The Genesis of Labrador's Indigenous Landscapes: A Review of Research Approaches and Current Knowledge

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ABSTRACT

This thesis presents an archaeological and paleoecological literature-based synthesis on the current state of knowledge concerning the development of Labrador's Indigenous landscapes and proposes a strategy for future research projects examining past human-environment interactions and anthropogenically influenced ecological change in the region. This is achieved through an examination and synthesis of archaeological literature on Labrador's archaeological culture histories and paleoecological research examining the environmental impacts of past and contemporary Indigenous groups from around the circumpolar north.

A review of 60 available paleoecological research papers demonstrates the efficacy of five methodological approaches in arctic and subarctic regions: geochemical soil analysis, palynology, archaeoentomology, paleolimnology, and dendrochronology. Then, following an account of Labrador's Indigenous culture histories based on available archaeological literature, a four-point research strategy is proposed to examine Indigenous-environment relationships at various spatial and temporal scales. This includes investigations of the following environmental contexts: (1) regional, through the sampling of lake and pond sediments; (2) local, by examining archaeological site-adjacent peat deposits; (3) site-level, for example through dendrochronological and geochemical soil analysis; and (4) community, including documentation of Traditional Ecological Knowledge and Indigenous toponyms. This research strategy is intended a useful tool for future sustainable research in Labrador but may be applicable more broadly.

GENERAL SUMMARY

This thesis lays out a plan to assist researchers in exploring the relationships between past Indigenous groups in Labrador and the environments they lived in. It first reviews research examining how past and present Indigenous groups around the northern regions of North America, Europe, and Asia have impacted biodiversity through the activities of their daily lives. Next, a history of Indigenous occupation in Labrador is presented, beginning from the First Peoples to present-day communities, based on archaeological research conducted in the area. This is followed by a discussion of what is currently known about how past Indigenous communities have contributed over time to small-scale environmental change throughout Labrador and concludes by proposing a research strategy for future projects exploring the relationships between past humans and Labrador's landscapes.

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First, I would like to respectfully acknowledge the territory in which this thesis was written as the ancestral homelands of the Beothuk, and the island of Newfoundland as the ancestral homelands of the Mi'kmaq and Beothuk. I would also like to recognize the Inuit of Nunatsiavut and NunatuKavut and the Innu of Nitassinan, and their ancestors, as the original people of Labrador, and whose heritage is discussed in this research. It is an honor to engage with their histories, and I hope that this work honors the beautiful land we share and the many stories that dwell within it.

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CHAPTER 1

INTRODUCTION

All landscapes that humans interact with are in some way affected by their presence. The degrees to which this occurs, however, are dependent on a number of factors and include climate, geology, and, not least of all, the human activities that cause the resulting impacts. This has likely been the case throughout human history but this idea had not been widely implemented by academic researchers until relatively recently (Balee 2014). A long prevailing idea held that human societies practicing agriculture changed the environments they lived within, manipulating earth and turning it into landscapes of production (Trigger 1980; Hodder & Hutson 2003; Reitz & Shackley 2012). The opposite notion accepted as part of this was that Indigenous and non-agricultural societies were environmentally undetectable, living in ways that left no trace in the environments they inhabited (Balee 2014; Holly 2013). This idea has largely fallen out of favor within the archaeological discipline as many researchers have come to recognize that humans, across all forms of social-cultural-political organization, are agents within complex environmental systems (Balee and Erickson 2006).

This recognition has since encouraged more research projects examining Indigenous-environment relationships and documenting the ways in which Indigenous peoples influence landscape change in the areas they inhabit. The work herein follows this line of examination by looking into paleoecological research (studying the relationships between organisms and their environments through time) from around the circumpolar north that demonstrates the effects that Indigenous groups have had throughout Arctic and Subarctic environments. The paleoecological data yielded by such studies document not only how Indigenous groups affect ecological systems but offers insights into the behaviors and activities that led to these changes. The scope of this project then focuses in on Labrador and the complex cultural histories that exist there. The place that was once described by Jaques Cartier as “The land that God gave Cain”, implying the land was barren and befitting a place of exile (Holly 2013), is in fact a region of rich cultural history whose inhabitants have influenced the ecological composition of many of its landscapes. Based on developments in the field of paleoecology, the work herein seeks to inform current understandings of Labrador’s landscape developments as they relate to the cultural histories that took place within the region and provide a blueprint for future paleoecological research projects examining Labrador’s Indigenous-environment relationships.

This thesis is driven by two main objectives: (1) to establish the current state of knowledge concerning Labrador’s Indigenous history and cultural landscapes; and (2) to outline a paleoecological research agenda that aims to further understandings of human-environment interactions throughout Labrador’s Indigenous culture history and the development of Labrador’s cultural landscapes. This work aims to synthesize research concerning the environmental impacts of hunter-gatherer cultures from around the circumpolar north and Labrador Indigenous culture histories to produce a narrative of what is currently known about the development of Labrador’s Indigenous landscapes from a paleoecological perspective. From there, a research agenda is presented as an approach towards furthering current understandings of Indigenous-environment relationships throughout Labrador’s history.

1.1. Theoretical Background

This research centers on the environmental processes and human activities that work together to co-create Labrador’s landscapes. In this way it is situated within the realm of, and inspired by, theoretical principles within historical ecology: a cross-disciplinary research program that concerns itself with studying how humans interact with natural environments and the consequences of these interactions on the formation of landscapes (Balee and Erickson 2006; Balee 1998, 2006; Beller et al. 2017; Crumley 2017; Jones et al. 2017; Watling et al. 2018). Historical ecology operates with four main assumptions:

> "(1) the non-human biosphere has been affected by human activity (most if not all); (2) human activity is not inherently harmful or helpful to life, either human or non-human; (3) effects on biospheres are not inherently similar, depending on environmental context and human activities/processes/organization; and (4) human and natural processes can be understood together as total phenomenon," (Balee 1998: 14).

Explicit in historical ecology approaches is that these assumptions hold true at all levels of human cultural organization (Balee 2006; Jones et al. 2017).

Rather than being a unified theoretical approach, historical ecology is more akin to a "conceptual toolbox" that guides research design while suggesting methods for obtaining data that include archaeological, ethnographical, historical, and natural sciences (Beller et al. 2017; Crumley 2017). It uses tools from various fields to access varying depths of time while being able to answer research questions from multiple perspectives towards understanding the nature of past ecosystems and landscapes (see Figure 1). While being an explicitly cross-disciplinary framework, it takes a human-focused approach where humans are a "keystone species" within environmental systems and agents of change (Balee and Erickson 2006). Rather than being exclusively concerned with how humans produce change within the environments they live, however, historical ecology examines the nuanced ways in which environmental and human systems influence change within each other. The relationship between the two is assumed to be dialectic in nature, where they respond to and influence one another over time, rather than existing as a dichotomy where humans are distinct from environments, two opposing entities that do not interact with each other (Balee 1998, 2006). In this way, the interacting human and environmental systems that exist together are considered as a total phenomenon, a singular unit of study rather than systems existing independent from one another.

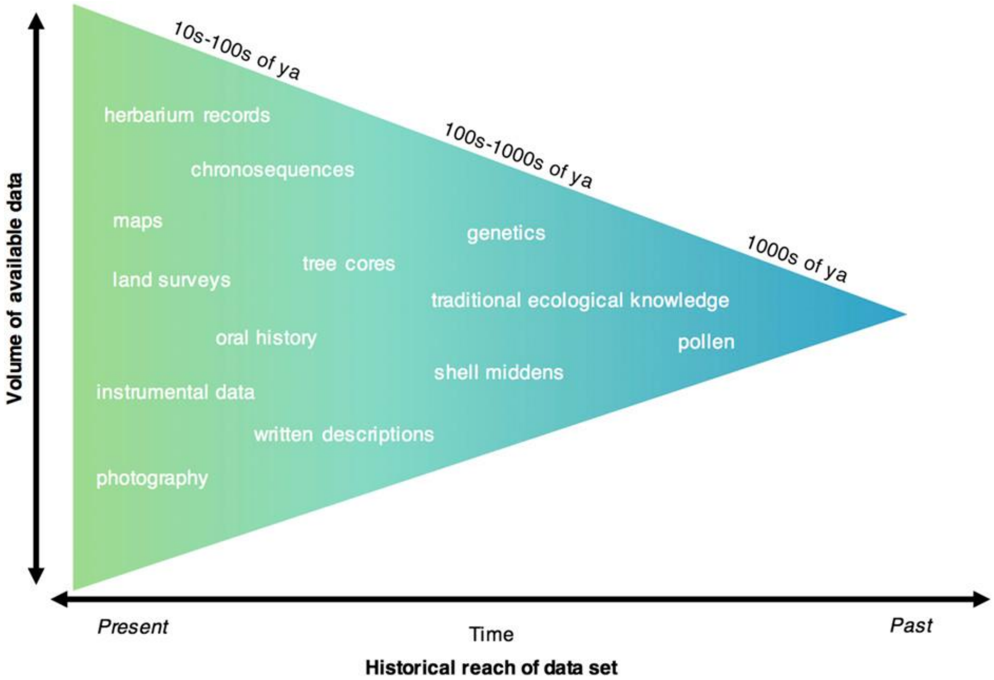

Figure 1: Historical ecology relies on the use of a broad range of environmental and archival resources to access various depths of time and perspectives (originally published in Beller et al. 2017: 646).

Central to historical ecology is the concept of landscape. Landscapes are both the stage where human and environmental systems interact and the product of these interactions. Archaeologically they are the combination of the physical space people occupy and the overlaying cultural significant significance that people attach to these spaces, which in part defines the way people interact with them (Crumley 1994, 2017; Ingold 1993). Human-environment interactions within these spaces create non-random patterns of change that are often visible through various methodological approaches (Balee and Erickson 2006). In this way, landscapes are considered as kinds of historical documents that hold information concerning past actions and behaviors of humans as they relate to changes within environmental systems. Paleoecological methods, among many others, are often used tools in studies of landscape change and formation, as the data sets produced by these methods are capable of recreating past environments and documenting changes that are brought about both by environmental and human processes (Beller et al. 2017). Oftentimes this data is used to examine resource management, strategies of land use, and structured activities within a landscape (Balee and Erickson 2006; Crumley 2017). An important assumption in this view of landscapes is that they do not adhere to principles of equilibrium that suggest environmental systems always trend towards some ideal state after change has occurred (Balee 1998, 2006; Crumley 2017). Instead, landscapes are viewed as dynamic spaces that experience short-term, long-term, and cyclical changes that often work to create novel environments with distinct histories. A central goal in the study of landscapes is documenting these histories and interpreting data to better understand past human behavior and activities.

Another important concept within historical ecology is that of disturbance. Disturbances result from actions that in some way alter the physical environment, bringing about both destructive and constructive changes to environmental systems at varying scales (Kluiving 2015; Laland and O’Brien 2010). Examples of human behaviors which lead to environmental disturbances among hunter-gatherer societies in Labrador include the harvesting of woodland resources, the depositing of waste materials within the surrounding environment, and construction of dwelling structures and settlements. These all directly or indirectly bring change to ecological systems and influence the impacted environments which respond to these changes in specific ways dependent on the types of activities that caused them and the broader environmental context. In this way, disturbance is central to another theory relevant to historical ecology: niche construction theory (NCT). Niche construction theory is a theoretical framework taken from evolutionary biology which posits that organisms have the potential to co-direct their own evolution as well as the evolution of other species through the modification of their own, and others', niches (Kluiving 2015; Laland and O'Brien 2010; Watling et al. 2018). Within an historical ecology framework, NCT focuses on human's ability to alter natural selection pressures as they modify the environments they occupy, and in doing so create both inceptive (new environmental modifications) and counteractive (in response to environmental modifications) changes within these spaces (Kluiving 2015). Further, the behaviors that cause disturbance-led environmental changes, and the environments they produce, are inherited by future generations of people who continue to enact changes because of these learned patterned behaviors (Bishop et al. 2014; Kluiving 2015; Laland and O'Brien 2010). Overtime, these behaviors may have the effect of influencing the structure of plant and animal populations and diversity in the impacted areas, as well as the genetic makeup of those species based on the altered natural selection pressures (see Figure 2) (Bishop et al. 2014; Laland and O'Brien 2010). In this way, through niche construction, humans become ecological engineers within landscapes, controlling the flow of energy and materials within ecosystems and both directly and indirectly affecting the natural selection pressures of various species of organisms effected by their disturbances (Laland and O'Brien 2010). The process of niche construction occurs through intentional and accidental processes, both of which are capable of producing significant ecological change. For instance, the clearing of trees from a patch of forest might promote the growth of berry-producing plant species, while this same action may affect the hydrological regime within the area as a result of decreased water evaporation from trees, thereby completely altering the selection pressure on local plant species and eventually resulting in changes to plant biodiversity.

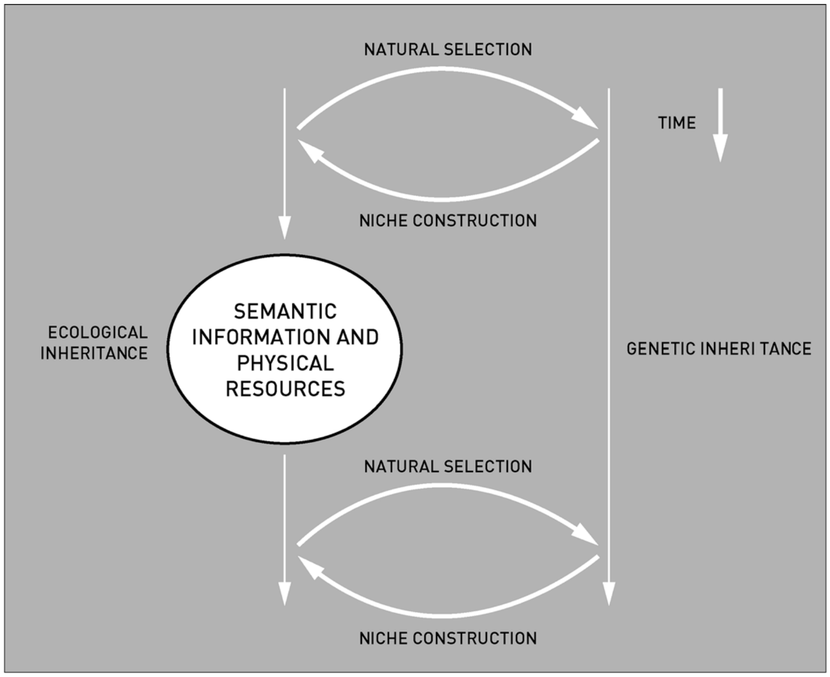

Figure 2: Model showing the relationships between ecological inheritance for human populations and the genetic inheritance of species within modified niches (originally published in Kluiving 2015: 559).

The concepts of landscape, disturbance, and niche construction all work together to contextualize human impacts within environments. This thesis examines the various disturbance patterns of Indigenous communities around the circumpolar north (i.e., the ways in which they interact with the environment) while looking specifically at how they contribute to the alteration of physical processes, the availability of nutrients, and species biodiversity within the environments they occupy. The goal from here is to consider and reconstruct the ways in which Labrador's Indigenous occupants have, over time, contributed to the development of Labrador's landscapes to better understand the behaviors and activities that influenced these developments.

1.2. Defining Terminology

Throughout this thesis there are terms that need clarification. Some of these are technical terms, while others substitute for terms that are often used in archaeological literature. Instead of including descriptions where they first appear, they will be explained here.

Many of the names used here are not the names that the people who they describe would call themselves. Archaeological cultures are identified based on shared sets of traits in their material culture, settlement patterns, region and time of occupation, and subsistence strategies. When enough change occurs within an archaeological culture that aspects of these traits no longer resemble what is seen elsewhere, a name is given to this “new” group to distinguish it from other groups. In some instances, local variation within a regional group is considered enough to warrant a new name being given to an archaeological culture (Holly 2013; Neilsen 2016). For instance, among Innu-descended archaeological cultures, there is a distinction between the “Daniel Rattle Complex” and the “Point Revenge Complex”, both of whom occupy Labrador but one after the other (Fitzhugh 1972; Loring 1992). Despite these two groups having different names (both of which are descriptive of the place where they are first identified), they are recognized as both existing within the “Recent Period” of archaeological history in Labrador, and both are ancestors of present-day Innu communities (Loring 1992; Neilsen 2016).

For the sake of being concise, here cultures are described using their archaeological name with few references to their regional or temporal variations, and wherever possible self-referring Indigenous terminology is used instead. For example, instead of referring to either the Daniel Rattle Complex or Point Revenge Complex specifically, here they will be referred to as Innu-descendant groups or Innu. In this case, there is enough evidence to suggest cultural continuity from Daniel Rattle and Point Revenge complexes to present-day Innu. Furthermore, Innu assert that these groups as well as all previous First Nations descendant groups in Labrador are their ancestors, and that notion is respected here (Loring 1992; Neilsen 2016). Therefore, First Nations groups are described under the same sub-section in chapter three. From there, they are described in chronological order from oldest to present day, beginning with Maritime Archaic and followed by Intermediate Period and Innu. It is also important to note that although these groups are presented here chronologically, they are not closed categories, given that many groups interacted with each other and existed at the same time and places.

Regarding Arctic-adapted cultures such as Inuit, while they make a distinction between themselves and previous groups who migrated south into Labrador, some Inuit also believe that all previous inhabitants of Labrador are their ancestors. The term used for pre-Inuit Arctic-adapted cultures here is Sivullirmiut, an Inuktitut word meaning “the first people” (Hodgetts and Wells 2016). This term is preferred here from previously used archaeological terminology as it respects Inuit sense of history and attempts to move away from outdated archaeological power structures. The subsection on Sivullirmiut also follows in chronological order from oldest to most recent, beginning with Pre-Dorset, then Groswater, and ending with Dorset. Inuit is the only term used to describe contemporary Inuit culture and its ancestral variation, commonly referred to in archaeological literature as Thule (Friesen 2013; Raghavan et al. 2014). The name Thule was first used by Therkel Mathiassen to refer to an ancient Arctic-adapted culture that predated modern Inuit (Ramsden and Rankin 2013; Rankin 2009; Whitridge 2016). Since then, it has been used archaeologically to refer to the pre-European contact ancestors of Inuit. The term has since undergone criticism as being problematic, both as a European name for an Indigenous population whose ancestors exist today, as well as the association with Germany's "proto-Nazi Thule Society" (Harris and Elliott 2019; Whitridge 2016). The term "pre-contact" has been applied to "Inuit" as an alternative, but given the uncertain nature of Inuit-Norse relationships in Greenland, it is unclear if this term is entirely fitting (Park 2008; Ramsden and Rankin 2013; Stopp 2002b). Given this, from here on the name Inuit, a term of self-reference for the population described here, will be used in contexts where "Thule" would otherwise apply.

The name NunatuKavummiut is used here to refer to the Southern Inuit, or Inuit Metis, who reside in southern Labrador. For the reasons mentioned above, this term is preferred here relative to Inuit Metis as it is a self-identifying term used by NunatuKavummiut in southern Labrador (NunatuKavut 2021).

1.3. Thesis Overview

This thesis is presented in four chapters. The chapter immediately following this one, chapter two, presents a review of paleoecological methods and approaches used around the circumpolar north in investigations of Indigenous, hunter-gatherer relationships with the environments they inhabit. Specifically examined are impacts, referring to changes in ecological systems, brought on by the activities of Indigenous communities. The chapter aims to compile research to a degree that is as exhaustive as possible, and focus on how these impacts appear in paleoecological data, followed by a discussion of what behaviors and activities lead to these various types of impacts.

Chapter three begins with a presentation of Labrador's natural history throughout the Holocene, from the moment the Laurentide Ice Sheet began its recession from coastal Labrador up to present day. It describes general climate trends along with changes to plant species throughout this period. It is then followed by culture histories for all of the archaeologically documented Indigenous cultures in Labrador's history. Discussed are attributes of each cultural group including subsistence and settlement strategies, technologies, movements throughout Labrador at various times, and relationships to other groups within the area.

Chapter four syntheses information detailed in chapters two and three to present the current state of knowledge concerning Indigenous influences on landscape development within Labrador. Information from recent paleoecological research is presented, constituting what is known about Labrador's Indigenous-environment relationships and their impacts influencing landscape development from a paleoecological perspective. Following that, hypotheses are presented concerning the potential environmental impacts of each culture group based on features of their lifeways. After presenting this information, a paleoecological research agenda is suggested for future researchers intending to study Indigenous-environment relationships in Labrador. The agenda focuses on four sampling approaches: coring pond and lake sediments; sampling peat deposits near archaeological sites; conducting more site-based sampling approaches; and incorporating Traditional Ecological Knowledge and Indigenous rightsholders. This aims to suggest a set of approaches that do not need to be carried out simultaneously, but instead may be applied or incorporated into research projects at the discretion of researchers.

Chapter five presents the concluding statements and directly addresses the main objectives presented in this chapter. This thesis aims to be robust in its presentation of information and helpful in its suggestion for research approaches, as a tool for directing future research.

CHAPTER 2

ENVIRONMENTAL IMPACTS OF NORTHERN INDIGENOUS GROUPS

Past Indigenous lifeways endure on contemporary landscapes around the circumpolar north. What changes are not visible on the surface are present within paleoecological archives, revealing human influences on the distribution of plants and animals, as well as suggesting activities that physically altered landscapes. This chapter focuses on research in Arctic and Subarctic environments that explores the ecological impacts caused by past Indigenous lifeways.

For the purposes of this text, the term "impact" refers fundamentally to any change within an ecological system resulting from environmental disturbances caused by human activities (Jones et al. 1994; Balee 2006; Laland & O'Brien 2010, 2011; O'Connor 2013). Many of the effects of these anthropogenic disturbances are visible as non-random patterns of ecological activity within the paleoecological record (Crumley 1994). These changes can be obvious, the direct result of human activity like the harvesting of woodland resources (e.g. Roy et al. 2012), or subtle, an indirect consequence of human activity like erosion of the edge of a pond caused by repeated foot traffic (e.g. Renouf et al. 2009).

This chapter is guided by three goals: (1) to present accessible and pertinent research on the topic of environmental impacts of northern Indigenous lifeways; (2) to discuss what this research tells us about these groups; and (3) to discuss the forms of ecological impact associated with northern Indigenous lifeways. It aims to be as methodologically comprehensive as possible while examining how these impacts feature in the paleoecological record. Within the broader scope of this thesis, this chapter establishes precedent for conducting similar research within the context of Labrador cultural and environmental history.

