Tapaiitam:
Human Modifications of the Coast as Adaptations to Environmental Change, Wemindji, eastern James Bay

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ABSTRACT

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Concerns about environmental changes have prompted scholars to search for adaptation lessons and insights from local ecosystem-based management approaches. Unfortunately, Eurocentric misconceptions of wilderness persist as powerful obstacles to understanding and appreciating aboriginal land and resource management. This thesis provides a comprehensive case analysis of the James Bay Wemindji Crees' responses and adaptations to coastal change. Specifically, it examines how Crees modify the coast for subsistence resource harvesting, how these modifications and associated harvesting strategies are intended to function, and their significance for local and mainstream society. I investigate past (as far back as four-hundred years) and present land management practices, as well as future initiatives, through ethnographic methods, field surveys, and remote image measurements. Crees' local knowledge is shown to inform camp location decision-making and the maintenance and/or creation of hunting areas. A dynamic interplay of various bio-physical, socio-cultural, and technological factors is reflected through persistence and change in camp locations. A humanized landscape is further evidenced by the dikes, tillage areas, burnings, fish weirs, and forest-corridors that Cree construct to increase resource predictability. I show that Cree adaptations to environmental change are informed by a commitment to maintaining tradition while also embracing contemporary opportunities. Cree resource management also seeks to harmonize investments in place by opposing or delaying environmental change, while remaining flexible and open to experimentation in accordance with change. The resulting relationships between Crees and their environment have immediate implications for Wemindji Cree efforts to establish a local-management based protected area. These relationships are also instructional for mainstream society as it grapples to find appropriate responses and adaptations to environmental change.

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DEDICATION

In memory of the late Lot Kakabat.

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> These concepts, abilities, and assessments [human – environment theories, methods and analyses] [...] are part of a deeper, more fundamental search for the meaning of earth transformation, an ancient search that is central to our endeavors; "What is and ought to be the relationship of humans to the earth?"
>
> (Kates, Turner and Clark, 1990:2)

Chapter 1: Introduction

Environmental changes at global, regional, and local scales are affecting local wellbeing and livelihoods around the world (IPCC, 2007; MA, 2005) and are often exacerbated in northern environments (Chapin, 2004). Recognizing the importance of ecosystem based local-management practices has paralleled understandings of changes and provided lessons and insights for stronger community wellbeing (Armitage, Berkes, and Doubleday, 2007; Berkes and Folke, 1998a; Berkes, Colding, and Folke, 2000, 2003a; Chapin, 2004; Davis, Whalen, and Neis, 2006; Mitchell and Brown, 2003; Olsson, Folke, and Berkes, 2004). Environmental protection frameworks are also increasingly reflecting local ecosystem-based management. For example, at the international level recognition is now given to the significance of human agency as part of the landscape in the IUCN Category V Protected Landscape/Seascape (Phillips, 2005). At the regional level Quebec's Natural Heritage Conservation Act, for example, provides opportunities for local municipalities and various provincial ministries to establish protection frameworks which can include, "activities carried out to meet domestic needs or for the purpose of maintaining biodiversity" (Ministère de l'Envionment du Quebec, 2003:III,34.2)

Managerial sharing by local communities and larger nation states can benefit local communities under the right circumstances (Armitage, Berkes, and Doubleday, 2007; Davis, Whalen, and Neis, 2006; Olsson, Folke, and Berkes, 2004). In other cases local-based management is best. For example, where self-management is clearly effective local authority should be supported as opposed to establishing co-management (Mulrennan and Scott, 2005). Additionally, different objectives and interests between local people and nation states can be problematic for co-management regimes. Nadasdy (2007:216) asks, given current management framed in non-equilibrium systems ecology where multiple system states exist, who decides "what the "desired" social-ecological configuration is?" And what happens when there is disagreement (*ibid*)? This is especially relevant in indigenous people's contexts because of different vested interests between native communities and government resource managers (*ibid*). Within the Canadian context, native peoples' land-use practices have all too often been interpreted by southern audiences, with disempowering misconceptions of wilderness, in ways that damage native interests leading to native's disempowerment (Brody, 2000; Cruikshank, 2005; Sandlos, 2001; Wenzel, 1991). Local communities and state governments have some distance to go in addressing this legacy. Consequently while local management should be learned from, it must also be culturally understood if more effective management frameworks are to be established

In this thesis I examine how Wemindji Crees, a First Nations community located in eastern James Bay, northern Quebec, Canada, modify the coastal landscape for "bush" resource harvesting, how these modifications and associated harvesting strategies are intended to function, and how human-environment relations surrounding these modifications are significant both locally in Wemindji and more broadly for mainstream society. I investigate past and present management practices and future initiatives through ethnographic methods, field surveys, and remote image measurements. My investigations go back as far as four-hundred years. By addressing human agency and notions of humanized landscapes this case analysis contributes to research supporting Wemindji's efforts to establish an inter-jurisdictional protected area[i] for enhancing cultural and environmental stewardship. The observed management dynamics also raise important questions about balancing agency and flexibility in a changing environment.

1.1. Thesis overview and research questions

This thesis consists of six chapters. Chapter one presents a thesis overview, research questions, and an overview and critique of relevant literature which leads to a conceptual framework. Chapter two presents an overview of the study area. Chapter three outlines the methodology.

Chapter four documents patterns of environmental change, as observed and understood by Wemindji Cree, and how these observations inform patterns of camp location and relocation associated with resource harvesting. Two questions are addressed.

1) What are the relationships between observed environmental changes and coastal camps?

2) How does a greater understanding of camp and coastal environmental change contribute to our understanding of human-environment relations among Wemindji Crees?

Dynamic interactions between bio-physical and social factors are explored revealing changing ways of dealing with and being adapted to bio-physical changes. Changing human-environment relations are contextualized in the wider history of Cree

[i] Because terrestrial areas fall under provincial jurisdiction and the offshore falls under federal jurisdiction in Canada, Wemindji is working with both governments to create a single protected area that includes terrestrial, coastal, offshore waters, and offshore islands (Scott, 2004; Mulrennan and Scott, 2001).

society as presented in chapter two. The case study of camp decision-making illustrates balancing tradition and future change through self-determining actions.

Chapter five provides a detailed analysis of landscape modification practices and their uses for resource harvesting. Ethnographic methods in combination with field survey work and air photo/satellite image measurements and interpretations are applied to address the following questions.

1) How have Crees modified the landscape both in the past and present?

2) How are these modifications and associated resource harvesting practices intended to function?

3) What does understanding these modifications and associated practices contribute to our understanding of Cree relations with their environment?

The chapter documents a wide array of landscape modifications and their functions. The bulk of the chapter focuses on two landscape modifications which are the chief landscape investments by Cree: dikes and *tuuhiikans* – corridors cut through the coastal forest for goose hunting. Additionally, historic practices only generally recalled, as well as recently arising practices, and plans for the near future are addressed. The balance between tradition and innovation is again an important aspect of modification practices. Also, the interplay between investing in place to oppose or delay environmental change and remaining flexible, willing to move, and experiment in accordance with environmental change is addressed as a major adaptation theme.

Chapter six synthesizes the thesis findings and discusses their significance for wider society.

1.2. Research context

My research is part of a larger interdisciplinary team project entitled *The Wemindji-Paakumshumwaau Project: Environment, Development and Sustainability in a James Bay Cree Community* (see www.wemindjiprotectedarea.org). This is a McGill University-based collaborative research effort with partners and co-investigators from the Wemindji community, McGill University, Concordia University, The University of Manitoba, and The University of British Colombia, as well as the provincial government of Quebec, and federal government of Canada. A primary research objective is to build a framework for culturally appropriate marine, coastal, and terrestrial environmental protection on the Wemindji territory. This includes cultural protection that enhances local self determination. The project also aims to understand how Cree / western-academic knowledge sharing can help achieve a balance between environmental protection and economic development in Wemindji.

I have been fortunate to work closely with a diverse group of researchers. Because my research focused on the historic period I was actively involved with the archaeologists and palaeoecologists whose research focuses on the prehistoric, as well as the anthropologists, ecologists, and other fellow geographers with interests in the contemporary and recent past. Through our shared insights we informed one another's queries. Studying the interactions between people's resource-uses and environmental changes, I (and the archaeologists) regularly conversed with the physical-coastal modellers, palaeoecologists and ecologists on one side of a social – natural science spectrum, and the cultural anthropologists and human geographers on the other side. These collaborations helped shape my research and helped me navigate many oceans of knowledge. Our combined efforts highlight the need for interdisciplinary collaboration to tackle contemporary human-environmental concerns (Liverman, 1999; Turner, 2002; Viles, 2005). Like my collaborations the literature I draw on is diverse. This literature is connected however, as I will illustrate.

1.3. Literature review

Understanding Cree's modifications of the landscape and associated practices requires addressing the product of social and ecological interactions – a result which is greater than the sum of its parts. Both human/cultural ecology[ii] and environmental history provide solid systems based frameworks for this analysis (Cronon, 1983; Ellen, 1982; Nietschmann, 1973; White, 1980). These sub-disciplines also address human modifications of the landscape and wilderness (i.e. Cronon, 1983; Denevan, 1992; Doolittle, 2000; White, 1980). Beyond these sub-disciplines complementary research aimed at land-use and landscape reconstruction is carried out by: palaeoecologists, archaeologists, historical geographers, geographers in general, and a host of environmental scientists (Birks *et al.*, 1988; Butlin and Roberts, 1995; Turner *et al.*, 1990). Nevertheless the combined guidance of human/cultural ecology and environmental history lenses is most central to my study.

Before situating my research contributions in specific human-environment niches I outline some broader intellectual roots that I draw on. Then specific niches in the literature are critically addressed. These include: social-ecological systems, adaptive

[ii] I have combined the terms human ecology and cultural ecology into human/cultural ecology, because I believe that in practice the terms overlap. Therefore, the term one ascribes to themselves reflects more personal affinities for either cultural anthropology or less culturally focused traditions. Indeed however, McCay (2008:12) has stated that Vayda and Rappaport's (1968) stance that "populations, not cultures or societies, be the unit of analysis, and that humans be seen as parts of dynamic ecological systems [...] was the birth of modern "human ecology" as distinct from "cultural ecology."" Thus some people may view a more concrete divide between the two than I do.

management, and resilience; environmental change and human response in the context of the arctic and sub-arctic; and humanized landscapes and wilderness – or the ideology of place and the role of humans in it. I then take stock of previous work addressing Cree modification of the landscape.

1.3.1. Broader intellectual roots – Human/cultural ecology, and Environmental history

The foundational roots of human/cultural ecology stem from the anthropologist Julian Stewart and the geographer Carl Saur in the early to mid 1900s (Butzer, 1989; Ellen, 1988). The subsequent development of human/cultural ecology and its offshoots has been richly reviewed (Davidson-Hunt and Berkes, 2003; Folke, 2006; McCay, 2008; Merchant, 1990; Robbins, 2004; Scoons, 1999; Smit and Wandel, 2006; Zimmerer, 1994), and is not replicated here. Environmental history arose later during the environmental and social movements of the 1960s and 1970s (McNeill, 2003). The human-in-environment lens used by both sub-disciplines was strongly shaped by incorporation of "the new ecology" (Cronon, 1983; Ellen, 1982; Nietschmann, 1973; White, 1980) which focuses on chance, disturbance, resilience, and alternative stable states (Zimmerer, 1994; Scoones, 1999). While human/cultural ecology and environmental history do not regularly inform each other, the former has certainly influenced the latter. For example, Cronon (1983:235), an influential figure in developing environmental history, draws on work by John Bennett, Bonnie McCay, Roy Rappaport, and Andrew Vayda, all cultural/human ecologists and ecological anthropologists. Additionally some subsequent human/cultural ecologists draw on the work of environmental historians like Cronon (i.e. Davidson-Hunt, 2003).

Cultural ecology until the 1970s focused on understanding how well adapted local cultures were to their environments (Butzer, 1989; Robbins, 2004; Smit and Wandel, 2006). The field suffered from a hyper focus on small scale local communities and avoided dealing with regional and global interactions (Robbins, 2004). Nietschmann's (1973) work was a landmark study in human/cultural ecology in part because it broke out, grappling with the role of regional and global markets, and the recognition that local systems were not closed, but rather interacting with larger scale systems (Robbins, 2004). The 1980s saw an emergence of human/cultural ecology that did indeed address larger scale interactions (Butzer, 1989), most likely in response to heightened concerns about regional and global dimensions of environmental change (Liverman, 1999).

McCay's (1978) work was another early and influential piece which expanded the systems perspective beyond the small-scale local subsistence system to include regional social and political processes. McCay (1979) and Vayda and McCay (1975) also explicitly questioned the units of analysis advocating that individual people or other social units should be the units of analysis in human ecology studies rather than systems, as had been the tradition at that time. They also advocated for more attention towards people's role as agents responding to environmental change. In this respect their work represented a shift in human/cultural ecology's focus from a preoccupation with how well adapted a society or culture was to their environment to a focus on how well societies or communities could adapt to environmental change (Butzer, 1989; McCay, 1978; Robbins, 2004; Smit and Wandel, 2006; Vayda and McCay, 1975). These intellectual developments set the foundation for some powerful human-environment views that are actively used today.

1.3.2. Some specific human-environment frameworks – social-ecological systems, adaptive management, and resilience

Social-ecological system thinking is a powerful human-environment epistemology which evolved from the incorporation of the 'new ecology' into human-environment studies. It brought with it a focus on multi-scale system interactions and open systems, interest in social groups and resource-user communities, and concerns for global and regional environmental change (Berkes and Folke, 1998b). Social-ecological systems are conceptualized where social and ecological components of the wider system have tightly co-evolved and any distinction between the two is arbitrary (Berkes and Folke, 1998b). Adger (2006:269) illustrates that a number of "traditions" have arisen, each which investigate social-ecological systems, such as: resilience, vulnerability, common property resource, ecological economics, and adaptive management; "each seek[ing] to elaborate the nature of social-ecological systems while using theories with explanatory power for particular dimensions of human-environment interactions." This astute observation by Adger highlights the breadth of the human-environment literature. I draw on the adaptive management and resilience traditions in particular (Berkes and Folke, 1998a; Berkes, Colding, and Folke, 2003a; Folke 2006).

Adaptive management is a way of living in a system where disturbance is incorporated and at times fostered in resource management and resource-user groups are flexible in the face of change (Berkes and Folke, 1998a). Resilience is a system's property where disturbances are absorbed while the system maintains essential structure and function and/or disturbances spark renewal, reconfiguration, and redevelopment of the system when too extreme for absorption (Berkes, Colding, and Folke, 2003a; Folke, 2006). Social groups that incorporate, accommodate, and recover from change are said to have a high adaptive capacity or adaptability (Smit and Wandel, 2006). Social memory is an important parameter for renewal in resilient systems (Folke, 2006). Resilience is framed in terms of panarchy – nested scales with smaller scales infusing change in larger scales while even larger scales reinforce the status quo, thus the system is creative and conserving: "combines learning with continuity" (Holling, 2001:402).

Maintaining essential structure and function is not concretely defined in social-ecological systems thinking. However, Scott (1996) and Wenzel (1991) (neither of whom categorize themselves as 'social-ecological systems scientists') look at social reorganization around important economic and cultural resource harvesting activities among Cree and Inuit hunting, respectively. Scott's work is further elaborated in chapter two. In these two examples hunting strategies and management were adjusted to perpetuate the more important cultural, subsistence, and economic aspects of the hunt in light of changes like resettlement, increased involvement in cash economies, and motorized transportation, thus maintaining the larger cultural and social system. Scott's and Wenzel's works are good examples of what it means to maintain essential structure and function because they provide understandings of the relations between people and place that are fundamental to people's interactions with their environment. Their works also addresses system scale. Change may occur at smaller system scales, such as the way people organize for hunting, to maintain the larger system, such as the social and cultural relations that are carried out through the procurement of bush foods.

In the face of change, an adaptation – a change in the system to better deal with problematic conditions – is a representation of adaptive capacity or adaptability (Smit and Wandel, 2006). There is confusion in the literature about the meaning of adaptation and adaptive capacity (Gallopin, 2006; Smit and Wandel, 2006), but it is apparent that adaptation is currently applied most often in relation to extreme system shocks and this trend is largely associated with the rise of climate change adaptation research (Smit and Wandel, 2006). A further distinction is often made between adaptive strategies, which represent a change in how individuals, households or communities procure a livelihood, and coping mechanisms or coping responses, which represent short-term responses to environmental changes that threaten livelihoods (McCay, 1978; Turner *et al.*, 2003). Coping responses/mechanisms can often become adaptive strategies (McCay, 1978; Turner *et al.*, 2003). The notion of adaptability has diverged from its original conception by early cultural ecologists seeking to understand how well adapted a culture was to its environment (Butzer, 1989; Smit and Wandel, 2006). Use of these terms gets confusing because resilience and adaptability are treated rather synonymously (Berkes, Colding, and Folke, 2003a; Smit and Wandel, 2006). Resilience however, is invoked when dealing with both normal system variability and extreme system shocks. For example, Colding, Elmqvist, and Olsson (2003) look at resilience to normal system variability of flood-pulse patterns in a river system. Berkes, Colding, and Folke (2003b) examine resilience in relation to novel shocks of global climate change. Tengo and Hammer (2003:155) focus on the resilience of Tanzanian agriculturalists with respect to natural seasonal climate variability and a novel shocking disturbance: "villagization following independence." Even two decades ago Denevan (1983:402) noted "most adaptation involves resilience in that adjustments are made to either gradual change [...] or to sudden, but short lived change," highlighting the coupling of the terms and spectrum of application.

In this thesis I treat adaptability, adaptive capacity, and resilience as rather synonymous. These three terms refer to system properties. An adaptation however, as Smit and Wandel (2006) discuss, is a feature of the system and through its interaction in the system contributes to the system's adaptability. I apply the adaptation concept to both novel system shocks and to normal system variability. As such, I look at structures or behaviours in the social-ecological system as ways of being adapted to change or "adaptedness" which contribute to "the viability of social and economic activities, and the quality of human life" (Gallopin, 2006:300).

The championing of system models in which societies incorporate and function around the ecological patterns of disturbance and renewal from which their livelihoods are derived, is a stance on what "ought to be the relationship of humans to the earth" (Kates, Turner, and Clark, 1990:2). At some level sustainability is part of the founding ideology of these human-environment frameworks and sustainability is valued by practitioners of these frameworks (Berkes and Folke, 1998b; Nadasdy, 2007). Indeed Folke (2006), Holling (2001), and Walker *et al.* (2004) have pointed out that resilience can be unfavourable if a system is in an undesirable state highlighting that as decision makers people must decide what it is they want. Desirable or undesirable resilience is subjective. Thus, it is important to understand local people's objectives for resource-use and relations to their environment.

1.3.3. Environmental change and human response in the arctic and sub-arctic

Query into local perceptions of environmental dynamics in the arctic and sub-arctic has been ongoing for many decades (i.e. Feit, 1987; Kemp, 1971; Nelson, 1969; see Wenzel, 1999). However, over the past decade local observation and understanding of environmental change in the north have received increasing attention as a result of contemporary concerns related to climate change (Berkes and Jolly, 2001; Berkes *et al.*, 2005; Krupnik and Jolly, 2002; McDonald, Arragutainaq, and Novalinga, 1997; Nichols *et al.*, 2004), interactions between western-scientific and local knowledge (Berkes *et al.*, 2005; Cruikshank, 2005; Dowsley and Wenzel, 2008; Fienup-Riorden, 1999; Krupnik and Jolly, 2002; Laidler, 2006; Laidler and Elee, 2007), animal resource changes (Dowsley and Wenzel, 2008; Fienup-Riorden, 1999), and changes in land-use and resource-use associated with changing environments, communities, and economies (Berkes, 1988; Berkes and Jolly, 2001; Berkes *et al.*, 2005; Ford *et al.*, 2006, 2008; Krupnik and Jolly, 2002; McDonald, Arragutainaq, and Novalinga, 1997; Pearce *et al.*, 2006; Usher, 2002; Wenzel, 1991, 1994).

Researchers often stress that northern communities remain flexible in the face of environmental change (Berkes and Jolly, 2001; Berkes *et al.*, 2005; Krupnik and Jolly, 2002). A simple picture is presented of two parallel flows: environmental change and the flexible and opportunistic response of local people. For example, both Berkes and Jolly (2001) and Jolly *et al.* (2002) articulate well the knowledge Inuit have of climate-related changes around them. However, in presenting peoples' responses to change these authors simply discuss a general flexibility of people opportunistically shifting when, where, and what to hunt in response to change, or making adjustments such as traveling with new technology, or additional equipment to assist in coping with the unknown (Berkes and Jolly, 2001; Jolly *et al.*, 2002). The absence of more nuanced accounts of interactions between humans and changing environmental conditions leaves an impression that people are passive in the face of change. Ford *et al.* (2006) provided an exception to this trend by illustrate how peoples' ways of adapting to change can be both advantageous in the context of some changes and disadvantageous in the context of others. Environmental change is not one massive wave, but rather many different changes which people can respond to individually.

A central theme of northern studies is that the north has long been changing and people and communities have by necessity been highly adaptable to these changes (Berkes and Jolly, 2001; Duerden, 2004; Ford *et al.*, 2006, 2008). Understandings of the past and present are known to inform about future adaptive capacity (Berkes and Jolly, 2001; Duerden, 2004; Ford *et al.*, 2006, 2008). However, relationships between contemporary social, economic, demographic, and technological changes must be carefully understood in any effort to project how people and communities might respond to future changes (Berkes and Jolly, 2001; Duerden, 2004; Ford, Smit and Wandel, 2006; Ford *et al.*, 2006, 2008).

