraries blog, https://lib-umanitoba.libcal.com/event/3521588

The exhibit included several display cases, free-hanging posters, and recreations of Buller's laboratory and office. The cases were arranged in themes described as follows:

1) One case highlighting the foundation of the University of Manitoba, and Buller's contributions to the development of the Faculty of Science;
2) Two cases describing Buller's introduction of "New Botany" to the University of Manitoba and the importance of experimental over observational science;
3) One case highlighting Buller's impact on his students;
4) One case on Buller's research contributions to the fields of botany and mycology;
5) Three cases of his personal records, exhibiting his interests, hobbies, and lifestyle.

The cases featured photographs, publications, specimens, correspondence, artifacts such as cameras and microscopes, and ephemera which illustrated his interests. The free-hanging posters were primarily Buller's own diagrams of botanical specimens, which Buller used in courses to provide "visually stimulating" content to his students, and to encourage students' observational skills.[98]

The case interpreting Buller's laboratory is the most demonstrably connected to the herbarium, as it contains several specimens and a metal vasculum "rumoured to have been Buller's."[99] Dried, pressed specimen sheets, on loan from WIN, are featured in this case. In other cases, dried, whole, three dimensional specimens are interspersed with other artifacts taken from the fonds. These specimens have been labeled with taxonomic names, and in some cases, where or who the specimens came from. In one case, perhaps as an example for the sake of realism, mushrooms in an old shoelace box with some detritus appear to harken to a research trip by Buller.

In all, the exhibit creates a narrative around a very varied man which shows his dedication and discipline to his crafts – botany and mycology, art and poetry – and sharing these

[98] Nicole Fletcher, Public speech presented at the launch of "He was the Very Model of a Modern Research Scientist" exhibit, University of Manitoba, Winnipeg, MB, October 17, 2019. My thanks to Nicole Fletcher for providing a written copy.
[99] "He was the Very Model of a Modern Research Scientist: Reginald Buller and the Founding of the University of Manitoba." University of Manitoba Archives & Special Collections. October 15, 2019 – August 31, 2020.

with a wider audience. The focus is primarily on education, and on Buller's contributions to the University of Manitoba and the fields of botany and mycology. While the specimens may act as an addition to the atmosphere of the exhibit, they also represent a significant part of Buller's life. In this way, the same could be said about the rest of his collection in WIN – to get a sense of Buller's work, the two collections should be connected. Buller provides a uniquely positioned example of the possibilities of total archives. Considering the variety of media he collected and created, his personal collections provide a great amount of insight into New Botany, the University of Manitoba in the early twentieth century, and the perspective of this individual. It is important to acknowledge that this will not be feasible for every botanist. Not everyone will want to donate their personal records to an archive, and not every archive will have a collection mandate that might allow for donations from botanists. However, it is fortunate to have the opportunity to consider these collections together.

Chapter 3: Conclusion

Without the concept of total archives, we risk missing the context of a creator's life. While this may not be feasible in terms of physical control, there is ample ability to create connections intellectually between herbaria and archival collections. In the case of Buller, as with many individuals, the records he created have ended up in a wide variety of institutions, sometimes as a part of separation by media. In the past, these connections may have been hindered by distance; with the capabilities of online databases and linked data, new ways of imagining a collection beyond an institution's walls are possible.

Conclusion

The "archival stage" of the history of knowledge creation continues by establishing herbaria as archives. By recognizing a broader spectrum of institutions, we make stronger impressions on the importance of preserving knowledge in our society. The creation of knowledge in any field is fraught with biases and influences. Additional contextualization of this information through archival intermediaries allows users to understand a more fulsome view of the content.

The comparison between archival and herbaria protocols shows the strong parallels between the two repositories, and demonstrate that herbaria can be considered a type of archival institution. The application of archival theories within herbaria allows for better comprehension of the collection. Specimens have been completely removed from their original environment, plucked out of the ground, and placed in a particular context within the herbarium. While this context serves a purpose to one discipline and one worldview's interpretation of the natural world, it is not the only knowledge derived from these plants. The work of applying societal provenance on botanical specimens and the colonial practices of botany is meant to illustrate the origins of sources of knowledge, and in turn, encourages decolonizing practices in those spaces. The example of using participatory description in herbaria is one way to recognize and begin to address botany's appropriation of Indigenous Knowledge. Shifting ideals about respectful consultation and community-driven research are also important in correcting the past harms of exploitative research conducted by academics.

Considering the collections of botanical specimens within the total archives concept allows for a more holistic view of the records, collection, and creator. We live in an age that allows for connections to be made on a global scale, not limited to physical arrangements.

Although it may not be possible to store all media by all creators in one institution, databases and linked data allow collections to be connected across barriers of location or discipline.

This thesis explored two case studies on individuals whose collections allow for a broader discussion on these archival theories: first, James Isham of the Hudson's Bay Company concerning societal provenance, and second, Dr. Arthur Henry Reginald Buller of the University of Manitoba concerning total archives. These case studies allowed for a deeper look at the contexts these individuals lived within while also considering how their collections act as examples of these theories in practice.

The removal of a record's context is a detriment to understanding and future use of said record. Whether concerning the origins of knowledge or the broader collection of records, applying archival theories of societal provenance and the total archives concept benefits the overall understanding of herbaria.

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