2.1. History of Research Examining the Ecodynamics of Northern Indigenous Groups

As early as 1937, researchers working in the circumpolar north recognized archaeological sites of former Indigenous settlements from landscape surface observations (Hrdlicka 1937). Sites could often be identified through a recognizable pattern of vegetation growth that stood out when compared to the surrounding landscape, often described as being greener and “more luxuriant” (Lutz 1951). Certain species of plants would demonstrate preferences for these areas, such as iris flowers which grew within the depressions left by Inuit sod houses (Renouf 1985), and ruderal species such as *Montia fontana* (water chickweed/water blinks) and *Rumex* sp. (sorrel). These patterns of vegetation are attributed to the activities that occurred on settlements, such as food processing, waste disposal, and repeated movements over the same areas of land (Lutz 1951) and altered soil chemistry. Especially in High Arctic areas, archaeological prospection still utilizes observation of above ground surface features and distinct anthropogenic patches of vegetation growth to detect archaeological sites (Walker 2020).

To understand the cause of these observed differences, researchers began investigating the chemical composition of soils in and around archaeological sites. Chemical analysis of soils from archaeologically defined areas showed marked increases in nutrients that promote plant growth, such as nitrogen, potassium, and phosphorous, relative to soils from surrounding, undisturbed areas (Lutz 1951). The discovery of this relationship encouraged research throughout the mid-late 20th century examining the effects of past Indigenous occupation on soil chemistry (Porsild 1955; Harp 1974; McCartney 1979; Moore 1986; Moore & Denton 1988; Brookes & Johannes 1990; Forbes 1996; Derry et al. 1999; Knudson et al. 2004), pushing back on previously held notions of Indigenous people as existing "harmoniously" (i.e. passively) within environments. Periodically during this time, and increasingly over the past 30 years, as research projects began to consider the broader ecological consequences of past Indigenous occupation of circumpolar landscapes, researchers began to expand the scope through which these ecological impacts are observed.

Beyond affecting soil chemistry, anthropogenic influences on floral composition are also recorded in pollen, spore, and plant macrofossil deposition. Early application of palynological research methods to assess the environmental impacts of Arctic and Subarctic hunter-gatherers occurred in the early 1990's. Work by Hicks (1993) and Aronsson (1991, 1994) examined pollen from layers of peat moss associated with past hunter-gatherer occupations in northern Finland. They demonstrated that a clear signal of activity can be detected in the local environment related to human occupation. This research influenced scholarship in the Fennoscandia region examining the impacts of Indigenous peoples on the landscape (Aronsson 1991, 1994; DeLuca et al. 2013; Hicks 1993; Hornberg et al. 1999, 2005; Josefsson et al. 2009; Kamerling et al. 2017; Olsson et al. 2010; Staland et al. 2010), which has since extended to research in Canada, Alaska, Greenland, and Siberia exploring Indigenous-environment relationships (Anderson et al. 2014, 2019; Bhiry et al. 2016; Ledger 2018; Ledger and Forbes 2020; Lemus-Lauzon et al. 2016; Roy et al. 2012, 2015).

Around the time Hicks and Aronsson were conducting research in Finland, Böcher and Fredskild (1993) were conducting similar research in west Greenland. Their approach combined palynological analyses on samples of peaty archaeological sediments with the analysis of insect sub-fossil remains from midden and house occupation layers of a Sivullirmiut (Saqqaq) site (2500–800 BCE (Fenger-Nelsen et al. 2019)). The use of this methodology has expanded across the Arctic and Subarctic regions to include a variety of temporal, spatial, and cultural contexts within the circumpolar north (Dussault et al. 2016; Forbes et al. 2014, Panagiotakopulu et al. 2018).

In 2004 pond sediment cores from the Canadian High Arctic were tested for signals of hunter-gatherer influence in the paleolimnological record (Douglas et al. 2004). Limnology is the study of inland water systems, and examines available nutrients, fossil pollen and algae, and plant macrofossils preserved in lake sediments as proxies to understand changes to these ecological systems (Hadley at al. 2010a, 2010b). Through limnological and stable isotope analysis, Douglas et al. (2004) demonstrated that ponds adjacent to hunter-gatherer occupations show evidence of human activities manifesting as the growth of certain algae communities to the detriment of others. That hunter-gatherers influence inland water ecology was further demonstrated by Bell et al. (2005) and Renouf et al. (2009). Their work at Port au Choix, Newfoundland suggested that not only do hunter-gatherers leave discernable traces in the paleolimnological record, but also that it may be possible to recognize distinct "ecological signatures" for specific Indigenous groups.

2.2. Methodology

Papers chosen for this chapter were selected based on four criteria. Each study: (1) focuses on areas within the Arctic and Subarctic as defined by Koppen Climate Classification System (Kottek et al. 2006); (2) directly explores human impacts and/or the implications of those impacts (what do they tell us about the people who initiated them?); (3) was written in English; and (4) was accessible through online databases. The two latter criteria imply that it is likely certain studies were missed due to issues of accessibility despite being topically relevant.

Once the selection criteria were in place, the author used the “OneSearch” searching engine provided through the Memorial University of Newfoundland Library website. To search for relevant sources, combinations of keywords were entered, which fall within three broad categories: general, geographical, and cultural. General keywords include “archaeology”, “human impact”, “human influence”, “Indigenous”, “hunter-gatherers”, “Arctic”, “Subarctic”, “ecology”, “paleoecology”, and “landscape”. Geographic keywords used were “Alaska”, “Fennoscandia”, “Scandinavia”, “Sweden”, “Norway”, “Finland”, “Russia”, “Siberia”, “Canada”, “Inuvialuit”, “Nunavut”, “Nunavik”, “Nunatsiavut”, “Labrador”, and “Greenland”. Cultural keywords were specific names of Arctic Indigenous peoples such as “Inuit”, “Saami”, “Thule”, “Dorset”, “Aleut”, “Yupik”, “Evenki”, “Nenets”, “Chukchi, and “Khanty”.

Once articles were vetted, they were subjected to backward snowballing (finding citations within a paper) and forward snowballing (finding citations to a paper) (Van Wee and Bannister 2016). Backward snowballing collects sources cited in research papers on relevant topics, often revealing clusters of research that share or are influenced by similar methodological traditions. Forward snowballing allowed for collecting more recent sources on relevant research topics. The accumulated articles were then sorted into two tables, one by order of chronology and the other by geographic location. It should be noted that this process does include biases, for instance it is entirely possible certain “clusters” of relevant research were missed because they did not share certain core research influences with the other discovered works.

2.3. Results

2.3.1. Description of Results

The review process yielded 60 works which fit the above criteria and are listed in Table 1. These works span the three continents around the Arctic and Subarctic region of the globe (Europe, Asia, and North America) and have further been divided into five sub-regions: Alaska, Canada, Greenland, Fennoscandia, and Siberia. Five paleoecological methodologies are employed within the reviewed works and are included in Tables 1 and 2. These include:

- palynology, the study of pollen, as well as microscopic charcoal and coprophilous fungal spores;
- geochemical soil analysis, examining the chemical composition of archaeological soils;
- archaeoentomology, the study of insect subfossils in archaeological contexts;
- limnology, the study of in-land freshwater ecosystems;
- dendrochronology, the scientific dating of tree rings.

Excluded from the final counts are two papers which include relevant research but are topical reviews themselves (specifically archaeoentomological in nature) and will be included in the list of works cited herein (Forbes et al. 2014; Forbes et al. 2017).

Table 1: List of selected case study in chronological order, beginning with the earliest publication to manuscripts currently in press.

#	Reference	Methods	Location
1	Lutz 1951	Geochemical Soil Analysis	Alaska
2	Haarlov 1967	Archaeoentomology	Greenland
3	McCarney 1979	Geochemical Soil Analysis	Canada
4	Moore 1986	Geochemical Soil Analysis	Canada

5	Moore & Denton 1988	Geochemical Soil Analysis	Canada
6	Aronsson 1991	Palynology	Fennoscandia
7	Bocher & Fredskild 1993	Palynology, Archaeoentomology	Greenland
8	Hicks 1993	Palynology	Fennoscandia
9	Aronsson 1994	Palynology	Fennoscandia
10	Derry et al. 1999	Geochemical Soil Analysis	Canada
11	Gron et al. 1999	Dendrochronology	Siberia
12	Hornberg et al. 1999	Palynology, Dendrochronology	Fennoscandia
13	Ostlund et al. 2003	Dendrochronology	Fennoscandia
14	Douglas et al. 2004	Limnology	Canada
15	Karlsson 2004	Geochemical Soil Analysis	Fennoscandia
16	Knudson et al. 2004	Geochemial Soil Analysis	Alaska
17	Ostlund et al. 2004	Dendrochronology	Fennoscandia
18	Bell et al. 2005	Limnology	Canada
19	Hornberg et al. 2005	Palynology	Fennoscandia
20	Josefsson et al. 2009	Palynology	Fennoscandia
21	Renouf et al. 2009	Limnology	Canada
22	Frink and Knudson 2010	Geochemical Soil Analysis	Alaska
23	Hadley et al. 2010a	Limnology	Canada
24	Hadley et al. 2010b	Limnology	Canada
25	Josefsson et al. 2010	Dendrochronology	Fennoscandia
26	Knudson and Frink 2010	Geochemical Soil Analysis	Alaska
27	Olsson et al. 2010	Palynology (charcoal)	Fennoscandia
28	Staland et al. 2010	Palynology	Fennoscandia
29	Butler 2011	Geochemical Soil Analysis	Canada
30	Lemus-Lauzon et al. 2012	Dendrochronology	Canada
31	Roy et al. 2012	Palynology	Canada
32	Butler and Dawson 2013	Geochemical Soil Analysis	Canada
33	DeLuca et al. 2013	Geochemical Soil Analysis	Fennoscandia
34	Michelutti et al. 2013	Limnology	Canada
35	Viberg et al. 2013	Geochemical Soil Analysis	Fennoscandia
36	Anderson et al. 2014	Palynology	Siberia
37	Freschet et al. 2014	Geochemical Soil Analysis	Fennoscandia
38	Forbes et al. 2015	Archaeoentomology	Alaska
39	Ostlund et al. 2015	Geochemical Soil Analysis	Fennoscandia

40	Roy et al. 2015	Palynology	Canada
41	Bhiry et al. 2016	Palynology	Canada
42	Choy et al. 2016	Geochemical Soil Analysis	Alaska
43	Couture et al. 2016	Geochemical Soil Analysis	Canada
44	Dussault et al. 2016	Archaeoentomology	Canada
45	Lemus-Lauzon et al. 2016	Palynology	Canada
46	Kamerling et al. 2017	Palynology	Fennoscandia
47	Roy et al. 2017	Dendrochronology	Canada
48	Butler et al. 2018	Geochemical Soil Analysis	Canada
49	Egelkraut et al. 2018	Geochemical Soil Analysis	Fennoscandia
50	Ledger 2018	Palynology	Alaska
51	Lemus-Lauzon et al. 2018	Dendrochronology	Canada
52	Panagiotakopulu et al. 2018	Palynology, Archaeoentomology	Greenland
53	Anderson et al. 2019	Palynology, Geochemical Soil Analysis	Siberia
54	Fenger-Nielsen et al. 2019	Geochemical Soil Analysis	Greenland
55	Harrault et al. 2019	Geochemical Soil Analysis	Siberia
56	Barbel et al. 2020	Geochemical Soil Analysis	Canada
57	Forbes et al. 2020	Archaeoentomology	Alaska
58	Oberndorfer et al. 2020	Geochemical Soil Analysis	Canada
59	Ledger & Forbes 2020	Palynology, Archaeoentomology	Alaska
60	Roy et al. 2021	Dendrochronology	Canada

2.3.2. Geographic and Cultural Scope

The material covers four contemporary Indigenous groups and their antecedents. Research from Canada, Alaska, and Greenland discusses contemporary Inuit and several Sivullirmiut cultures, including Groswater (Canada), Dorset (Canada/Greenland), and Saqqaq (Greenland). Within Alaska, Yup'ik settlements are subject to paleoecological investigation, (Yup'ik being related to the broader Inuit cultural designation). Within Siberia the material covers two Indigenous groups: Evenki-Iakuts and Nenets. Both groups are semi-sedentary reindeer herders whose ancestors occupied similar land in Siberia as today: Evenki-Iakuts along the tundra tree-line and northern taiga of China and Mongolia; and Nenets on the tundra of the Siberian High Arctic. Research from Fennoscandia focuses on historic Saami reindeer herders whose traditional lands cover northern Norway, Sweden, Finland, and western Russia on the Kola Peninsula. Sami descendants are discussed as well during investigations of past Fennoscandian Indigenous cultures.

Table 2: Table displaying case studies by region. The case numbers (those italicized in the third column) refer to those provided in Table 1. The total number of studies conducted in each region (second column) may differ from the total number of methods used in that region (numbers in bold in the third column), as some case studies employed multiple methods.

Regions	**Total Studies**	**Methods*** – (case numbers) *Numbers in bold refer to total number of studies using the associated method per region.
Alaska	9	**5** Geochemical Soil Analysis – (*1*, *16*, *22*, *26*, *42*) **3** Archaeoentomology – (*38*, *57*, *59*) **2** Palynology – (*50*, *59*)
Canada	25	**10** Geochemcial Soil Analysis – (*3*, *4*, *5*, *10*, *29*, *32*, *43*, *48*, *56*, *58*) **6** Limnology – (*14*, *18*, *21*, *23*, *24*, *34*) **4** Palynology – (*31*, *40*, *41*, *45*) **1** Archaeoentomology – (*44*) **4** Dendrochronology – (30, 47, 51, 60)
Fennoscandia	18	**9** Palynology – (*6*, *8*, *9*, *12*, *19*, *20*, 27, 28, 46) **4** Dendrochronology – (*12*, *13*, *17*, *25*) **6** Geochemical Soil Analysis – (*15*, *33*, *35*, *37*, *39*, *49*)
Greenland	4	**3** Archaeoentomology – (*2*, *7*, *52*) **2** Palynology – (*7*, *52*) **1** Geochemical Soil Analysis – (*54*)
Siberia	4	**1** Dendrochronology – (*11*) **2** Palynology – (*36*, *53*) **2** Geochemical Soil Analysis – (*53*, *55*)

2.4. Defining the Impact of Indigenous Foragers’ on Northern Environments

2.4.1. Fluctuations in Available Nutrients

Around the circumpolar north, archaeological sites create distinct vegetation growth patterns resulting from the input of nutrients into soils. The chemical inputs begin from the time the site is occupied and persist after the site is abandoned (Fenger-Nielsen et al. 2019). The nature of these chemical signatures is dependent on the intensity of occupation, and are often activity-specific (Barbel et al. 2020; Butler et al. 2018; Butler and Dawson 2013; Couture et al. 2016; Knudson et al. 2004). In boreal settings, sites that were repeatedly occupied or were continuously occupied have chemical signatures that tend to be strongest around the immediate area of occupation. The intensity of this signature decreases as the distance from the site increases (Freschet et al. 2014). The removal of woodland nutrients is more visible in deforested areas where the overharvesting of trees creates a very nutrient-poor soil which tends to experience water saturation resulting from decreased evaporation from trees, inhibiting the reestablishment of woodland in the affected areas (DeLuca et al. 2014; Ostlund et al. 2015).

In tundra settings the anthropogenic chemical signature is more contained to the immediate area of the site, often creating surface vegetation that differs in species and color relative to the surrounding environment, creating an observable color contrast. Areas within and adjacent to housing structures demonstrate enriched geochemical presence (Barbel et al. 2020; Butler 2011; Butler and Dawson 2013; Butler et al. 2018; Couture et al. 2016), and areas where open-air activities took place appear as patches of enriched areas through broader geochemical surveys around sites (Butler and Dawson 2013; Frink and Knudson 2010; Knudson et al. 2004; Knudson and Frink 2010). In instances where reindeer live alongside humans in Fennoscandia and parts of Siberia (Anderson et al. 2019; Egelkraut et al. 2018), reindeer urine and fecal matter recycle nutrients back into the soil, enriching the areas they graze over. This may have the added effect of depleting levels of potassium in the soil as the year-round maintenance of antlers requires large amounts of potassium, thereby limiting the amount that is recycled back into the environment (Egelkraut et al. 2018). This contrasts with boreal settings, where natural sources of potassium are more available and recycle more easily despite grazing pressure.

Ecological characteristics of ponds are altered near areas of Indigenous occupation as activities on the water's edge deposit organic nutrients through both direct and indirect causes, such as tossing waste, and indirect causes, such as erosion (Douglas et al. 2004; Renouf et al. 2008). The increase in available nutrients is dependent on the activities that occurred near or in the pond, as well as the intensity of the nearby occupation. Ponds in the Canadian High Arctic show an acute sensitivity to nearby activities, with intensity of site occupation greatly affecting eutrophication. There, ponds near sites that were continuously occupied by Inuit and Sivullirmiut communities demonstrate ecological change associated with heightened levels of nitrogen specifically sourced from sea mammals (Michelutti et al. 2013). No evidence of anthropogenic eutrophication has been observed in ponds near sites where occupation was brief or highly seasonal. Conversely, ponds near sites in the Subarctic indicate that intensity of occupation is not as strong as a factor, suggesting that direct activity involving the deposition or processing of resources into the water is a stronger factor of eutrophication than intensity of occupation (Michelutti et al. 2013).

2.4.2. Changes to Biotic Communities

As humans move into or over a landscape, ecological changes create opportunities for some organisms while inhibiting the growth of others. This is most readily observed in the altered vegetation that exists on archaeological sites across the circumpolar north. In the paleoecological record these changes are readily apparent, resulting from the succession from the initial vegetation to plant species that are disturbance-resistant or favor nutrient-enriched habitats (Aronsson 1994; Hicks 1993; Ledger 2018; Roy et al. 2015). Around the circumpolar north these plants include apophytes such as *Montia fontana*, *Silene*, *Rumex*, *Achillea*-type, *Ranunculus acris*-type, *Senecio*-type, and *Poaceae* (Anderson et al. 2019; Aronsson 1994; Hicks 1993; Ledger 2018; Kamerling et al. 2017; Roy et al. 2012, 2015). Increased activity in certain fungal species is noted in archaeological contexts as well. In areas where humans co-occupy space with animals, such as dogs or reindeer, *Sporormiella*-type coprophilous fungal spores are present in greater numbers relative to environmental baselines (Kamerling et al. 2017; Ledger 2018). Decrease in populations of select tree species is often an accompaniment to occupation of circumpolar landscapes, such as species of *Pinus* (pine), *Betula* (birch), and *Picea* (spruce) as a result of humans harvesting trees and woodland resources (Hicks 1993; Kamerling et al. 2017; Ledger 2018; Roy et al. 2012). Relative increases of these species occur following abandonment of the area. Similarly, abundance of *Sphagnum* sp. mosses decreases throughout occupation due to trampling caused by foot traffic in the area, only to rebound following site abandonment (Ledger 2018).

Changes to diatom communities in freshwater ponds are observed in proximity to occupied areas as well. These changes are connected to increased salinity and nutrient input from resource processing, disposal, and increased sedimentation rates as a result of erosion caused by pond side activities. There do not seem to be any strictly synanthropic taxa within diatom assemblages, and changes are observed with relative increases in the species *Amphora ovalis*, *Stephanodiscus minutulus*, *Gomphonema angustatum*, and *Staurosirella pinnata* (Hadley et al. 2010a, b; Michelutti et al. 2013).

Insect communities show drastic increases in abundance in areas close to Indigenous archaeology (Bocher & Fredskild 1993; Dussault et al. 2016; Forbes et al. 2015; Panagiotakopulu et al. 2018). The one truly synanthropic taxa associated with pre-European contact Indigenous settlements in Arctic and Subarctic landscapes is the human louse *Pediculus humanus* L., found to occur in large numbers within settlement structures (Dussault et al. 2014; Forbes et al. 2015; Ledger and Forbes 2020). Insect taxa are often identified that suggest changing environmental conditions related to periods of human occupations versus hiatuses in occupation. This can go from increase in taxa associated with marsh-like environments as a site becomes wetter over time (Dussault et al. 2016), to increase in rove beetles (Staphylinidae) indicative of nutrient-enriched areas and decaying organic matter (Forbes et al. 2017). Further, it is common to find taxa that typically occupy niches that are different from the areas they are discovered during entomological investigations, such as insects associated with trees or sod found inside winter dwelling structures, suggesting transport by site inhabitants (Forbes et al. 2014). In these ways, the habitats provided by human built environments mimic or act as substitutes for ecological niches that attract foreign insects to the occupation area, while creating sustainable conditions for high-nutrient and disturbance-loving indigenous insect species to thrive.

2.4.3. Transitions in Local Hydrology

Indigenous land use practices often affect hydrological regimes around areas of occupation. This occurs where soil drainage patterns change as direct or indirect consequences of land use. The saturation of soils is documented in instances where tree harvesting has taken place as less water is lost to evaporation by trees (Lemus-Lauzon et al. 2016). Additionally, the repeated trampling and use of landscape is documented as contributing to gradually increasing dampness of ground cover (Dussault et al. 2016). The opposite can be true as well, where cultural practices directly influence drainage. For example, the digging of trenches during occupation can promote better drainage in the immediate area and create dryer ground conditions over time (Ledger 2018). After the abandonment of a site, it is common that the area becomes wetter, contributing to marsh-like conditions.

These changes, which contribute to the transformation of plant and animal communities around the site, presumably also influenced the lived experiences of Indigenous occupants. Changes to local hydrology at times are compounded by larger climatic events such as the Little Ice Age. Permafrost contributes to poor drainage, creating more water-saturated soil, and often augmenting the effects of impacts from Indigenous occupation, such as the deforestation of areas adjacent to areas of occupation (e.g., Roy et al. 2012). In such instances, marsh and bog-like conditions may expand around sites during warm months in Arctic and Subarctic, as melt water pools on land surfaces with shallow permafrost persisting beneath the ground.

2.5. Reconstructing Paleoeconomies and Domestic Practices Using Environmental Proxies

2.5.1. Land and Resource Use

Wood is an important resource for northern peoples who use it as fuel and in the construction of shelter and various tools. Activities related to its harvesting and use are represented in paleoecological archives as decrease in tree pollen, an increase in microscopic charcoal in association with human occupation, the presence of wood-specific insect taxa and forest tree species, and changes to available nutrients in harvested soils where harvesting took place relative to undisturbed areas. In the boreal forests of northern Fennoscandia, cultural landscapes exist around former areas of Saami occupation where the composition of tree age and species differs from otherwise undisturbed environments (Freschet et al. 2014). The absence of forest litter, dead trees, and old trees is suggestive of selective woodland resource harvesting and is reflected in the area's soil chemistry. In some instances, landscape repurposing is evidenced in intensive woodland harvesting to clear areas for reindeer grazing (Kamerling et al. 2017). Additionally, trees in proximity to Saami forest settlements sometimes display scars from bark peeling, a subsistence activity where the inner bark of pine trees is harvested while the tree is left standing. Scots pine inner-bark was often peeled from trees and harvested as a plant-food source rich in vitamin C (Ostlund et al. 2003, 2004).