Most studies addressing peoples' responses to environmental change focus on behavioural, strategic, and/or technological adaptations or coping strategies (Berkes and Jolly, 2001; Ford *et al.*, 2006, 2008; Krupnik and Jolly, 2002; Pearce *et al.*, 2006). Limited consideration has been given to documenting physical modifications of the landscape as a human response to environmental change. This focus, particularly when taken from an historical perspective, has significant implications for appreciating the role human agency plays in northern environments.

1.3.4. Ideologies of environmental space and time – the wilderness debate and humanized landscapes

Seeking an understanding of past land-use and the role of humans in shaping landscape is often glossed as 'the wilderness debate' (Callicott and Nelson, 1998;

Cronon, 1995; Loo, 2006; Mulvihill, Baker, and Morrison, 2001; Sandlos, 2001) and understanding humanized landscapes (Cronon, 1983; Denevan, 1992; Doolittle, 2000; Vale, 2002; White, 1980). Wilderness – the assumed existence of pristine virgin landscapes void of human influence; "where the earth [...] is untrammelled by man, where man himself is a visitor who does not remain" (U.S. Congress, 1964); where "visitors will also have the opportunity to experience remoteness and solitude [...] activities will be encouraged only when they do not conflict with maintaining the wilderness itself" (Parks Canada, 2006:2.2.3.2) – was built as part of the American identity by thinkers and politicians like John Muir, Henry David Thoreau, and Theodore Roosevelt (Callicott, 1991, 1994; Cronon, 1995; Nash, 1967) and as part of the Canadian identity by The Group of Seven Painters, authors like Farley Mowat (*Never Cry Wolf*), cinematographers such as Bill Mason (*Call of the Wild*), activists like Grey Owl, and Government Wildlife Managers such as Gordon Hewitt (Loo, 2006). But as Callicott (1991, 1994), Cronon (1995) and Loo (2006) illustrate, such ideology misrepresented human-environment relations. North America has had a long human-environment history extending back thousands of years (Cronon, 1983; Denevan, 1992; Doolittle, 2000; White, 1980; Vale, 2002). By consciously erasing this history and/or through failure to recognize alternative land-use practices, the dominant Euro-American/Canadian society provided themselves the rights to appropriate and determine the fate of land and people (Cronon, 1983; Denevan, 1992; White, 1980). The ideology of wilderness that is not of or for people extends beyond North America to both Central America (Gomez-Pompa and Kaus, 1992) and Australia (Plumwood 1998, 2006).

The wilderness ideology, with the connotation not of or for people (Cronon, 1995), is disempowering because it ignores local land and resource uses and erases local human-environmental histories. Wilderness is not wilderness when viewed by local inhabitants (Gomez-Pompa and Kaus, 1992; Nabhan, 1995). However, the myth of the empty and hence pristine north has been advanced for the Canadian north and has at times prevailed to the detriment of northern aboriginal peoples (Brody, 2000; Cruikshank, 2005; Desbiens, 2004; Roue, 2003; Sandlos, 2001; Wenzel, 1991). Indeed, both Desbiens (2004) and Roue (2003) illustrate the fundamental role that wilderness ideology played in James Bay hydroelectric development by the Quebec government – an ideology that will be contextualized in the region's history in chapter two. Alternatively, when native land/resource-uses are identified and recognized, if they fail to comply with romantic views, they are often discredited as being non-traditional (Nadasdy, 2005; Wenzel, 1991), an equally detrimental interpretation. The idea of the Ecological Indian living as a harmonious part of an untrammelled wilderness persists (Nadasdy, 2005). Of course the converse does not have to be true in order to discredit the Ecological Indian fallacy. Nadasdy (2005) provides an excellent discussion on this issue, highlighting that at times native people have chosen to appropriate, though not without some cost, terms such as wilderness. In contrast however, Pratt (1994) presents a case from Alaska where the notion of wilderness was seen as extremely offensive and culturally undermining by the native population of Nunivak Island. Indeed the debate around native peoples and conservation has been highly contentious (Feit, 2007; Hakin and Lewis, 2007; Kretch, 1999, 2007; Nadasdy, 2005). Closer documentation of native people's relationship to the land, including their use and understanding of associated resources, will help dismiss naive assumptions and misconceptions, contributing to a more informed debate on this matter.

Ironically there seems to be a disjunction between studying human investments in place when seeking to understand humanized landscapes and studying co-evolution with local disturbance when understanding adaptive management and resilience. Fortunately a growing body of literature seeks to address this combination of humanized landscapes and adaptive management (Berkes and Davidson-Hunt, 2006; Davidson-Hunt, 2003; Natcher *et al.*, 2007; Peacock and Turner, 2000; Turner, Davidson-Hunt, and O'Flaherty, 2003).

1.3.5. Previous documentation of Cree landscape modifications

There has been no detailed study of Cree modifications of the landscape. Scott (1983) mentions Cree's construction and use of dikes and *tuuhiikans* – corridors cut through the coastal forest (see chapter five) – for goose hunting. Forest (2006:35) also mentions the cutting of *tuuhiikans* describing their function as "leading geese to their preferred feeding grounds." Reed (1991:346) discusses the creation and maintenance of coastal wetlands by building dikes saying; "The Cree are seeking more than open water for hunting; they are placing emphasis on creating high quality wetland habitat which will provide additional food resources for migratory waterfowl." Reed (1991:346) also mentions "shrub clearing projects to slow down the invasion of certain salt marshes and fens by willows." While fire and gardening (i.e. through root digging, soil tilling, or weeding) are known to be resource management strategies used by many native North American societies (Berkes and Davidson-Hunt, 2006; Cronon, 1983; Davidson-Hunt, 2003; Doolittle, 2002; Natcher *et al.*, 2007; Peacock and Turner, 2000; Turner, Davidson-

Hunt, and O'Flaherty, 2003; Turner, Ignace, and Ignace, 2000; Vale 2002; White, 1980), there is only limited mention of fire use by Cree and none of gardening. Morantz (2002) mentions the historic use of fire to promote berry growth and attract bears for hunting. Morantz (1983:30) also mentions the historic "damming of creeks" as a fishing strategy.

Beyond these isolated statements, not much has been documented about Cree modifications of the landscape. Even less attention has been given to the function and significance of Cree landscape modifications. I employ a simple systems based framework, drawing on theories and viewpoints discussed above, to understand the function and management roles of such modifications.

1.4. Conceptual framework

Conceptually, I combine the social-ecological systems – adaptive management lens (Berkes and Folke, 1998) with a focus on people's role in shaping landscape (Cronon, 1983; Denevan, 1992; Doolittle, 2000; Vale, 2002; White, 1980). Figure 1.1 is a schematic representation of this framework. In a system, ecological, socio-economic, and cultural drivers of change operate at multiple scales and interactions occur between and within scales (Battista, 1977). The local land tenure system in Wemindji, which I describe in chapter two, is my unit of analysis as variations in resource management should be apparent at this scale. These units can readily be aggregated to consider the Wemindji community as a whole, but it is methodologically unsound to make smaller scale conclusions based on larger-scale analysis. Indeed chapter four is based on aggregate units to address coastal Wemindji as a whole. The arrow going from small to large scale in figure 1.1 is question marked because while many small scale processes certainly affect large scale processes it is unrealistic that small scale processes affect a large scale geomorphic driver of change in this case. This driver, in the Wemindji system, called coastal land emergence will be discussed in chapter two.

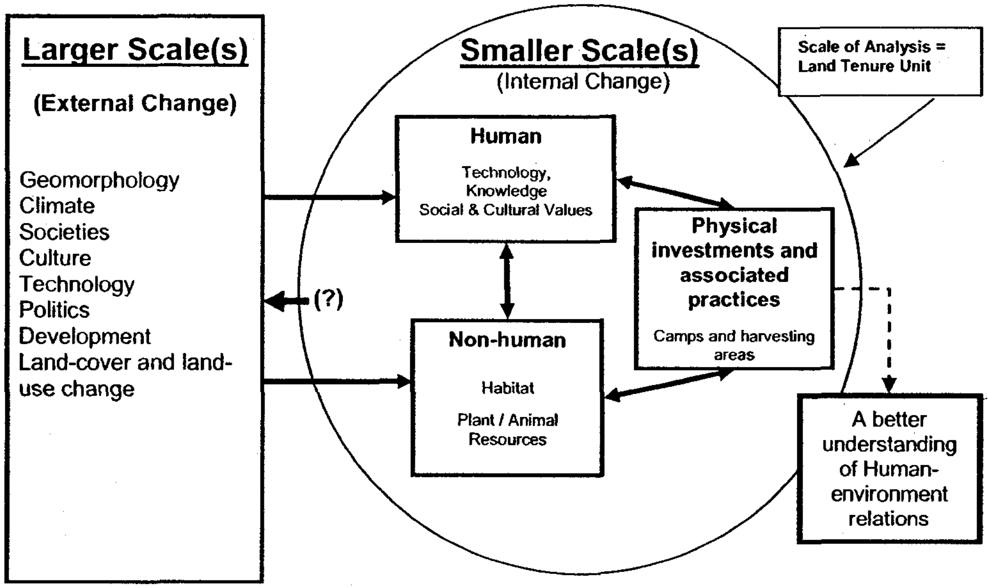

Figure 1.1. Schematic diagram of an adaptive management perspective on human modification of the landscape in a social-ecological system to learn about human-environment relations.

A significant dimension of human-environmental relations is reflected in people's modification of landscape, or their physical investment in it, plus the practices that make these investments function. In chapter four Cree investment in landscape is examined though camp location decision-making. In chapter five physical investments are understood though landscape modifications for resource harvesting and associated harvesting techniques. Examining the interactions between non-human variables (plant and animal resources and/or their habitats), human variables (technology, knowledge, and socio/cultural values), and the physical investment of humans in the landscape and associated practices offers insight into this social-ecological system. Such conceptualization represents an adaptive management perspective on human modification of the landscape in a social-ecological system.

Chapter 2: Wemindji's Coastal Landscape

Wemindji is a First Nations community on the shores of eastern James Bay. Wemindji territory is roughly bounded by latitudes 52°30'N and 53°10'N, and extends about 300 kilometers inland to the east (Fig. 2.1). Wemindji's population is 1,267 people (Cree Nation of Weminji, 2006). Wemindji represents a mixed economy incorporating formal wage-labour, income subsidies, and subsistence harvesting from the 'bush' (Scott, 1988, 1996). While many families work as fulltime hunters/fishers/trappers, others partake in 'bush activities' on weekends or after the wage-labour day is done, and others receive bush food through a culture of sharing and gift giving (Scott 1988, 1996). The community's motto, displayed front and center on their web page, is; "A Community Where Tradition Lives On" (Cree Nation of Wemindji, 2008).

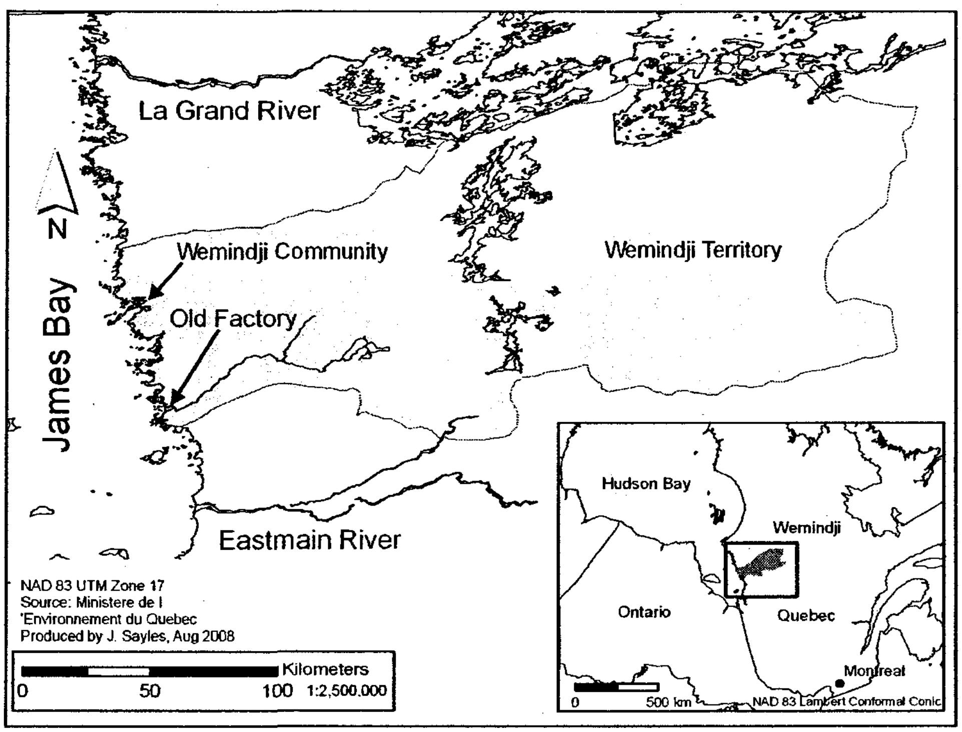

Figure 2.1. Location map of Wemindji territory and relevant landmarks.

2.1. Bio-physical setting

Ten thousand years ago the entire James and Hudson Bay regions, including the Wemindji territory, lay under the Wisconsin glacier (Hillaire-Marcel, 1980). Bearing down on the land, this massive ice sheet depressed the continental crust into the earth's mantel (Hillaire-Marcel, 1980; Peltier and Andrews, 1983). Ten-thousand years ago however, marked the start of a warming period in the earth's history known as the Holocean epoch (Kump, Kasting, and Crane, 1999). By eight-thousand years ago the majority of glacial ice had melted in the James and Hudson Bays region, with the last remaining ice liquefying about fifteen hundred years later (Hillaire-Marcel, 1980:217-218). Like a barge rising up after being unloaded the land began to emerge as the glacial weight melted away causing shorelines to shift westward following the gradient of the land (Hillaire-Marcel, 1980; Peltier and Andrews, 1983). The land continues to rise out of the water today at rates between 0.5 and 1.6 meters per century (Andrews, 1970:703; Hillaire-Marcel, 1980:224; Hardy, 1982:349; Begin, Berube, and Gregoire, 1993:87; Lajeunesse and Allard, 2003:27; van Moris and Begin, 1993:22). As new terrestrial surfaces are exposed upland vegetation invades seaward at a roughly equivalent rate (van Moris and Begin, 1993). Coastal changes are dramatically noticeable in human lifetimes (Bussiéres 2005) because the coast is shallow (< 6 m) (Martini, 1986:119) and terrestrial relief is low (often 1° to 2°) (Dionne, 1980:316).

Tides in James Bay are semi-diurnal with moderate amplitudes of 1 to 3 meters (Dionne, 1980:319). Tidal range along the Wemindji coast is around 1 meter (Manning, 1951:123-124,126: Godin, 1974:107-108). Wind can be a major tidal driver in James Bay and the meteorological tide often overwhelms the lunar tide (Benessaiah *et al.*, 2003;

Manning, 1951; Scott, 1983) creating tidal surges of many meters (Manning, 1951). The region is sub-arctic and for about half the year the coast is fringed with ice (Dionne, 1980).

South of Wemindji, or Paint Hills Bay, the coastline is a mosaic of large shallow bays and rocky islands (Dionne, 1980; Gantcheff, McGormack, and Coulture; 1982). To the north the shore becomes rockier with smaller and narrower bays (Dionne, 1980; Gantcheff, McGormack, and Coulture, 1982). Eelgrass (*Zostera marina*) beds grow in the off-shore waters of James Bay (Dignard *et al.*, 1991), however Wemindji Cree have observed drastic declines in eelgrass over the past decade (Berryman *et al.*, 2004). Transitioning inland, the intertidal is dominated by salt marsh or mud flats in low energy environments and boulders and cobbles, fringed by vegetation, along high energy shores (Dignard *et al.*, 1991). Lichens, heaths (dominated by lichens and/or Ericaceous shrubs), and white spruce forests (*Picia glauca*) characterize the mainland and interiors of many of the islands (Dignard *et al.*, 1991). The dense white spruce forest on the coast, as opposed to the black spruce (*P. mariana*) inland, results in part from the thick marine fog that frequently blankets the coast (Reed *et al.*, 1996). Poplars and willows (*Salix* spp.) are also common along many of the rivers and upper sections of marsh (Benessaiah *et al.*, 2003).

2.2. Land tenure, resource-use, and resource management

The Wemindji territory is subdivided into multi-family hunting territories called traplines (Scott, 1986). There are seven coastal traplines in Wemindji extending between 30 and 130 kilometers inland (Fig. 2.2). A hunting boss or tallyman manages the trapline by promoting 'proper use,' rather than by prohibiting improper practices, and is chosen by trapline-user consensus (*ibid*). Animals are viewed as gifts from the land (*ibid*). If the land ceases to provide for people the tallyman is regarded to have not managed the territory properly (*ibid*). He may loose respect as a leader and eventually a new tallyman will be chosen to succeed (*ibid*).

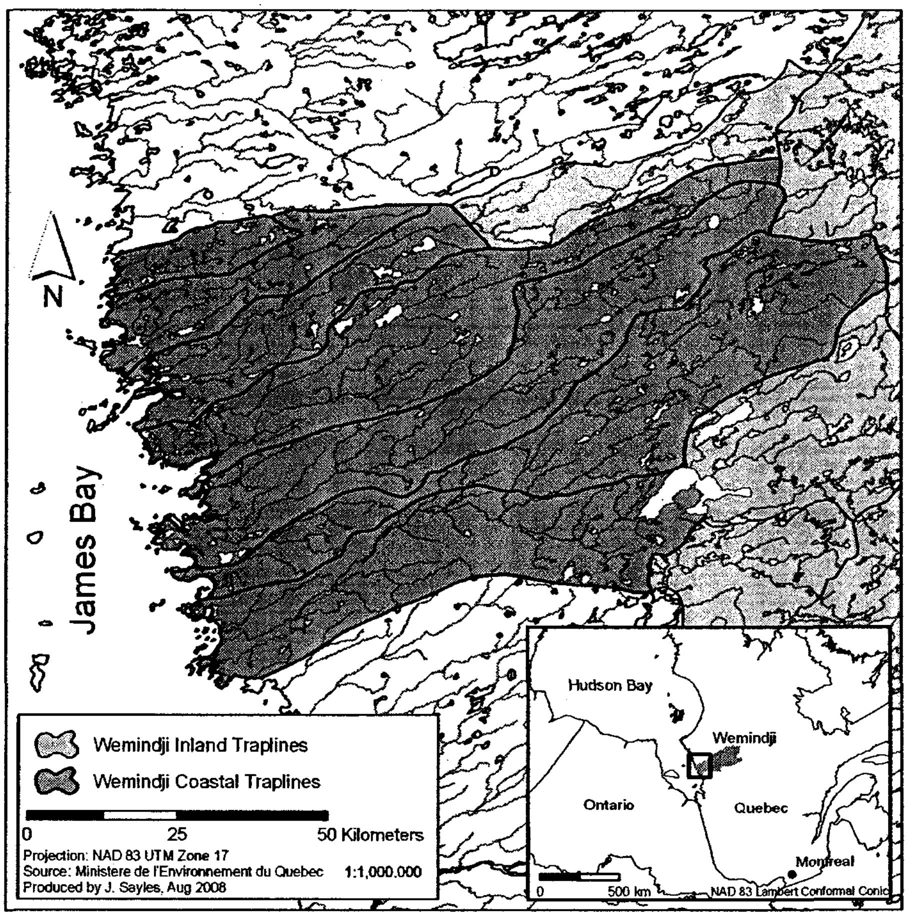

Figure 2.2. Seven coastal traplines on Wemindji territory.

The verb *tapaiitam* expresses the tallyman's conduct and is glossed as "he decides," "controls," or "is in charge of it," but it literally means "he matches it to his thinking" (Scott, 1988:39). Forrest (2006:43) approaches *tapaiitam* as "the land and [tallyman getting] to know one another in a dynamic learning process [leading towards] matching the land to his thinking," because there is not "whole scale modification of the subarctic taiga." Essentially the tallyman's thinking must be informed by his surroundings so that when he in turn matches the land to his thinking, "whole scale" change is not required.

There has been some debate (Bishop and Morantz, 1986; Kretch, 1999; Preston, 1986; Tanner, 1986) if the trapline system existed prior to The Hudson's Bay Company (HBC), an English backed mercantile group dominated by Scottish personnel, which established trade posts in the region during the late 1600s (Frances and Morantz, 1983). However, Morantz (1986, 2002) and Feit (2007) illustrate that general trapline frameworks existed prior to HBC's arrival, but were probably solidified by HBC's involvement.

Resource harvesting activities vary with the seasons both historically and in the pressent (Frances and Morantz, 1983; Morantz, 1983; Scott, 1983). During spring and fall waterfowl are, and have been, the major resource focus on the coast (Morantz, 1983; Scott, 1983) as geese pass through Wemindji while journeying between summer arctic breeding grounds to the north and wintering grounds to the south (CWS, 2005). Waterfowl harvested include Canada geese (*Branta canadensis interior*), ducks, lesser snow geese (*Anser caerulescens caerulescens*), loons (*Giva* spp.), and Atlantic brant (*Branta bernicla hrota*) (Scott, 1987). During summer months resource harvesting efforts shift towards fishing (Morantz, 1983; Scott, 1983). Morantz (1983) has noted that in the more distant past, 1700s and 1800s, fishing seems to have been restricted to coastal streams and lakes rather than the coastal waters themselves. Fish were caught using "hooks, nets and even spears", and through the "damming of creeks to trap the fish" (Morantz, 1983:30). Additionally smaller game and berry harvesting are, and have been, important resources along the coast (Bussiéres, 2005; Flannery, 1995; Morantz, 1983; Scott, 1983). Currently fall moose hunting also takes place by some families on the coast (unpublished field notes, 2006), though moose are primarily considered an inland resource (Morantz, 1983; Scott and Feit, 1992). Cree have traditionally rotated their camps from season to season as they shift resource harvesting focuses (Morantz, 1983; Scott and Feit, 1992).