Selective curating of forest landscapes exists in examples from Siberia and northern Labrador as well. Nenets herders in Siberia similarly construct shelter for themselves and reindeer in forested areas. The areas in proximity to the settlement contain younger trees than further from the settlement, while several stands of tall, old growth trees are maintained around the camp for shade during summer months (Gron et al. 1999). In the Nain area, extensive wood harvesting seems to have occurred as a response to changing climate during the Little Ice Age (Roy et al. 2012), resulting in patches of deforested landscape. Past Indigenous use of woodland resources is perhaps best represented by the presence of microscopic charcoal near archaeological sites. Fire regimes are evident in palynological analysis where microscopic charcoal and soot are observable in addition to providing evidence for the chronological dimensions of site occupation (Egelkraut et al. 2018).

In addition to woodland resource use, other subsistence activities are observable in paleoecological data. Seal skin processing among Dorset Sivullirmiut took place at the edge of freshwater ponds and altered pond ecosystems by distributing small amounts of nutrients into the water (Renouf et al. 2008). On sites, domestic activities distribute nutrients into the soil and create microhabitats that supported various species of insects generally associated with organic matter (Forbes et al. 2014). In an example from western Alaska, salmon processing is shown to leave distinct chemical markers in the soil from each area where the fish were cleaned, washed, dried, and smoked (Knudson et al. 2004). Salmon consumption has also been observed in 13,000 to 11,500 year old hearths in central Alaska due to the distinct chemical markers in soil chemistry left behind after the cooking of salmon, followed by the discarding of salmon remains into the hearths (Choy et al. 2016). Similar observations have been made in Fennoscandia where food processing areas previously within Saami dwellings are denoted by the distinct chemical signature present in the soil relative to the surrounding area (Karlsson 2004).

The use of reindeer is well documented and is a contemporary practice among herders in Fennoscandia and Siberia. Landscapes in northern Fennoscandia would be repurposed by Saami herders, creating openings in forested landscapes to accommodate grazing and maintenance of reindeer herds (Kamerling et al. 2017). Woodland resources would be harvested to construct pens and milking stations (*renvall*) for reindeer. Milking activities often took place within the confines of pens and create distinct plant and geochemical soil patterns in these areas over time (Egelkraut et al. 2018; Gron et al. 1999; Karlsson et al. 2004). Reindeer were also a means of mobility, being rigged to sledge and pulling supplies across landscapes (Anderson et al. 2015, 2019). Their presence on sites is often identifiable through the presence of coprophilous fungal spores within the area of occupation and are useful in questions concerning the origin of reindeer domestication in Northern Siberia (Anderson et al. 2019; Harrault et al. 2019).

Activities around waste disposal create environmental conditions specific to a site of occupation. As noted previously, differing degrees of pond eutrophication between Arctic and Subarctic ponds may be the result of culturally distinct methods of waste disposal. In the High Arctic, it is common to find nitrogen originating from sea mammals near sites of prolonged occupation, suggesting a sustained practice of disposing sea mammal carcasses in ponds adjacent to occupations (Douglas et al. 2004; Hadley et al. 2010a, b; Michelutti et al. 2013). This feature does seem to be shared in Subarctic ponds, where eutrophication occurs mostly through erosion and direct pond activities such as the processing of seal skin (Renouf et al. 2008). Waste disposal is also represented through the presence of insects associated with nutrient-enriched habitats such as middens (Bocher and Fredskild 1993; Dussault et al 2016; Forbes et al. 2015; Haarlov 1967). The high frequency of insects near archaeological sites suggests practices around waste disposal help to create ideal environmental conditions for a variety of insects, attesting to the nutrient abundance within human built environments.

2.5.2. Spatial Organization of Settlements

The intentional purposing of space and the activities attached to those spaces are visible to varying degrees in paleoecological archives. In Fennoscandia, historical reindeer milking grounds are evidenced by the distinct patterns of vegetation growing where these activities took place. Patterns in soil chemistry support these observations, and suggest these activities occurred adjacent to housing structures (Karlsson 2004). These same lines of evidence suggest that in northern Siberia the presence of distinct spaces for reindeer among Evenki-Iakuts herders are present within a fairly confined settlement space, with reindeer living unpenned among housing structures (Anderson et al. 2019; Harrault et al. 2019). In both Fennoscandia and Siberia, dendrochronology and palynological studies demonstrate that wooded areas around settlements were highly groomed, both for the purposes of harvesting wood and to improve the area for reindeer holding (Freschet et al. 2014; Gron et al. 1999; Kamerling et al. 2017).

The division of space for highly specific activities such as the various stages of fish processing are observable within soil chemistry on sites. This is demonstrated again in examples from Yup'ik fishing camps in western Alaska, where each step in the processing and preservation of salmon leaves distinct chemical signatures in the soils where these activities took place, from butchering, to washing, to drying, and then smoking (Knudson et al. 2004). In areas where former Saami tents stood, distinct geochemical composition outlines the tent ring caused by residual organic matter from maintenance of the living space (Karlsson 2004). In the middle of this area the former fire pit can be discerned. A space adjacent to the fire pit contains geochemical evidence suggesting butchering and food preparation took place, a sacred activity which was traditionally associated with Saami men (Karlsson 2004).

2.5.3. Living Conditions

Paleoecological evidence can offer insights into the conditions in which people lived in the past, the broad climatic patterns, and sensorial aspects of peoples' qualitative experiences. Archaeoentomological evidence suggests that the environment around a Pre-Inuit settlement in Newfoundland became wetter throughout the period of occupation (Dussault et al. 2016). This seems to be common as continued occupation often leads to altered soil hydrology, which was compounded during the Little Ice Age as soil drainage became more difficult. At a Yup'ik site in Alaska, attempts seem to have been made to control the water saturation of the occupation area by digging a drainage ditch near the settlement (Ledger 2018). In other areas, ditches were used to create a natural barrier for reindeer holding while acting at times as a large midden (Anderson et al. 2019). These features contribute to the building of preferred environments for certain species of insects. The presence of certain fly and beetle taxa which prefer microhabitats with rotting organic matter suggests the presence of carrion and decaying organic matter within settlements and the surrounding local environment at sites around Greenland and Alaska (Bocher and Fredskild 1993; Forbes et al. 2015; Haarlov 1967; Panagiotakopulu et al. 2018). In many of these same regions and around the circumpolar north, Indigenous people have historically cohabitated with animals such as reindeer and dogs. If not grazing nearby, reindeer would occupy space adjacent to and among human dwellings, depositing faecal matter and grazing on available plants (Anderson et al. 2019; Gron et al. 1999; Harrault et al. 2019). This is true for dogs as well who would occupy space around the settlement and certain areas within dwellings (Dussault et al. 2014; Forbes et al. 2014; Ledger 2018), depositing faecal matter and food remnants around sites.

Personal hygienic practices and experiences are visible with the presence of human lice. These are found both within dwellings and the local environment (Dussault et al. 2014; Forbes et al. 2015; Ledger and Forbes 2020). The presence of human lice in hearths within dwellings suggests delousing practices among individuals of the settlement, lending insight into the lived experiences and intimate cultural practices among Inuit in Greenland and Yup'ik in southwest Alaska (Dussault et al. 2014; Forbes et al 2019).

Harvesting *Picea* (spruce) limbs was a common practice among Arctic peoples who would use it as bedding and insulation within dwellings (Roy et al. 2015). When deposited on domestic floors, this would offer opportunities for insects to occupy this niche which closely resembles areas within the surrounding environment where ground litter is common. The increased insect activity and food sources made available by human subsistence activities contributes to a constructed environment where insect abundance can greatly exceed environmental baselines for the duration of occupation (Ledger and Forbes 2020). Dwelling interiors show evidence of regularly being cleaned, with debris collected and thrown outside of the dwelling or into a midden, and the maintaining of these spaces is reflected in both the accumulation of soil nutrients in areas immediately adjacent to dwelling structures and around the inside perimeter of dwellings, where small debris gathers as cleaning activities push it into the corners (Butler 2011; Butler and Dawson 2013; Butler et al. 2018; Karlsson 2004).

2.5.4. Chronologies of Occupation

Determining the seasonality of a site can be straightforward in areas where distinctions between seasonal types of dwellings exists, but challenging where these differences are less clear. In research from archaeological sites in Siberia, seasonality has be inferred through situating the settlement within the context of reindeer migration routes (Gron et al. 1999). Where these may have changed overtime, geochemical analysis can determine seasonality through the presence of distinct signatures of faecal lipids in animal feces. The winter diet of reindeer depends on the consumption of lichen species which alter the lipid signature of reindeer faecal matter relative to more grass-based diets during warmer months. Through this, researchers have been able to determine the late autumn-winter-early spring diet of the reindeer that occupied a northern Siberia Nenets site (Harrault et al. 2019).

Many of the paleoecological methodologies discussed here share the potential to produce precise chronologies for archaeological sites' occupation. Dendrochronology can develop robust chronologies in wooded areas, but oftentimes radiocarbon dating is used which requires the presence of suitable organic dating materials. Paleolimnological analysis can capture a signal of human activity provided the appropriate activities and/or occupation intensity occurred adjacent to the body of water to induce ecological change, as well as provide macrofossils which may be used to obtain radiocarbon dating assays (Michelutti et al. 2013). The input of chemical nutrients into soils, and presence of organisms ecologically associated with nutrient-rich habitats, happens as a site is occupied, and has been shown to continue for varying durations after site abandonment (Fenger-Nielsen et al. 2019). Palynology and archaeoentomology have demonstrated similar potential in being able to generate relative chronologies for site occupation as the methods often used to obtain these samples (extracted from peat deposits) which include the presence of short-lived plant materials well suited to providing precise radiocarbon dates (Ledger 2018, Ledger et al. 2016). These paleoenvironmental proxies also tend to share a feature where the ecological changes associated with occupation tend to slowly decrease in visibility over time following site abandonment, rather than resulting in a sharp and drastic ecological change immediately after the site ceases to be occupied. This is a particularly strong in the Arctic where environments recover slowly from change (Forbes 1996). In order to determine the end of occupation more precisely, palynological studies rely on the presence of microscopic charcoal as these proxies are very strong indicators of human activity (Anderson et al. 2019; Kamerling et al. 2017; Ledger 2018; Ledger and Forbes 2020).

2.6. Conclusion

This chapter presents research that demonstrates the continuing legacies of past Indigenous lifeways in ecosystems around the circumpolar north. The methodology employed here yielded 60 paleoecological research papers. Most of this research has been carried out in Canada and Fennoscandia but has created a foundation on which recent research programs in Greenland, Siberia, and Alaska have built on. In many ways this area of research is still developing, and there are many topics which are yet to fully be explored. For instance, there is the question of whether singular culture groups generate the same environmental signature of impact wherever they are. This seems unlikely because different biomes seem to be effected by human activity differently. Following that, does a singular culture group create disturbances unique or characteristic enough to result in the identification of culturally distinct ecological signatures? This is also unlikely, although future research may prove otherwise. It is likely there are very general patterns of impacts that all culture groups within a biome share, and then it breaks down levels of specificity dependant on people in the time and place they live. Whatever the answer, the question merits investigation, and it is clear through this review that the versatile set of methodological approaches described here can be (and has been) applied to future paleoecological studies within Labrador. To better understand how these might be utilized it is necessary to outline Labrador's Indigenous past and contextualize the cultural activities that have influenced the development of its contemporary landscapes.

CHAPTER 3

THE HISTORIES OF LABRADOR’S INDIGENOUS CULTURES

This chapter outlines the histories of Labrador’s Indigenous groups, from the first people who migrated into the area following the recession of the Laurentide Ice Sheet up to present-day inhabitants. Labrador has seen the migration and development of many groups since as early as 8,000 BP (Fitzhugh 1978; Holly 2013), some of whom are better understood archaeologically than others. Culture histories here will present information on the subsistence, settlement patterns, material culture, land-use practices, dwelling styles, and spread of all of Labrador’s documented culture groups. A description of Labrador environmental history from the Holocene to the present day will be provided to contextualize the cultural developments outlined later in the chapter. These histories will be considered within the archaeological tradition in Labrador, examining the issues and gaps in current understandings that prevent researchers and invested communities from accessing the full account of Labrador’s cultural heritage. The objectives here are as follows: (1) to provide an environmental context for Labrador’s Indigenous occupations through the Holocene; and (2) present concise and descriptive histories of Labrador’s Indigenous cultures since the first people up to the modern-day communities. This chapter is meant to address these goals while providing the context for a broader discussion on how a paleoecological research agenda may contribute to furthering current understandings of Labrador cultural history (following chapter).

In the following sections, Labrador's environmental history during the Holocene will be outlined in order to provide the broad environmental context for the proceeding sections, followed by concise culture histories for each of Labrador's Indigenous groups throughout history. They are organized into four groups: First Nations descendants, Sivullirmiut, Inuit, and NunatuKavummiut. First Nations descendants are grouped together to respect present-day Innu beliefs that consider the preceding archaeological groups, Maritime Archaic and Intermediate Period, their direct ancestors. The following grouping, Sivullirmiut, is an Inuktitut word meaning "the first people" and is used to describe the archaeological groups preceding the Inuit: the Pre-Dorset, Groswater, and Dorset (Hodgetts and Wells 2017). Because of this distinction, Inuit culture history receives its own section immediately following Sivullirmiut. Where two of these groups contain several Indigenous cultures ("First Nations descendants" and "Sivullirmiut"), the culture histories will be presented chronologically beginning with the oldest culture in each group. The last culture group discussed will be NunatuKavummiut, who are recognized and self-identify as a distinct Indigenous culture of mixed Inuit and European heritage and are also commonly referred to in the literature as Inuit Metis. A conclusion will follow, highlighting the main points from this chapter.

3.1. Geographic Setting

Labrador extends between 60˚ and 50˚ N on the north-eastern coast of Canada and is the mainland portion of the province of Newfoundland and Labrador. It borders Quebec to the west with the Labrador Sea running south along the east coast carrying cold water from the High Arctic. Labrador can be segmented into four biogeographical zones (Figure 3): tundra in the northern portion; forest tundra from around Okak Bay and south through much of central Labrador; boreal forest throughout the southern interior spreading west into Quebec; and coastal tundra which extends all along the entire Labrador coast, an effect of the cold current from the Labrador Sea (Richerol et al. 2015). Beginning around late fall-early winter, ice develops along the shore and extends past the outer islands along the coast through winter and spring (Spiess and Cox 1980). The northern Labrador landscape consists of tundra vegetation with small shrubs, mosses, and lichen covering an otherwise rocky landscape, accentuated by the Torngat Mountains dominating the far northern region within the interior and along the coast. The southern and western interior of Labrador contains bogs, ponds, lakes, and rivers throughout the landscape, with occasional parklands breaking up the boreal forest covering the area (Richerol et al. 2015). Labrador today lies in both Arctic and Subarctic climate zones with typically long dry winters and shorter warm months with more precipitation. It is known to have a relatively stable climate despite recent climate warming trends (Richerol et al. 2015; Roy et al. 2015). Despite this relative stability over time, Labrador's climate throughout the Holocene has gone through many fluctuations albeit almost in counterpoint to global climate trends during the same period.

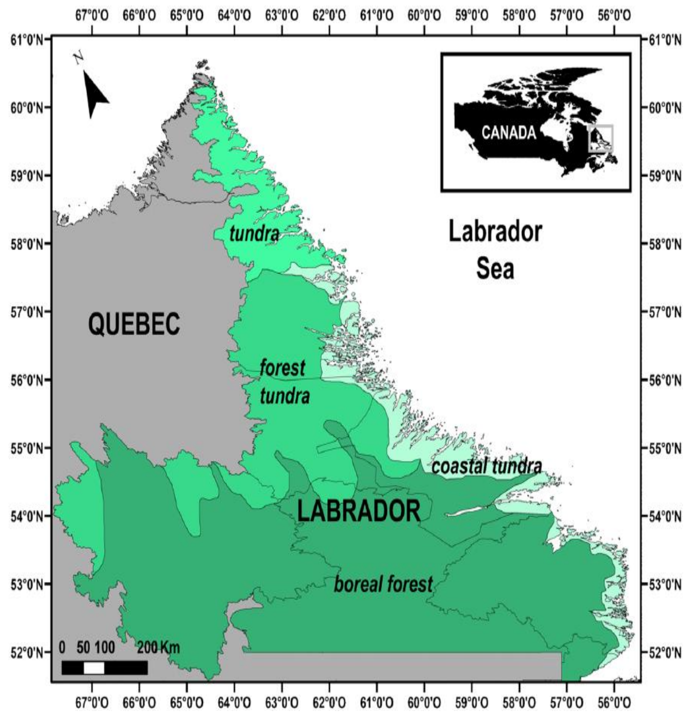

Figure 3: Map of the four biogeographical zones of Labrador (published in Richerol et al. 2015: 46).

The Holocene is the most recent geological Epoch and begins ~ 11,700 years before present (BP), following the Younger Dryas, which was a period of intense cold at the end of the previous Epoch, the Pleistocene (Renssen et al. 2009). At this time, the Laurentide Ice Sheet covered much of Canada, although global warming trends caused melting in areas as early as 14,000 BP (Dyke et al. 2002). Deglaciation in Labrador began on the coasts around 13,000 BP in Northern Labrador and 11,500 BP in Southern Labrador, with most of the coast completely free of ice by ~9,500 BP (Vacchi et al. 2018). From the coasts the ice continued its gradual retreat through the Labrador interior, where it persisted in some places until ~ 7,000 BP (Smith et al. 2003). This pace of glacial retreat is considerably slower than in other areas around the North American continent, in part due to a cold period taking place ~ 8,200 BP. An outburst of glacial meltwater from glacial Lake Agassiz, combined with an increase in meltwater run-off through the Hudson Straight into the Labrador Sea, weakened current circulation and heat transfer around the North Atlantic, causing a climate anomaly that last for ~ 150 years (Daley et al. 2009; Renssen et al. 2009). This had the effect of slowing the westward retreat of the Laurentide Ice Sheet in Labrador as well as freezing much of the Labrador Sea year-round until the area began to warm again a few hundred years later (Daley et al. 2009).

From 7,000 BP until around 5,800 BP the region continued to experience general warming, with temperatures comparable to, if slightly warmer than, today. The retreat of the ice sheet left behind a fresh landscape of boggy wetlands and coastal rocky shores, which were slowly colonized by moss, herb, and shrub populations (Fitzhugh and Lamb 1985; Richerol et al. 2015). These populations expanded up the coast and through the interior, eventually replaced by moss-dense boreal forests of spruce, birch, and fir by 6,500 BP. The northward expansion of these forests was slowed by colder northern temperatures, and until 4,5000 BP the region was dominated by tundra shrub vegetation (Fitzhugh and Lamb 1985). There was minimal sea ice cover from 7,600 BP until 6,000 BP during which the Labrador Sea underwent intense and prolonged periods of freeze-up (Solignac et al. 2004).

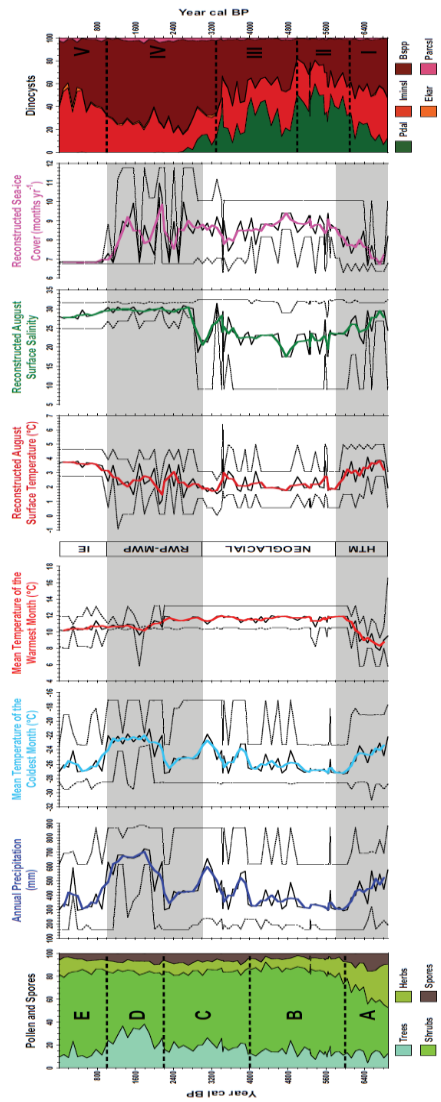

Figure 4: This figure represents paleoenvironmental reconstructions of climate patterns, from sediment samples obtained at Nachvak Fjiord in northern Labrador, based on fossil pollen and spores (left) and dinocysts, fossilized plankton (right). It is divided into two charts from the middle, where "HTM" means Holocene Thermal Maximum, "Neoglacial" refers to the Neoglacial climate period, "RWP-MWP" refers to the Roman Warm Period and Medieval Warm Period, and "IE" means Industrial Era. From the left of this divide are the mean temperatures in the warmest and coldest months of the year (published in Richerol et al. 2015: 56).

Around 5,800 BP marks the beginning of the Neoglacial period, with a cooling climate trend across Labrador. Tundra shrub environments dominated northern and coastal Labrador, with boreal forest tundra covering the southern interior and parts of the south coast (Richerol et al. 2015). During this time until around 4,000 BP winter temperatures were colder than they are today with little variation (Meese et al. 1994; Richerol et al. 2015). After 4,000 BP was a period of relative climate instability with mean winter temperatures rising until 3,800 BP, and then again rising at 3,400 BP and peaking at 3,200 BP before dropping over the next 1,000 years (Richerol et al. 2015). It was not until 2,000 BP that the temperature rose again in Labrador, a trend that was sustained until 1,000 BP, coinciding with the "Medieval Warm Period", a period of time around the North Atlantic when temperatures rose to be warmer than the Neoglacial period before it. Wet bog and tundra woodland environments expanded in most of Labrador (Elias 1982) until 1,000 BP, though changes occurred sooner on the coast, displaying a more tundra-dominated biome and decrease in tree populations (Elias 1982; Roy et al. 2015).

From 1,000 BP to the present day, the Labrador climate experienced a general cooling trend with a slight temperature increase from 700 – 500 BP (Elias 1982; Roy et al. 2015). This was followed by a prolonged period of cold known as the Little Ice Age. The effects of this were felt from around 500 – 150 BP, during which modern biogeographical zones were established and the coast experienced prolonged periods of intense sea ice (Kaplan and Woollett 2000; Richerol et al. 2015; Roy et al. 2015; Woollett 2007). Following the Little Ice Age was a period of warming temperature, which led to generally wetter conditions and an increase in regional tree species that is believed to be at least partly a consequence of human-induced global warming trends (Roy et al. 2015). With these trends continuing, it creates challenges for contemporary Indigenous lifeways tightly connected to the land and sea, which need to find ways to cope with the ever-changing Labrador environment.

3.2. Labrador Indigenous Culture Histories

3.2.1. First Nations and First Nations Descendants

3.2.1.1. Maritime Archaic

The name Maritime Archaic refers to the first Indigenous populations of Labrador who traveled north from the area known today as New England, through the Canadian Maritime Provinces and the Lower North Shore of Quebec, to reach Southern Labrador by 8,000 years BP (Fitzhugh 1978; Holly 2013). They came to occupy most of coastal Labrador from the southern end (51.5˚N) up to the southern edge of the Torngat Mountains (~59˚N), including sparse areas of the Labrador interior, as well as much of the island of Newfoundland, until 3,200 BP (Brake 2006; Holly 2013; Wolff 2008). The name "Maritime Archaic" was first used by Jim Tuck (1971) due to the group's seeming economic and ideological focus around the sea along with their positioning in the cultural chronology of Labrador recognized by archaeology at the time (Brake 2006; Hood 1993). They are also referred to as "Early Period" First Nations-descendant cultures, due to their temporal position in archaeological culture history as the first people of First Nations descent to occupy Labrador (Fitzhugh 1978).

There are two recognized "branches" of Maritime Archaic culture thought to represent separate migration events into the area: The Northern Branch, sometimes referred to as Labrador Archaic, who entered Southern Labrador around 8,000 BP and reached Northern Labrador by 6,500 BP, lasting there until 3,200 BP; and the Southern Branch, sometimes called *the* Maritime Archaic in contrast to the earlier migration, who appear in Southern and Central Labrador between 5,500 and 3,200 BP (Bell and Renouf 2004; Brake 2006; Fitzhugh 1978; Holly 2013; Wolff 2008). Whether or not these people would have considered themselves to be a part of a unified group, archaeologists consider them a singular cultural entity despite some differences in material culture because evidence suggests they shared a maritime resource focus, mortuary practices, lithic material type preferences, technology, and expansive trading networks (Brake 2006; Holly 2013; Hood 1993).

Faunal remains around habitation areas and cemeteries, stable isotope analysis of human remains, and a specialized maritime-adapted toolkit consisting of harpoons and lances, all suggest a focus on marine mammals as a food source, with fish, berries, birds, caribou and other terrestrial mammals all contributing to a seasonally rotating subsistence strategy (Brake 2006; Fitzhugh 1978; Guiry and Grimes 2013; Hood 1993; Renouf et al. 2008; Tuck and Mcghee 1975). Seal and bird hunting occurred in the warmer months on the outer islands, and seal, caribou, and fish harvesting occurring in the inner bays during the colder months (Fitzhugh 1978). Sites near wooded areas were likely important year-round as wood was used for fuel and construction, likely including dwelling structures, a number of tools, and dugout canoes evidenced by the occurrence of adzes, celts, and gouges. Sites can often be found on inlets and coastal islands with sandy areas and protected harbors and are typically east facing towards open water (Fitzhugh 1978). Many of these sites can be found up-shore from their original orientations due to isostatic rebound causing the land to slowly rise, after thousands of years under the weight of the Laurentide Ice Sheet (Bell and Renouf 2004). Sites are present further inland as well, consisting of similar raw material and tool types as coastal areas, and are often interpreted as either caribou hunting camps or inland bands of Maritime Archaic populations, often expressly tied to coastal groups (Holly 2013).

In northern Labrador above the tree line, trade was an important function for access to wood and other resources. A prized raw material type called Ramah chert was used in the production of stone tools, accessed upon the arrival of Maritime Archaic in northern Labrador as its only known quarry lies north of the tree line in Ramah Bay (Figure 5). Evidence that the Maritime Archaic were prolific traders with access to expansive trade networks lies in the fact that Ramah chert has been found at sites ranging from northern Labrador to New England, and even as far as Chesapeake Bay in the United States (Loring 2002).

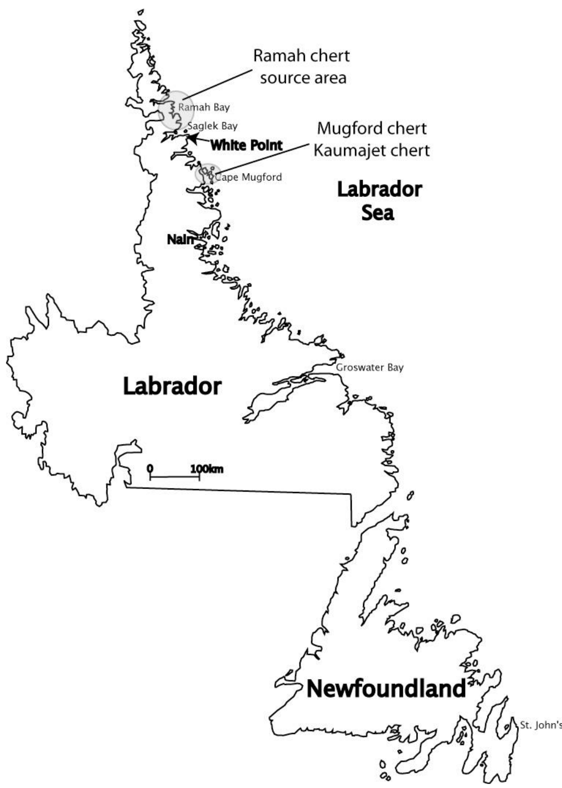

Figure 5: Map of Labrador showing the location of Ramah Bay, the source of Ramah chert, as well as the source area for Mugford and Kaumajet cherts (published in Wolff 2008: 37).

Maritime Archaic sites exhibit a range of domestic structures that vary over time and geographic location (Fitzhugh 1978). Single family subterranean house pits, partially excavated into cobble beaches and around 4-5 meters in diameter, have been interpreted as cold-season dwellings, whereas rectangular tent structures are believed to have been warm-season dwellings (Hood 1993; Wolff 2008). These tent structures appear individually, perhaps as transient camps, as well as in large groups, and seem to somewhat merge or give way to longhouse structures in central and northern Labrador between 6,000 BP and the Maritime Archaic disappearance around 3,200 BP (Wolff 2008). Longhouses seem to have begun as dwellings 8-metres long with a partition in the middle, housing two separate families, eventually growing to be 100-metres long with equally sized, partitioned segments. These likely housed large gatherings of people during warmer months (Fitzhugh 1978; Holly 2013; Hood 1993; Wolff 2008). Lithic analysis suggests domestic activities took place in specified areas of each dwelling, where tool manufacturing occurred by the entry way to each structure, beside the fire and opposite likely sleeping areas (Wolff 2008). Other Maritime Archaic structures include boulder fields where caches for storing excess food, tools, and raw materials can be found, as well as cemeteries and grave sites. These exist often as large, multigenerational burial sites near settlements that were frequented for as long as several thousand years (Fitzhugh 1978; Holly 2013; Tuck and Mcghee 1975).

By 4,000 BP a migration of people named “Pre-Dorset” (belonging to the larger group Sivullirmiut) had begun coming down to Labrador from the Arctic and occupied parts of coastal northern and central Labrador. For 700 years, Pre-Dorset and Maritime Archaic coexisted and occupied similar areas, but do not seem to have interacted very much as each group used different raw materials and had different technologies that would have benefitted the other had they interacted (Holly 2013). It seems that the two groups may have even practiced mutual avoidance (Rankin 2008a). Suggested drivers for an eventual increased movement of Maritime Archaic populations towards the Labrador interior may have included a combination of cooling Neoglacial temperatures causing increased sea ice, the retreat of the northern tree line, and altered distribution of sea mammal populations, along with competition with Pre-Dorset for similar subsistence resources (Fitzhugh 1978; Holly 2013; Hood 1993). Despite no direct evidence of the two groups interacting, Maritime Archaic presence in the north and central part of the territory dwindles until it disappears entirely from the archaeological record in Labrador by 3,200 BP (Holly 2013; Hood 1993).

3.2.1.2. Intermediate Period

Following the Maritime Archaic occupation of Labrador, the proceeding "Intermediate Period" is less well understood. The people of the Intermediate Period existed in Labrador between 3,200 – 1,800 BP (Loring 1992; Neilsen 2006) and are so named due to their historical and cultural placement among First Nations descendant archaeological cultures in the area. They become archaeologically visible immediately following the disappearance of the Maritime Archaic, also referred to as the Early Period cultural group, and preceding the Innu of the Late Period in Labrador archaeological terminology (Brake 2006). The reason why the Intermediate Period is poorly understood is because of the relatively small size of sites (cobble stone hearths and tent rings), and the few diagnostic tools among their collections (Stopp 1997; Tuck 1997). There is some debate about whether the Intermediate Period represents a cultural continuum from Maritime Archaic to Innu populations, or whether their presence is the result of migrations of new people coming from the south and the west (Rankin 2008). The latter suggestion would then beg the question: what happened to the Maritime Archaic?

Artifacts and features that were diagnostic of Maritime Archaic sites and assemblages, such as ground (polished) stone wood working tools, longhouses, and cemeteries, disappear around 3,200 BP (Brake 2006; Rankin 2008; Tuck 1997), and there is evidence suggesting the people of the Intermediate Period may have been part of a larger culture group of the Northeast, including the Canadian Maritimes and Quebec (Holly 2013; Loring 1992; Neilsen 2006).

However, it may also be possible that the Maritime Archaic underwent a culture shift and developed into the Intermediate Period cultural tradition, as there is no gap in the archaeological record to suggest that coastal or inland Labrador were completely abandoned (Rankin 2008). In additional support of this are the observations that Intermediate Period projectile points are stylistically similar to those made by the Maritime Archaic and the fact that Ramah chert was still used (if more sparingly) as a raw material type (Neilsen 2006; Rankin 2008). One significant distinction in terms of raw material use is that Intermediate Period groups seem to prefer locally available cherts from inland Labrador and Quebec to Ramah chert, unlike their Maritime Archaic predecessors (McCaffrey 1989).

Lifeways of Intermediate Period communities seem to have centered on a more mixed, generalized economy than that of their predecessors, as suggested by their toolkits and the location of known sites (Neilsen 2006; Rankin 2008; Stopp 1997; Tuck 1997), which are close to evenly split between the coast (44%) and inland (56%) (Brake 2006). These inland occupations exist in areas where there is no evidence of Maritime Archaic travel and are located as far west as the Labrador-Quebec border near Schefferville, Quebec (McCaffrey 1989). Evidence from the distribution of lithic raw materials from around the Labrador interior and among Intermediate Period sites suggests that these populations regularly traveled across the province and may have participated in trade networks spanning vast tracks of land (Holly 2013). The prevailing understanding of Intermediate Period populations was that they traveled to coastal areas during the warm months to take advantage of maritime resources and traveled back into the interior during the cold months where caribou would be accessible (Brake 2006; Rankin 2008; Stopp 1997).

During the Intermediate Period, Labrador was also home to Sivullirmiut populations who occupied much of the coast at various times: the Pre-Dorset (4,000 – 2,800 BP) and succeeding Groswater (2,800 – 1,900 BP). Intermediate Period peoples occupied parts of northern Labrador up to Okak following the Pre-Dorset occupation, but retreated from the north and central coast upon the southward migration of Groswater. From 2,700 BP onwards, Intermediate Period groups occupied southern and interior Labrador, and there is evidence to suggest they had an amicable relationship with their Groswater neighbors as there is an increase in the use of Ramah chert in Intermediate Period assemblages during this time (the sole source of which was located in northern Labrador, which was then occupied by Groswater populations) as well as an increase in its circulation around the Labrador-Quebec Peninsula (Brake 2006; Neilsen 2006; Tuck 1997).

Between 2,000 – 1,800 BP there is a decrease in the number of Intermediate Period sites, coinciding with the appearance of a new archaeological tradition: the Innu of the Recent Period, who introduce new technology into the area such as the bow and arrow, and are noticeably and considerably more active throughout the Labrador-Quebec peninsula (Holly 2013; Neilsen 2016). There is strong evidence to connect Intermediate Period populations to the Innu, as they possessed similar lithic toolkits, used Ramah chert, occupied the same areas, and there is no evidence of a major inland migration to the area (Holly 2013; Loring 1992).

3.2.1.3. Innu

Towards the end of the Intermediate Period, around 2,100 BP, evidence of a new cultural tradition in Labrador emerges, demonstrated to be direct ancestors of present-day Innu who occupy the southern coast and interior of Labrador into Quebec (Armitage 1991; Jenkinson and

Ashini 2015; Loring 1992; Neilsen 2016). It is unclear whether this transition in the archaeological record is due to culture changes occurring within Intermediate Period populations or caused by an immigration event of Algonquian-speaking people from the west and south moving into the area. The Intermediate group and Innu not only share similarly styled small stone tools, which may be an indicator of cultural continuity, but they also occupy the same areas within the interior of Labrador (Rankin 2008a, b). The introduction of ceramics and bow and arrow technology to the region, however, suggests a migration of new people and ideas (Holly 2013). The answer probably lies somewhere between these two views. Whatever the reasons, around 2,100 BP the region sees a population increase and a more intensified use of the Labrador interior and southern coastline, along with a surge in the use and distribution of Ramah chert throughout the Labrador-Quebec peninsula and Canadian Maritimes (Holly 2013; McCaffery 2011). The Recent Period in Labrador has typically been represented archaeologically by two phases, the Daniel Rattle Complex (~1,800 – 1,000 BP) and the Point Revenge Complex (1,000 – 400 BP) (Hood 2008; Loring 1992; Neilsen 2016). Despite some differences between these two designations, as previously mentioned, they share significant cultural attributes not only with each other but also with several other cultural groups that occupy adjacent areas during these time periods (Holly 2013; Loring 1992; McCaffery 2011; Neilsen 2016).

Whereas the Intermediate Period saw First Nations-descendant groups making more use of the interior of Labrador, Innu descendants moved seasonally between the coasts and the interior, practicing a more generalized economy by making use of both maritime and terrestrial resources (Arbour et al. 2012; Holly 2013; Loring 1992; Neilsen 2016). The frequency and timings of movements likely varied between communities, as some groups may have spent more time on the coasts, inner bays, or traveling across the interior, but archaeological evidence generally suggests summer months were spent on the coast with travel into the interior during the fall to hunt caribou (Holly 2013; Jenkinson and Arbour 2014; Loring 1992; Neilsen 2016). Winter would be spent in the interior or sheltered inner bays, with a return to coastal areas in the spring to hunt harp seals coming down the Labrador coast and through the Strait of Belle Isle (Loring 1992; Pintal 2003; Rankin 2008b). It is likely that travel was undertaken year-round for trade and to visit friends and relatives, much as it is among Innu today (Jenkinson and Ashini 2015; Neilsen 2016).

Taking advantage of seasonal abundance, ethnographic and archaeological evidence demonstrates that Innu dried and smoked meat in tents, and cached foods for later consumption: caribou, moose, beaver, berries, and fish during the fall in preparation for winter (Loring 1992; Stopp 2002a); and harp seal along the southern coast during the spring migration through the Strait of Belle Isle (Pintal 2003; Rankin 2008b). Caching included storing objects and supplies besides food, where cached materials would be concealed in boulder fields, buried under ground, and even placed in trees (Rankin 2008a). Ethnographic accounts demonstrate Innu would construct wooden scaffolding (Figure 6) and tent-like structures from felled trees to cache meat and supplies out of the reach of animals (Rankin 2008b; Stopp 2002a). Wood, black spruce in particular, was harvested for use in construction, figuring into the construction of longhouses, tents, tools, and watercraft, as well as being harvested for fuel (Loring 1992; Stopp 2002a). Although Innu hunted seal and walrus, there is no evidence to suggest they used blubber as a fuel source. Evidence of multifamily dwelling structures similar in style to Innu longhouses (*shaputuan*) appear during this time with long, linear cobblestone hearths (Holly 2013; Hood 2008; Loring 1992; Neilsen 2016). These structures may have been seasonal or ceremonial, for gatherings of large people, with individual families residing in tents throughout much of the year.

Figure 6: A recent Innu cache constructed from wooden scaffolding at Lake Mistassin (original photograph by Adrian Tanner, published in Rankin 2008b: 121).

From 2,100 BP onward, Innu shared Labrador with several culture groups and interacted with others beyond the Labrador-Quebec peninsula. That Ramah chert was the preferred raw material for stone tool production among Innu, and is found around Quebec and the Canadian Maritimes, attests to the social connectedness of Innu to their neighbors (Holly 2013; Loring 1992; McCaffrey 2011). Until around 1,400 BP, the northern and central coast of Labrador was occupied by Dorset Sivullirmiut, who made exclusive use of coastal areas and rarely traveled into the interior, although they moved often across the Strait of Belle Isle into Newfoundland which they occupied intensively (Loring 1992). During this time Innu lived along the southern Labrador coast and through most of the Labrador interior and into Quebec. Since Ramah chert quarries lay well within Dorset-occupied territory, it is suggested that trade occurred between Dorset and Innu, and that some amicable relationship existed between them is suggested further by the lack of evidence the two groups engaged in conflict (Holly 2013; Loring 1992; Rankin 2008a). The period between 1,400 – 1,000 BP saw a decrease in Dorset activity along the coasts, and a subsequent occupation of Innu along the central and northern coasts of Labrador, likely granting them access to Ramah quarries, further suggested by Innu stone tools located within the quarry (Holly 2013; Loring 1992).

A Dorset reclamation of the north and central coastline occurred by 1,100 BP, coinciding with Innu abandonment of the area. Ramah chert still dominates Innu lithic collections during this time, although chert from areas within the interior of Labrador becomes more common and stone tool production techniques using Ramah chert seem to become more conservative, suggesting Ramah was still available but may have been more difficult to obtain with the newest wave of Dorset occupation (Loring 1992; McCaffrey 2011; Rankin 2008a). By 600 BP the relationship between Innu and their coastal neighbors seems to change again, with the Inuit migration along the coast of northern Labrador.

Besides relationships with their coastal neighbors, evidence suggests Innu engaged in trade with groups around Quebec, Newfoundland, and the Canadian Maritimes including Cree, Naskapi, Mik'maq, and Iroquois (Holly 2013; Loring 1992; Loring et al. 2003; McCaffrey 2011; Renouf 1999). Ramah chert is found throughout these areas during this time, as well as cherts from Quebec and Labrador, suggesting an expansive trade network and amicable relationships with regional Indigenous groups. These relationships seem to experience stress upon the arrival of European fishing and whaling crews around the Strait of Belle Isle, and further upon the construction of year-round trading posts which attracted migrations of Indigenous groups into the area (Loring 1992). Pressured by the southward expansion of Inuit to take advantage of European goods and increased European activity along the coasts, Innu abandoned their coastal settlements entirely and focused their subsistence on caribou and other terrestrial resources around the interior and inner bays of Labrador (Holly 2013; Loring 1992; Loring et al. 2003).

Interior-focused subsistence for Innu shifted to include a larger coastal component around the early 20th century, due to a collapse of caribou herd populations around Labrador (Loring 1992). Settlements moved to coastal settings and around inner bays where sealing and trade for European goods could be more easily accessed. Innu land-use practices have continued to be challenged with the intervention of the Canadian government after Newfoundland and Labrador were incorporated into Canada. Seasonal movement into the Labrador interior and out to the coasts still occurs, but continued mining operations, the Upper Churchill Hydro development, and the construction of the railway and settlements across Labrador have all had the effect of limiting Innu access to their traditional lands (Loring 1992; Loring et al. 2003; Neilsen 2016).

3.2.2. Sivullirmiut

3.2.2.1. Pre-Dorset

By 4,000 BP a new group had migrated into Northern Labrador from the Arctic, settling the coastline down to Okak and then Nain. Bearing similarities to the Independence I cultural tradition from Greenland, they descended from people of the "Arctic Small Tool Tradition", the first people to inhabit the North American Arctic from Siberia (Friesen 2013; Raghavan et al. 2014). These new inhabitants of Labrador are referred to archaeologically as Pre-Dorset, due to their temporal positioning before the prolific Dorset cultures that would later occupy the same areas and southward into the island of Newfoundland. Pre-Dorset occupation of Labrador occurs between 4,000 – 2,800 BP, overlapping with both Maritime Archaic (4,000 – 3,500 BP) and Intermediate Period (3,200 – 2,800 BP) First Nation-descendant cultures (Cox 2003; Hood 2008; Renouf 1991). Despite the Pre-Dorset arrival coinciding with several significant Maritime Archaic cultural developments (larger settlement size and more elaborate ritual ceremonialism) and their eventual disappearance from Labrador entirely (Holly 2013; Rankin 2008a), the relationship between the two groups is poorly understood, as is the question of whether they met at all. It has been suggested that the presence of larger Maritime Archaic settlements in northern Labrador around the time of Pre-Dorset arrival, and the near absence of Ramah chert from Pre-Dorset assemblages, points to an effort by Maritime Archaic to exclude the new Pre-Dorset population (Rankin and Squires 2006).

Pre-Dorset subsistence was generalized, taking advantage of seasonally available food sources such as seal, walrus, birds, fish, berries, caribou, and other small terrestrial mammals, and potentially competed with Maritime Archaic populations for available resources (Friesen 2013; Rankin 2008a). To this end their settlements likely rotated between inner islands and coastal areas during the spring and summer, moving inland to sheltered bay areas during the fall and winter (Cox 1978; Hood 2008). Settlements consisted of one to three small structures with multifamily camps during the warmer months (Hood 2008). Warm and cold weather dwelling structures appear in largely the same forms but with slight structural differences. The overall shape is described as oval or bi-lobate (Figure 7), with two segments divided by a middle passage between them containing a hearth and cooking area, with the whole structure supported by wood or sea mammal bones and covered in skins (Friesen 2013; Renouf 1991, 2003). Winter structures typically had paved middle passages with upright slabs of stone in the middle creating a box-shaped hearth that would either house fire-heated rocks or act as a lamp shelf (Friesen 2013; Renouf 1991, 2003). Warm season dwellings would be of a similar shape but less formal in interior design, sometimes without paving stones or a box hearth (Cox 1978; Renouf 2003).