Wildlife resources are managed through a system of land rotation and social sanctions and are guided by an ethos of respect for animal resources (Berkes, 1986; Scott, 1983, 1986). Goose hunting exhibits a high complexity of orchestrated management. The hunt is overseen by the tallyman who may also appoint a hunting or shooting boss for assistance; a senior hunter who is respected for his knowledge and ability to manage successful goose hunts (Berkes, 1986; Scott, 1986). The hunting or shooting boss leads by example in the same manner as the tallyman (Berkes, 1986; Scott, 1986). An important strategy of Cree goose hunting is to shoot geese in small flocks and to kill all geese that are fired upon (Scott, 1996). Cree hunt like this to avoid possible survivors joining a new flock and diverting them from certain hunting sites (*ibid*). Cree believe geese learn to avoid hunting sites (*ibid*). Hunting on calm days is avoided for much the same reason; the sound of gun fire will travel over long distances and disturb geese that are not the target of the hunt (Berkes, 1986; Scott, 1983, 1986). Hunting locations are also rotated so that at any one time a majority of the territory is being rested with Sunday being a general day of rest (Berkes, 1986; Scott, 1986). A hunter who does not abide by these rules will not be invited to participate in future hunts (Scott, 1986; 1996). In addition to behavioural strategies of management, Cree also modify the landscape in certain ways to maintain or improve success in hunting (Forrest, 2006; Scott, 1983).

Fish are more or less an open access resource (Berkes, 1986; Scott, 1986). One does not need to consult the tallyman to take fish (Berkes, 1986; Scott, 1986). However, fish are still treated with the respect due all animal resources and are not to be wasted (Berkes, 1986).

Goose hunting is highly important for both cultural identity and social relations (Scott, 1996; Scott and Feit, 1992) in addition to its subsistence role (Scott, 1987). Indeed there are multiple rituals associated with the first geese shot in a season (Scott, 1983, 1996). Additionally there are strict social obligations of sharing, but also humility surrounding goose hunting. A good hunter warrants respect, but if he does not respect the animal gift through sharing and humility his prowess as a hunter may dwindle (Scott, 1983, 1996).

Both Lesser snow and Canada goose populations have been increasing dramatically in North America (Abraham, Jefferies, and Alisaukas, 2005; CWS, 2005; Hass, 2002). However, Cree hunters express concern about significant declines in geese on the coast over recent decades (CRA, 2005). Declining goose numbers on the eastern James Bay coast are resulting from migration pattern changes associated with southern agricultural practices, regional climate change (Abraham, Jefferies, and Alisaukas, 2005), and possibly regional hydroelectric development (Peloquin, 2006).

Geese feed in high marsh pools during spring and in low marshes during fall (Reed *et al.*, 1996). Bulbs and rhizomes are major diet constituents (*ibid*). By digging in the low marsh geese can suppress seaward invasion of the high marsh that follows land emergence, thus increasing low marsh areas which they find more attractive (Hik, Jefferies, and Sinclair, 1992). If maintained, this negative feedback can last from ten to fifty years, but if broken the expanded low marsh succeeds to high marsh in as little as two to five years (Hik, Jefferies, and Sinclair, 1992:402,404-405; Handa, Harmsen, and Jefferies, 2002:96). Wemindji Crees have observed such changes in coastal marshes correlated with goose decline (Benessaiah *et al.*, 2003; Berryman *et al.*, 2004; unpublished field notes, 2006, 2007).

2.3. Social, economic, and political setting

The earliest dated signs of occupation in the James Bay region date back 3,500 years, but archaeologists estimate human occupancy goes back two thousand years before this (Morantz, 2002:29). Prior to the establishment of the HBC in the late 1600s, Cree traded directly with other aboriginal groups in North America and indirectly with Europeans via a network of trade routes (Frances and Morantz, 1983). Once the HBC established posts in James Bay relationships with these English/Scottish, and later French, traders were mutually shaped by Crees and non-natives (*ibid*). From what is now Wemindji territory, early trade was brought north to Fort George at the La Grande River, or south to Eastmain House at the Eastmain River (*ibid*). HBC activity is documented in Old Factory Bay, in the southern part of Wemindji territory, as early as the late 1600s and early 1700s (Frances and Morantz, 1983; Denton, 2001), however a permanent HBC post was not established until 1935 on an island in Old Factory Bay (Morantz, 2002:206). The Wemindji community began to gather at this post in Old Factory during the summer months, but would return to the bush for fall, winter, and spring hunting and trapping (*ibid*). In time a log church was even built on this island (*ibid*). Cree often engaged in seasonal labour for the HBC during summer months which provided additional trade credits for items such as shot, flour, sugar, and tea (*ibid*). While active and self determining participants in trade relations Cree's eighteenth and nineteenth century involvement with the HBC did not significantly alter their society (Frances and Morantz, 1983; Morantz, 1983, 2002). Society continued to function around subsistence hunting, trapping, and gathering (Frances and Morantz, 1983; Morantz, 1983, 2002).

Cree society began to change however in the twentieth century (Morantz, 2002). The 1920s and 1930s hit Cree hard (*ibid*). Economic depression, following the First World War, and increasing reliance by the HBC on technology rather than local labour led to both poor fur prices and a lack of seasonal employment from the HBC (*ibid*). At the same time white sport hunters gained increasing access to the territory by bush plane leading to disastrous competition for beaver – the primary winter food – ultimately resulting in resource collapse (*ibid*). Additionally, small game, which Cree had always turned to when larger game could not be found, were at a natural low point in their multi-year population cycles (*ibid*). With all livelihood options faltering this was a period of starvation and only made worse by epidemic diseases like tuberculosis and scarlet fever which killed many and left others demoralized (*ibid*). When the federal government offered aid, Cree took it (*ibid*). Yet southern institutions were not adjusted for Cree society (*ibid*). For example, financial subsidies available to families were dependent on children's attendance at school which did not accommodate the winters spent trapping in the bush (*ibid*). These hard times, and federal aid which created dependence rather than self-reliance, gradually led to an increasingly settlement based society.

In the early 1950s the Department of Indian Affairs (federal government) began receiving complaints about unsatisfactory and unsanitary conditions on the island in which the Old Factory community (to later become the Wemindji community) was situated (Morantz, 2002). The island was denuded of wood, lacked drinkable water, and sickness was a problem (*ibid*). Government officials proposed that the Old Factory Cree move south to Eastmain House (*ibid*). The Crees rejected this proposition choosing instead to establish in Paint Hills Bay (*ibid*). In 1958 the Old Factory Cree pushed for this move as soon as possible following the death of a child to typhoid fever in Old Factory (*ibid*). The move was made that winter in 1958 (Bussiéres 2005:63).

It was then, in the 1960s, that the Quebec Government became involved in the James Bay region. The James Bay territory, formerly known as Rupert's Land, had been transferred from the HBC to the federal government of Canada in 1869/1870 (Morantz, 2002:132-133). As part of the deal it was Canada's responsibility to negotiate cession of land rights with the Cree (*ibid*:133). Cession was not negotiated (*ibid*). The eastern James Bay territory was then transferred to the Quebec government in two parts starting in 1898 and finishing in 1912 with the Quebec Boundaries Extension Act (*ibid*:133). This act recognized that Quebec would negotiate surrender of unextinguished aboriginal title of the land; something they would not do until 1975 (Desbiens, 2004:104; Morantz. 2002).

In the 1960s, Quebec nationalist politicians, provincial premier Jean Lesage and minister of natural resources René Lévesque, campaigned on a platform to increase Quebec's economic and social autonomy (Morantz, 2002). The James Bay region was the 'wilderness frontier' and future for these aspirations in Quebec's eyes (Desbiens, 2004; Morantz, 2002; Roue, 2003).

> Thus, during the 1970s and 1980s, Québécois nation building intersected in several important ways with the large-scale building of hydroelectric facilities in what was stereotypically perceived at the time as *terra incognita*: a rugged, uninhabited land and a natural extension – physically, culturally and economically – of southern Québec.
>
> (Desbiens, 2004:105)

> Framed in such a way, the hydroelectric landscape could be inserted into a larger imaginative geography of the North that celebrated the ascension of the Francophone settler state into new territories.
>
> (Desbiens, 2004:107)

In 1971 the Quebec government announced plans to develop a hydroelectric complex on the La Grande River (Desbiens, 2004:104). Quebec did so without an environmental review, nor consultation with Cree in the region (*ibid*). Cree and Inuit formally protested hydroelectric development in 1973, and while winning an injunction, this was overturned and Cree and Inuit were unsuccessful in stopping development (*ibid*:104). However this court battle lead to signing of the James Bay Northern Quebec Agreement (JBNQA) – widely regarded as the first comprehensive claims settlement in Canada (Mulrennan and Scott, 2001).

One provision under the JBNQA was establishment of an Income Security Program (ISP) in 1976/1977, for full-time hunters, to ensure hunting and trapping as a viable way of Cree life (Scott and Feit, 1992). The ISP "allowed expanded access of hunters to goods and services of industrial origins" (Scott and Feit, 1992:32). Skidoos where first used on the Wemindji coast in the mid 1960s with lighter skidoos arriving on scene in 1975 as a result of more people being able to acquire them following the ISP (*ibid*:36). Large freighter canoes and outboard motors started appearing on the coast in the early 1970s, again with more hunters able to afford them after the mid 1970s (*ibid*:36). Additionally freezers for storing bush meat back home in the community and chain saws became more common in the mid to late 1970s (*ibid*:36-37). The ISP also increased the use of chartered air service to some of the more remote inland traplines, although Cree had been using planes to access these traplines since the mid 1950s and early 1960s (*ibid*:33).

These technologies brought some changes in hunting organization. With increased access to skidoos many hunters rotated winter bush camp less because skidoos allowed access to a larger portion of the territory from a single location (Scott and Feit, 1992). Skidoos also increased the working lifetime of elder hunters who could not walk long distances in the bush because of faltering health (*ibid*). Increased use of motor boats lead to more hunters only making day trips from the community out on to the coast (*ibid*). In the past few decades the islands have become a place where an increasing town-based population of Cree can go to hunt after work or on weekends (Scott, 1996). In accordance, islands are not as tightly managed by the shooting boss and tallyman, as are the coastal bays and shallows (*ibid*). This is seen as a compromise as it does negatively affect the overall hunting success, but shares an important cultural and substance resource with the community (*ibid*). Also in the past two decades Cree have been using helicopters to access spring goose camps, both to avoid skidoo travel during spring break-up and to adhere to job and school obligations in town (Peloquin, 2006).

Today regional hydroelectric development continues in eastern James Bay flooding large tracts of land, redirecting large flows of water, and changing the physical landscape (Hayeur, 2001; Hydro-Quebec, 2004). However, this time Cree have had much more power in settlement negotiations and have secured a much more favourable settlement than they did twenty-five years ago when they had little political power (Desbiens, 2004;

Mulrennan and Scott, 2005). Despite Cree assertions of their rights and interests and the prominence of the political position they now occupy, the legacy of a wilderness ideology still persists and is promoted to support Quebec's involvement in the region. For example, in the Easitmain-1-A Powerhouse and Rupert Diversion Environmental Impact Statement (an environmental impact statement for the most recent phase of regional hydroelectric development) the landscape is described in terms of aesthetics and contiguous undeveloped areas (Hydro-Quebec, 2004). Value is ascribed in light of visitor descriptions of beauty through a poll of 581 tourists to the region in 2003 (*ibid*:18-50). 41.6 percent of survey respondents rated the landscape as "extraordinary", and 45.6 percent rated it as "beautiful" (*ibid*:18-51). "Wide open spaces, wilderness and vegetation were the main points of interest they mentioned" (*ibid*:18-51).

Hydro-Quebec has also used the Fédération Québécoise du Canot et du Kayak (FQCK) five point classification system in evaluating the landscape. Tier five, the most valued, includes "Exceptional landscape that inspires respect and awe" among the selection criteria. Tier four includes areas where "Signs of human presence have had little influence on the natural evolution of the ecosystem and their original appearance." Tier three invokes "A pleasant landscape that conveys a sense of harmony. Nature in its simplicity, but with signs of human presence (e.g., a pastoral setting)" (Hydro-Quebec 2004:M23-6). Thus, areas void of human presence, where humans are but a visitor, are valued. The James Bay landscape is indeed beautiful and worthy of special distinction by groups like the FQCK, but to imply the land is void of human presence is inaccurate and marginalizes the people whose home it is. Though the importance of the landscape to the Crees is acknowledged (*ibid*), the valued landscape is presented as not of or for people.

More recently mining has also become a central issue in the Wemindji area with mining claims in direct conflict with Wemindji's protected area aspirations (Moore, 2007). Three land categories, as established under the JBNQA, criss-cross the Wemindji territory each with specific rules and rights of access, hunting, and surface and subsurface resource extraction (Mulrennan and Scott, 2001). Additionally the political jurisdiction of the islands, traditionally used by Cree for hunting and fishing, are in dispute, though an agreement in principle has been negotiated (*ibid*).

Against a backdrop of so much change the Wemindji community is determined to continue traditional hunting and trapping ways of life while also embracing future change, but wishing to position themselves as self-determinant in the directions they take (Scott, 2004). Environmental health goes hand in hand with social well being in Wemindji (Cree Nation of Wemindji, 2006; Scott, 2004). The community is currently negotiating with provincial and federal governments to pursue environmental protection regimes framed in their traditional values and practices – frameworks that secure for them a significant level of self management and autonomy (Scott, 2004).

Chapter 3: Methodology

Landscape is a product of people and place over time (Birks *et al.*, 1988; Butlin and Roberts, 1995; Cronon, 2003; Phillips, 2005; White, 1980, 1995). Likewise, temporal interactions between people and place inform adaptive resource management (Berkes and Folke, 1998a). For these reasons I took an historic approach in addressing Cree modification of the landscape for resource harvesting. I employed unstructured and semi-structured interviews with key informants combined with participant observation, field survey methods, and air photo/satellite image measurements and interpretations. Some of the best insights for understanding people's past and present uses of their land can be understood through conversations with knowledgeable individuals in the community (Bernard, 2006). However, interdisciplinary approaches, or multiple data sources, also provide additional insights and additional ways of knowing (Roberts and Butlin, 1995). Thus, I complemented ethnographic work (unstructured and semi-structured interviews and participant observation) with field surveys and remote image analysis to gain a fuller picture of Cree modification of the landscape. While written archives are often used to understand human-environment interactions on decadal and hundred year times scales (Birks *et al.*, 1988; Egan and Howell, 2005; Meier, 2004; Roberts and Butlin, 1995; Simpson *et al.*, 2001) Morantz (1984, 2002) showed that written archives in James Bay give little insight into Cree's lives beyond trading post activities. Indeed, I did consult the HBC Old Factory Post records, as well as some late eighteenth and early to mid nineteenth century regional traveler's reports (Bell, 1897; Curran and Calkins, 1917; Theiault, 1994; Low, 1896; Miner, 1923, 1929, 1969; Ogilvie, 1891) only to confirm

Morantz's assessment. The best historical records pertaining to environment and Cree resource management in eastern James Bay lie in local people's knowledge.

I conducted seventeen weeks of field research over two years (six in 2006, eleven in 2007) and built upon a previous three year research and personal relationship with the Wemindji community. I also conducted a few follow-up phone interviews in winter/spring 2008 which were fruitful and possible because of close working relationships mutually built with informants.

3.1. Working with locals through a key informant approach – theoretical approach

Insights gained in this thesis are largely derived from traditional ecological knowledge. Traditional ecological knowledge is defined as,

> "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment."
>
> (Berkes, 1999:8)

The term local knowledge is also often used, but Berkes (1999) distinguishes local knowledge as having a more recent origin and this distinction will be used here. Traditional ecological knowledge is then a subset of local knowledge (*ibid*). The idea of continual development or growth of the knowledge system as informed by changes in the social-ecological system in which it is contextualized is important.

How traditional ecological knowledge-based research is conducted, contextualized, and reported has been criticized in recent years (Bates, 2007; Ellis, 2004; Davis and Wagner, 2003; Usher, 2000; Wenzel, 1999, 2004). Because information is "integral to the individual" who contributes "subjectively and selectively," independent "truthing" or cross-validation is necessary just like any other data type (Wenzel, 1999:111,117). Additionally, meagre attention has often been given to illustrating key informant selection processes (Davis and Wagner, 2003).

Traplines were the basic unit of analysis in this study as each trapline represents the scale at which local management decision-making occurs (see chapter two). Thus, informants included elders, tallymen, and senior hunters of each coastal trapline, as well as the head of the local Cree Trappers Association (CTA) who is also a senior hunter. These demographic groups are considered experts by the community. Informants were selected purposefully and/or through referral by other informants. Verification of key informants came though informal query within the community based on reputation. Multiple informants, participant observation, and field survey work were all drawn upon to understand the dynamics between environmental change and Cree use of the land. While these multiple venues of inquiry allow for some cross-validation one aspect of a key informants approach is to learn from specific insights that knowledgeable individuals may have (Bernard, 2006) and cross-validation is neither always possible, nor appropriate. Thus I clarify in chapters four and five when multiple insights are drawn upon, either through multiple informants, participant observations, or field surveys, or when information represents a single informant's insight, so that analysis can be evaluated in respect of the data's nature.

No individual is a universal expert (Wenzel, 1999) and thus field work was approached as a process. Subjects that individuals felt most confident and comfortable talking about were identified early on and built upon subsequently. Additionally, not all knowledge is the same (Usher, 2000). To the researcher, some information may seem strongly rooted in fact or rational and other information rooted more in culturally based value (Usher, 2000; Wenzel, 2004). It is important to understand the contexts in which information is produced, communicated, and used to ensure valid and respectful interpretations (Wenzel, 2004). Information is treated here both critically and with respect by having continually built an understanding of Cree culture and world-view through literature and personal involvement in the Wemindji community.

3.2. Ethnographic materials and methods

Wemindji community members were engaged though formal interviews (pre-arranged and voice recorded when permitted), less formal interviews (while traveling in the bush), and participant observations. I worked with seventeen key informants extensively (fourteen men, three women), plus seven additional informants to a lesser extent (six men, one woman). At least three informants were consulted for all traplines; though for two traplines only one individual was someone extensively worked with, an elder tallyman in both cases.

I held formal interviews at people's homes in town or at bush camps. Spatial data was recorded on 1:50,000 or 1:35,000 topographic maps. These interviews lasted between one to three hours for two to five repeated sessions, with the exception of four informants where only one specifically focused session was held. Unstructured sessions often led to semi-structured sessions with questions building from previous interviews.

Less formal interviews were either unplanned and arose spontaneously during other events, or were conducted at places of specific interest such as old campsites or resource harvesting sites while traveling in the bush. A Garmin e-trex GPS was used to record spatial information at these times. Significant time was spent hunting, fishing, gathering, traveling, and living with informants and their families in both bush camps and in town. Living and traveling with informants provided ample opportunities for participant observations. Superior arabic numerals are used in chapters four and five to indicate ethnographic source information which is listed in appendix A.

3.2.1. Resource harvesting and management

I recorded a general inventory of old and currently used camps, dikes, *tuuhiikans*, trails, hunting areas, fishing areas, and gathering areas (boughs and berries) for each trapline. Different past and present resource harvesting methods involving modification of the landscape was a major category of inquiry. I often framed questions about modification practices in terms of "taking care of the land by changing it," or "enhancing the land" as Crees themselves often expressed landscape modification in such terms. Understanding how modifications and their associated harvesting techniques work(ed) was also a major theme of inquiry. Additionally I asked informants why specific places were used as resource harvesting areas or camps. Also, what aspects made the area desirable, and when discussing old areas that were no longer used, why the area ceased being used, were both major foci of inquiry.

Establishing when a practice first started, or the oldest known camps, was an important priority. I also compiled dates for all dikes, *tuuhiikans*, and camps in addition to when the practice first started or the oldest known camp. Dating was done by oral account. Over the past half or full century informants often placed events in specific decades or portions (early, mid, late) when unsure of exact years. Sometimes informants used proximity to major life events (births, weddings, beaver trapping moratoriums, 1958 community relocation, etc.), or generations (father, grandfather, great-grandfather, etc.) for dating as well. When necessary, generational dates were converted to calendar dates using parents' ages at the time children were born, or when not possible, twenty to thirty years between generations was assumed. Informants often contextualised many older events according to significant historical changes or events (i.e. "before nets," "before the Hudson Bay Company," and "long ago") and these dates are reported as such.

While I knew about certain practices like creating dikes, *tuuhiikans*, and stone fish weirs from both the literature and my previous involvement with the community, other practices had to be deduced through a combination of making my own interests clear and well known, and through participant observation. Two simple examples illustrate the dynamic nature of such inquiry.

Prescribed burnings are a well known berry and herb management technique among native peoples of the North America (see chapter one). In 2006, I asked informants if they or their parents/grandparents/etc. ever "used or heard about fire being used to make berries or plants grow better?" All informants said such techniques were never practiced. However, while on a goose hunting trip in the spring of 2007 I saw a large area where the dune grass had been burnt. Upon further inquiry I was informed that such burning was done to attract the geese and thus my questioning about using fire was renewed. Indeed, Cree had answered truthfully in 2006. Fire was not used for berry management. But my question had been too specific; the question needed to be framed in broader terms, or with respect to goose hunting.