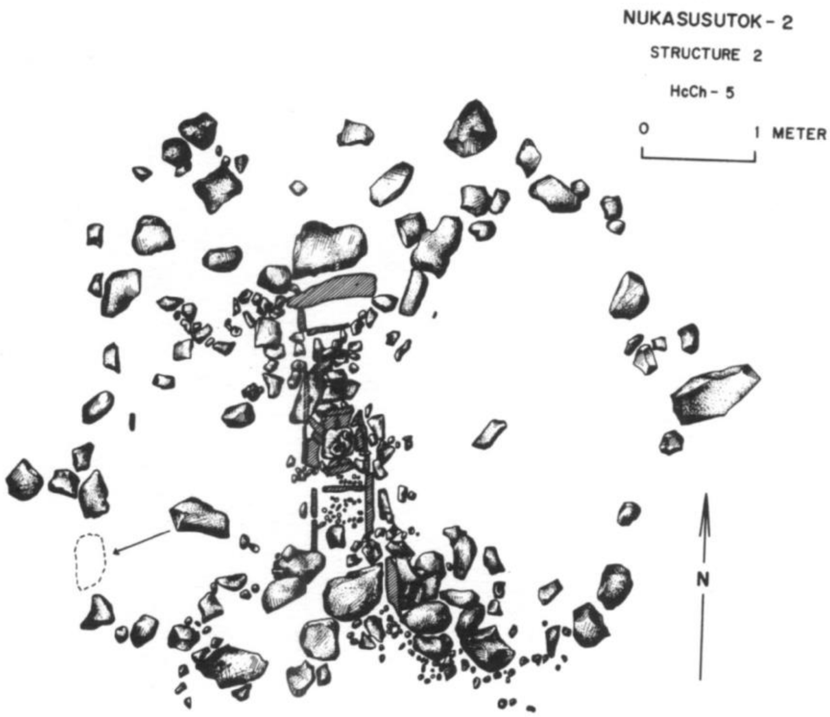

Figure 7: An example of a Pre-Dorset bi-lobate dwelling structure (published in Cox 1978: 101).

Soapstone lamps were used to burn sea mammal blubber for fuel, light, and heat, with fire-heated rocks providing heat for warmth and cooking, which were likely heated with wood fire (Renouf et al. 2009). That Pre-Dorset had an industry around wood use is indicated by the presence of tools such as burins, adzes, and gouges, although it is unclear if their wood harvesting practices exclusively entailed driftwood foraging or if they harvested trees from forested areas (Cox 1978). Their toolkits differed greatly from those of Maritime Archaic and Intermediate Period groups and included the use of burins for carving wood and bone, distinct harpoon technology, quartz microblades, and preference for fine grained cherts found around Cape Mugford in northern Labrador (Cox 1978; Fitzhugh 1976; Holly 2013). Despite having access to Ramah chert, which Maritime Archaic made intensive use of, Pre-Dorset used it sparingly, favoring instead the Mugford chert. Like Maritime Archaic, however, it is likely that Pre-Dorset had dogs. Despite there being little direct evidence of this in Labrador, dogs have been documented around the Canadian Arctic around this time, among the Independence I cultural tradition of Greenland and other groups living around the Eastern Arctic (Brown et al. 2015; Morey and Aaris-Sorensen 2002).

The timeframe between 3,000 – 2,800 BP has been described as a "period of transition" within Pre-Dorset culture (Cox 2003). While maintaining many similarities within their toolkit, house forms, and raw material preferences, their harpoon endblade, knife, burin, and projectile point styles change and there is more use of cherts from Newfoundland (Hood 2008). By 2,800 BP, these changes in material culture are significant enough that archaeologists have named a new cultural tradition born out of these Pre-Dorset cultural developments: Groswater (Holly 2013; Hood 2008).

3.2.2.2. Groswater

Following "in situ" cultural developments of Pre-Dorset society around central Labrador, the Groswater cultural tradition was established by 2,800 BP and immediately spread along the coasts of the Labrador-Quebec peninsula, encompassing all of Labrador and Ungava Bay and the Lower North Shore of Quebec, as well as much of coastal Newfoundland (Anton 2004; Cox 1978; Fitzhugh 1980; Holly 2013; Hood 2008; Lavers and Renouf 2012; Leblanc 2000). The cultural developments that lead to the establishment of Groswater cultural traits occur over the course of several hundred years, and so defining the "beginning" of Groswater culture is challenging, leading to disagreements on when this occurs (see Anton 2004; Lavers and Renouf 2012). The length of occupation throughout Groswater occupied areas varies, with settlements existing in northern Labrador until around 2,500 BP (Anton 2004; Cox 1978; Fitzhugh 1980), central Labrador until 2,200 BP (Anton 2004; Hood 2008), and southern Labrador and

Newfoundland until 1,900 BP (Anton 2004; Erwin 2016; Lavers and Renouf 2012; Renouf 1999) with the possibility of persistence until 1,750 BP (Anton 2004).

The term “Groswater Dorset” was first used to describe Groswater by Fitzhugh (1972), who excavated what he thought to be a regional variant of Dorset culture when working in Groswater Bay near the mouth of Hamilton Inlet, Labrador. Tuck (1975), working in Saglek Bay further north in Labrador, uncovered similar materials, and upon examining the two assemblages they decided that together they represented a distinct culture which they decided to call “Groswater” (Tuck and Fitzhugh 1986). Evidence strongly suggests that Groswater culture was born out of Pre-Dorset cultural developments, supported by the presence of similar toolkits, dwelling types, and settlement locations, along with evidence that Groswater and Pre-Dorset seemed to practice similar subsistence strategies (Anton 2004; Cox 1978; Hood 2008; Leblanc 2000; Holly 2013).

Evidence suggests Groswater subsistence had a year-round marine focus that was supplemented with terrestrial mammals and waterfowl (Anton 2004; Fitzhugh 1972, 1980). To this effect they seemed to rotate settlement locations between outer coastal areas (including islands near shore) between spring and fall, where seasonal migration of harp seal could be met as well as various species of fish and bird (Leblanc 1996, 2000), with winter movement into sheltered inner bays and forays into the interior to hunt caribou (Cox 2003; Holly 2013; Hood 2008; Loring and Cox 1986). Settlements were near the shore where marine resources could be easily accessed, and evidence along the Lower North Shore of Quebec and west coast of Newfoundland suggests seal hunting and butchering took place on beaches near settlement areas, with seal meat being transported from butchering areas on the beach and walked back to camp (Lavers and Renouf 2012). There are not many Groswater sites containing dwelling structures, but those that exist are nearly identical in form to Pre-Dorset structures. In Labrador, they are typically bi-lobate or oval structures with a paved middle passage containing upright slabs of stone creating a box hearth or lamp shelf (Cox 2003; Hood 2008; Loring and Cox 1986; Renouf 2003). The paving in the middle passages usually runs along the back of the structure, creating paved areas of vertical slabs that have been interpreted as sleeping platforms, and occasionally box hearths are located on either end of the structure instead of the middle (Cox 2003; Renouf 2003). Groswater dwellings in Newfoundland demonstrate more structural variability where both the shapes of the structures differ as well as the materials used in construction from those found in Labrador (Renouf 2003).

Groswater raw material types differ from those of their Pre-Dorset predecessors. Among Groswater toolkits, there is a significant preference for the use of fine-grained Cow Head cherts from the coast of western Newfoundland, as well as Ramah chert (more so closer to the source in Ramah Bay, northern Labrador), and quartz crystal used to produce microblades (Fitzhugh 2006; Leblanc 1996, 2000; Lavers and Renouf 2012). That these Newfoundland cherts are a fundamental material type at every Groswater site suggests Groswater were engaged in extensive trade throughout Newfoundland and the Quebec-Labrador Peninsula (Fitzhugh 2006; Hood 2008; Leblanc 2000). Furthermore, the toolkits recovered at many sites, along with the style of dwelling structures, suggest Groswater were highly mobile, moving frequently to take advantage of seasonal resources (Holly 2013; Leblanc 2000; Renouf 2003). Soapstone appears to be a significant material at Groswater sites, used for lamps to burn sea mammal blubber as fuel for heat and light, while the use of wood is also suggested through the presence of tools such as burins and adzes (Erwin 2016; Lavers and Renouf 2012). Given that much of the Groswater territory was enclosed within the northern tree limit, it is likely that they engaged in wood harvesting and use as well. Cox (2003) suggests that gender-specific activities may have taken place within dwellings, but little detail is provided to explain what is meant specifically by this. While it appears that Pre-Dorset had dogs (Morey and Aaris-Sorensen 2002), there is no evidence to suggest Groswater did. Overall, information around Pre-Dorset and Groswater assemblages is hindered by a lack of evidence, which is partly suggestive of a research bias in Labrador that has historically put more value on understanding Maritime Archaic, Dorset, and Inuit occupations (Wolff 2003).

During the Groswater occupation of the Labrador-Quebec peninsula, Intermediate Period groups were present in the interior of Labrador with occasional settlements along the coast (Brake 2006), and it is highly likely Groswater interacted with them as well as other groups along the Quebec Lower North Shore (Fitzhugh 2006). Ramah chert is present around the Ungava Peninsula (Holly 2013), which suggests an active Ramah trade mediated by Groswater (Nagy 2018). This may indicate relationships between Groswater and groups in the Arctic, however beyond this Ramah trade, Groswater relationships with groups around the Labrador-Quebec peninsula remains unclear. By 2,500 BP, the Early Dorset culture migrated south from the High Arctic into northern Labrador, occupying central Labrador by 2,200 BP (Anton 2004; Fitzhugh 1980), but again, the nature of their relationship with Groswater is unclear. Given their common ancestry, it is difficult to establish whether there was direct cultural transmission between the groups (an indication of friendly relations), however, evidence suggests there was a quick and outright replacement of Groswater by Early Dorset (Fitzhugh 1980). There may have been indirect or passive interaction between the two groups or even avoidance based on different preferences for raw material types and settlement patterns (Groswater preferred inner coastal areas where Early Dorset preferred the outer island areas) (Anton 2004). Early Dorset replace

Groswater throughout northern and central Labrador, but the duration of the presence of Groswater in southern Labrador and the Quebec Lower North Shore is less well understood. It is possible Groswater interacted with Innu ancestors in this area, as well as with Beothuk ancestors on the island of Newfoundland after 2,000 BP. Around this time Middle Dorset moved into Newfoundland and occupied many of the same areas as Groswater, where the two groups may have interacted, but the state of this is unclear. Groswater presence along coastal Labrador eventually gives way entirely to both Innu descendants and the succeeding Dorset Sivullirmiut culture.

3.2.2.3. Dorset

Around 2,500 BP, while Groswater (2,800 – 1,900 BP) occupied much of coastal Labrador and Intermediate Period First Nations descendants (3,200 – 1,800 BP) dwelt within the Labrador interior, Dorset Sivullirmiut moved from the High Arctic and onto the northern and central coast of Labrador down to Groswater Bay (Anton 2004; Cox 1978; Fitzhugh 1980; Holly 2013; Hood 2008; Loring 1992; Rankin 2008a). Dorset were an Arctic-adapted people named after Cape Dorset in Nunavut, where they were first identified (Jenness 1925), and shared cultural ancestors with Pre-Dorset before they migrated into Labrador (~4,000 BP) and developed into Groswater (Friesen 2013; Raghavan et al. 2014). From the time of their establishment in Labrador there are three archaeologically recognized periods of Dorset occupation: the Early Dorset period from 2,500 – 2,000 BP where settlements are limited to coastal areas north of Groswater Bay (Cox 1978; Fitzhugh 1980; Hood 2008; Rankin 2008a); the Middle Dorset period from 2,000 – 1,100 BP which extended along the entire coast of Labrador to the Quebec Lower North Shore and throughout coastal Newfoundland (Fitzhugh 1980; Hood 2008; Rankin 2008a; Stopp 1997, 2016; Wolff 2019); and the Late Dorset period beginning around 1,100 BP along coastal Labrador, though focused in northern Labrador where the tradition disappears before 500 BP (Cox 1978; Hood 2008; Rankin 2008a; Renouf 1999). The emergence of Dorset populations in Labrador is marked by the introduction of new technology (soap stone cooking pots, semi-subterranean house forms, and raw material types), economic strategies, and settlement patterns that included making use of the outer islands along the coasts (Cox 1978; Cox and Spiess 1980; Fitzhugh 1980; Hood 2008; Rankin 2008a).

The outer island occupation of Dorset along the Labrador coast is a consistent phenomenon throughout all Dorset periods. It is believed to have been part of their seasonal settlement pattern where they established small camps of a few families on the inner islands near the coast (or within fiords in northern Labrador) with forays into sheltered bay areas from summer to early winter (Anton 2004; Cox and Spiess 1980; Hood 2008; Rankin 2008a). There, they would hunt terrestrial and sea mammals including caribou and harbor seal, capture fish on the coast during char and salmon runs, and collect berries (Stopp 2016; Wolff 2003). A significant consideration in establishing settlements near the coast, however, seems to have been the fall harp seal migration down the coast of Labrador (Cox and Spiess 1980; Rankin 2008a; Renouf 1999; Stopp 1997, 2016; Wolff 2003). During this time, harp seal would have been easily accessible close to shore and in quantities large enough to cache stores through winter (Rankin 2008b; Stopp 2016). Evidence suggests that as sea ice formed over winter, by early spring Dorset moved their camps to the outer islands (outer edges of fiords in northern Labrador) closer to the sea ice where they would hunt walrus and seal, and in anticipation of the spring harp seal migration back up the coast of Labrador (Cox and Spiess 1980; Fitzhugh 1980; Rankin 2008a; Stopp 1997, 2016). Evidence suggests spring settlements may have been larger, an opportunity for people to reaffirm social and economic bonds and cooperate in the landing of spring harp seals, before disbursing into smaller groups and moving back towards the inner islands and sheltered bays for summer (Holly 2013; Stopp 2016; Wolff 2003).

Dorset settlements exhibit two main types of dwelling structures which varied seasonally: semi-subterranean rectangular house forms during colder months, and rectangular and oval tent structures used during warmer months and at hunting camps (Cox 1978; Fitzhugh 1980; Renouf 2003). The semi-subterranean houses vary in size and construction with walls made from some combination of packed earth, rocks, and sod, with rooves likely constructed from skins stretched overhead and supported by driftwood (Cox 1980; Renouf 2003). Hearths and cooking areas were typically centralized though occasionally found in the rear of the structure, with the central area being paved with rock slabs or cobblestones (Renouf 2003). Sleeping areas were located along the back and sides of the structures, sometimes raised and paved, other times strewn with sand or pea gravel (op. cit.). During the Middle Dorset period semi-subterranean structures developed entrance passages and sometimes contain a dip in the middle, a feature called a "cold trap" built to reduce the outside draft into the structure (Cox 1978; Fitzhugh 1980; Rankin 2008a). Evidence suggests Dorset had some industry around wood, used in building, the construction of tools, and as fuel, and it is likely this involved harvesting trees within forested areas (Cox 1978; Renouf 2003). Sea mammal blubber was also used as fuel and burned in soapstone lamps; however, these seem to be more common at sites associated with cold weather and may have been mostly for seasonal use (Erwin 2016).

When Dorset migrated into Labrador, they entered previously occupied Groswater land, but whether these groups met each other and interacted is poorly understood. The archaeological record suggests a complete replacement of Groswater by Dorset, and there is no evidence to suggest they mixed populations judging by the absence of Groswater influence in Dorset toolkits

(Fitzhugh 1980; Holly 2013; Rankin 2008a). As Dorset made their way further south and into Newfoundland, it seems increasingly likely that the two groups met given the documented southward migration of Dorset populations aligns with the disappearance of Groswater sites from the archaeological record. It has been suggested that Groswater were incorporated by Dorset (Renouf 1999), but this remains unproven. Given that their settlement patterns do not overlap and their differing preferences for raw material types (Groswater used Cow Head cherts from Newfoundland, while Dorset use Ramah chert), it might be that if they did meet each other, they actively avoided one another (Anton 2004). Contrary to this, it seems that Dorset had amicable relationships with Intermediate Period First Nations and Innu in Labrador, and Beothuk groups in Newfoundland. Evidence of working relationships between these groups is found in the distribution of Ramah chert throughout late Intermediate Period and Innu lithic assemblages during the Dorset occupation of Labrador (Brake 2006; Loring 1992; Neilsen 2006; Tuck 1997), and in the distribution of Cow Head cherts from Newfoundland throughout Late Dorset assemblages (Renouf 1999). It is unclear if they met their successors in Labrador: Inuit.

3.2.3. Inuit

Most of this chapter has so far used the abbreviation BP meaning Before Present (c. 1950). When dealing with more recent cultural groups, the literature tends to refer to periods of time in “year” AD (Anno Domino, under Gregorian Calendar), while also referring to the century an event took place in. For the sake of consistency with the literature the same approach is used for this section.

Labrador Inuit are descended from cultures that developed within the Bering Sea region and Alaska around 1,000 BP (Friesen 2013; Holly 2013; Rankin 2009). Evidence suggests that by AD 1,200 they began rapidly migrating east across the Canadian Arctic during a brief warm period with less than typical sea ice (allowing for easier travel across the High Arctic by boat), occupying the northern coastline, Arctic Archipelago and Greenland within a few decades (Friesen 2013; Whitridge 2016). The Inuit migration across the High Arctic is likely due to several factors: increased accessibility of bowhead whale migrations traveling east and the over-population of the northern Alaskan coast (Friesen 2013; Holly 2013). Due to poorly resolved radiocarbon-based chronologies, it is unclear when this Inuit migration reached Labrador, with suggested dates ranging from mid-13th to late 15th centuries (Fitzhugh 2009; Hood 2008; Loring 1992; Ramsden and Rankin 2013; Rankin 2008a, 2009; Whitridge 2012). It is also unclear why Inuit migrated into Labrador: whether due to a collapse in bowhead whale populations driving people from the central Arctic (Whitridge 2016); or in pursuit of European metals (Ramsden and Rankin 2013; Rankin 2009). Because of the uncertainty around the entry of Inuit into Labrador, the timeline for their southward movement along the Labrador coasts is also unclear (Loring 1992; Rankin 2009). Archaeologists have suggested a period of occupation along the north and central coasts before moving to the southern Labrador coast and Quebec Lower North Shore (Fitzhugh 2009; Rankin 2008a; Whitridge 2012). That Innu or Dorset populations were occupying this area may have prevented the Inuit southward advance (Fitzhugh 1980). It seems likely, however, that Inuit continued their movement south unimpeded. Archaeological and archival evidence suggests Inuit were not only present in southern Labrador but living there on a year-long basis by at least the mid-16th century (Hood 2008; Rankin 2009, 2015; Stopp 2002b; Whitridge 2008). Again, issues around radiocarbon dating have prevented Inuit chronologies from being completely understood. Issues with radiocarbon dates in Labrador archaeology have been widely acknowledged (Delmas 2018; Ramsden and Rankin 2013; Rankin 2008a, 2009;

Whitridge 2016). These stem from the use of dating materials that are now understood to suffer from two main issues: the marine reservoir effect that produces errors in radiocarbon date assays; and the old wood problem around the use of driftwood and recycled wood materials pre-dating the sites where they are found (Ramsden and Rankin 2013).

The early Inuit who traveled across the Canadian Arctic are known to have been prolific hunters of bowhead whales, and while whale hunting continued in Labrador their subsistence was more focused on hunting various species of seal (harp, harbour, and ringed), and supplemented by local fish, shellfish, caribou, birds, berries, and small terrestrial mammals (Hood 2008; Loring 1992; Ramsden and Rankin 2013; Rankin 2008a, 2009; Whitridge 2012; Woollett 1999; Zutter 2012). Whales were hunted during summer and fall in open water with *umiaks* (large skin boats) manned by eight-person teams that would capture and haul whales onto shore where they would be processed by the village; meat would be distributed and preserved, blubber rendered into oil, and bones and baleen collected for use in tool and dwelling construction (Kaplan and Woollett 2000; Rankin 2009; Whitridge 2012, 2016). Seal would be hunted in open water from kayaks throughout the year and would be obtainable during cold seasons on the edge of the sea ice and through ambushing seals as they came up for air through breathing holes on the ice (Cox and Spiess 1980; Stopp 2002b; Woollett 1999). Dogs were necessary components of successful breathing hole hunting as they would be able to identify the seal breathing holes in the ice by smell from on top of the snow cover (Cox and Spiess 1980). In addition to this, dogs were used for hauling sleds during the cold seasons (Hood 2008; Rankin 2009).

Inuit settlement patterns traditionally involved moving seasonally between outer islands during the cold months with forays to the ice edge to hunt seal and walrus (in northern

Labrador), and inner coastal areas during the summer with occasional trips into coastal bays and inland to hunt caribou and fish (Cox and Spiess 1980; Loring et al. 2003; Rankin 2015; Stopp 2002b). Cold weather settlements consisted of several semi-subterranean winter homes, which were oval to rectangular structures walled with rocks and sod, with a skin and sod roof supported by driftwood poles, whale ribs, and/or whale mandibles (Hood 2008; Ramsden and Rankin 2013; Rankin 2009, 2015; Whitridge 2008, 2012; Woollett 1999). These structures had a paved entrance passage with a dip in the middle to trap cold from drafting into the interior, where the floor was paved, containing an area with a lamp stand, and a rear sleeping platform (op. cit.). Early in the Inuit occupation of Labrador these structures typically held families of six-eight individuals, but as the social and economic climate in Labrador changed throughout the 18th century they moved into sheltered coastal bays and dwellings came to house several families with as many as 40 individuals (Kaplan and Woollett 2000; Woollett 1999).

When Inuit migrated into Labrador and spread down the coast, they brought along technology that had not been documented in the region before such as dog sleds, kayaks and umiaks, and a toolkit made up primarily of bone, antler, ivory, wood, nephrite, slate, copper, and iron (Friesen 2013; Hood 2008; Ramsden and Rankin 2013; Rankin 2009; Whitridge 2012). Despite having access to Ramah chert, Inuit seem to have stuck to their preferred raw materials and not used any flaked chert at all (Whitridge 2012). Soapstone was also frequently used for cooking containers and lamps that would burn sea mammal oil (Whitridge 2008). Wood was harvested from forests and stands of trees where available, otherwise driftwood was gathered and used for fuel and in the production of tools and lumber for dwellings (Roy et al. 2012).

Given the uncertainties around Labrador's cultural chronology it is difficult to determine if the Dorset occupation overlaps with Inuit arrival in northern or central Labrador. There is an argument that the initial Inuit movement into the region was slowed by the presence of Dorset, effectively blocking their way south (Fitzhugh 1980). Besides a questionable radiocarbon date, there is no archaeological evidence to suggest the two came into contact in Labrador (Hood 2008; Rankin 2009). It appears that they met in the central Arctic after Inuit descendants left northern Alaska after AD 1,200, as not only do Inuit myth and oral history suggest such an encounter took place, but it has also been suggested that the use of meteoritic iron and soapstone may have been adopted by Inuit from Dorset upon their meeting (Whitridge 2008). Whether or not there was a contemporary Dorset presence in Labrador, evidence shows that Inuit encountered Innu, Iroquois, Mik'maq, and Europeans as they continued south through the Strait of Belle Isle and Lower North Shore of Quebec, as well as Beothuk along the northern coast of Newfoundland (Delmas 2018; Fitzhugh 2009; Howley 1915; Loring 1992; Rankin 2008a). Archaeological and archival records indicate Inuit families with year-round settlement patterns lived in the area, and both directly and indirectly engaged with Basque and French whaling and fishing stations along the coasts (Delmas 2018; Fitzhugh 2009; Loring 1992, Stopp 2002b; Rankin 2009). European accounts over the succeeding years indicate both hostile and amicable relationships with Inuit, who initially would raid and scavenge off-season fishing and whaling camps and became more openly hostile to access European goods (Delmas 2018; Loring 1992; Whitridge 2008). At times, the southern shore of Labrador was described as "being in a virtual state of war" (Loring 1992), as both groups fought each other. Documents suggest there was a working relationship between Europeans and Inuit as well, each side willing to trade commodities with the other (Loring 1992; Woollett 1999).

Despite continued European settlement and exploitation of the Strait of Belle Isle and Lower North Shore of Quebec, archaeological evidence suggests many Inuit in the area maintained their traditional seasonal rounds and subsistence patterns (Rankin 2015; Stopp 2002b), while others were becoming incorporated into European settlements (Fitzhugh 2009). Things progressively changed and by the mid-18th century Inuit adopted new styles of winter houses which were much larger and housed many more people than they previously had (Kaplan Woollett 2000; Woollett 1999). This also coincided with settlements moving into more sheltered locations around inner bays and islands. Moravian missions were established from the late-18th to mid-19th centuries up the Labrador coasts to control Inuit settlement patterns and gain direct access to Inuit labor and goods such as sea mammal oil, baleen, and furs, as well as with the hopes to convert Inuit populations near the missions (Loring 1992; Whitridge 2008). In the 1950s the scattered Inuit communities and mission along the coast of Labrador were consolidated, forcing many Inuit to resettle along the central coast area from Nain to Hopedale. Today, Labrador Inuit have achieved self-governance within Nunatsiavut which includes much of their traditional lands in central and northern Labrador and is composed of five main Inuit communities in Nain, Hopedale, Postville, Makkovik, and Rigolet (Nunatsiavut Government 2021a).

3.2.4. NunatuKavummiut

As more European men came to Labrador and settled permanently, they began to marry Inuit women and create families with both Inuit and European cultural traits. Children from these families often grew up and married people from a similarly mixed background, reinforcing what became a distinct cultural identity based on their shared heritage (Beaudoin 2013, 2014). By the late 18th or early 19th century NunatuKavummiut families occupied areas around the southern Labrador coast, participating in what may have been the dominant cultural pattern of southern Inuit in Labrador during this period (Beaudoin et al. 2010; Rankin 2015). Inuit archaeology in southern Labrador from the late 18th century onward has been understudied, resulting in a gap in the archaeological record concerning Inuit southern history (Kelvin 2011). This has also led to gaps in the archaeological documentation of NunatuKavummiut settlements during the same period, and what is known has come from archival documents and local oral histories (op. cit.). Recent archaeological research since the early 2000s has demonstrated that NunatuKavummiut are an archaeologically distinct culture group from both Inuit and Europeans and are visible in the archaeological record (Beaudoin 2013, 2014; Beaudoin et al. 2010; Kelvin 2011; Rankin 2015).

Based on archaeological and archival evidence, along with oral histories provided by NunatuKavummiut community members, it is evident that NunatuKavummiut traditionally followed a seasonal round focused on taking advantage of the availability of certain food sources. During winter they occupied sheltered bay areas where wood was easily accessed and hunting and trapping of fur bearing mammals could take place (Beaudoin et al. 2010; Kelvin 2011; Rankin 2015). These areas were occupied through the spring and into early summer if there was a river nearby to harvest salmon. Before leaving for summer to the inner island areas, gardens would often be planted, so when they returned to the site again during the fall there would be vegetables ready to harvest (Kelvin 2011; Rankin 2015). Summer would be spent with several other NunatuKavummiut families on the nearby islands, fishing for cod and collecting eggs and berries (op. cit.). Come fall, they would disperse and return to their winter homes. Many of these areas are still occupied by the same families, with land being passed down through generations (Kelvin 2011).

The winter houses that NunatuKavummiut occupied closely resemble both Inuit and European fishermen sod houses of the time, at least from the exterior. Europeans were quick to adapt their dwellings in a style like that of Inuit semi-subterranean winter homes given their suitability in the Labrador climate. NunatuKavummiut winter homes seemed to blend both Inuit and European architectural styles with a wooden frame covered in sod for insulation. A storage compartment inside the house and a saw pit for producing lumber nearby demonstrate elements of European style homes, with an interior that was open concept, while material culture found within it resembles that used in Inuit food preparation and clothing production (Beaudoin et al. 2010; Kelvin 2011; Rankin 2015). Foods seem to have mostly been eaten in liquid form, such as soups and stews, and consisted of wild game with seal being the most common animal food source, all qualities of Inuit traditional foodways (Beaudoin 2013, 2014; Beaudoin et al. 2010). The combined elements seem to have been largely based on gender roles with the men's work being to build the house while the women's work took place inside (Beaudoin 2013, 2014; Beaudoin et al. 2010; Kelvin 2011; Rankin 2015).

In addition to identifying as NunatuKavummiut, people of mixed heritage descended from Inuit women and settler men refer to themselves as Southern Inuit as well as Inuit Metis (Beaudoin et al. 2010). Many NunatuKavummiut still live throughout Labrador and are represented by the NunatuKavut Community Council (NCC) that is working towards Indigenous self-determination and land rights for Inuit in central and southern Labrador on their traditional lands (NunatuKavut 2021). It is worth noting the legitimacy of the NCC land claim has recently undergone criticism by the governing bodies of both the Innu of Nitassinan and Inuit of Nunatsiavut who argue the NCC land claim both overlaps with and delegitimizes parts of their own land claims (Leroux 2021; Nunatsiavut Government 2021b).

3.3. Conclusion

This chapter set out to describe the histories of Labradors Indigenous cultures in the context of Labrador's environmental history. Paleoenvironmental research around the area paints a picture of a landscape fluctuating between periods of steady climate trends and relative climate instability, and Indigenous groups navigate these changing environments and influx of new people. Side by side it is easy to get a general sense of how these two things interact throughout Labrador history through the Holocene.

While the Maritime Archaic solely occupy the region, they spread north during the warmest period of the Holocene referred to as the "thermal maximum" (Meese et al. 1994; Richerol et al. 2015). During the Neoglacial period beginning around 5,000 BP temperatures steadily decline, and around 4,000 BP starts a period of climate instability with periods of prolonged sea ice along the coast. This coincides with both the arrival of Pre-Dorset from the Arctic and the gradual decline of Maritime Archaic populations until their disappearance by 3,200 BP (Holly 2013). Climate begins a cooling trend, during which Intermedaite Period groups occupy much of the Labrador interior and areas along the southern coast, while Groswater development sees their spread down the coast and into Newfoundland. Dorset arrive during this cold period and spread all along the coasts and around Newfoundland as temperatures begin to rise again during the Medieval Warm Period. During this same period, Innu spread throughout the interior and coastal areas. The most recent climate period includes the Little Ice Age, a period of generally colder temperatures, which coincides with the migration of Inuit from the Arctic, who quickly establish themselves along the coastal breadth of Labrador, and the eventual development of NunatuKavummiut communities in the south.

The culture histories presented here are complex and not fixed in place, meaning current understandings of the movements and lifeways of past cultures are still subjects worth investigating. This chapter helps to establish Indigenous lifeways from Labrador's history that can now be compared to lifeways of groups studied in paleoecological research around the circumpolar north. From this comparison, it becomes possible to begin establishing the current state of knowledge concerning the development of Labrador's Indigenous landscapes and formulate a complimentary research agenda focused around further developing this body of knowledge.

CHAPTER 4

A PALEOECOLOGICAL RESEARCH AGENDA FOR LABRADOR

The previous two chapters outline the current states of knowledge regarding hunter-gatherer environmental impacts around the circumpolar north and Labrador's Indigenous culture histories, respectively. This chapter aims to synthesize this knowledge and present an account of the formation of Labrador's Indigenous landscapes and how people have influenced their development from the time when Maritime Archaic groups first arrived. After examination of this synthesis, a paleoecological research agenda is proposed to further current understandings of the formation of the Indigenous landscapes around Labrador. To this effect, the objectives in this chapter are as follows: (1) Establish the current state of knowledge about Labrador cultural histories and landscapes; and (2) outline a paleoecological research agenda that aims to further our understanding of human-environment interactions throughout Labrador's Indigenous history. The research agenda proposed here aims to combine paleoecological research methods and apply them at four distinct scales: regional; local; site; and community.

In the sections that follow, a synthesis of Labrador's Indigenous and natural history from chapter three is combined with the findings from paleoecological research in chapter two to produce a narrative focused on Labrador's Indigenous culture groups' interactions with the landscapes they have occupied. This is discussed in two parts: detailing what is known based on recent paleoecological research in Labrador, followed by the formulation of hypotheses based on research from chapters two and three. Specific attention will be paid to how these impacts may differ depending on the environmental context as well as how the cultural patterns of each group would have potentially impacted these environments in different ways. To avoid repetition as the narrative carries on towards present day, culturally-specific ways in which culture groups may have impacted the environments become the focus. This is because certain kinds of impacts will be similar across cultures, often caused by the disturbance of ground cover or soil nutrient enrichment resulting from food processing, consumption, and discard. The resulting narrative outlines the potential environmental legacies existing along Labrador's coastline and throughout its interior regions.

The second part of the chapter then outlines a paleoecological research agenda that focuses on four paleoecological research approaches for better understanding the genesis of Labrador's Indigenous landscapes and human-environment interactions throughout time. Lakes and ponds are first discussed, given that they function best as regional (rather than local) environmental archives, while being able to capture certain details of human environmental impacts. Peat bogs are then examined as local paleoecological archives, able to offer intimate, site-level human-environment histories. Paleoecological investigations of the site itself (e.g. examination of samples collected directly from archaeological site and deposits, as well as from areas where natural resource harvesting is likely to have taken place) are then examined. How engagement with present day Indigenous communities can enrich further understandings of human-environment relationships is then discussed. This is then followed by a conclusion that outlines the main points of the chapter.

4.1. The Development of Labrador's Indigenous Landscapes

Putting the research from the previous two chapters side-by-side presents images of landscapes from around the circumpolar north that have been continuously occupied and in constant states of change. The ebb and flow of climate fluctuations disrupt stasis within ecological systems while the daily activities of hunter-gatherers cause environmental disturbances that impact ecology at scales that range widely in scope. Zooming in from the general to focus specifically on the interactions between past Indigenous groups within Labrador and the environmental systems they lived within requires both an understanding of the complex history of people with the area, as well as familiarity with the research that has so far been done from a paleoecological perspective. Table 3 represents paleoecological research projects conducted in Labrador that specifically examined the impacts of past Indigenous disturbances to ecological systems, whether those caused from harvesting woodland resources, the enrichment of chemicals into soils around settlement areas, or through other means. It is important to note this table is not necessarily exhaustive as relevant research that otherwise would have been included was likely missed due to bias in the selection procedure, online journal pay-wall encumbrances, and language accessibility issues. However, this literature begins to contextualize the interplay between Labrador's Indigenous groups and the environments they occupied, and more specifically the relationship between Inuit and coastal landscapes in Nunatsiavut.

Table 3: Paleoecological research conducted within Labrador. From left to right, the table lists authors of research, location of data collection and area of study, the culture groups discussed in this research, and methods used to obtain data.

Study Number	Research	Location	Culture Groups Studied	Methods Used
1.	Butler 2011	Iglosiatik Island, Nachvak Village, Komaktovik fiord	Inuit	Geochemical analysis
2.	Roy et al. 2012	Nain Region	Inuit	Palynology
3.	Lemus-Lauzon et al. 2012	Nain Region	Inuit	Dendrochronology
4.	Roy et al. 2015	Uivak (Okak Region)	Inuit	Palynology
5.	Couture et al. 2016	Oaks Island (Nain Region),	Inuit	Geochemical analysis

		Uivak (Okak Region)		
6.	Lemus-Lauzon et al. 2016	Nain Region	Inuit	Palynology
7.	Roy et al. 2017	Dog Island (Nain Region), Okak Bay	Inuit	Dendrochronology
8.	Lemus-Lauzon et al. 2018	Nain	Inuit	Dendrochronology
9.	Oberndorfer et al. 2020	Makkovik	Inuit	Geochemical analysis via vegetative survey, TEK
10.	Roy et al. 2021	Nain	Inuit	Dendrochronology

From reviewing this research, a general pattern of Inuit-influenced environment change becomes evident along the coast of northern Labrador. Decreases in local levels of *Picea* sp. (spruce) and *Sphagnum sp.* with increases in local apophyte populations such as *Montia fontana* (water blinks or water chickweed), *Silene* sp. (catchfly), and *Polytrichum piliferum* (bristly haircap moss), accompanied by increases in *Larix laracina* (tamarack) are found around past settlements in the Nain area (Lemus-Lauzon et al. 2016; Roy et al. 2012, 2015). Areas within semi-subterranean houses demonstrate chemical enrichment (phosphorous, sulfur, cesium, lanthanum, calcium-oxide, and zinc) from cleaning, cooking, tool maintenance and craft activities during seasonal occupation, with the specific chemical enrichments changing (increased presence of lead and barium) as Inuit lifeways incorporated more European goods (Butler 2011; Couture et al. 2016). Around Makkovik, sites with a legacy of Inuit occupation display patches of vegetation that differ in species composition from undisturbed areas within the surrounding environment, such as with *Angelica atropurpurea* (purplestem angelica) around traditional Inuit fishing locations, and suggest that fishing practices enriched these areas in a way that promoted the growth of different plants compared to adjacent and commercial fishing areas

(Oberndorfer et al. 2020). Areas around Nain and Okak demonstrate the effects of Inuit wood harvesting that took place within the last 600 years, as areas that once contained stands of *Picea* sp. were deforested, leaving areas that now resemble tundra more than boreal forest (Lemus-Lauzon et al. 2012, 2018; Roy et al. 2017, 2021). Further, the rate of harvesting changes throughout Inuit occupation of the area, as the rate of deforestation increases with as Inuit and settler demands for wood change through the 18th and 19th centuries (Roy et al. 2021). The opposite effect is observable further south in Makkovik, where afforested areas appear after the abandonment of fishing sites. Further, aside from forested areas, Inuit site occupation not only altered local plant species biodiversity at the time of occupation, but also created plant communities that are still influenced by the effects of these initial impacts.

This small body of research illustrates the constant engagement between Inuit and the coastal Labrador environment and give a sense of the broad range of effects caused by every-day environmental disturbances, from chemical enrichments within settlement areas, to localized influences in plant biodiversity around areas of settlement and encompassing the deforestation of patches of wooded areas more generally, near to and away from areas of settlement. This research also connects Inuit history within archaeological literature to the broader environmental spaces where these histories are experienced. As change occurs within Inuit society, the landscape is changed with it, reflecting the inseparable nature of human-environment relationships.

The research from Labrador in Table 3 demonstrates an Inuit-heavy focus on paleoecological research, but this does not prevent a report on the current state of knowledge concerning Labrador's other Indigenous culture groups. It should be noted that the prevalence of Inuit-centered paleoecological studies may in part have to do with the fact that more recent cultures will have stronger, more clearly defined signals of activity within paleoecological proxies. This is because older paleoenvironmental data, often consisting of organic material, has a greater potential to degrade over time (Mander and Punyasena 2018). On this topic, it is also worth noting that the environment is a palimpsest of activity, and that paleoecological archives document a layered record of both human and non-human activity written at the same time. This can sometimes lead to the erasure of previous records of human activity, and other times ecological changes caused by past disturbances are compounded by disturbances that follow. This means that in some cases paleoecological data becomes more challenging to interpret the older it is – which is especially true when palaeoecological samples are collected directly from archaeological sites, but this does not mean attempts should not be made to access it.

It is with this in mind that the following sections continue to explore the genesis of Labrador's Indigenous landscapes through a synthesis of paleoecological research and archaeological culture histories. Table 4 illustrates expected impacts of common activities among Labrador Indigenous groups based on paleoecological data provided in chapter two. This chart is generalized and with the understanding that the above difficulties with data resolution and availability hold true for older culture groups, and that equal quality of data should not necessarily be expected during research. The following subsections will proceed by culture and chronology, beginning with the Maritime Archaic and ending with present day groups, except for the Inuit who are covered here to some extent, and who would likely share impacts with other coastal occupying cultures. Where Table 4 is general, what follows intends to lean into the more specific aspects of each culture's likely ecological signatures based on literature.

Table 4: Based on research presented in chapters two and three, this chart depicts what are common disturbance-causing activities among Labrador's culture groups and the expected ecological impacts based on the observed impacts of similar activities from Indigenous groups around the circumpolar north. Also depicted are the general scale at which these impacts are observable through paleoecological methods: site-level (around the immediate area of occupation and activities using geochemical soil analysis and dendrochronology); local environment (within the area surrounding archaeological sites, visible in data obtained from peat bogs); and regional (visible among broader paleoenvironmental data sets obtained through sampling pond and lake sediments).

Common Disturbance Activities	**Expcected Ecological Signatures**	**Scale of Paleoecological Visibility**	**Methods for Observing Signatures**
Hunting Fishing Foraging Food processing	Chemical enrichment of soils patches around sites. Increase in plant species associated with soil enrichment. Increase in insect species associated with carrion, food waste and other types of decaying organic matter.	Site-level Local Environment	Geochemical soil analysis Palynology Archaeoentomology
Waste disposal	Chemical enrichment of soils within and adjacent to structures. Increase in insect species associated with carrion, fetid, and forest litter type environments. Chemical enrichment of site adjacent ponds/lakes.	Site-level Local environment	Geochemical soil analysis Archaeoentomology Paleolimnology
Dwelling construction and maintenance	Chemical enrichment of soils (disturbance). Increase in plant species associated with disturbed areas. Increase in insect biodiversity. Decrease in select tree species in the local area.	Site-level Local environment	Geochemical soil analysis Palynology Archaeoentomology Dendrochronology
Wood harvesting	Decrease in pollen abundance for select tree taxa in the local and potentially broader surrounding areas.	Site-level Local environment	Dendrochronology Palynology Archaeoentomology

	Increase plant species associated with opened canopies and wetter environments. Fluctuations in insect taxa associated with woodland environments. Nutrient depletion within harvested areas. Microscopic charcoal present within surrounding area.	Regional visibility	Geochemical soil analysis Paleolimnology
Foot traffic	Increase in plant species associated with disturbance, as well as a decrease in plants and mosses sensitive to disturbance. Chemical enrichment of site adjacent ponds/lakes.	Local environment	Palynology Paleolimnology
Seal and caribou skin processing	Chemical enrichment patches around settlement areas. Chemical enrichment of ponds/lakes.	Site level Local environment	Geochemcial soil analysis Paleolimnology

4.1.1. Potential Maritime Archaic Impacts

It is likely that from the time Maritime Archaic populations first settled on this newly formed Labrador landscape (by 8,000 BP) their presence impacted it in ways that influenced the development of the areas they came to occupy (Fenger-Nielsen et al. 2019; Fitzhugh 1978; Holly 2013). Their seasonal rotation between the outer islands during warmer months and the inner coastal bays during cold months would have caused ecological impacts in these areas right away (Fitzhugh 1978). Based on palynological evidence that demonstrates how certain types of plant species respond to anthropogenic disturbances, the establishment of settlements would disrupt local ecological systems, at least at a very local level, as walking over the area and the construction of dwellings would have created micro-habitats more suited to disturbance-resistant plants such as apophytes. These apophytes would also likely exist in areas where Maritime Archaic grave sites were established. Given that their construction involved the movement of earth and resources into and around the grave area and that some appear to be multigenerational, visited and manipulated repeatedly, the area would presumably experience a decrease in certain local plant species and a prolonged presence of others that would find the area more suitable.

Local hydrological regimes would likely undergo change due to the presence of Maritime Archaic settlements as repeated trampling over an area often compacts soils, and over time, creates wetter, marshier conditions. Wood harvesting would have a similar effect, as fewer trees in a harvested area would lessen the amount of water that would otherwise evaporate from the area, also creating wetter conditions over time, and therefore altering the plant and insect communities living in the area.

As Maritime Archaic settlements were established in northern Labrador by 6,500 BP (Bell and Renouf 2004; Brake 2006; Fitzhugh 1978; Holly 2013; Wolff 2008) they would have encountered a landscape consisting of tundra shrub vegetation and few trees (Fitzhugh and Lamb 1985). As more southern settlements would create concentrated, nutrient enriched patches on the coastal Labrador landscape, the same would occur to a potentially more exaggerated degree around areas beyond the tree line and those along the coast on the outer islands where environmental nutrients would have been generally scarcer on the tundra shrub landscape. Maritime Archaic settlements likely would have created microhabitats in northern Labrador through the gathering and storing of natural resources and construction of settlements. This would create areas of more luxuriant, weedy plants, much like the kind of growth that has been used to identify archaeological sites (Lutz 1951). These activities would also have both attracted and carried insect species onto site areas and into dwelling structures, insects like the carrion beetle *Thanatophilus lapponicus*, bark beetles like *Polygraphus rufipennis* from felled trees, and insects that are associated with decomposing matter such as the rove beetle *Micralymma brevilingue* (Forbes et al. 2017).

These impacts are likely to have been magnified from 6,000 BP onward, as Maritime Archaic longhouses grew and settlements were more intensely occupied during warmer months. Nearby ponds and lakes would likely feel the effects of these larger settlements, as any interaction and foot traffic near them would affect erosion along the banks and the deposition of nutrients into their ecosystems, thereby affecting local freshwater diatom communities, as was demonstrated at the multi-component archaeological site of Phillip's Garden in Newfoundland (Renouf et al. 2008). Any direct use of ponds or lakes, such as depositing waste materials into the water, would increase the amount of available nutrients into the ecosystems, effecting both the microscopic diatom communities as well as aquatic plant communities, as demonstrated by the dumping of whale carcasses into ponds by Inuit in the high-Arctic (Douglas et al. 2004). It is conceivable that the increased human activity caused an expanded area of ecological impact from previous years, as more people around settlements created higher nutrient concentrations over a larger area, coupled with the increase in trampling and colder weather (potentially effecting the duration of summer permafrost) creating marshier conditions, altering local plant and insect populations.

The period from 4,000-3,200 BP marks a period of relative climate instability in Labrador, with temperatures alternating from warm peaks to cold dips that caused decades of prolonged sea ice (Richerol et al. 2015). This period also marks the decline of Maritime Archaic populations in the north until their eventual disappearance from the archaeological record by 3,200 BP (Brake 2006; Holly 2013; Wolff 2008). As it stands, their nearly 5,000-year occupation of the Labrador coasts came to an end but was likely significant, formative, and lasting in their influence on local and regional biodiversity.