Another example of this dynamic inquiry relates to a new modification practice. While I was preparing to leave for the field in 2007 a key informant called me at my home in Montreal. He and his family were thinking of digging up an area on the coast for managing geese on the trapline. He wanted to let me know about this and take me to the site when I got to Wemindji because he knew this was something I was interested in. Both these examples highlight the importance of an open and flexible methodology and of building relationships with key informants.

3.2.2. Ecological and environmental changes

Often by discussing old resource harvesting areas the conversation naturally turned to how the coast was changing. For example, changes in fishing locations or goose hunting areas often illustrated the impacts of land emergence and shoreline displacement. How the land had been changing was a major theme. Addressing the "land" often opened up discussions about land emergence, climate change, changes in animals, or changes in plants. I often asked informants *what* geese, fish, berries, small game, etc. were present during their father's/grandfather's/etc. time. I also asked *how* these elements of the land had changed during the given period. Furthermore, I gave specific attention to documenting the dates at which different types of waterfowl had decreased in abundance or changed their behaviour and the dates of eelgrass decline.

3.3. Field survey, air photo, and satellite image materials and methods

I used field surveys and air photo and satellite image analysis in addition to ethnographic methods to understand the dynamics between environmental changes and Cree use of the land. Two modification practices were the primary focus of field and remote survey work: dikes and *tuuhiikans*. I also visited in the field, and described, other landscape modification practices such as stone fish weirs, areas where contemporary burning for goose management had been carried out, areas where corn was being used to attract geese, and numerous old and new camp sites to complement interview work.

I made site visits opportunistically. The idea was to go to places with key informants and learn from them. However, visiting a temporal range of camps, dikes, and *tuuhiikans* was a priority. In the filed I measured dikes and *tuuhiikans*. I also measured *Tuuhiikans* using air photos and satellite images.

3.3.1. Dikes

I visited ten dikes (out of a total of twenty-two inventoried) across four traplines in the field between 2006 and 2007, including one that was to be built in the fall of 2007. I measured lengths for eight dikes, two on each of these traplines, using a Garmin e-trex GPS and/or a measuring tape. I also measured heights using a measuring tape. In order to compare an older and younger dike, and to compare an area that had been diked with an undiked area, I measured three topographic profiles using a surveyor's level. For the diked/undiked comparison both profiles abutted a coastal lake. I used the water level in the lake as a comparative bench mark for comparing the two profiles. Additionally I measured lake height above the high tide mark using the surveyor's level. The presence of a wrack line indicated the high tide mark. I marked profile lines using surveyor's flags and kept points parallel within one degree from the level. Along the profiles I recorded presence/absence of plant species and/or genera.

3.3.2. *Tuuhiikans*

I visited Nineteen *tuuhiikans* (out of a total of thirty-one inventoried) in the field and measured them along one to four sides depending on ease of access, available time, and/or consideration of accompanying informants using a Garman e-trex GPS and in one case a measuring tape. Consideration of accompanying informants was important as field visits were often part of travel to other destinations with these informants.

I then measured *tuuhiikan* lengths, widths, and areas from available satellite (2006, 1 meter panchromatic IKONOS; 2007, 10 meter panchromatic SPOT; or 2001, 15 meter panchromatic Landsat) and/or air photo imagery. I digitized and measured nineteen *tuuhiikans* at a 1:5,000 (Spot and Landsat) or 1:3,000 (IKONOS) scale from satellite images in Arc GIS 9.2. I also digitized and measured one *tuuhiikan* at a 1:3,000 scale from a 1959 1:31,680 air photograph that I scanned at 6,000 dpi and referenced in Arc GIS to the 15 meter panchromatic Landsat image with a total RMS error of 13.72953 meters. No orthorectification was done. I derived length and width for four *tuuhiikans* by hand from air photo analysis done by Poly-Geo Inc. and Goyette (2003) who were contracted by the CTA to determine man-hours necessary for maintenance work on various hunting infrastructure. These consultants had already calculated the *tuuhiikan*'s areas. Finally, I measured one *tuuhiikan* from a major correction sketched by one informant to these consultants' work. I digitized and measured this correction using Arc GIS 9.2. Thus a total of 25 *tuuhiikans* were measured. One inventoried *tuuhiikan* is being planned for cutting in the next few years and thus could not be measured. Two *tuuhiikans* could not be measured because they were destroyed by fire. Three others could not be measured because they had not been visited in the field and could not be clearly deciphered in the remote images.

Tuuhiikans are presented as high confidence measurements when derived from high resolution imagery (air photos, 1 meter panchromatic IKONOS) and/or groundtruthed (Garman e-trex and in one case a measuring tape) lower resolution images. *Tuuhiikans* are presented as lower confidence measurements when derived from Landsat imagery with no groundtruthing. In general delineation using Landsat imagery tended to underestimate *tuuhiikan* size when compared to measurements of the same *tuuhiikan* using IKONOS or air photos as I only used the highly reflective cells of the image which would exclude the margins where vegetation most likely was re-establishing.

A temporal comparison of high resolution remote images was used to investigate correlations between the cutting of *tuuhiikans* and land emergence. For this comparison I georeferenced a 1959 1:31,680 air photo scanned at 6,000 dpi to 2006 1 meter panchromatic IKONOS imagery with a total RMS error of 8.09276 meters in arc GIS 9.2. No orthorectification was done.

3.4. Spatial data compilation

At the end of each field season I compiled all spatial data generated on topographic maps during interviews and GPS points from field survey and participant observation in a GIS database. I gave priority to GPS locations when the same location had been recorded during interviews on maps and by GPS. Additionally I digitized and calculated areas for the planned restoration projects in Arc GIS 9.2 from sketches made on Google Earth images which were printed and drawn upon by the key informant.

Chapter four draws heavily upon narrative to illustrate environmental changes and changes in camps location decision-making over time. Maps of people's personal family histories are not presented in building this narrative. Rather I represent spatial relationships by describing distance, direction, and landscape topography. The subscripts "gps," "int" and "gps/int" are used to indicate if data comes from infield GPS measurements, topographic maps, or one end of a measurement from each, respectively.

Chapter 4: Where islands meet the mainland – environmental change, resource harvesting and bush camps

In this chapter I draw on Cree understandings of coastal environmental changes and the ways in which this knowledge informs Cree use of the coast and adaptation to such changes. Given the fundamental importance of bush camps to Cree use of the coast, I address the following questions. 1) What are the relationships between observed environmental changes and coastal camps? 2) How does a greater understanding of camp and coastal environmental change contribute to our understanding of human-environment relations among Wemindji Crees?

My findings show that Cree both monitor and account for a variety of bio-physical changes with respect to camp establishment decision-making. In fact, Cree monitoring of the bio-physical environment often illustrates the complexity of ecological interactions at play on the Wemindji coast. While responses to bio-physical changes are a key factor in camp-related decision-making other factors such as sentimental attachments, as well as wider societal drivers also play a role. Cree have long been attuned and adapted to a highly variable coastal environment and have established a set of adaptive responses, such as camp mobility, to these bio-physical changes. Rapid changes in Cree society during the past forty years have lead to the adoption of several new technologies and led to the emergence of new relationships between people and their bio-physical environment, changing peoples' ways of being adapted to change. These new relationships are formed however, within existing traditional values and norms, albeit with modern means, bringing the town into bush and the bush into town.

This chapter is structured thematically. I present Cree observations and interpretations of environmental changes followed by an inventory of historic and contemporary camps identified by Cree. I then explore the dynamics between environmental changes and camp location decision-making.

4.1. Environmental changes in Wemindji

The Wemindji coast has always been in the process of changing. Here I relay Cree observations and interpretations of three major categories of environmental change: land emergence and associated habitat shifts, changes in waterfowl resources, and changes in weather which affects travel and plant growth. Over decades and centuries Cree have observed, interpreted, and responded to these changes and communicated them across generations.

4.1.1. Changing shorelines and vegetation shifts

"The land is growing" is a common statement from elders and tallymen. Wemindji Cree measure land emergence using observations and stories.

On one trapline lies a piece of cedar driftwood on top of a hill outlined by a 50-foot contour interval on the topographic map roughly 1_{int} kilometer inland. It is said to be "ancient",[1] stranded by a retreating shoreline. "The bay came all the way up to here [...] way back, [during my] great, great grandfather's time"[2] another elder said on a different trapline, indicating another 50-foot contour interval on the map around 12_{int} kilometers inland. "This is a story that has been passed on," explained his nephew the tallyman.[3]

Elders have literally watched the coast emerge and become land during their lifetime. "When I first saw this island it was a reef," said a ninety-two year old elder talking about the bay where he grew up. "Later we would leave decoys there, [...] around 1936 is when we started storing decoys. There were some berries and some small trees. Now you can get berries there. Now there are poplar trees and willow trees. First time I saw this island it was just sand and rock."[4] About 2_{int} kilometers southeast of this location is an island called *Minishtikw pichistwaakin*, "Island where you put your fish nets out." "Could put their fish nets there when [he] was a child" this elder's son translated. Now this area is land "you can walk on."[5] Obviously this required that fishing activities be relocated to a new place. Indeed, Cree point out many locations that were once good for fishing but have since become too shallow to set nets.[6] Interestingly, *Minishtikw pichistwaakin* and surroundings have become a major goose hunting area. Thus while the ecosystem has changed it continues to be a prime resource harvesting area but for a different resource.

There are areas now connected to the mainland that elders recall as former islands. Two elders talked about two former channels that "you could paddle [through] at a normal tide" in the early 1900s. These are now well-developed salt marshes.[7] In one of these areas, called *Aashiipwaayaashic*h, "Channel used to be there", people even set white fish nets in the early 1900s.[8] The distinction of a "normal" tide is important because in spring and fall high winds often produce "extreme" or "big" tides which flood the land. A normal tide means these were marine areas under average conditions. Furthermore, *Aashiipwaayaashich* has become a goose hunting area,[9] illustrating again how areas changed from one resource-use to another.

Decreased depth and infilling of bays are not only the result of land emergence. Crees observe that bays fed by large rivers tend to grow faster than bays lacking major river discharge due to sedimentation and debris deposition.[10] Over shorter time periods Cree observe shifts in coastal zonation. When asked to describe the major changes that result from 'the land growing', one elder responded: "Growth of the willows. [This area] was all mud in [the] early 1950s," he said, pointing to a bay on the map. "Nothing was growing [...], was good hunting for snow geese in the spring."[11] Thus because of land uplift and the inevitable invasion of terrestrial vegetation that followed hunting was relocated to a more favourable area. Vegetation shifts not only affect goose hunting, but berry harvesting areas too. One elder woman said, "[the] willows would grow over where [the] berries were" as the land grew, requiring her to seek alternative harvesting areas.[12]

Land emergence and resulting habitat shifts are dramatic along James Bay. Yet perhaps one of the most significant changes on the coast is related to change in waterfowl resource availability over time. Cree not only document changes in abundance and behaviour, but the historic disappearance of a species.

4.1.2. Changes in waterfowl on the coast

According to informants, swans were once an important waterfowl resource on the coast, but survive only in stories now. "[My] late grandfather did not hunt swans, it was almost extinct," said a tallyman who is in his early seventies. There was "a bit of [swan hunting] in the [...] 1800s," a second elder told me. "Another hundred years back is when they were really doing it," he elaborated.[13] Swan hunting stories continue to reveal the ever-moving coastline. "Swans lived along the coast," my ninety-two year old informant explained pointing out old coastal hunting sites that are now 7.5_{int} kilometers inland. "This was the coast," he said. [14] Another elder on a neighbouring trapline indicated where he had seen a large stone swan hunting blind about 11_{int} kilometers inland. "The coast was probably around there when they hunted swans," he said.[15] Swan stories document the changing nature of James Bay. But swans may not be relics of the past for ever. One senior hunter thinks they might be coming back. He saw two in 2005 and heard of one being killed in the 1980s.[16]

More recently, wavies (lesser snow geese), Canada geese, and brant, all important food and cultural resources (Scott and Feit, 1992), have started to decline. Elders recall the 1950s or 1960s as the last time when wavies were abundant. Wavies declined in the Wemindji area over the following decades becoming effectively gone from a resource harvesting perspective by the 1980s.[17] These observations are supported by findings at the continental scale which show that wavies have shifted their migration westward largely following corridors of southern agriculture (Abraham, Jefferies and, Alisaukas, 2005). Subsequently, in the late 1980s to mid 1990s, Canada geese started disappearing from the Wemindji coast.[18] Cree attribute this change to a shift in Canada geese flight paths inland due to hydro-electric reservoirs attraction (Peloquin, 2006).

One elder tallyman, considered a goose expert in the community,[19] described how "there were more wavies than geese a long time ago. [Wavies] were the ones that would break the mud," he said. "The geese were less in the spring hunt because they had less to eat; the wavies used to chop the earth for the geese to find food."[20] This elder tallyman is alluding to a sophisticated dynamic of coastal change involving a negative feedback between salt marsh development and goose foraging pressure (see chapter two). The impact of wavie decline on the abundance of Canada geese as explained by this expert highlights the complexity of coastal dynamics.

Brant have also decreased in number[21] and people have stopped eating brant as consuming the birds was making people ill.[22] Hunters discuss how the decline in brant is correlated with a decline in eelgrass (*Zastra marina*) which started in the 1990s or early

2000s, the timing varying among informants across five of the coastal traplines. Indeed one elder tallyman, on a sixth trapline, believed the decline started as early as the 1980s.[23] A senior hunter hypothesized that the sickness associated with eating brant is associated with brant's dietary switch now that eelgrass is less abundant.[24] Both Cree[25] and Read *et al.* (1996) note that eelgrass was a favourite food of brant in the past.

One elder described how everything from grasshoppers, to frogs, to geese were changing in abundance and/or behaviour on the coast. While many species were decreasing he said, long-neck geese – a goose variety arriving in late spring which is hunted by Cree – have been increasing in number since the mid 1980s or early 1990s.[26]

Indeed such waxing and waning of waterfowl populations is interpreted within a larger historical pattern of waterfowl abundance. According to one elder "probably there were not [wavies when there were swans.] I did not hear that they were there at the same time," he said, though he was "not sure."[27] The era of swans may have given way to the era of wavies and Canada geese. Another senior hunter recalled a story his grandfather told him about goose declines. One day, his grandfather said, the geese would fly inland, but they will eventually come back to the coast. He was told this story in the mid 1970s when wavies were on the tail end of decline and geese were still abundant,[28] thus the story was predictive of the decline in geese and reflects Cree understandings of fluctuating waterfowl resources.

Coastal waterfowl change is a major topic among Wemindji hunters and often dominates conversation about changes because of the resource's subsistence and cultural importance. However other changes are also discussed, such as changes in the weather, which in turn affects additional aspects of the coastal system.

4.1.3. Climate-related changes

Cree have observed that freeze-ups are arriving later in the season, spring thaws are coming earlier, and snow accumulation has declined.[29] Interestingly, informants noted that the decrease in snow accumulation is not attributed to decreased precipitation. Rather, increased melting following precipitation is leading to reduced snow accumulation.[30] Additionally, the snow is described as softer by some causing difficulties for snowmobile travel and resulting in more frequent accidents.[31]

Climate-related changes have also caused changes in berry growth. There is general consensus among eight elder informants across the seven traplines that berries along the coast have not been growing well.[32] While two elders expressed a general pattern of berry decline the others felt that recent poor berry growth was part of general weather variability. "One season there could be lots and others less. It is all on the climate" said one elder tallyman.[33] Another tallyman said, "When it is hot in summer they don't grow well, when it is cold they grow well."[34] Berries are important both for human consumption as well as food for geese.

The Wemindji coast is dynamic and changing. Cree have clearly articulated this. However, observations and interpretations of change go hand in hand with how people live on and use the coast. I now explore the relationship between camp location decision-making and these observed bio-physical changes.

4.2. A spectrum of camps

Eighty-seven camps were documented during interviews and in the field. Twenty of these are present-day camps. The rest represent old sites (Fig. 4.1).

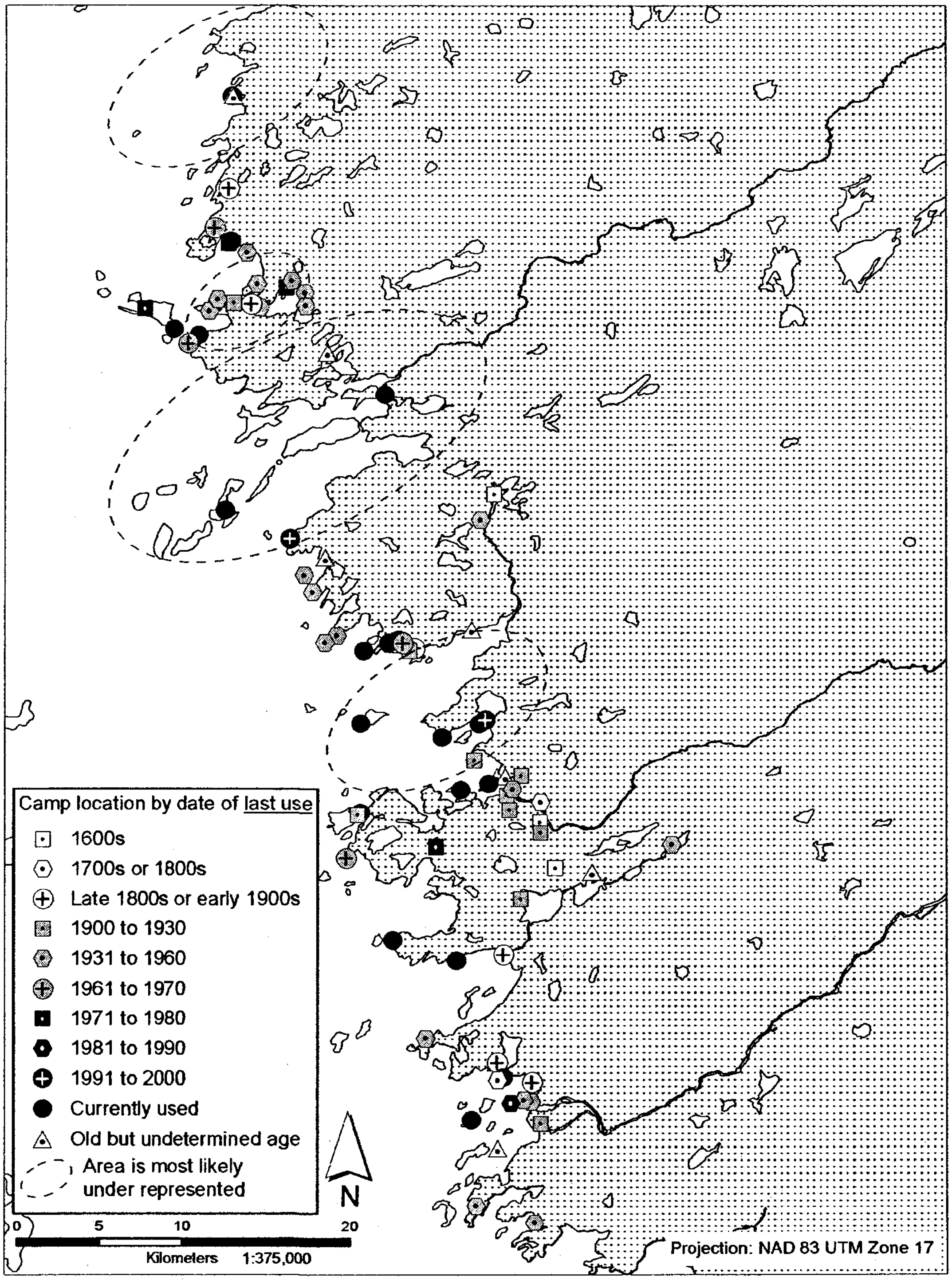

Figure 4.1. Inventoried coastal campsites on the Wemindji coast categorized by age.

Some camps date back to the distant past, "before the Whiteman," or "before [fishing] nets" when people constructed stone weirs to fish, and in the days of swan hunting. One elder dated a spring swan hunting camp as far back as the 1600s.[35]

Other camps are from the more recent past. At many of these camps artefacts like old rusted double barrelled shotguns, sealskin dogsled harnesses, discarded food cans, and Jack Miner bird bands – a self taught ornithologist who conduced waterfowl migration studies in the early 1900s (Loo, 2006) – sit in old storage sheds (Plate 4.1). The bird bands found, for example, were banded in the mid to late 1930s (Jack Miner Bird Sanctuary, pers. comm. 14 May 2008), giving clues to when the area was used. Old tepee rings are easy to make out in the lichen covered ground (Plate 4.2).

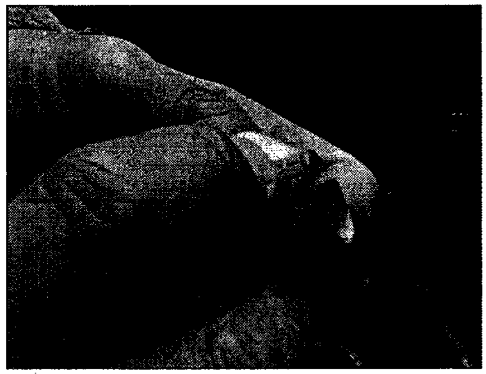

Plate 4.1a (top) and **4.1b** (bottom). Jack Miner bird bands found in Wemindji territory. Photos: J. Sayles, June 2007.

Plate 4.2. Exploring an old tepee site in Wemindji territory. Photo: J. Sayles, June 2007.

The present day camps, built in recent decades, often consist of plywood cabins built for sleeping and a tepee next door where cooking and general living take place.

However, many of these contemporary cabins stand on sites where more "traditional" structures like *miichiwaahps* – tepees – or *mitutisaanaachinikimikws* – dome shaped dwellings – stood. Generator-powered televisions and even satellite dishes can be found at some of these bush camps illustrating that there are no bounds between "traditional" and "modern", only a union (Plate 4.3).

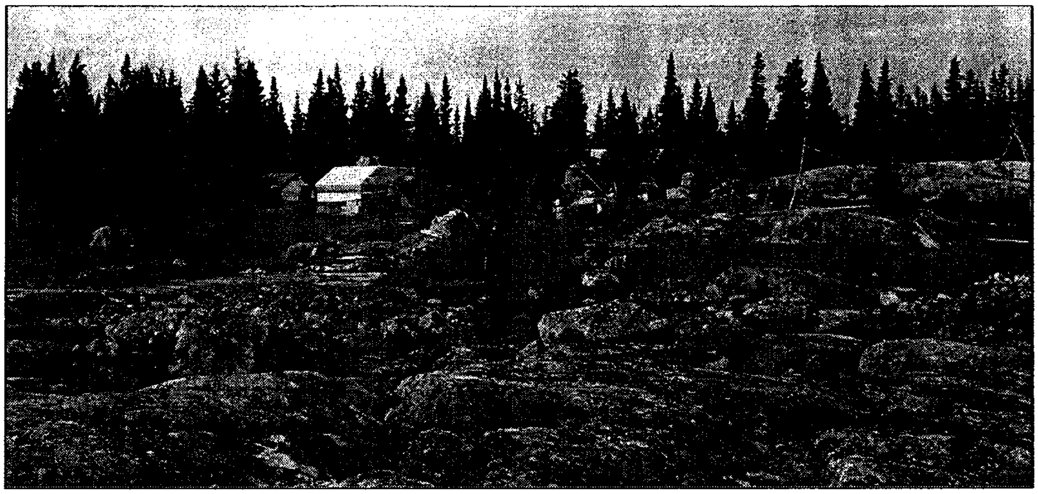

Plate 4.3. A contemporary fish camp. The top of the *miichiwaahp* can be seen behind the large white roofed cabin. Photo: J. Sayles, August 2006.

This inventory of camps covers a large temporal and spatial spectrum. It illustrates Cree's legacy on the land. It is by no means an exhaustive list however. Indeed, often just when it seemed all campsites had been documented in an area more would be pointed out by elders or a tallyman while gathered around a map or traveling in the bush. Additionally, there is under-representation in figure 4.1 because traplines represent multi-family or extended family hunting territories. It was not possible to work with all extended family branches on a trapline and it became clear in interviews that some elders or tallymen were less comfortable relaying information about other branches of the family,[36] in essence out of respect for others' autonomy. Four specific areas have been indicated as underrepresented in figure 4.1 based on references to other families' use of an area. However, the large number of camps documented and their temporal and spatial spectrums do illustrate that habitation on the coast is dynamic.

4.2.1. Dynamics between shoreline displacement and camp location

As shorelines shift, channels disappear, and vegetation changes, access and exposure regimes change. These changes often spark a decision to move camps. For example, one elder tallyman explained that in the late 1960s he decided to relocate the family's spring camp near *Aachiiuchiwaachushich*, "Small creek runs back and forth with tide." The near-shore coastal zone was becoming shallow making access difficult.[37] In fact this elder, in his early seventies, said *Aachiiuchiwaachushich* had not been tidal in his memory,[38] thus the changing landscape is embedded in the place name. The land has uplifted enough, beyond the tidal range, that this creek no longer ebbs and flows. He moved the camp 2.5_{gps} kilometers to the southeast were the water was deeper, but still in close proximity to the old hunting sites which the family still uses today.

One year later he moved the camp 90_{gps} meters farther into the trees as he found the new site was too exposed. He wanted the camp to be better hidden from geese and more sheltered from south winds.[39] Ten different families lived in tepees at this new site. Then in the late 1980s he relocated the camp again, 80_{gps} meters farther into the trees, where they built wooden cabins.[40] Quite possibly he felt that the cabins required increased tree cover.

Spring and fall goose camps require a certain amount of forest shelter. Cree want the camps, and especially the camp fires, to be hidden from the geese. Cree prefer fish camps to be more open and on sandy soil. The breeze afforded by this makes the summer heat more comfortable and keeps the summer flies at bay.[41]

The ninety-two year old elder who talked about watching rock and sand grow into a vegetated island pointed out an area where his grandfather relocated a camp in the late 1800s. "When the trees came they moved here," one of his daughters translated.[42] Presumably this was a goose camp. Conversely forest development can be a reason for moving a fish camp. One elder woman said; "when trees are growing around the camp area they move it," regarding the move of a fish camp in the 1940s.[43] So interestingly, the same environmental changes, forest invasion associated with land emergence, can be both attractive and unattractive depending on the area's intended use (fishing or goose camp).

Living in a place also suppresses forest development. The new camp this elder woman and her family moved to, and still use today, remains open, though the forest has grown around it. "There were no trees [...] when we first moved here," the elder woman said reflecting on how much the land around her had changed. "There were trees on [the south-west side of the island], but not around the fish camp."[44] Her brother in-law, an elder, commented that they did not clear the trees around the camp, "it has just always been open."[45] Of course there are a few stumps around the camp where the family cut some trees. And indeed the elder woman's son, the tallyman, recently cut a few small trees north of the camp. These trees were cut to attract geese, making it easier to hunt as geese like to fly low to the ground in the absence of trees and so that in winter the north wind will blow snow away from his storage shed allowing him access to it.[46] These activities illustrate how smaller trees and brush are at times managed around the camp.

But the sentiment is that the simple act of living in this area has suppressed forest development around the fish camp thus maintaining desirable regimes of exposure.

Another tallyman on a nearby trapline provided a further example of moving in response to shoreline emergence. In the 1960s his father, the former tallyman, decided to move the spring goose hunting camp in Old Factory Bay about $1_{int/gps}$ kilometer west, following the retreating shoreline. It was becoming too shallow. This decision to move however might be more nuanced than a simple one to one relationship between bio-physical change and access. The new location was a former trading post that was abandoned when the community relocated north. Perhaps infrastructure on the island, or some element of nostalgia, was also incentive for moving there. Then in 1985 his father moved the goose camp again about 2.5_{gps} kilometers north to a bay as the area continued to become shallow. Today this tallyman is thinking that once more they may need to move the camp because of shoreline retreat.[47] "In the spring time when we move [...] to [the fish camp] we have to wait for days for a high tide to get out," said his nephew.[48]

In 1990, another elder on a nearby trapline moved his moose hunting camp roughly 500_{int} meters west along the north shore of the narrow opening of a round bay. It had become too shallow to access the old camp he said. Apparently this short move seaward was all that was needed for deeper water.[49]

4.2.2. Dynamics between resource change and camp location

Like the ever-moving shoreline the comings and goings of animals factor into camp location decision-making. For example, around 2000 one tallyman moved his fish camp from a small cove in a headland to a large island, $4.5_{gps/int}$ kilometers northwest. Yet he continues to set his nets at the same cove near the old camp as he did when he lived there. Why move farther away only to fish in the same location? The old site, he said, "was for hunting different kinds of brant." At the new site they hunt long-neck geese. The two camps were not used in overlapping time periods.[50] Thus these fish camps doubled as late spring waterfowl camps and a change in waterfowl led to a change in camp location. Yet some weighing of factors must have been made in the decision to move. The old site was opportune being close to both the fishing grounds and brant hunting. But the change in waterfowl meant only one resource could be close by. It makes sense to be closer to the long-neck geese. Once a fish net is put out it only requires checking twice a day.[51] But geese cannot be hunted with the same clocklike certainty. Though there are better and worse times to hunt waterfowl, hunts require long hours of waiting to intercept the birds.[52] With the move of the camp at least one can wait close to home.

Sitting with another elder tallyman at his fish camp, he too discussed an example of long-neck goose allure. He was born on an island about 2_{int} kilometers northwest along the coast. This island and another, about 4_{int} kilometers farther north, were used as fish camps in the early 1900s he said. Later, after 1958, they moved to a third island, then back to the island of his birth, and finally to the island where he presently has his camp. The island of his birth, he said, is now too shallow to comfortably access and maintain a fishing camp. But the island is good for long-neck goose hunting and there is a family that moves there just after spring break-up to hunt long-necks and do some fishing.[53] They leave at the end of June when the long-neck season is done. Apparently the benefits of long-neck hunting outweigh the cost or inconvenience of shallow waters.

Camp relocation associated with resource changes can also come from resource depletion as indicated by the elder woman who spoke about relocating a fish camp in the

1940s. The local supply of spruce boughs used for tepee flooring, wood for building, and firewood had been exhausted at their old site and was in part a large reason for the move. "[Wood for building and fuel] were used a lot back [then]," she said. "[People] did not use Coleman stoves or plywood."[54] However, just as depletion is incentive to move, the presence of resources is motivation to stay. When asked what made this new island, where they moved the fish camp, a desirable location, she pointed out that there are "good resources, berries, trees, water nearby."[55]

A second resource depletion example comes from the elder tallyman who talked about long-neck hunting at the shallow island. His winter camp is a 400_{gps} meter walk from the shoreline. They moved to this location in the early 1980s because of depleted firewood supplies at their old camp. However, they still return to the old site to get spruce boughs.[56] Perhaps because firewood is heavier to transport than spruce boughs the former was more attractive than the latter to have close by?

A change in the state of resources can occur because of the resource moving or being depleted as in the previous examples. However, resource change can also arise from changing importance of certain resources given economic incentives or demand. "In the old days", according to the elder tallyman who lived at *Aachiiuchiwaachushich*, they would spend some springs on a coastal lake about $1_{int/gps}$ kilometer inland. Here, muskrats were trapped and were once important trade items fetching a good price. Today though, this family does not hunt muskrats. This might simply be out of personal preference, but a senior hunter reported a ten fold decrease in muskrat fur prices since the 1970s.[57] Thus resource change occurred not because of changing animal behaviour or abundance, but because of an externally driven change in the market which in turn resulted in a decline in muskrat trapping and the abandonment of the campsite that supported this particular activity.

Shoreline displacement and/or a shift in the availability, or desirability, of a particular resource are certainly key factors in camp location decisions. Ecological relations however, are only part of the story. Societal changes and the interactions between societal changes and ecological changes also affect camp location decision-making.

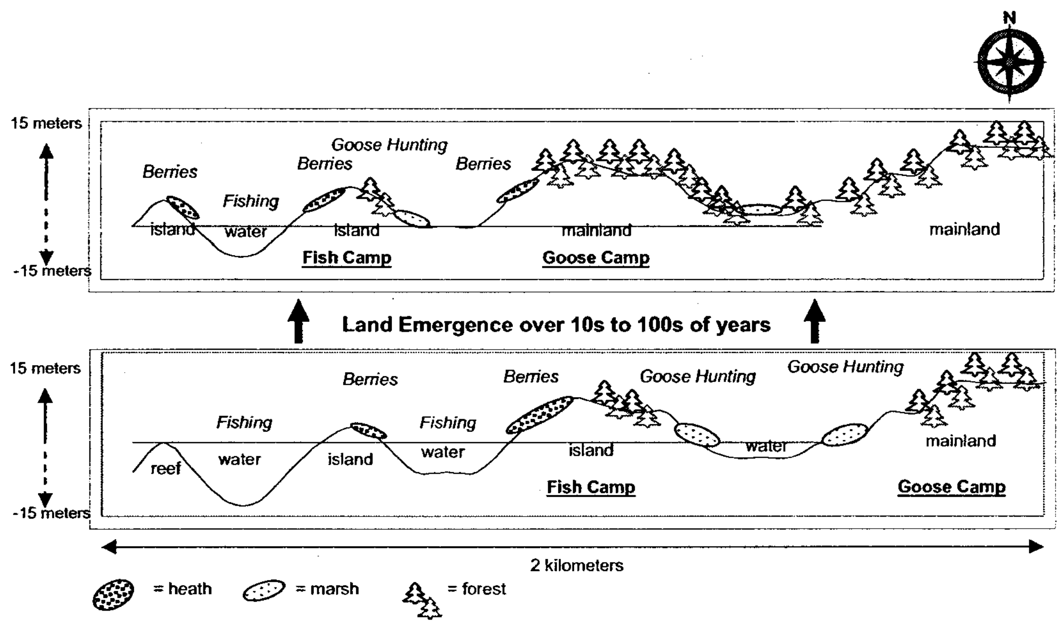

Figure 4.2. Landscape change cartoon showing shifting habitats, camps, and resource-uses following land emergence. This diagram summarizes many of the landscape change dynamics talked about in sections 4.1.1, 4.2.1, and 4.2.2. The lower and upper scenes represent before and after scenarios, respectively following land emergence. Shifting shorelines, habitats, and associated shifts in camp location are indicated between the two scenes. The use and reuse of space, but for a different resource activity as the land changes, is also apparent in the left-hand portion of the image. Here, fishing areas in the lower scene become goose hunting areas in the upper scene.

4.2.3. Social and technological changes and camp location

Outboard motor boats have effected camp location decisions. For example, one morning I was with a tallyman checking fish nets located 2.5_{gps} kilometers from the current fish camp. On the shore next to these nets he pointed out where he lived at age ten. [58] This area would still be a good place to have a fish camp he said, but "now we have fast motors so we can set nets far away."[59] The increased mobility afforded by motorboats has enlarged the harvesting area accessible from a camp so prime fishing areas can be accessed from farther away. An area might be a good location for a camp because it is close to a good fishing ground, but with such spatially expanded access it can easily be fished from other sites as well reducing the weight given to two of the criteria considered when establishing a camp: easy access and resource proximity.

For a number of years now, Wemindji has funded a local fishery program to distribute 'bush food' to people in town who do not have the opportunity or means to fish for themselves. The elder tallyman who talked about long-neck hunting at the shallow island reflected on how the establishment of this program has influenced where people camp. "Since they started the fishing program this [island] is the only camp [we use]," he said. "So that is why people don't go there, [another island used when he was a child]. But after the program is done, then people will go there to use it as a fish camp."[60] The community only pays for the operation of a few fish camps in the local fishery program so people tend to stay at those camps when they are working in the fishery.

Emotion and sentiment embedded in place also influences camp location decisions. An elder woman, now seventy-five years old and the older sister of the tallyman who moved the family camp from *Aachiiuchiwaachushich* talked about an old camp rotation pattern. In the early 1900s the family would set up their winter camp on an elongated island a few hundred$_{int/gps}$ meters from the shoreline in the southern corner of a bay. In spring they would move about 1.5$_{int}$ kilometers inland to the northern part of a coastal lake. There, they would set up their spring goose camp and trap muskrats. At the end of the goose season they would move to the south-western corner of the lake to watch and wait for the ice on James Bay to melt. When the ice was gone they would move out onto a small headland at the south-western side of the bay to fish for the summer. In fall they would move back to where they waited for the spring break-up and erect their fall goose camp. Upon winter's onset they would move back to the elongated island. Year after year they would make this rotation.[61]

In the winter of 1948 however, five family members died from disease. The following spring, instead of moving to the lake, they moved to a small headland on the northern corner of the bay. "It was a change of scenery for people who lost loved ones," said this elder. "There were too many memories at the old site."[62] Memories and emotions were enmeshed in the landscape and in this case drove camp location decisions.

Another elder, a tallyman, talked about a disagreement on her trapline. Recently she had a cabin built for herself on a ridge overlooking a small bay. The other hunters using this trapline were upset by this. They felt the site was too open and would prevent geese from coming into the bay which is a main hunting area. However the tallyman said, "We see geese all the time flying low over the community. What is one little cabin going to do?" She felt that geese had become accustomed to buildings and she valued the view afforded by her chosen cabin site. "She likes to be able to see around," her grandson translated.[63] Thus, camp location is governed by factors other than proximity to hunting sites.

This same elder tallyman also mentioned an area where there "should not be a camp. It would be bad to put one there, spiritually" she said.[64] Again, the non-tangible, defined at least from a western-cultural perspective, is an integral part of decisions about living on this land.

Ecology, geomorphology, chosen materials, and technologies, as well as the concepts, decision, and values that all go into the general make up of society are all part of the Wemindji landscape. It has been somewhat easier to approach most of these examples considering only one or two variables. However, all variables together form an integral whole which determines use of space and place over time. Subsequent paragraphs illustrate this interdependency between various variables.

4.2.4. Ecology, geomorphology, technology and society

In 1988 an elder and his family relocated their fish camp roughly $8.5_{int/gps}$ kilometers south from the northern bounding headland of their territorial bay to an island in the center. This move was not permanent though. They would come to the island for part of the season to host a weeklong community gathering[65] as this area was the original site of the community and the HBC trading post. Of course the actual site of the community was on a neighbouring island but that island is now too shallow for comfortable access. The island hosting the community gathering had been used by oblate missionaries for storage during the fur trade era.

This family would live on the gathering island for part of the season and then return to their old fish camp to the north. In time however, they made the decision to move the fish camp to the island, yet a cove on the headland, the site of the old camp, was retained as a main fishing site and still is today.[66] There is one peculiarity about the use of the island however. "We like [this] island," said the elder's son, a hunter himself. "Though I don't know why we don't go somewhere where there is drinking water?"[67]

The island itself lacks a drinking water supply, usually available in the form of large rock pools where rain water accumulates. The closest water supplies are on neighbouring islands 1.2_{gps} and 1.5_{gps} kilometers to the south and north respectively. However, a large supply of water can be gathered relatively easily by motor boat and the fishing grounds, $8.5_{int/gps}$ kilometers north, can also be accessed relatively quickly by motor. As confirmed by the younger hunter, despite some drawbacks, the island is an appealing place and this trumps other considerations. Presumably the infrastructure investments and/or nostalgia associated with the annual gathering, as well as the compensations afforded by technology, particularly motorized watercraft, contribute to its appeal. The realities of habitation decisions are clearly complex and nuanced.

A further example of the complex interactions of bio-physical changes, technology, and people's values are seen through changing responses to coastal uplift. Today people are less inclined to move or feel they do not need to and are incorporating new ways to deal with emerging shorelines. A goose camp next to one of those former channels elders recall as navigable eighty years ago provides a good example. This camp was established in the 1940s.[68] A cove on the south side of this former island, where the mouth of this channel once was, provides a sheltered mooring area for the family's boats. They know that it is only a matter of time however, until this cove becomes too shallow to access. "Well we can always park [the boats] on the north side [of the island]. It is deeper there," said an elder. "We can always build ramps," he said responding to potential difficulty in parking boats on the north side because of exposure. His plan would be to build a slipway and drag the boats up when the weather gets rough.[69] This elder sees infrastructure development as a buffer against the impacts of coastal uplift.

Similarly, this elder's nephew, the tallyman, said that in the future they probably will not move the goose camp even though access will become difficult due to land emergence. This camp is a good place for hunting with easy access to their hunting sites this tallyman said. Perhaps they will get ATVs in the future to "make things easier."[70] ATVs are common in camps that can be accessed from the community by road, but are uncommon in the coastal camps and thus would represent a new development. Furthermore, this specific example shows a change in personal preference. While this tallyman is proposing to use ATVs at the camp in the future, this is not a decision made at whim. For this tallyman it is "important to [...] continue doing things the way it was done in the old days," he said.[71] Once when helping this tallyman move lumber for a new cabin he was building at the goose camp he specifically stated he did not want to get an ATV when a friend suggested it to him. He prefers walking, he said. He likes to keep things simple.[72] So while it is significant that the incorporation of new technologies is seen as a new way for dealing with coastal change, this example goes farther. This tallyman is also reordering his preferences when the continuity of the campsite and maintenance of life on the land is at stake.

New relations between people and ecological change, seen through coastal uplift, are also illustrated by the construction of a road. The old spring camp at *Aachiiuchiwaachushich* is still regarded a good place for hunting geese according to the tallyman's son, a senior hunter. In fact this senior hunter is in the process of having a road built from the community to this site where he lived as a small child. The area holds nostalgia. I hiked there with him. We laughed together as this hunter recalled a time when the other kids would not share a box of cookies with him. He pointed out the now dilapidated wooden tent frame where he eventually found the other kids, hiding, eating all the cookies. He pointed out the small rock piles he and the other children would make to play goose hunter; imitating the larger hunting blinds their fathers would build.

The area remains an excellent hunting site. In 1990 he cut a large *tuuhiikan* – a corridor cut through the coastal forest for goose hunting (see chapter five). Recall that the family relocated camp in the late 1960s but remained sufficiently close to continue their use of the old hunting locations. "The ridge is still a good place for hunting," he said. "I would put my cabin near where the old tepee site is." "The *tuuhiikan* needs to be upgraded a little bit" he said; "maybe extend it to the north [...]" "I would hunt here in the morning."[73] In this example the construction of a road represents a new relationship between people and coastal change. An area that was undesirable from one perspective – the interaction between bio-physical gradients and access – but desirable from both resource harvesting and social perspectives becomes desirable on all three fronts: access, harvesting, and social.