After the Maritime Archaic disappearance, the outer islands along Labrador's coast would have been relieved from periods of direct human impact, seeing how there is little evidence other groups made much use of these areas until the arrival of the Dorset. Although settlements were no longer being constructed and inhabited seasonally, the areas where settlements had previously existed would still experience lingering effects from Maritime Archaic presence. The nutrients deposited into the soils, and the areas having been trampled on for prolonged periods, would affect local ecology for some time after. This is demonstrated in paleoecological research from Nunalleq in western Alaska, where palynological samples from near an archaeological site demonstrate a lagging and gradual shift in local biodiversity beginning after site abandonment (Ledger and Forbes 2020). Nutrients would encourage luxuriant growth that would differ from the surrounding area, consisting of weedy apophytes, and the contrast would stand out visually on the landscape. The affected soil hydrology and decreased ground disturbance would also encourage the growth of *Sphagnum* moss (Ledger 2018). These outer island areas may have been interacted with by proceeding Sivullirmiut cultures, but evidence suggests they were not extensively settled again until the arrival of Dorset around 2,500 BP (Cox 1978; Fitzhugh 1980; Hood 2008; Rankin 2008a). The inner-islands and sheltered bays along Labrador's coast, however, continued to be occupied throughout all of Labrador's cultural periods.

4.1.2. Potential Pre-Dorset Impacts

As Pre-Dorset came to occupy much of previously Maritime Archaic inhabited northern and central Labrador, their settlement area preferences overlap slightly, while their general way of life differs considerably from their predecessors. Pre-Dorset settlements were typically smaller (one-to-three family camps) during cold months and consisted of larger multifamily camps during the summer with each family residing in their own tent (Hood 2008). Further, archaeological evidence suggests that Pre-Dorset were highly mobile, more so than Maritime Archaic (Holly 2013) potentially having less impact on local environments as the larger Maritime Archaic settlements would have. Local ecology would still be altered in similar ways, however, as outlined in Table 4.

Another factor that would distinguish Pre-Dorset environmental impact from Maritime Archaic is methods of wood harvesting. Coming from the high-Arctic, Pre-Dorset populations had access to wood mostly as it washed up on the shore. This was used as fuel, along with sea mammal blubber, and in the construction of dwelling structures (Cox 1978). Although their relationships to forested areas remains unclear, it is perhaps fair to assume it would have differed from the Maritime Archaic, given that Pre-Dorset fuel consumption was not as reliant on wood to begin with. If this were the case, while Maritime Archaic populations disappeared from the Labrador coasts, tree species would have increased in number from the reduced harvesting pressure.

Upon the arrival of Pre-Dorset populations in Labrador, it is likely they brought dogs with them (Brown et al. 2015). Maritime Archaic communities had dogs as well (Guiry and Grimes 2013) and their impact on local environments would likely be noticeable in paleoecological archives. Dogs around the site would have added more waste and deposited more nutrients in the settlement area, further affecting the composition of both local plant and insect communities. Where their impact may be most noticeable is in microscopic fungi species, where fecal matter would promote the growth of *Sporormiella*-type coprophilous fungal spores in greater numbers relative to the surrounding environment (Kamerling et al. 2017; Ledger 2018).

4.1.3. Potential Groswater Impacts

Much like their Sivullirmiut predecessors, Groswater settlements rotated seasonally between coastal areas and inner islands during spring-fall and sheltered inner bays during the winter, with forays into the interior to hunt caribou (Cox 2008; Holly 2013; Hood 2008; Loring and Cox 1986). As Groswater culture is described as being highly mobile (Cox 1978; Leblanc 2000), the smaller winter and summer settlements would still impact local environments in similar ways as Pre-Dorset settlements, where local plant and insect species would be affected by even the ephemeral presence of Groswater settlements. These affects may have been stronger if they chose to repeatedly settle in the same locations throughout their yearly rotation. Spring gatherings would presumably have produced a quite a pronounced impact on local environments, however, as more people over a greater area would have created a larger scale of impact and with increased intensity. Where there is evidence that these gatherings were in part to take advantage of the spring harp seal migration, it is likely seals were caught and processed in great quantities around settlement areas annually. The nutrients deposited into the soils and waste materials discarded during these events would have greatly impacted local plant and insect populations that likely would have been felt for quite some time after sites were long abandoned.

It seems likely that boreal forests along the Labrador coast experienced increased harvesting pressure with the presence of Groswater settlements (Renouf et al. 2009). Wood harvesting, depending on the scale, would have affected the hydrology and plant species composition around harvested areas, with apophytes colonizing newly opened and disturbed areas of the landscape, as well as created soils that were less nutrient rich than surrounding un-harvested areas while transferring these nutrients into settlement areas.

4.1.4. Potential Intermediate Period Impacts

While Pre-Dorset and then Groswater communities spread along the Labrador coasts and made more use of woodland environments, Intermediate Period First Nations descendants dwelled within Labrador's interior and southern coast. They were pioneers in their own right as the first cultural tradition to make extensive use of Labrador's interior waterways, boreal forested landscapes, and extensive parklands. Less is known about Intermediate Period lifeways compared with other Labrador cultural traditions. However, population movement throughout the Labrador-Quebec peninsula would have affected both the places they traveled through overland, as well as the places where they camped and settled. Soils would have been enriched as they processed, consumed, and discarded foodstuffs, altering plant and insect biodiversity in the process, while movement overland would have created trails of disturbance-resistant plant species, while inhibiting the growth of others susceptible to the effects of trampling. This is based on research on Baffin Island that examines the species composition of variously disturbed surface vegetation in the high-Arctic, and findings suggest disturbed trails over these landscapes promoted the growth of disturbance-resistant graminoids (grass-like herbaceous plants, for example foxtail grass or *Alopecurus alpinus*) (Forbes 1994, 1996).

Forested areas would have felt the effects of wood harvesting, leading to declined numbers of certain tree species while promoting the growth of apophytes in the harvested areas. Forest fires may have occurred either on purpose or by accident (Holly 2013), clearing large areas of trees and encouraging new plant growth and increase in abundance of insect associated with decaying organic matter. Settlement areas would have altered local environments with repeated use while trails were formed throughout the interior, and the lives and decisions of Intermediate Period communities would have gradually altered the biodiversity of places they crossed over the landscape over the course of their nearly 1,400-year presence (Loring 1992).

4.1.5. Potential Dorset Impacts

Throughout the tail end of the Intermediate Period occupation of interior and southern Labrador, the Dorset occupied areas along the coast of Labrador and were the first cultural tradition whose settlement areas included the outer islands along the coast since the Maritime Archaic in 3,200 BP (Brake 2006; Holly 2013; Wolff 2008). Larger multi-family settlements were established in these areas during the late winter to early spring (Anton 2004; Cox and Spiess 1980; Holly 2013; Hood 2008; Rankin 2008a; Stopp 2016; Wolff 2003). The smaller summer-early winter settlements on the inner islands would likely have contributed to or maintained the legacy of impact from previous cultural traditions occupying the inner island areas. The larger late winter-spring camps would have made a considerable impact on the outer island areas that had likely developed some amount of *Sphagnum* moss cover (Ledger 2018; Roy et al. 2012, 2015). Immediately the trampling of these soils would disturb the moss cover and encourage the growth of more disturbance resistant plant species (Lemus-Lauzon et al. 2016; Roy et al. 2012, 2015). The large number of people at the site would concentrate nutrients onto settlement areas, both transporting and attracting local insect species in the process, and enrich the soils in the area, encouraging growth of plant species that are quick to capitalize on the sudden change in nutrient availability such as *Montia fontana*.

Another feature of Dorset settlement that would alter the landscape in novel ways is the construction of semi-subterranean winter dwellings. These features require the movement of earth, sod, and rocks from the immediate area, creating ditches that effect local hydrology, plant growth (such as *Carex nigra* or common sedge) (Oberndorfer et al. 2020), and insect communities (Dussault et al. 2016; Forbes et al. 2015). During warm months when they were unoccupied, semi-subterranean dwellings would create micro-habitats where the soil was compact and nutrient rich. These features were repeatedly used during cold months, but as some fell out of use over time, they would grow luxuriant plant cover relative to the surrounding area and sometimes pool with water, likely effecting the plant and insect communities that grew within them. These structures existed all along Labrador's coastal landscape and were at times reused as Inuit communities migrated down from the high-Arctic and reclaimed them as their own winter dwellings.

4.1.6. Potential Innu Impacts

Sometime around 2,100 BP the Innu cultural tradition emerged and come to occupy the same area as Intermediate Period First Nations descendants (Armitage 1991; Jenkinson and Ashini 2015; Loring 1992; Neilsen 2016). The Innu impact on the environment would be similar to that of Intermediate Period communities as their settlement patterns followed the same seasonal rotation between coasts and the interior with year-round interior communities existing along with year-round travel (Holly 2013; Jenkinson and Arbour 2014; Loring 1992; Neilsen 2016). It is likely, however, that the intensity and scale of impact would likely have been greater as evidence suggests an increase in population throughout southern Labrador and the interior (Holly 2013; McCaffrey 2011). Wood was harvested for both fuel and the construction of tents, longhouses, and scaffolding among other structures, with black spruce seeming to be the preferred species (Loring 1992; Stopp 2002a). This selective harvesting would have cleared areas of black spruce and forest litter, opening harvested areas for new plant species to take root, while effecting local hydrology and taking away nutrients that would have otherwise been recycled into the soil. The burning of certain forested areas would have created large open parklands and new plant growth while altering insect biodiversity.

Foods were often preserved during the fall for winter consumption, a task that included obtaining large amounts of both the food sources and wood for constructing smoking huts, drying racks, and scaffolding for caching the preserved foods (Loring 1992; Pintal 2003; Rankin 2008b; Stopp 2002a). During this process drippings from the drying and processed foods would have been deposited all over sites and enriched local soils, while the waste products would have attracted local insects either feeding on or predacious on carrion or other decaying organic matter to the area (Forbes et al. 2014; 2017). There are records of Innu fall caribou hunts where massive amounts of caribou would he hunted and processed immediately on site, and the intensity of this activity would leave a lasting impact on local plant biodiversity as the ground disturbance and nutrients entering the soil would influence plant growth for some time. Such patterns are described by Butler et al. (2018), when conducting geochemical soil analysis of Taltheilei settlement areas in southern Nunavut. These activities result in patches of chemically enriched soils with high levels of various compounds such as potassium oxide, iron oxide, and trans-fat residues.

The eventual arrival of Inuit and Europeans on the coasts meant that Innu lifeways became more focused on the Labrador interior. Inland areas would have been more intensely occupied as seasonal camps rotated throughout the interior, and forested areas would have felt greater harvesting pressure. Overland travel throughout the Innu period likely would have created trails of disturbance resistant plants (Forbes 1996), while places along traveling and hunting camps may have undergone change even with the ephemeral nature of travel, as discarded wastes and trampling would have affected plant and insect biodiversity. As Innu met with Europeans and settled around European settlements, they would have contributed to landscape change in much of the same way as they would elsewhere through harvesting wood, trampling of settled areas, and processing, consuming, and discarding food waste. Throughout the 20th century, as Innu populations moved to occupy around coastal and inner bays along Labrador's coast (Loring 1992), their impacts likely became more concentrated around these settled areas, with seasonal movement into the interior during warmer months contributing the landscape change much as they traditionally though perhaps with less intensity.

4.1.7. Potential NunatuKavummiut Impacts

The settlement pattern of the NunatuKavummiut cultural tradition rotated seasonally between sheltered inner bays during the winter and spring and nearby islands during the summer where multiple families would gather to fish for cod and collect eggs and berries (Beaudoin et al. 2010; Kelvin 2011; Rankin 2015). Near dwelling structures outdoor middens seem to have been established by the entrance. This would have attracted local insect species such as rove beetles and other insects associated with decaying organic matter, while enriching the soils where they were located with potassium, magnesium, phosphorus, calcium, and iron. At one NunatuKavummiut archaeological site, there is a ditch constructed near the dwelling, which may have been the location from where the peat and sod was taken in the construction of the sod house, and this would have affected soil hydrology around the house while creating a pool of water that likely would influence insect and plant species composition around the area. There is evidence that gardens were planted near the dwellings, where seeds would be planted in spring before families left for the inner islands in the summer. When the families returned to their homes in the fall these gardens would have grown vegetables that were harvesting for consumption throughout the fall and winter. The movement and tending of the soil would encourage the growth of weedy plants and sedges. These family dwellings were often passed down through generations, with repeated use of the area if not the dwelling for many years. The impacts of NunatuKavummiut families dwelling on these locations would have created sustained environmental changes that are likely still evident today.

4.2. Outlining A Paleoecological Research Agenda for Labrador

Labrador's environmental history through the Holocene is directly related to the genesis of Labrador's Indigenous landscapes, as from the time of Maritime Archaic arrival in 8,000 BP (Fitzhugh 1978; Holly 2013) people began interacting with the environment in ways that influenced its development. With this in mind, there are clear gaps in current paleoecological research investigating Indigenous-environment relationships within Labrador, namely the lack of paleoecological research focused on identifying environmental signals of all of Labrador's

Indigenous culture groups except for Inuit. The reasons for this are partly described above in subsection 4.1. This chapter has so far represented what we might expect when investigating these signals based on research around the circumpolar north, the following sections lay out a paleoecological research agenda towards furthering current understandings around all of the the Indigenous-environment relationships that influence the development of Labrador's landscapes.

4.2.1. Ponds and Lakes

4.2.1.1. Contextualizing Regional Environmental Trends

To better understand human-mediated environmental impacts, first developing an understanding of regional climate trends is necessary. As has been demonstrated through previous paleolimnological research discussed in chapter two (Bell et al. 2005; Douglas et al. 2004; Hadley et al. 2010a, b; Michelutti et al. 2013; Renouf et al. 2009), the human impacts depicted in limnological data are a reflection of anomalies in presence of pollen, charcoal, and diatom levels that contrast with relative to baseline ecological responses to various climate and environmental phenomenon (e.g. cooling and warming climate trends). The strength of examining lakes and ponds is to understand these larger climate trends because the large surface areas of these bodies of water act as catch basins for windswept microbotanical particles (such as pollen and spores) from the surrounding area. Though human impacts are sometimes visible, depending on the size of the body of water, its proximity to human activity, and the kinds of activities occurring within its proximity, they are less often as visible. Within these larger regional archives, it can be difficult to distinguish the human impacts from ecological reactions to environmental and climate stimuli. Despite this, testing ponds and lakes to gain a more regional understanding of environmental trends in the face of these climate variables is necessary for both understanding environmental patterns of biodiversity change as well as the human components that interact with them.

Defining regional environmental baselines requires obtaining core samples of pond or lake sediments near known archaeological sites. Testing bodies of water that exist adjacent to archaeological sites would allow for the reconstruction of long-term environmental change while outlining regional biodiversity responses to climate and weather phenomenon, such as the expansion or clearing of forested areas (Renouf et al. 2009). Once this data is obtained it becomes possible to track environmental anomalies attributed to human activity.

In the instance where an archaeological site does not have a still body of water nearby, it may not be worthwhile to take obtain sediment samples if the goal is to assess human impacts. With a goal of examining human environmental impacts solely, approaches outlined in the following subsections (4.2.2., 4.2.3.) may be best. If the goal is to reconstruct regional environmental change over time subject to climate trends (rather than cultural activity), then it may still be advantageous to locate testable bodies of water within the regional area. Developing an understanding of how varying climate regions across Labrador have changed over time is essential towards understanding how human activity influences ecological change because it contextualizes environmental anomalies caused by human activities. Further, it contextualizes not only how humans interact with these systems but also informs some part of people’s sensorial experiences. Part of what a regional environmental construction offers is a reconstruction of the phenomenological context of lived experiences.

A consideration of this approach is that it does require access to a watercraft to access the middle of the body of water to obtain a core sample of the pond sediments. This provides a logistical challenge, one which local communities may have a better idea of how to solve given their familiarity with the study area. It may be possible to portage watercraft overland, or to transport a compact inflatable raft and assemble it upon reaching the destination. Alternatively, it might be much easier to access the appropriate area for coring during winter when the water surface is frozen over (Renouf et al. 2009). This would require logistical planning to access the ponds and lakes at appropriate times during the winter but could be an efficient solution. Further consideration needs to be given to the depth of ponds when choosing which to sample. In places where surface ice can reach thickness of around 2 meters, ponds should be at least 3 meters deep to ensure the sediment layers have not been disturbed by seasonal ice accumulation (Gajewski et al. 1995).

4.2.1.2. Observing Potential Localized Human Impacts

As noted above, ecological changes caused by hunter-gatherer activity are sometimes recorded in paleoecological data from ponds and lakes as anomalies within broader environmental trends. Pond sediments capture several types of data that are useful in identifying human-related impacts. Pollen from core samples provide evidence of changes to terrestrial plant communities, while changes to diatom communities may represent discrete traces of direct activities with ponds or those taking place along the water's edge. Examples of this range from people discarding waste into the water itself (Douglas et al. 2004; Hadley et al. 2010a, b) to repeated foot traffic around the ponds' area (Bell et al. 2004; Renouf et al. 2009), both activities which deposit nutrients into pond ecosystems and occasionally lead to eutrophication. Decreases in certain species of tree pollen suggest the active harvesting of woodland resources (Renouf et al. 2009), while increase in pollen from apophytes suggests activities around settlements created conditions that supported the new growth of weedy plant species associated with human activity. The most telling sign of human activity is perhaps the increased presence of microscopic charcoal within pond sediments, caused by the domestic burning of wood or other organic matter as well as burning woodland to create cleared areas (Renouf et al. 2009). This marker, coupled with changes to local plant and diatom populations, would strongly suggests human-influenced environmental change, as regionally anomalous charcoal deposition is uncommon except in circumstances where a natural forest fire took place. This is not always the case, however, especially in Labrador, where Sivullirmiut and Inuit populations often relied on sea mammal blubber for fuel. Where this might be the case, changes to plant and diatom communities may be enough to suggest human influence where the archaeology is relatively well understood (Douglas et al. 2004; Hadley et al. 2010a, b).

Considering the ecological impacts often associated with human activity, it should be noted that these changes may be difficult to identify concretely in pond sediment data. Impacts likely need to alter biodiversity enough so the changes stand out among regional trends. To better obtain signals, several variables must be accounted for. The larger the body of water the greater area the data will represent, and so smaller bodies of water may be best. Proximity to archaeological sites matters, as the signal of activity from a hunter-gatherer site tends to be more subtle than those of agricultural societies, and with decreasing observability the further away the testing takes place (Aronsson 1994; Hicks 1993). Further, the intensity of occupation and whether the inhabitants were directly interacting with the water makes a significant difference in their observability (Michelutti et al. 2013).

In southern Baffin Island, Michelutti et al. (2013) suggests this approach may have limitations with sites that were less frequently or intensely occupied. Inuit settlements in the area seemed to consist of more permanent settlements and have a greater impact on ponds they lived beside, where they regularly butchered sea mammals and deposited food waste. By contrast ponds near more short-term seasonal Dorset settlements left no clear signs of change due to Dorset activities. This may be an issue with sites in Labrador, where this same pattern of occupation occurs, particularly among Sivullirmiut cultures such as Pre-Dorset, Groswater, and Dorset, where the populations are described as having been highly mobile. In this case, it may be safer to initially test around early spring and summer settlement areas that are archaeologically understood as having been larger, and often constructed to take advantage of the harp seal migration. The large numbers of seals butchered and processed around these sites may leave observable impacts in ponds, if not through direct contact, then at least through passive means such as trampling. Research at Port au Choix in western Newfoundland has documented such settlements and the resulting Dorset impacts on pond ecology (Bell et al. 2005; Renouf et al. 2009). Sites like these may be ideal, as examining human impact in ponds in northern Labrador may be better suited initially for larger sites to ensure a human signal of impact is detected. Regardless, this approach offers value in being a useful first step to investigating human-environment impact within Labrador. It should be noted, however, that this approach's main contribution to the paleoecological research strategy is to establish regional baseline ecological trends in the context of changing climate and environmental variables.

4.2.1.3. Accessing Culture Chronologies at Greater Time Depth

Obtaining core samples from ponds has some limitations concerning time depth, notably that younger bodies of water may be limited in the length of time they capture due to thinner layers of pond sediments as a result of being "younger". This may be an issue when studying older cultures such as the Maritime Archaic. Despite this potential obstacle, examining pond sediment cores may still provide the best opportunity to study such cultures. As demonstrated in work by Bell et al. (2005) and Renouf et al. (2009) these sediments can capture evidence of environmental conditions as far back as 7,000 BP and likely more, time which is difficult to access through other paleoecological sampling locations. However, paleolimnology is limited in the resolution that is visible in the sample. Environmental data from pond sediments capture long term trends but are less suited to capture more discrete (shorter) segments of time. This may be more easily accessed by examining data from peat bogs (which will be further discussed in the following section). For this reason, it should again be stressed that sampling ponds and lakes is best suited for generating regional climatic and landscape change trends over time. As previously discussed, some studies have demonstrated that they may allow for the capture of ecological signals of human activity (Bell et al. 2005; Douglas et al. 2004; Hadley et al. 2010a,b; Michelutti et al. 2013; Renouf et al. 2009), but that pond size and distance from archaeological sites needs to be accounted for in order to obtain the best chance of signals being observed. Coring pond and lake sediments offers regional environmental histories, and together with exploring other paleoecological methods (detailed below), this approach will assist in furthering current understandings of broader climate trends that have influenced the formation of landscapes around.

4.2.2. Peat Bogs as Local Archives

4.2.2.1. Recognizing Anthropogenic Signatures

While ponds and lakes offer regional environmental contexts with the benefit of potentially capturing adjacent human activity, peat bogs offer the advantage of capturing a more amplified signal of human activity within the local environment, thereby making it easier to distinguish environmental change caused by humans rather than environmental stimuli. The process of obtaining data requires the excavation of a suitable profile of peat and extracting monoliths or cores from peat deposits (Figure 8) off the immediate area of archaeological sites, but close enough to still capture a strong signal of human activity.

Figure 8: An example of a box-like monolith tin inserted into the face of an excavated peat profile at Kivalekh, Nunatsiavut (photograph taken by author).

Previous studies have demonstrated that while the ecological effects of human activities are visible from 50 meters away (Aronsson 1994; Hicks 1993), the signals are less distinct than those captured from samples closer to archaeological sites. Ledger and Forbes (2020) obtained samples from 30 m away from the site of Nunalleq in Alaska and successfully captured a clear anthropogenic signal reflected in both pollen and insect data in their sample. Considering these research projects, a range beginning within the immediate site area up to 50 m is suggested for this approach. This largely depends on the availability of peat deposits with a sufficient depth and accessibility (facing restrictions due to permafrost layers). This approach is well suited to Labrador's landscapes, as peat bogs are present along the coasts and throughout the interior.