The road however is part of larger societal changes. For example, the road is like helicopter use for spring goose hunting (see chapter two), helping to bring town and bush life closer together. The road is not only intended to improve access to *Aachiiuchiwaachushich*. The road opens up the territory to a family who loves and identifies with the land. Yet this is only part of life. People hold jobs and children go to school. The road would facilitate access to the trapline for people whose time is limited by obligations in the wage economy in town. Furthermore, time spent on the land is seen as essential for taking care of and managing the land. In their opinion the road would allow the family to spend more time on their trapline, thus ensuring users are respecting the principles of good stewardship: hunting in appropriate places and carrying out trash for example.[74]

Interest in road construction is not limited to one family on the coast. An elder tallyman on another trapline expressed the same view; a road would facilitate her being on the trapline and being present on the trapline is essential for stewardship of the land. She talked about how the season for safe snowmobile travel has become shorter because the weather is changing and that the weather has become less predictable often rapidly bringing about stormy conditions that make boat travel on the bay less safe. She is old she said, and it is harder for her to travel now. The road would mean that she could better watch over the land.[75]

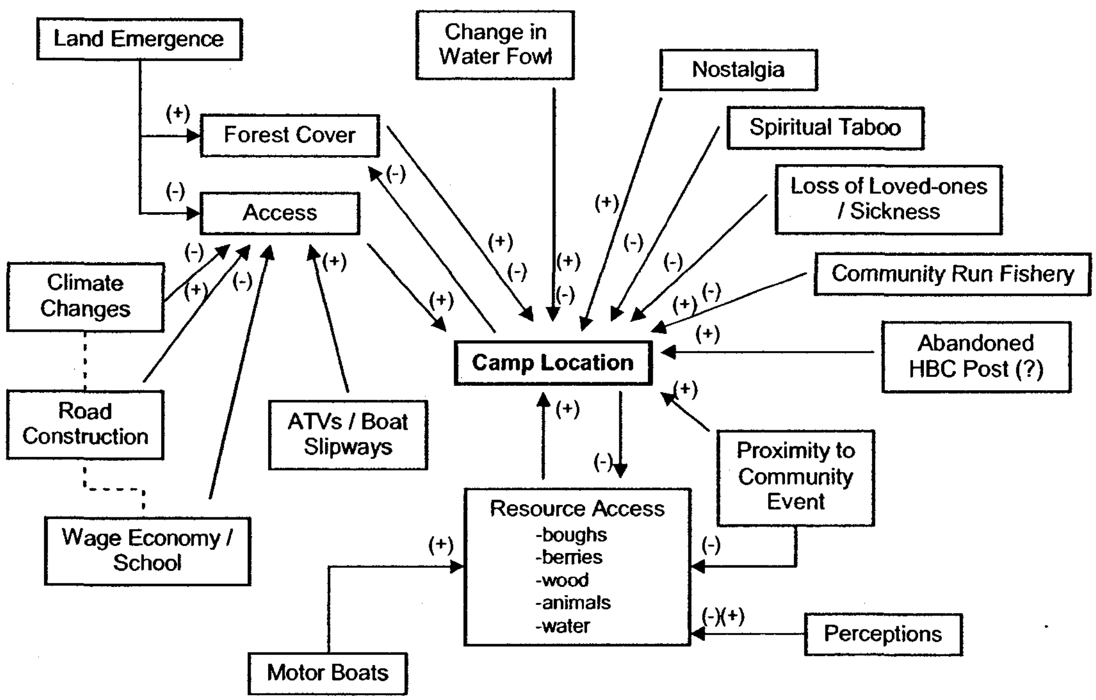

Figure 4.3. A flow diagram summarizing the bio-physical and social parameters influencing camp location decisions as reported by Wemindji Cree. Arrows indicate direction of interaction. Plus signs mean a positive relationship or that as the influence of a parameter increases so does the one it influences. Negative signs indicate a negative relationship or that as the influence of a parameter increases the parameter that it influences decreases. Dashed lines indicate that two parameters are associated. Question marks indicate that the role of this parameter is assumed as a possibility, although not explicitly mentioned by informants.

4.3. Discussion

The Wemindji coast is clearly characterized by a variety of dynamic environmental changes. The ways in which people have dealt with such environmental change are also dynamic over time.

Some ecological changes are unidirectional. Shoreline movement and associated vegetation changes tend to operate in a continuous fashion. Marine areas once used for fishing often develop into goose hunting areas as the land emerges. Additionally, areas transition from being desirable for fish camps into being desirable for goose hunting camps as forests develop on rising shorelines. Thus space is not only used, but it is re-used as the land changes. However, land emergence also leads to changing regimes of access as coastal waters become shallower. Thus, at times space is abandoned.

Other changes are more episodic or perhaps even cyclical. There are certainly episodic events surrounding availability of different waterfowl resource abundances. Cree suggest that some changes in waterfowl population numbers may be part of a larger cycle. Climate is also changing and affecting life on the coast. Some changes, like the onset of winter and spring, are deemed to be deviating from what is considered normal and affect snowmobile travel for example. Other climate-related changes contributing to berry crop development are seen by many as just part of normal variability.

The idea that lesser snow goose declines caused or contributed to Canada goose declines due to the collapse of negative feedbacks is extremely interesting. Though lesser snow geese started decreasing in the late 1950s and early 1960s their disappearance was not reached until the 1980s. Canada geese then decreased in the late 1980s and 1990s. The time period between these episodes is in sync with the two to five year time period that is documented for reversion of suppressed high marsh development following break down of negative feedback pressure (Hik, Jefferies, and Sinclair 1992:402,404-405; Handa, Harmsen, and Jefferies, 2002:96). This possible causality in species change highlights the complex ecological interconnectivity on the coast.

The dynamics between Cree's observation of environmental change and how their interpretations of these changes inform camp location decisions illustrate some important trends. There are certainly relationships between bio-physical gradients and camp location patterns like access associated with land emergence, or proximity to wildlife resources. But social elements like emotions embedded in place associated with the loss of loved ones, or changes in market demands for certain animals are also an integral aspect affecting camp location. Additionally, in more recent times decisions to adopt or use certain technologies are adjusting the parameters of camps and resource harvesting activities. For example, motor boats expand the spatial range of access to certain resources, while ATVs or infrastructure developments like roads and slipways facilitate access in areas that otherwise have become, or will become, more difficult to access. Thus relationships between people and environmental change cannot be understood through bio-physical relationships alone.

The Wemindji camp location example illustrates that there is a diverse array of changes occurring on the coast and that people make complex decisions in response, taking multiple factors into account. There are multiple pathways of change and response rather than a singular environmental change and singular response from people. For example, land emergence is one change and changes in goose population are another. At times people will adjust to one change at the cost of being in a less favourable relationship with another aspect of their environment. Examples include proximity to long-neck goose hunting outweighing the cost of poor camp access due to land emergence, and choosing proximity to long-neck hunting grounds over fishing grounds in camp location selection. Thus people are willing to put up with certain hardships, or less opportune situations, for the benefit of others. Yet this dynamic is directly related to the ways in which decisions around technology adoptions are leading to changes between people and bio-physical gradients.

The adoption of new technologies is allowing people to avoid enduring less opportune situations as they deal with complex interactions of environmental changes, which include attachments to the land. The values and attachments people hold for certain places on the land comes across strongly in their narration. While certain camps can be attractive locations in light of social or cultural values, their use would come at the cost of less favourable access to resources, or less favourable site access, if people were not adopting technologies which change relations with these latter parameters. Indeed these two drivers, wanting to live in places of emotional and cultural significance and choosing to adopt certain technologies, probably mutually inform one another. Such dynamics are seen regarding the establishment of a fish camp in Old Factory accompanied by the use of motor boats to access fresh water and the main fishing grounds which would otherwise be at a prohibitive distance from the camp; the maintenance of the goose camp on a former island that is now attached to the mainland through acquisition of ATVs and construction of slipways to deal with future access difficulties associated with land emergence; and the reestablishment of the goose camp at *Aachiiuchiwaachushich* using a road to bypass unfavourable access that has resulted from land emergence. While these decisions to adapt certain technologies are allowing people to avoid unfavourable relations between camp location and specific bio-physical parameters, these decisions are not without cost.

Flexibility in camp location has clearly been an adaptive strategy in a highly changing environment. However, if people continue to favour investment in technology and infrastructure development to deal with environmental change, Cree likely will find themselves in a situation where their adaptive capacity is contingent on expensive equipment, if it is not already. Such a situation may be undesirable. Whether Cree should or should not revert to historic ways of living, continue as they are, or explore other options can only be decided by the Wemindji community themselves. However the community should consider these relationships when deciding what they want their future to look like.

Yet all of this discussion about past, present, and future relations between people's camp location decisions and environmental change are about what the community wants their future to look like. Camp locations embody identity, history, and the dynamics between preservation of the past and directing future changes in society.

Road construction is a good example of balancing tradition and future change. The road facilitates being on the land in order to monitor the land in accordance with traditional management. Indeed, road construction is just one of many initiatives taken by the community to facilitate 'being Cree' in a modern world as described by other authors in chapter two. Examples include the use of helicopters for spring goose hunting, or readjusting hunting management to accommodate hunters who have less time because they hold down jobs in town. Given observed changes in environment which affect access and societal changes like obligations to schooling or wage employment, the road is a new means to the same ends. This cultural contextualization is important to convey as Cree work towards political frameworks for increased local management. Indeed southern or western audiences might look at road development contrary to environmental protection, but for Cree the access granted by these developments promotes environmental protection.

While retreating shorelines have left historic coastal places inland, these places have not been forgotten by people. Old camps, swan hunting sites, and islands that have disappeared into the mainland are remembered and recalled. They are part of the landscape. The Wemindji community is striving to ensure that this knowledge is passed on to younger generations in a time when formal academic schooling and a commercial and consumerist culture are competing for young people's time and attention. Creation of a protected area is intended to facilitate such transmission. Thus it is important that an accurate understanding of the changing dynamics of people and environment, as presented here, are understood by all involved in protected area creation.

Chapter 5: Being adapted and securing a future – landscape modification for resource harvesting

As demonstrated in chapter four, camp location and relocation decisions reflect Cree adaptations to the coast. In this chapter I examine another dimension of Cree relations with their environment by exploring modifications to the coastal landscape for resource harvesting and management activities. I address three questions. 1) How have Crees modified the landscape both in the past and present? 2) How are these modifications and associated resource harvesting practices intended to function? 3) What does understanding these modifications and associated practices contribute to our understanding of Cree relations with their environment?

My findings illustrate several relationships between Cree hunters and their environment. Cree have significantly modified their environment illustrating agency and occupation. Cree's landscape modifications reflect their strong understandings of the bio-physical system in which they live. Patterns at both the community scale and the smaller trapline scale reveal dynamic interaction of culture, tradition, and experimentation in management. These practices hinge on enhancing resource predictability and are clearly adaptive for living in a rapidly changing environment. Finally, successful resource management on the coast involves an interplay between investing in place and opposing or delaying environmental change on the one hand, and remaining flexible, willing to move and experiment, in accordance with environmental change on the other.

The chapter is structured chronologically and then thematically with two main modification practices given central focus: dikes and *tuuhiikans*. First, landscape modification practices that are recounted generally though oral histories and have not been carried through to present times are addressed. Then the bulk of the chapter addresses the construction and use of dikes and *tuuhiikans* and how they relate to harvesting resources in a changing environment. The analysis is rounded out through looking at practices arising in recent years and plans for the near future.

5.1. Past practices recounted generally – stone weirs, marsh tilling and prescribed burnings

There are historic landscape modification practices that elders recount in a general sense. Stone fish weirs for example, are standing relics on some rivers in Wemindji. These bowl shaped stone structures created a pool in which fish aggregated and were harvested.[76] Stone fish weirs were used generations ago, "before the white man came,[77]" "before there were nets,[78]" or during an elder's "grandfather's time.[79]" Once in these pools fish were gathered by hand or with a spear though the elder recounting this cautioned that he did not know exactly how people gathered the fish.[80] The practice continued, if only as an addition to gill net fishing, into recent memory by a few fishers. One elder, born in 1916, says that he never fished with stone weirs in Wemindji, but did fish with them once in Eastmain.[81] Another family used stone weirs up until the 1940s.[82] Similar to the idea of a stone weir is the use of stone deflectors discussed by an elder tallyman, again "before nets," "before the Hudson's Bay Company." "Rock piles" he said, were used to "funnel fish into a specific spot" such as "natural pools" where they were harvested with a "bow or a spear."[83]

Another historic practice described only in general terms,.was digging up marshes with shovels to make them more attractive to geese. However, this practice seems to have varied from family to family, at least according to informant's recollections. Three elders on different traplines, one a tallyman, said this practice was never carried out, that it would have been too much work; or they were unsure about it, not having heard or seen this practice themselves.[84] The elder tallyman and another elder said there were enough geese that the geese turned over the marsh themselves.[85] They felt digging up the mash was not necessary. Two other elders however, on different traplines, one a tallyman, said their relatives did toil in the marshes with a shovel.[86]

Several elders and tallymen talked about fire as a management tool though it does not seem to have played a major role in Cree landscape management. One elder tallyman talked about his father "experimenting" with fire to see how the grasses that geese feed on, as well as berries, would grow after being burnt. This was done before "his time" he said.[87] Another elder tallyman said he had heard stories as a young boy about people burning grasses a "long time ago" to promote new growth for attracting geese. He pointed out the location where this was done.[88] Another elder tallyman said he once experimented with burning grasses in the fall during the 1960s. The next spring, when the "snow melted [the] burned grasses washed away and geese were feeding there. [...] There are more things that [grew] faster," he said. This same tallyman said his grandfather did not use fire to attract geese. It was not necessary; "the feeding areas were very good for the geese" during his grandfather's time.[89] A younger tallyman recalled seeing his older brother burning grasses around a goose hunting area, but he had never heard about his grandfather burning grasses to attract geese.[90]

Indeed there is no consensus across the coastal traplines about the historic use of fire for attracting geese. Six other elders, one a tallyman, also stated that to the best of their knowledge, fire was not historically used for managing geese.[91] Additionally, two of these accounts are from users of the above mentioned trapline where fire was discussed historically for attracting geese. However, three of these elders spoke of fire being used in the past to clean up around camps or when the grass got too long. This includes the two conflicting accounts just mentioned.[92] Additionally one of these elders said that burning to clean up camp grounds was done around the 1930s, but not before that.[93] The danger of fires getting out of control also came up in these discussions.[94]

Fire was not used to manage or improve berry harvesting areas. This was agreed upon by all coastal families. We "just let nature do the work," joked one elder woman.[95] "Willows would grow over where the berries were," said another elder woman "There is not much [we] could do, so [we] would just go to another place."[96]

Living and talking with Cree on the coast, it quickly becomes apparent that two landscape modification practices take center stage: creation of dikes, and cutting of *tuuhiikans*. Both are used for harvesting geese. Indeed, such prominence is not surprising given the historic and contemporary economic and cultural significant of geese.

5.2. Dikes – a major modification practice

In the early spring geese arrive in Wemindji on their migration north. At this point the coastal marshes where they feed are still covered in snow and the geese look for pools of water to feed in. Knowing this, Cree build dikes in some coastal marshes to facilitate goose hunting.

5.2.1. Building dikes – material structure and history of practice

Fieldwork confirmed a wide variety in dike form, size, and construction material. Dikes are primarily made of mud or sod dug from the immediate area. Digging up sod blocks from the planed impoundment serves a triple purpose one elder tallyman explained. The impoundment elevation is lowered, any undesirable vegetation (from the perspective of both the hunters and the geese) is removed, and building material for the dike is made available.[97] Logs, stones, and in the case of one particular dike I observed boards are used in construction.

In general a 15 to 30 centimeters high u-shape structure tens to hundreds of meters long is built (Table 5.1). However, one dike visited was a straight 4 meter obstruction across a creek draining a much larger natural pond used for hunting. The relatively small investment of time, energy, and materials involved in such a construction compared to dikes of 80 to 180 meters (Table 5.1) is rewarded by impacting an area of considerable size. At the opposite spectrum another dike visited consisted of a 269 meter circular mud embankment creating a 3,239 m^2 pond. This embankment, 6 to 9 centimeters high, was shorter than the average height of the u-shaped dikes. One elder tallyman explained that he did not make any permanent dikes but that he had built a temporary dike of mud and logs to block a small coastal creek in the past. The impoundment, he said, would eventually "be covered with grasses" so he would destroy the dike at the season's end.[98]

L (m)	H (cm)	Trapline	Date made
44	15 - 30	A	Generations ago
269	6 - 9	A	Generations ago
24	30	B	1988 or 1989
180	16 - 25	B	1981
87	10 - 20	C	Early 1960s, 2nd oldest of 3 in bay
91	20 - 30	C	Early 1960s, youngest of 3 in bay
4	15 - 30	E	Early to mid 1980s
24	15 - 30	E	2001 or 2002

Table 5.1. Dike lengths (meters), heights (centimeters), and time of creation organized by trapline. Traplines are coded and have no relation to spatial arrangements of traplines.

Construction dates for the twenty-two dikes inventoried cover a large time period (Table 5.2). Reflecting on the oldest dikes known, three families recalled dikes from the early to mid 1900s, while two families were aware of dikes established as far back as the late 1700s and early 1800s, or "generations ago." This historic legacy on five traplines was not found on the remaining two traplines. In one case an elder tallyman said there were no dikes on her trapline until the 1980s, after her husband, the former tallyman, died. In the other case, on one trapline only a temporary dike was erected in recent decades as discussed above. On traplines with historic dikes informants confirmed that dike building continued in recent decades. Again, one dike was being planned for the fall of 2007. Thus, the dike is clearly a management practice with a significant historic presence and is very much still in vogue.

#	Trapline	Date made
1	A	Generations ago, (1800 to 1900s)
2	A	Generations ago
3	A	Will build in fall (2007)
4	A	No Data
5	B	1988 or 1989
6	B	1981
7	B	1988 or 1989
8	B	Early to mid 1900s
9	C	Early 1960s, newest of 3 in marsh
10	C	Early 1960s, middle of 3 in marsh
11	C	Early 1960s, oldest of 3 in marsh
12	C	1940s
13	C	Early 1900s
14	C	No data
15	D	Late 1700s, Early 1800s
16	D	2000
17	D	2000
18	E	2001 or 2002
19	E	1980s
20	F	Grandfather's time (1940s - 1950s)
21	F	1999 or 2000
22	G	Mid to late 1900s; temporary

Table 5.2. Dike creation dates inventoried during interviews and organized by trapline. Traplines are coded and have no relation to spatial order of traplines.

The difference in earliest known dikes could be due to differences in individuals' abilities to recollect dike origins. It became clear during interviews that some individuals were less comfortable talking about occurrences beyond their own lifetime while others would easily convey stories that had been passed down through generations. Also, one of the oldest mentioned dikes was recollected by the eldest informant, a ninety-two year old elder. He clearly has a primary mental archive spanning twice as long as many of the younger hunters I consulted. Indeed, while information can be of tertiary sources for younger informants, information from the same time reflects secondary source material for older informants. Thus, age difference may influence historic reporting of dikes.

Notwithstanding possible differences in recall accuracy, the absence of dikes on one trapline until the 1980s, and the presence of only a temporary dike on another, illustrates diversity in dike construction practices between traplines.

The use and construction of dikes truly illustrate the expertise of the hunter. In a simple sense the pool created or maintained by the dike attracts geese. But Cree's intent in using and building dikes is based on understanding sophisticated dynamics. It is the interaction between the surrounding landscape and the created or maintained pool that Cree hunters wish to take advantage of.

5.2.2. Hunting at dikes – dike function

Dike placement takes advantage of natural drainage as marshes thaw in the spring, often by blocking a small creek. This creates or maintains a pool of water which attracts waterfowl. Cree place hunting decoys in this pond to help attract geese.[99] Informants said that the pond is attractive to geese both because the geese feed there and because the geese are attracted to the pool itself and decoys in it.[100]

Comparing the topography and flora in profile of an area highly modified by dikes to a similar area a few hundred meters away illustrates how these relative relief changes create or maintain wetland environments. Figure 5.1a is a profile through two major dikes. These dikes were built in the early to mid 1960s. There were also three to five less pronounced dikes in the profile. The senior hunter I was with wondered if some of these could be older than the two main dikes.[101] This hunting site has been used for many generations according to the tallyman and clearly there have been significant investments to modify this area as evidenced by the complexity of smaller dikes and size of the two main larger dikes: 87 meters and 91 meters. Figure 5.1b is a profile a few hundred meters away.

These profiles start on the east side of a small coastal lake 0.4 meters above the high tide mark indicated by a wrack line – a line of seaweed deposited by the high tide. The Creek is *Aachiiuchiwaachushich* "Small creek runs back and forth with tide". It has been at least sixty or seventy years since *Aachiiuchiwaachushich* was a tidal creek according to oral history.[102] Thus these dikes must have been created shortly after this area ceased to be tidal assuming land emergence around 1m/100yrs which is a rough average of documented land emergence rates (see chapter two).

The two profiles (Fig. 5.1a, 5.1b) are a good comparison as overall slope and elevation are similar in each and there is a drainage channel near both (Fig. 5.2). The topography of the two profiles differs in one aspect however. In profile 5.1a there is a general upward slope from the lake margin inland about 100 meters to a coastal fen. In profile 5.1b there is an upward slope for about 100 meters and then the topography slopes downward for another 150 meters. Though not a perfect match, the first 100 meters of profile in figure 5.1b is comparable to the profile in figure 5.1a.