4.2.2.2. Establishing Site-Specific Chronologies

Data obtained from sampling peat deposits offer value in the time-depth it is possible to capture, and the precision with which human impacts can be temporally defined due to the close proximity to the areas of human activity. Using current Labrador research again as an example, Roy et al. (2012, 2015) and Lemus-Lauzon et al. (2016) determine the beginning of Inuit impacts by the start of observed changes in the composition of plant communities in levels that can be correlated with the occupation of specific archaeological sites. Further, they do so in a fairly precise manner, with Roy et al. (2012) suggesting impacts start at their site near Nain around 610 BP, while giving a range of around 50 calendar years (1309 – 1361 AD). While being able to determine the beginning of Inuit impact on the site, they also capture around a 5,700-year history of the site through their sampling method. This is encouraging for peat sampling around other sites in Labrador, as it falls within the range of every cultural group within Labrador archaeology, and it may simply be a matter of choosing sites effectively to ensure ecological signatures of human impact are identifiable, and encompassing the time-period of interest. To this end, larger sites where the archaeology is well understood may provide the best opportunities for beginning sampling of peat deposits in close proximity to archaeological sites within Labrador. Another advantage of this sampling method is that it could establish the chronology of sites before they are excavated. This could aid in decisions on whether to excavate the site or not, potentially leading to saved time and labor.

This sampling approach can assist with providing precise and accurate archaeological chronologies within Labrador that has so far been difficult to obtain. While cultural chronologies are relatively understood in terms of what cultures succeed previous ones, radiocarbon dating in Labrador has been beset by issues, including the “marine reservoir effect”, caused by the variability of carbon content in the hard tissues of marine organisms on which many northern cultures relied, and the “old wood problem”, referring to the fact that dates obtained from wood represent averages of the time when the tree was cut as opposed to the age of use (Ramsden and Rankin 2013). To circumvent these problems, short-lived terrestrial macrofossils (twigs, seeds and leaves) can be selected as dating materials instead of wood and marine mammal bone (Ledger et al. 2016). Peat monoliths can be subsampled at 1 to 0.5 cm intervals, providing a high level of resolution to archaeological chronologies.

4.2.2.3. Generating Local Histories of Human-Environment Interaction

After obtaining samples from peat deposits in the field, they can be processed in thin horizontal segments. The rate of peat growth in bogs varies depending on various climate and hydrological factors such as temperature and precipitation and so will not have been constant throughout the development of older bogs. Based on the accumulation rate of peat moss in Eagle River (which feeds into Sandwich Bay in southern Labrador) of .39 mm per year since around 9,000 BP (Gorham et al. 2003), it has taken on average 25.64 years to accumulate 1 cm of peat cover. The exact rate of accumulation has changed throughout time given the differing variables, but this gives researchers a rough estimate of time captured through sampling peat monoliths at 1 cm horizontal intervals, which may then be corroborated with radiocarbon assays of material from those samples. With this level of detail, researchers will be able to track the development of local-scale ecology alongside generations of occupation at archaeological sites. This creates opportunities to generate precise local accounts of human-environment interactions throughout Labrador history and observe the generation of its landscapes within intervals of time that are meaningful to human timescales. Further, these also provide local environmental contexts in which people lived, allowing researchers (depending on the methods and proxies studied) to recreate the past conditions (e.g. precipitation, temperature, biotic communities composition and structure) that people experienced as they lived on the site.

This approach is not without its logistical constraints. Year-round permafrost exists beneath much of ground cover which creates a limited depth from which a sample is obtainable. There is core sampling equipment which is capable of drilling into permafrost layers and extracting complete core samples (Gajewski et al. 1995), but this may limit how much material can be captured that would be viable for archaeoentomological sampling (which traditionally have examined larger samples, as discussed in Forbes et al. 2015). This could potentially be solved by taking more samples until an amount suitable for archaeoentomological sampling is obtained. How much peat needs to be obtained for an archaeoentomological sample to amplify human impact within environmental signals remains unclear, but current practice suggests around one liter of material, or 1,000 cm^3 is amply sufficient (Forbes et al. 2015). Based on the availability and cost of equipment suited for obtained cores in permafrost layers, it may be more viable to extract monoliths from thawed peat layers. There are accounts of researchers extracting permafrost layers using chainsaws (Nichols 1974) but transporting frozen peat monoliths from the field back to research institutions may prove to be challenging. Another important consideration when the goal is to study older cultures is surveying areas that have peat beds that may be deep enough to capture their ecological signatures. This may require some time in the field where sampling in various locations can occur to ensure the area is suitable for the time depth required. Further, this may be an opportunity to engage members of the local communities who may have interest in participating in these research projects. These logistical challenges may require some time spent in the field, but they provide opportunities to engage with local community members. Further, in addition to supporting a research agenda aimed towards understanding human-environment relationships within Labrador, sampling of peat deposits can assist in obtaining data for conservation projects. By providing long-term biodiversity data from around Labrador, this approach can assist conservation stakeholders in better understanding environmental resilience and variability, while monitoring the long-term effects of climate change on local and regional ecologies (Froyd and Willis 2008).

4.2.3. Site Level Exploration

4.2.3.1. Understanding Intensity and Continuity of Occupation

Previous research discussed in chapter two details the benefits of various methods of soil analysis towards better understanding how sites were used, specifically detailing the nature of the intensity and longevity of site occupation, as well as uncovering spatial elements of how people organized space around settlements. Human impacts altering chemical soil compositions typically involve the enrichment of archaeological soils with heightened inputs of nitrogen, potassium, phosphorus, magnesium, iron, and calcium (DeLuca et al. 2013; Egelkraut et al. 2018; Freschet et al. 2014; Knudson et al. 2004; Lutz 1951; McCarney 1979; Oberndorfer et al. 2020; Ostlund et al. 2015; Viberg et al. 2013). This method is further supported by surveying vegetation on a site and the surrounding area, offering a non-invasive approach for learning more about how the land and resources were utilized by past and present Indigenous communities. Geochemical analysis, vegetation survey, and dendrochronological analysis are here suggested for furthering current understandings of cultural landscape formation along the coasts and throughout the interior of Labrador.

For the suggested soil analysis, small soil monoliths measuring c. 20 x 20 x 20 cm can be taken from around site areas, and as deep as the soil will allow (Fenger-Nielsen et al. 2019). Samples must be taken from areas where archaeological excavation has not disturbed the natural soil stratigraphy, away from archaeologically disturbed soils, to ensure the monolith maintains the original soil stratigraphy. Monoliths should, however, be excavated from around the site, near features, and known midden deposits. This will ensure that a cultural signal is captured in the sampled soil chemistry. Essential to this is that control samples are taken as well from off-site areas, to ensure that the impacts from human activity are observed alongside relative baselines throughout the time period captured by the soil monoliths. Previous research discussed in chapter two detail how the effects of human occupation within soils are observable from the time the site is occupied, and so geochemical analysis can be used to corroborate dates obtained from other paleoecological methods to generate site chronologies. Further, these effects last in soils potentially for centuries, but the nature of these impacts depend upon the intensity and frequency of site occupation. To this end, geochemical analysis of sites around Labrador can help identify how sites were used, if they were sites of repeated or limited use, and the nature of the intensity of those occupations. The samples will also give general idea as to when sites were abandoned, although, like with palynological sampling methods, there is a lag that exists where elevated levels of geochemicals persist in decreasing amounts as time goes on (Fenger-Nielsen et al. 2019).

Examining site areas around Labrador, particularly in forested areas along the coast and interior, can help researchers understand how archaeological cultures have utilized the landscapes around occupations sites and broader surrounding areas. This would best be carried out during summer months when there is no snow cover on the ground as the presence of cut wood is a solid indicator of human disturbance and will not otherwise be visible (Lemus-Lauzon et al. 2012, 2018). Further, research from Siberia and Fennoscandia observed how harvested woodlands typically are free of forest litter that would otherwise occupy the forest floor. Selective curation of woodland resources has been documented around sites all over the circumpolar north and examining forested landscapes can offer insights into the harvesting practices around Labrador's Indigenous cultures.

4.2.3.2. Revealing Spatial Elements of Occupation

One of the more revealing attributes of geochemical analysis is its ability to inform researchers about how space is used within archaeological sites. This ranges from the organization of structures on sites and the activity areas within those structures (Anderson et al. 2019; Karlsson 2004), to the areas on a site where specific activities took place such as food processing and preserving (Knudson et al. 2004). Excavating soil samples from stratigraphic profiles at strategic areas around sites within set intervals (Butler et al. 2018 suggest 3 m intervals on a grid over the site), perhaps following a grid, the spatial elements of how sites were used can be better understood for sites around Labrador. For instance, activities around the preservation of food are documented in historical records and where these activities took place around an archaeological site can be observed. Knudson et al. (2004) researched soil samples from a fishing site in western Alaska and was able to observe different chemical signatures within site areas for each step in the processing and preserving of salmon; from the initial cleaning and through the washing, drying, and eventual smoking of the fish caught. Similar practices have also been historically documented within Innu communities in the interior of Labrador (Loring 1992), where many caribou would be hunted in the fall before winter, and then processed and preserved on site. Geochemical analysis on within an area where this is known to have taken place would reveal the area where the animals were butchered and then where they were brought into tents to be dried over fire. Both the butchering and drying areas would leave distinct chemical signatures from the different processes. This would give researchers a distinct spatial chemical soil signature to compare to other sites where similar activities may have occurred. This may give a sense of the gendered elements of these taskscapes as well, as certain activities such as butchering the hunted caribou during these large events was considered a task typically done by women (Loring 1992).

Spatial analysis on sites can extend into dwelling structures around archaeological sites as well. Extracting soil samples from archaeological deposits and testing the geochemical properties of various locations within dwellings can offer insights into how space was used, as illustrated in research by Karlsson in Fennoscandia (2004). This approach combined with knowledge of Saami gender roles around the cooking and preparation of food, allowed Karlsson to determine where these activities took place within a Saami dwelling and outline the gendered use of space within the dwelling.

The analysis of archaeological soil samples, along with vegetative survey and dendrochronological analysis, offer the benefits of being able to further understandings around the land-use practices and elements of spatial organization of settlements while doing so through relatively non-invasive means. Site level approaches combined with those examining peat deposits and ponds and lakes offer robust site histories of Indigenous occupation of archaeological sites.

4.2.4. Community Engagement

4.2.4.1. Traditional Ecological Knowledge

A challenge in Labrador archaeology is understanding how past cultures made use of plants. This is largely due to preservation issues as these materials easily decompose over time and are not always present at archaeological sites. In some instances, historical records have been able to fill in these gaps in knowledge, and more recently researchers have been collecting traditional ecological knowledge from Indigenous communities to both archive this knowledge and make it more accessible to those communities, as well as researchers who study cultural legacies of plant use (see the "Interviewing Inuit Elders" series by the Nunavut Arctic College, Oosten et al. 1999).

Seeing this work applied in paleoecological research projects, Oberndorfer et al. (2017, 2020) and Zutter (2009, 2012) have worked alongside Inuit plant mentors within communities in Labrador. Their research has demonstrated benefits of working alongside Indigenous communities to facilitate traditional ecological knowledge sharing while applying that information to better understand how people utilized local plant species in the past and influenced small scale ecological development. This knowledge assists in critically informing the interpretation of paleoecological data in Oberndorfer et al. (2020), where a discrepancy existed between the presence of certain plant species at Inuit fishing sites, where *Angelica atropurpurea* was abundant, and sites of commercial fishing operations, where *Salix glauca* was significantly more common. Both areas experienced disturbance and nutrient enrichment, and when this discrepancy was discussed with members of the Makkovik community, it was suggested that the cause was because the diets at the two sites differed considerably. The researchers were told how Inuit at the fishing sites ate a more widely varied diet than the commercial fishers, effectively altering the nutrient enrichment patters of each area. This, coupled with the use of salt in salting cod at the commercial fishery, had created soil properties at the site that allowed *Salix glauca* to establish itself in the area, while *Angelica atropurpurea* was unable to do the same. The community members were aware of the differences in the plant species composition at each site and had an intimate familiarity with the processes that led to their development. Collecting Traditional Ecological Knowledge is necessary in Labrador archaeology as it connects people to their environment in ways essential to understanding past human-environment relationships and the development of Indigenous cultural Landscapes.

4.2.4.2. Indigenous Toponyms

The lifeways of Labrador's Indigenous communities have traditionally relied on an intimate knowledge of the environments they dwell within. This includes where to find animals at various times of the year, the medicinal and practical value of various plant species, and the topographical features of the landscapes they encounter (Aporta 2009; Collignon 2006; Rankin et al. 2008; Whitridge 2004, 2016). Indigenous place names, or toponyms, are an integral part of how Indigenous cultures experience the land and are often described in a manner that offers people who experience them direction and the knowledge needed to survive within them (Aporta 2003, 2009; Taylor 2018; Innu Nation and Sheshatshiu Innu First Nation 2008 (Higgins 2008)).

Where these place names are known, they can be used to inform understandings around traditional Indigenous-environment relationships.

Much like Traditional Ecological Knowledge, understanding Indigenous topography offers researchers a chance to understand archaeological data in an Indigenous context and informs archaeological interpretation. Key to understanding the development of Labrador's Indigenous landscapes is the attitudes their occupants have towards them. Aporta (2003, 2009) discusses not only the significance of the landscape to Inuit in Nunavut, but also where mobility has traditionally been an integral way of life in the high-Arctic, topographic knowledge has been passed down through oral history for many years and provides knowledge that is experienced while traveling over the landscape. In this way, the landscape constitutes "memoryscapes" that house the collective experiences of generations of people who existed on the landscape (Collignon 2006). When talking about the formation of Indigenous landscapes, it would be interesting to not only pay attention to the places people have decided to settle in the archaeological record, but also to the places they have traveled through, as the webs of human influence within Labrador's environments may have nodes of impacted places caused by generations of travel through them. In this way, Indigenous toponyms may not only assist in the interpretation of archaeological sites and areas but may also provide further avenues for paleoecological research examining the influence that travel and mobility have on landscape development.

4.3. Conclusion

This chapter illustrates how Indigenous groups have played a part in influencing change across Labrador's landscapes and has provided an outline of a paleoecological research strategy for further exploring these human-environment relationships. While paleoecological research from around the circumpolar north demonstrates how hunter-gatherer societies impact ecology at various scales upon the landscapes they occupy, the legacy of Indigenous occupation throughout Labrador suggests these impacts occurred in the same areas along the coasts and within the interior over the course of several thousand years. What these anthropogenic signatures look like is suggested by paleoecological research done in Labrador more specifically, although more research is needed to understand the ecological impacts of Labrador's other Indigenous groups (previous and contemporary). This will help in contextualizing contemporary ecologies around Labrador as well as the impacts upon them through years of Indigenous occupation.

The research strategy proposed here to further explore Indigenous-environment relationships exists as guidelines that can be incorporated into research projects however researchers see fit. Each research area (ponds/lakes, peat bogs, sites/activity areas, and communities) can be utilized individually or with others, and adjusted to best suit research objectives. They all offer ways of exploring archaeological sites and contextualizing them within the broader environment at various scales, and do so in relatively sustainable (non-invasive) ways. There is the potential to use them in lieu of traditional archaeological excavations, for the prospection of archaeological sites, and for making determinations on whether sites should be excavated or not. Overall the established state of knowledge concerning Labrador's Indigenous landscapes provides ample room for researchers to further explore human-environment relationships within the area.

CHAPTER 5
CONCLUSION

This thesis set out to address two main objectives: (1) to provide an account of the current state of knowledge concerning the genesis of Labrador’s Indigenous landscapes; and (2) to outline a research strategy to explore the relationships that existed between Labrador’s past Indigenous groups and the environments they lived in, based on a review of relevant palaeoecological literature. The road to addressing these traveled down two main paths. The first went through a review of paleoecological research from around the circumpolar north that use environmental proxies to examine the environmental effects of past Indigenous occupations. The second leg of this thesis focused on Labrador’s Indigenous culture history, spanning from ~8,000 BP to present day. This includes recounting what is currently known of the lifeways of Labrador’s Indigenous past as illustrated within archaeological literature from the area. After working through these two areas of research, the focus turned back to addressing the main research objectives for this thesis. Below, these will be summarized and discussed, with an eye towards future paleoecological research throughout Labrador.

5.1. The Genesis of Labrador’s Indigenous Landscapes

The current state of knowledge is largely informed by paleoecological research from around the circumpolar north and archaeological research from around Labrador. More directly, there is a growing body of paleoecological research in Labrador specifically that suggest a northern and coastal specific signature of Inuit environmental impact, including: decreases in local levels of *Picea* sp. with increases in local apophyte populations such as *Montia fontana*, *Silene* sp., and *Polytrichum piliferum*, accompanied by increases in *Larix laracina* around past settlements (Lemus-Lauzon et al. 2016; Roy et al. 2012, 2015, 2017, 2021); chemical enrichment of soils from within semi-subterranean dwellings (phosphorous, sulfur, cesium, lanthanum, calcium-oxide, and zinc), with the specific chemical enrichments changing (increased presence of lead and barium) as Inuit lifeways incorporated more European goods (Butler 2011; Couture et al. 2016); and patches of vegetation that differ in species composition from the surrounding environment, such as with *Angelica atropurpurea* around traditional Inuit fishing locations (Oberndorfer et al. 2020). These may be comparable to impacts of Inuit, Innu, and NunatuKavummiut groups elsewhere within Labrador, however this is unclear because the paleoecological research that currently exists in the area is confined to Nunatsiavut. The broader circumpolar research provides insight into what can be expected based on Indigenous lifeways throughout Labrador's Holocene history, but more research needs to be done to determine the specific outcomes of ecological disturbances outlined in Table 4.

The door is open for more research examining Indigenous-environment relationships throughout Labrador. Specifically, there have been very few investigations using the approaches outlined here for any group besides Inuit, and even that can be expanded upon. Understanding how these groups interact with the environment and identifying their environmental signatures can aid in understanding more about their daily activities, movements, chronologies, and landscape-use while also filling out the environmental context for the development of Labrador's Indigenous and natural landscapes.

5.2. A Paleoecological Research Agenda for Labrador

Recent paleoecological research has demonstrated a pattern of Inuit environmental impact along the central and northern coast of Labrador, while research from chapters two and three suggest further paleoecological research can expand current understandings of human-environment relationships for all of Labrador's Indigenous cultures. Considering this body of knowledge, a paleoecological research agenda has been proposed here that includes four main approaches, incorporating ponds and lakes, peat bogs, soil analysis and vegetation survey, as well as community engagement. Below, the main points of each approach described, and are depicted in Table 5. It should be noted that not all of these approaches need to occur simultaneously. It is recommended that the approach taken for any research project is what is best suited for that specific project.

Regional contexts can be established through the examination of ponds and lakes. If the goal of research is to establish regional environmental histories, documenting trends and ecological responses to climate trends and weather phenomenon, then the size of the body of water is less important, as these mediums tend to capture data from broader environmental contexts regardless of size. If the goal includes capturing a signal of human activity, sampling should be limited to smaller ponds near archaeological sites that are known to have been occupied intensely and over repeated periods of time. Smaller more ephemeral sites may not show up within the sediment profiles, while larger sites may affect local ecology enough to be distinguishable from the broader environmental data.

Table 5: Guidelines for future paleoecological research studies in Labrador.

Scale of Environmental Data	Sampling Location	Technical and Logistical Requirements	Types of Analysis	Community Involvement
Regional trends	-Ponds and lakes adjacent to archaeological sites (for best change of capturing human signature), or within 5 km of sites of interest. -Smaller bodies preferred to observe human signal. -Larger bodies for broader regional contexts	-Coring equipment for extracting sediments from lake beds. -Tools or machinery to cut through ice (if sampling when frozen). -Access to watercraft (if sampling when thawed). -Transportation to sites; cost and difficulty varies with location	-Paleolimnology -Palynology -Geochemical	-Consultation on research design. -Logistical assistance. -Identification of trainees/field and laboratory assistants. -Interpretation and dissemination of results.
Local Environmental Signals	-Peat bogs within 30-50 m of peripheral structures or activity areas on archaeological sites.	-Coring equipment for identifying viable sampling area (~45-40 cm of undisturbed peat). -Monolith tins for extracting blocks of peat (a 30 liter tin, contains 30 1 L samples, for capturing both insect and pollen data is 40 x 35 x 26 cm). -In summer with no snow and ground the has thawed. -Means of transporting samples to research facilities.	-Palynology -Archaeoentomology	-Permission to conduct research in specified areas. -Scouting suitable areas to conduct research. -Interviews to document environmental knowledge. -Design and construction of field equipment.
Spatial Elements of sites and activity areas	-Around and within features on archaeological sites and activity areas. -Within wooded areas where both coring and dendrochronological analysis can occur.	-Hand operated soil corer (2 cm diameter, ~ 30-50 cm long) for extracting samples. -Increment borer for extraction of tree cores. -In summer with no snow cover and the ground has thawed. -Means of transporting samples to research facilities.	-Geochemical soil analysis -Dendrochronology -Vegetative survey	

Sampling from peat deposits near sites will capture a more local environmental context while also provide intimate culture histories for specific sites. These samples provide environmental data from a much smaller area than ponds or lakes, and so any anthropogenic effects may be easier to discern amongst the localized environmental data, as long as samples are collected close (within a 50 m radius) of archaeology. Late summer would provide the best opportunity to obtain these samples while the ground is thawed, ensuring that samples can be reached an appropriate depth for the time period of intended study. Samples from peat can be partly processed in the field, where subsampling into 0.5 to 1 cm horizontal layers can be achieved from the obtained monolith and placed into bags that may be distributed among containers to make them easier to travel with. However, this is best undertaken indoors to limit risks of contamination. A 1 cm subsampling layer will ensure that enough material is captured to effectively assess archaeoentomological data in the context of timescales meaningful to human scales. Smaller samples at subcentimeter resolutions should be obtained if the goal is to only assess human impact through microfossil data obtained through palynological sampling. Larger sites may be preferable to sample from at first, as they provide the best likelihood of obtaining an observable ecological impact. Surveying local peaty areas around sites needs to be undertaken to ensure a depth of peat that will capture the chronological time depth from the intended cultural period.

Site-level explorations including geochemical and faecal biomarker analysis, as well as dendrochronological analysis and vegetation survey, should be conducted around sites during summer periods when ground is thawed when small soil samples can be obtained. Control samples must be obtained at the same time to get environmental baseline characteristics of soil chemistry. These approaches offer insights into land-use practices of the occupants as well as provide opportunities for the spatial analysis of settlements.

Throughout this research agenda, community engagement is essential, because archaeology serves nobody if it does not work for Indigenous communities (also see Atalay 2012 and Colwell 2016 for similar arguments). For the research agenda put forth here, it is recommended that researchers consult with Indigenous communities on research design, reach out for logistical support both within communities and in the field, ask for assistance in identifying field assistants and trainees, and disseminate the results of research back to the stake holding communities. This thesis is meant to recount to researchers what has been done, and outline how to effectively and sustainably continue to research human-environment relationships within Labrador's Indigenous history. This should ideally be accomplished in partnership with the communities whose heritage is being studied.

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