The creation of dikes has retained water due to more than 50 percent modification of elevation relative to overall elevation. Thus the formation of a well drained upland and defined channel is prevented, while in the comparative profile a well drained upland heath and channel have formed. Additionally, the wetland created by these dikes hosts species known to be palatable to geese. The five most important spring foods for Canada geese assessed for an area just north of Wemindji are: *Carex paleacea* seeds, *Hippuris tetraphylla* leaves, stems, and rhizomes, *Eleocharis acicularis* plants, and *Triglochin*

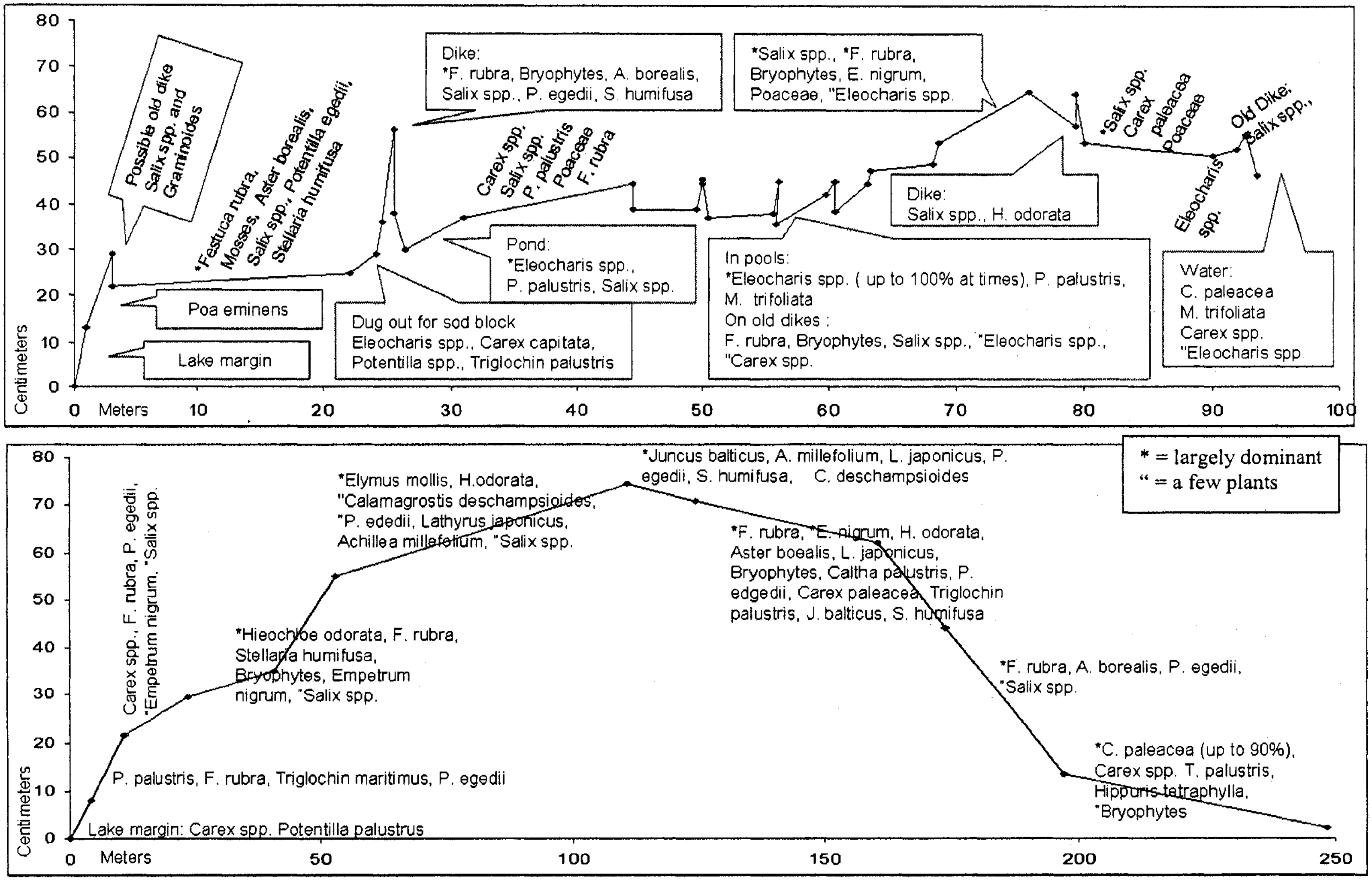

Figure 5.1a. (above) Topographic profile and species composition through dikes made in the early 1960s, and **5.1b** (below) comparative profile.

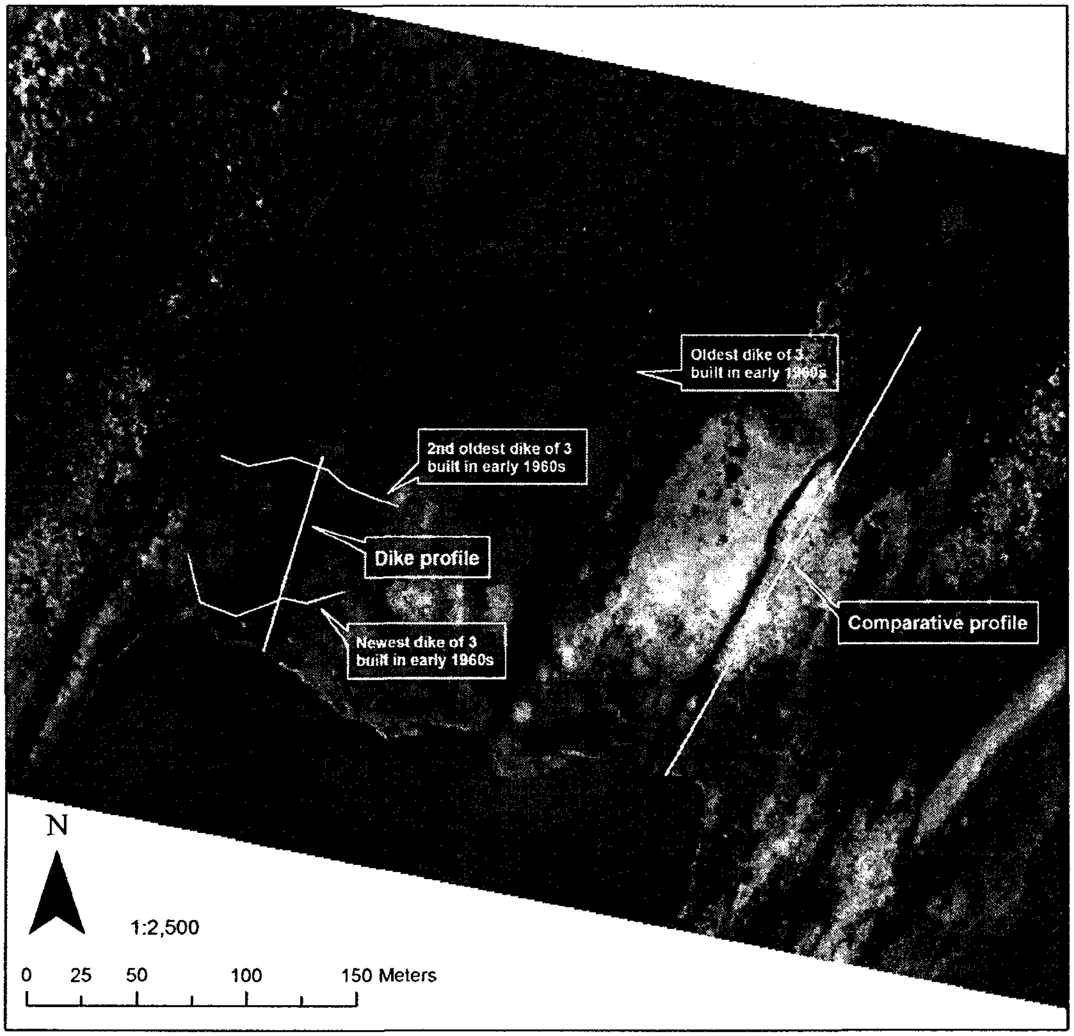

Figure 5.2. Map of profile through two dikes, comparative profile, and surrounding area. Dikes were delineated using a GPS. Profiles are based off end point GPS markers, but are for spatial representation only. Image from Google Earth (2006) and referenced to SPOT imagery in Arc'GIS 9.2. Total RMS = 6.29847m.

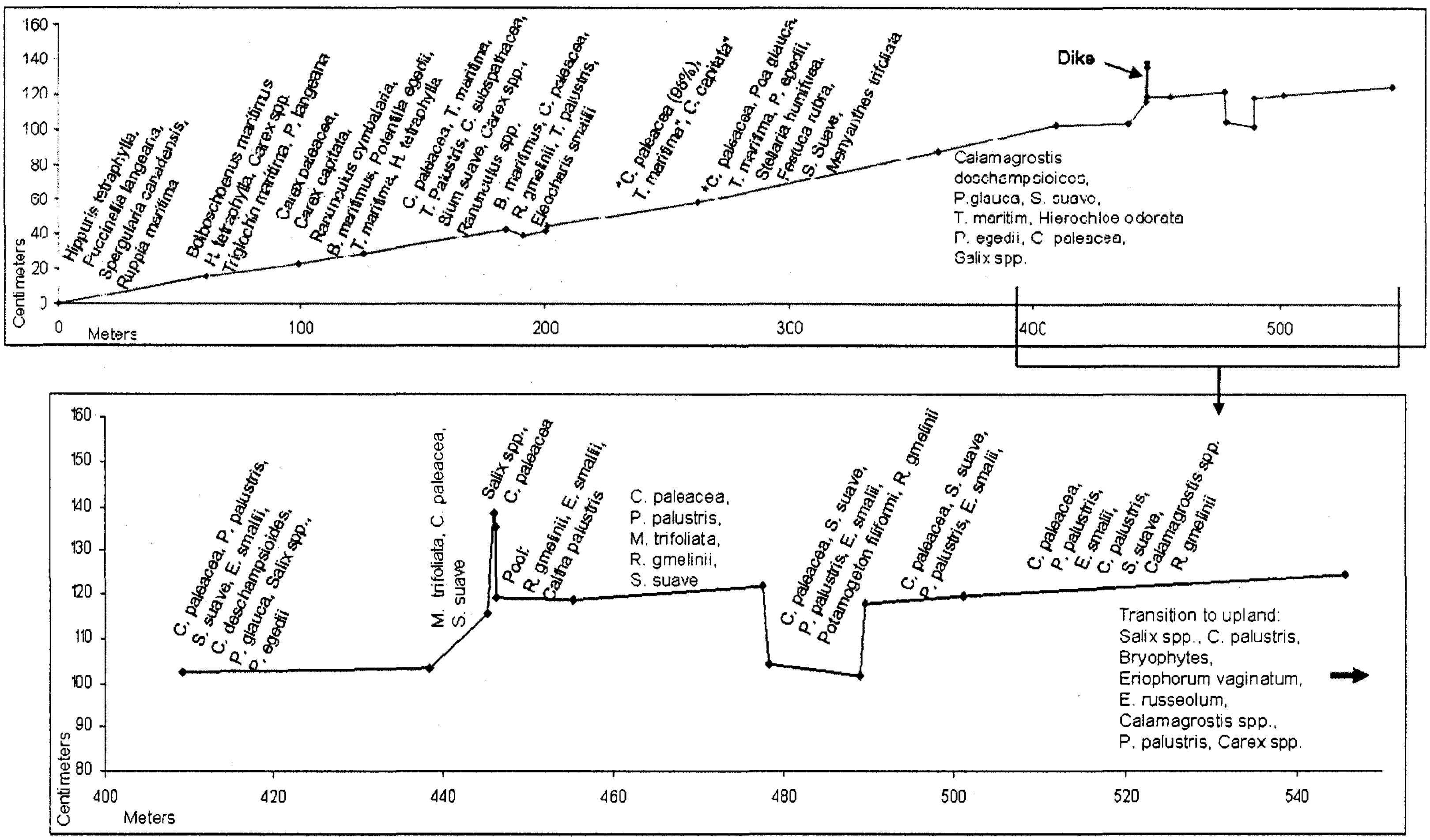

Figure 5.3. Topographic profile and species composition along a transect through a dike made in 1981. *= largely dominant, " = few plants.

palustris bulbs (Reed *et al.*, 1996). The impoundment of these dikes host many of these favourable foods, especially *Eleocharis* (Fig. 5.1a), though it was only possible to identify the plant to the genus level, and it is unknown if geese discern between different species. The comparative profile is dominated by less attractive plants. Thus in this area the dike is creating a water body to attract geese, as well as increasing the abundance of food plants which may help attract and/or retain the geese.

However a profile of a younger dike built in 1981 shows little difference in the flora inside versus outside the impounded area (Fig. 5.3). The surrounding area along the isobasis of the dike – the area of equal elevation running parallel to the slope – is also dominated by *C. paleacea* (Fig. 5.4). Most likely this dike helps attract geese simply by retaining water. The dike may also be preventing invasion of upland species by increasing soil moisture.

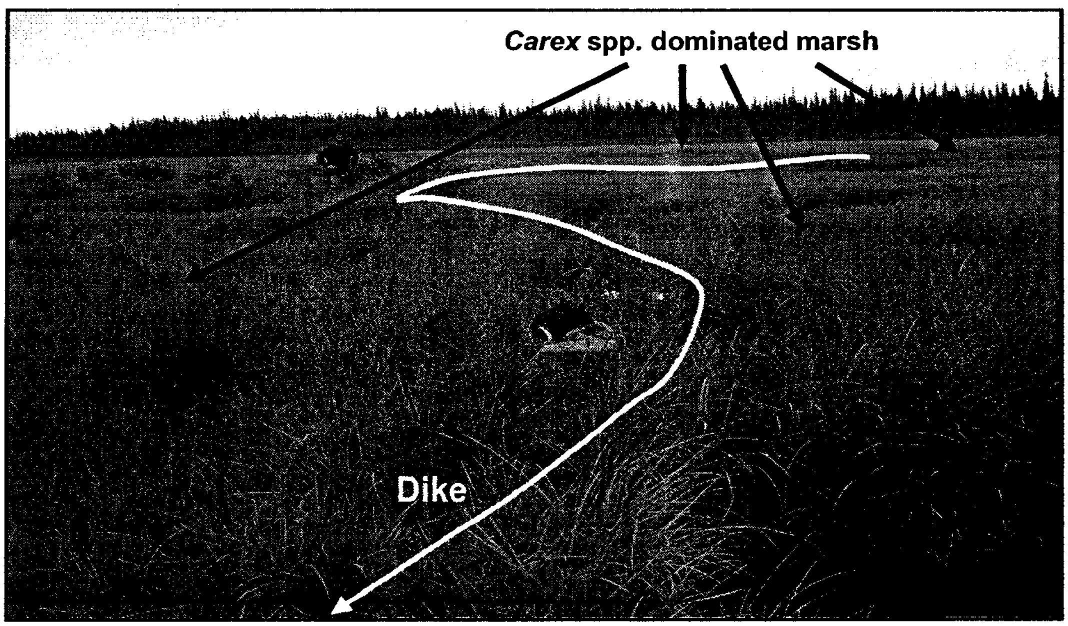

Figure 5.4. *Carex* spp. dominated marsh inside and outside of dike. The white line indicates the location of the dike. Up-slope (photo right), down-slope (photo left), and outside the dike along an isobasis (photo background) are all dominated by *Carex*. spp.

Dikes create an attractive environment at the pond scale; however their function and intent go much farther. Ponds are built in areas that are desirable locations for hunters. The surrounding landscape is an important component of a good hunting area affecting how the geese approach the pond and where hunters will position themselves in relation to approaching geese. A narrow bay for example is often an advantageous setting for hunting facilitating a hunting strategy by which hunters effectively trap geese in cross fire.[103] In this strategy hunters sit around the pond with the experienced hunters upwind and the less experienced hunters downwind. Geese land into the wind. The experienced hunter has the patience to wait until the flock gets close enough so that when he shoots, hopefully killing some of the flock, the remainder will be chased across the pond where the younger hunters wait. If the lead hunter is impatient and shoots too soon the geese will takeoff and be out of range for other hunters.

After the lead hunter shoots and the remainder of the flock are chased across to the down wind side of the pond, fleeing from the shots, the young hunters shoot. The young hunters try to kill all the geese that come their way. If they fail the remaining geese are chased back across the pond to where the experienced hunter takes a second shot at them. This strategy is designed to give all hunters a chance to shoot but also maximizes the chance of killing the entire flock that comes into the pond.[104] Cree believe that failure to kill the entire flock will result in the survivors, along with the new flock they join, avoiding the area in the future because geese learn to avoid hunting sites (Scott, 1996).

The proximity of tree and shrub lines to the pond is also important for hunting success. At one dike I visited hunters had cleared the shrub growth on the surrounding ridges so that geese would approach the pond more slowly.[105] In fact, brush clearing around hunting ponds can be seen on all the coastal traplines in recent years (PolyGEO and Goyette, 2003). The diameter of the clearing greatly influences the speed at which geese approach as larger diameters promote slower approaches.[106] Cutting back shrubs to maintain ponds is not a new practice. For example, one elder tallyman also talked about clearing the willows and small trees around a favourite hunting pond with an axe, "before chainsaws" in the late 1950s.[107]

While dikes function in association with local landscape topography and topology at the local scale, some ponds are also built to function at the larger landscape scale. Hunters build ponds to take advantage of the wider spectrum of goose flight patterns on the coast. For example, the tallyman who was planning to construct a new dike on his trapline was also considering rebuilding an old dike in another bay. This dike, which requires maintenance, has been used for generations, was last maintained in 1992, and has been little used since the late 1990s. When asked whether it was better to maintain old dikes or build new ones he did not comment on investing in old or new dikes. Rather he responded that in a south wind the location of the proposed dike is one of the best hunting locations and that the old dike is good for most wind directions.[108] His response indicates that the status of the dike, old or new, and thus age of the site relative to land emergence, is not the major focus in deciding where to invest time and energy. Whether the site is part of goose flight paths dictates time and energy investments.[109] This judgment is based on a well developed understanding of goose flight paths on the territory. Indeed this tallyman discussed how he had consulted with numerous elder trapline users in deciding if this new dike should be built or not. Thus the proposed dike is informed by the accumulated knowledge of multiple trapline users' understandings and opinions about local goose behaviour and ecology.[110]

This new dike is being built in a bay that has also been used for generations. As the land rises and drains and upland vegetation invades, the area becomes unattractive to geese. Building a dike will prolong the lifespan of this hunting site. "It will be a good spot for the young generations. They will have a place to hunt here," said the tallyman.[111]

Sentiment around maintaining hunting areas for the future was eloquently articulated by another elder tallyman. When asked about the possibly of having to abandon a set of dikes in one bay and relocate to a new hunting site in the future as the land uplifts he said; "The routine is going to keep going. People will keep hunting there, where people used to hunt; we might just upgrade it a bit I guess."[112] Future generations will hunt where past generations hunted according to this elder, and he and others will continue investing in this hunting area to ensure this continuity.

Based on the above it is apparent that dikes function on three scales. At the smallest scale they create or maintain a pond that attracts waterfowl by delaying wetland succession. The use of decoys enhances this attractiveness. At a larger scale the pond is part of a desirable landscape topography and topology that Cree utilize in their hunting. At an even larger scale the pond functions with the interaction of goose flight patterns and wind directions. By building and maintaining ponds Cree prolong the lifespan of hunting areas. By manipulating and enhancing desirable aspects of the landscape Cree create predictable locations for hunting geese year after year.

5.3. *Tuuhiikan* – a major modification practice

Later in the spring as the geese get ready to fly to their northern breeding grounds the *tuuhiikan* is used for hunting.[113] A *tuuhiikan* is a corridor cut in the coastal forest and used for hunting. Cree hunters note that geese like to fly low to the ground and will thus fly through the gap created in the trees. One hunter, who also has a personal interest in airplanes, described the *tuuhiikan* in terms of wind turbulence. The rough boundary layer of the trees creates turbulent eddies and the geese will fly high to avoid this rough air he said. Cutting the *tuuhiikan* creates a more attractive place to fly.[114]

I inventoried thirty-one *tuuhiikans* during interviews and field work (see chapter three). This number includes one proposed *tuuhiikan* and probably constitutes the majority of *tuuhiikans* in Wemindji. It is not a complete inventory however. During a follow up interview with a senior hunter to confirm cut dates of *tuuhiikans* he informed me of two additional *tuuhiikans* that had been destroyed by forest fire in the mid 1980s. These two *tuuhiikans* were added to the inventory. Their earlier omission can probably be explained by the fact that because these *tuuhiikans* had been destroyed and were not among the oldest *tuuhiikans* my informant did not think them worth mentioning during our previous interviews. This incident highlights the possibility that there may be other *tuuhiikans* that hunters did not mention. Another senior hunter observed that my map omitted a few *tuuhiikans* located in the bay close to where the present village is.[115] Thus while I am confident that my inventory addresses the majority of *tuuhiikans* in Wemindji it is not exhaustive.

Crees cut *tuuhiikans* to be orientated southwest to northeast or south to north following the dominant flight paths of geese as they fly north.[116] Indeed such orientations were confirmed during remote measuring of *tuuhiikans*. Additionally my observation indicate that most *tuuhiikan* are situated on headlands with bays and/or marsh to the south and north, or are situated to run over a ridge on the north side of a bay with the southern end of the *tuuhiikan* abutting the coastal marsh and the northern end often opening towards a coastal lake or marsh. However, these are only general parameters. The precise placement of *tuuhiikans* is informed by Cree observations and understandings about the movement and behaviour of the geese on their territory.

5.3.1. Hunting at *tuuhiikans* – *tuuhhikan* function

When asked why a *tuuhiikan* is located where it is, informants responded; "because people saw geese flying there."[117] *Tuuhiikans* are often cut in locations that were long used for hunting even before cutting the *tuuhiikan*.[118] The *tuuhiikan* is not designed to bring geese to a specific location. No one would cut a *tuuhiikan* where geese do not normally fly. The *tuuhiikan* is intended to take advantage of an area where geese already pass and to increase the likelihood that the geese will pass over a given spot in that area.

"The *tuuhiikan* gives you a place to sit,"[119] said a senior hunter. Before the *tuuhiikan*, explained this senior hunter and his father the tallyman, hunters would run out onto the ridge where they thought the geese would pass upon hearing them. Sometimes the geese did pass overhead and they got a good shot. Other times the geese did not pass overhead. However, by the time it was possible to see that the geese were not going to pass overhead it was too late to change position. Cutting the *tuuhiikan* creates a more predictable location on the ridge for geese to pass.[120] This senior hunter credited the *tuuhiikan* with an 80 percent success rate in promoting geese to pass through.[121]

Cutting the *tuuhiikan* also aids hunters in observing and monitoring goose flocks. *Tuuhiikans* are often cut so that the southern side opens up wider than the rest of the structure to enhance visibility of the approaching geese. This increased visibility allows the hunter enough advanced notice to reposition himself on those occasions when geese do not pass through the *tuuhiikan*.[122]

5.3.2. Building *tuuhiikans* – material structure and history of practice

Tuuhiikan size varies greatly (Table 5.3, Fig. 5.5a). There is a rough linear relationship between length and width (Fig. 5.5a), illustrating there may be a favourable size ratio, but this trend is driven by a few large *tuuhiikans* and visual inspection reveals a range of shapes such as hourglass, rectangular, square, and trapezoidal. Some clustering of *tuuhiikan* size is also apparent when grouped by trapline (Fig. 5.5b) which hints at either personal preferences or perhaps catering to spatial variations in goose behaviour. However, overlaps in these clusters indicate that there are also commonalities in size across traplines. Indeed, there is no substantial trend regarding *tuuhiikan* size or shape, but neither are size and shape distributions erratic. Thus there seems to be some favourable size ratio for the construction of *tuuhiikans*. However, local landscape topography or observations about goose movement on the trapline probably influences *tuuhiikan* structure. Responding to local conditions is supported by a hunter's use of

	Minimum width (m)	**Maximum width (m)**	**Length (m)**	**Area (ha)**
Minimum	30.00	45.00	80.00	0.34
Maximum	270.00	370.00	1100.00	32.16
Average	120.60	149.80	399.80	5.17

Table 5.3. *Tuuhiikan* widths (meters), lengths (meters) and areas (hectors). Manny *tuuhiikans* tend to be wider at one or both ends thus a minimum and maximum width was measured for each. n=25.

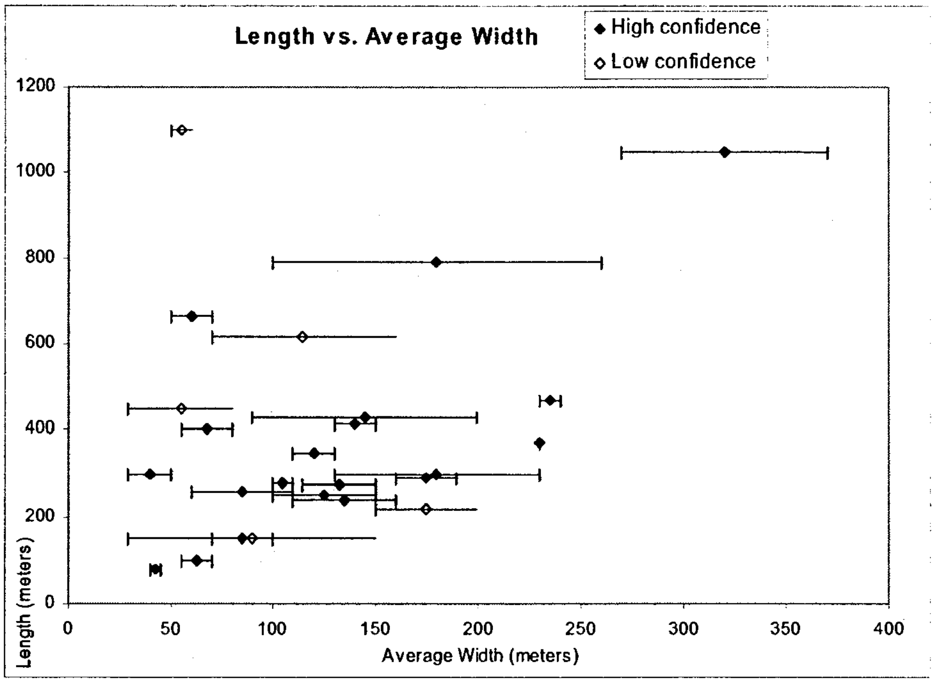

Figure 5.5a. *Tuuhiikan* size represented as length vs. width. X-error bars represent the range in width. The data point represents average width. n = 25. Measurement confidence levels are based on image resolution and groundtruthing.

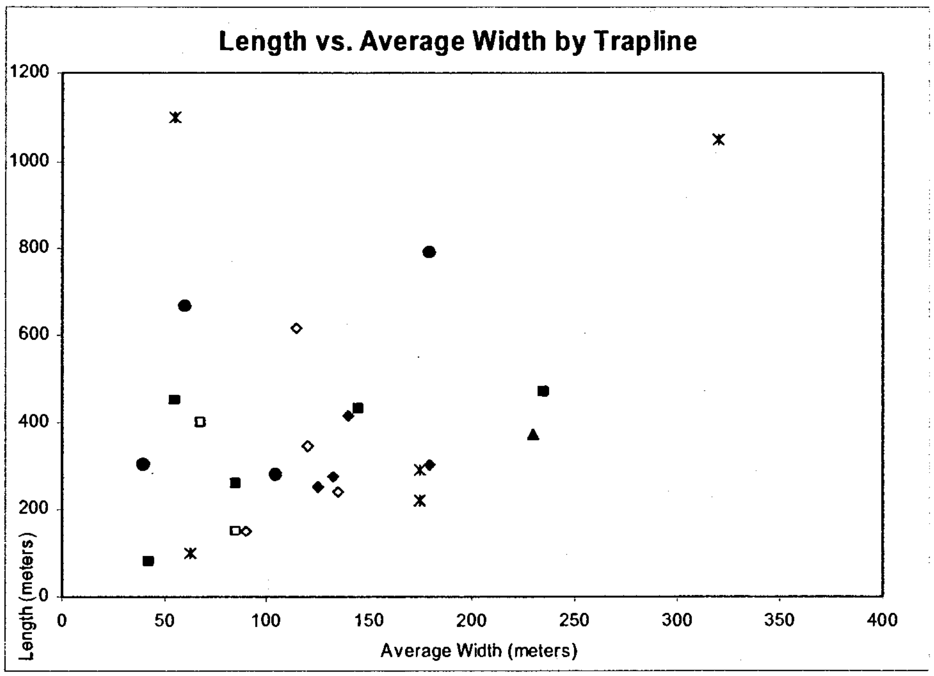

Figure 5.5b. *Tuuhiikan* size represented as length vs. width displayed by trapline. Traplines are coded and have no relation to spatial order of traplines. Error bars, as presented in figure 6a, have been removed for clarity. (▲ = A, ♦ = B, ● = C, ■ = D, □ = E, ◊ = F, ✳ = G)

knowledge about local goose behaviour on the trapline when building *tuuhiikans*. For example, one senior hunter said he noticed that geese have a preference for narrow *tuuhiikans*, pointing to an hourglass shaped *tuuhiikan* he made that was 90 meters in the middle and about 200 meters at each end. The southern end was cut wider for increased visibility.[123]

Tuuhiikan cutting seems to have started in the 1930s to 1950s based on the earliest known *tuuhiikans* on each trapline (Fig. 5.6). However, one elder said his family has been cutting *tuuhiikans* since 'time immemorial'. This elder said the *tuuhiikan* in question had been maintained twice in his lifetime; once in the late 1950s and again in 2003.[124] The oral history for this hunting site goes back at least to the 1600s and perhaps farther.[125] In all likelihood this site certainly dates back many, many generations. But weighted against the first *tuuhiikans* reported on other traplines, including by older elders, it seems possible that this hunting location resembled and functioned like a *tuuhiikan* for generations but was not formally cut until much later in response to tree

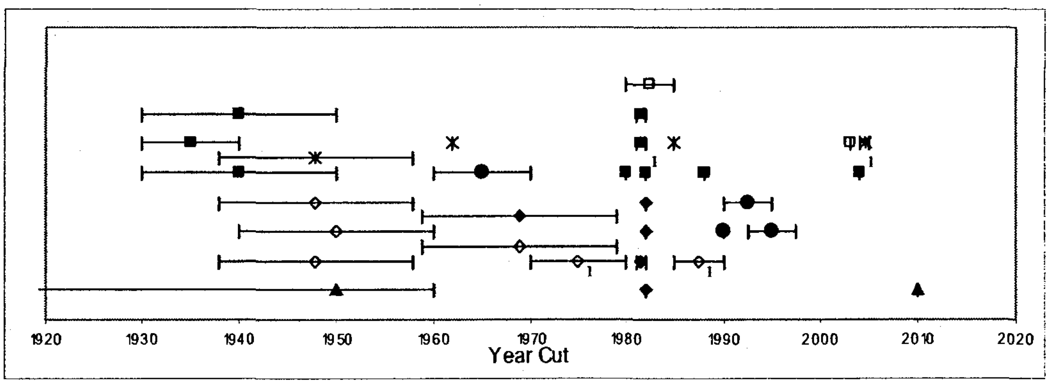

Figure 5.6. *Tuuhiikan* cut dates displayed by trapline. Traplines are coded and have no relation to spatial order of traplines. X–error bars represent the range of date reporting. For example, a *tuuhhikan* cut in the early 1980s is centered at 1982.5 + or – 2.5yrs. A *tuuhiikan* cut in the 1980s is centered on 1985 + or – 5yrs. n = 32 (30 +2). Cut dates were recorded for thirty *tuuhiikans* however two *tuuhiikans* were re-cut and increased and are represented as a second cut date in the figure. The pairs are indicated with a "1". (▲ = A, ♦ = B, ● = C, ■ = D, □ = E, ◊ = F, ✳ = G)

growth associated with coastal uplift; possibly during the late 1950s as recalled by the respective elder. As another elder enlightened; "[a *tuuhiikan*] is where someone cut the trees down with a saw or axe. If you see the same thing but the trees were knocked down naturally it is not a *tuuhiikan*."[126]

As in the case of dike construction, one tallyman said that no one built *tuuhiikans* on her trapline until her husband, the former tallyman passed away in the 1980s. "No, others did that," she said. "People wanted to act like they own the land. The only thing [my husband and my grandfather] would do is make a trail to where they hunted." The cut dates of the two *tuuhiikans* on this trapline, early 1980s and 2003, as reported by other senior hunters, corroborate this account. Disapproval of *tuuhiikan* cutting by this tallyman highlights some of the diversity in management approaches and attitudes across these coastal traplines. Despite this, the *tuuhiikan* is a common and significant resource harvesting practice when looking at Wemindji as a whole.

There was a hub of *tuuhiikan* cutting from the 1930s to 1960s and another surge of activity in the 1980s tapering off during the 1990s. This pattern is roughly correlated with goose declines. According to informants snow geese starting declining in the 1950s and 1960s through to the 1980s,[127] while Canada geese declined in the 1980s and 1990s.[128] It is possible that as geese decreased people invested more energy in building *tuuhiikans* which decreased the uncertainty of intercepting geese and increased hunting return. Though this temporal pattern is only suggested in the data on *tuuhiikan* cut dates this hypothesis is strengthened by my ninety-two year old informant who claimed that in the days before the *tuuhiikan* people did not need goose decoys; "there were so many geese you just needed to call them." People knew where to hunt geese simply by looking at them he explained.[129] Though probably embellished, like reports from early explorers of the western Atlantic coast describing fish so numerous one could walk on their backs (Cronon 1983), this elder's statement clearly indicates a time in the past when geese were more plentiful and easier to come by.

Tuuhiikan construction dates are clustered around individual traplines showing periods of creation at the trapline scale (Fig. 5.6). Many *tuuhiikans* received subsequent maintenance one or more decades after the first cut, and some hunters are planning to carry out maintenance of *tuuhiikans* in the near future. In addition to conducting maintenance of two existing *tuuhiikans* one hunter wants to increase the size of one cut in 1990, extending it down the north side of the coastal ridge to a wetland area. The *tuuhiikan* "is more visible to the geese" when it goes from shore to shore he said.[130] Figure 5.6 illustrates two *tuuhiikans* that were significantly expanded and are represented as a second cut date. One of these *tuuhiikans* involved expansion down the north side of the coastal ridge to a lake. Thus *tuuhiikan* cutting activity is more prominent and complex than figure 5.6 suggests.

Starting in 1979 a remedial works program was established supported by funds laid out in the JBNQA (SOTRAC, 1980). The remedial works program was intended to offset negative consequences to Cree natural resource-use following hydro development and, among other provisions, included funds for gas and labour involved in building dikes and *tuuhiikans* (*ibid*). This program may explain some of the clustering of cut dates by trapline starting in the 1980s. It is also possible that this program might have encouraged more people to build *tuuhiikans* or dikes through financial incentives. However, according to local informants the program seems more to have deterred construction due to the slow approval process that projects must go through. For example, one senior hunter who wishes to re-cut multiple *tuuhiikans* on his trapline has been waiting for approval by the remedial works program board. Though maintenance work is needed, he is concerned that if he does the work before getting approval thorough the remedial works program he may never receive the compensation payments which are an important income supplement.[131] The tallyman with plans to build the new dike expressed similar frustrations. He is also waiting for final approval from the remedial works program. He explained that the three family members he would enlist to work on the project want to wait until the transfer payments are finalized because they depend on the financial supplement.[132]

There are twenty-four *tuuhiikans* for which both age and size have been determined with a slight semi-log linear trend between size and age (Fig. 5.7). However, this trend is driven by a lack of small *tuuhiikans* cut in recent decades and three small *tuuhiikans* cut in the 1930s/40s, the 1940s/50s, and 1960s/70s. The 1960s/70s *tuuhiikan* was delineated with low confidence and quite possibly may have been bigger with re-growth between cutting and Landsat image capture reducing size. In the data are also the two *tuuhiikans* which were expanded at later dates, one of which was increased by approximately 50 percent in cutting down the north ridge face. These have been represented with the later cut dates from the late 1980s and 2004 as this respects the size delineated. The original cut dates of these two *tuuhiikans* are 1970s and 1982, respectively. Even considered at their first cut dates these would not contribute to a trend of small *tuuhiikans* at early dates. Additionally, the small *tuuhiikans* from the 1940s/50s and 1960s/70s were re-cut in the late 1990s and 2001, respectively. Thus, even if there is a trend away from cutting smaller *tuuhiikans* in contemporary times they are still maintained and used showing continuity in modification practice over time. Finally the five cut dates of *tuuhiikans* with no size are: 1930s, 1940s, 1950s, 1960s, and 1979. The *tuuhiikan* with no date is 5.41 hectors. While these *tuuhiikans* could influence the trend in figure 5.7, there is no substantial trend in size versus age based on the data available.

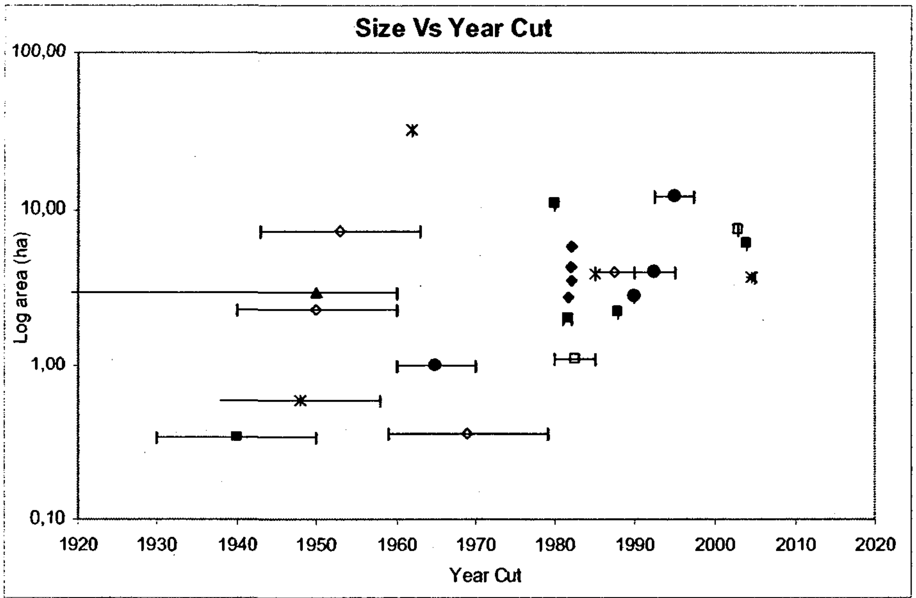

Figure 5.7. *Tuuhiikan* size vs. year cut displayed by trapline. Traplines are coded and have no relation to spatial order of traplines. X–error bars represent the range of date reporting. For example, a *tuuhhikan* cut in the early 1980s is centered at 1982.5 + or – 2.5yrs. A *tuuhiikan* cut in the 1980s is centered on 1985 + or – 5yrs. Size is represented as the log area in hectors as the distribution of values range two orders of magnitude from 0.34ha to 32.16ha, however the distribution is heavily skewed to the left. n = 24. The five cut dates with no sizes are; 1930s, '40s, '50s, '60s and 1979. The *tuuhiikan* with no date is 5.41 ha. (▲ = A, ♦ = B, ● = C, ■ = D, □ = E, ◊ = F, ✱ = G)

This continuity of size over time is especially interesting given the labour reduction afforded by mechanized technologies that hunters began acquiring in the late 1970s and 1980s (see chapter two). Chainsaws obviously would have made *tuuhiikan* creation simpler. Consistency of the structures overtime, notwithstanding a large variation in *tuuhiikan* size and shape overall, implies that labour is not a prohibitive limitation to these large hunting investments. In fact the largest *tuuhiikan* was built in

1962 "us[ing] an axe, no saw"[133] further weakening any notion that *tuuhiikan* creation is significantly influenced by labour saving technology.

Ruling out labour as a major parameter strengthens the argument that *tuuhiikan* creation is tightly guided by intent. The slight pattern linking variation in *tuuhiikan* structure to individual traplines suggests that Cree are catering to local topography and/or local patterns or goose behaviour at the trapline scale. Personal preferences probably also play a role in *tuuhiikan* creation, but more likely as a secondary characteristic to understandings of goose behaviour as Crees always spoke of *tuuhiikan* creation based on observing geese. In summary, *tuuhiikan* are constructed and located based on intimate understandings of goose behaviour, local topography, and ecology with technological changes and personal preferences as more secondary considerations for their creation.

5.4. Dikes, *tuuhiikans*, and land emergence

Both dikes and *tuuhiikans* serve to reduce the uncertainty of harvesting geese as the coastal system changes due to land emergence. "Maintaining the pond makes it so the land does not grow" said one elder. "Cutting trees keeps it the same. If you don't cut them, they will grow back,"[134] he added. "Nothing is destroyed when you cut the *tuuhiikan*, land keeps growing," said a deferent elder tallyman. "The trees don't grow back though, but the land still grows,"[135] he continued. "When you make a dike for a pond," another elder tallyman said, "when you cut off ground from the earth, the earth would turn into mud; it was like it was all starting over again."[136]

Dikes prevent desirable hunting areas from deteriorating into less desirable areas dominated by willow thicket. In so doing, dikes provide a more predictable location where geese can be successfully hunted from season to season. Similarly, *tuuhiikans* allow an established hunting area to stay an attractive place for geese as the coastal forest grows. They prolong the useful lifespan of hunting areas and increase resource predictability when hunting geese (Fig 5.8). However, while dikes and *tuuhiikans* are intended to retard change and prolong the useful lifespan of harvesting areas, there are times when structures are abandoned and new ones constructed.

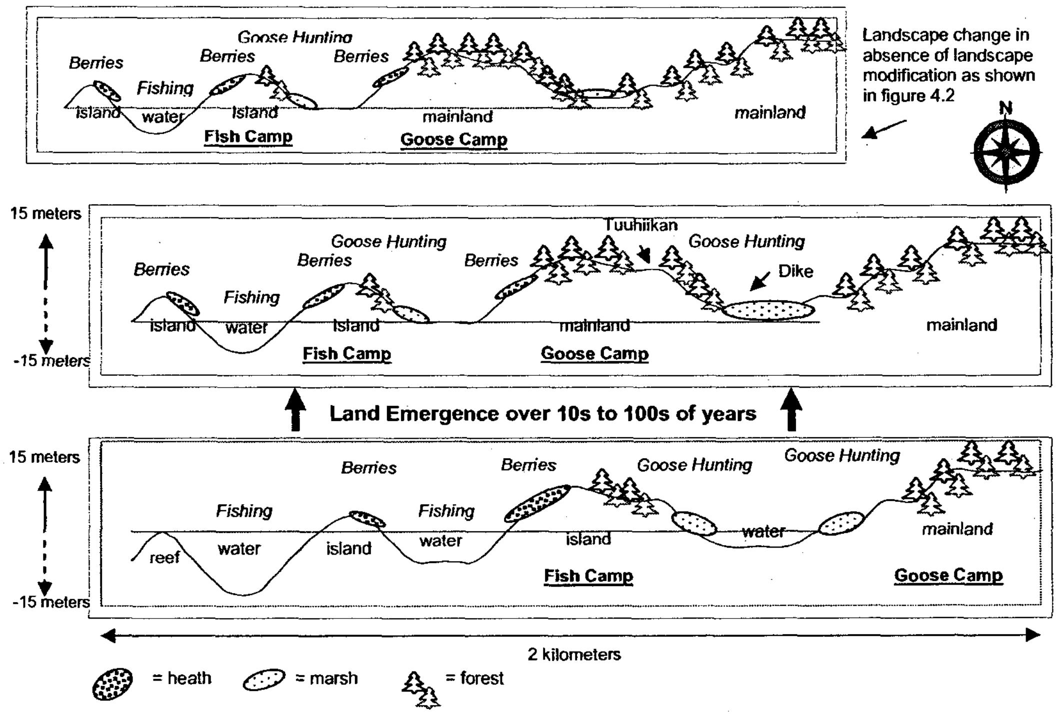

Figure 5.8. Landscape change cartoon showing shifting habitats, camps, and resource-uses following land emergence and maintenance of harvesting areas through dikes and *tuuhiikans*. The lower and middle scenes represent before and after scenarios, respectively following land emergence. Shifting shorelines, habitats, and associated shifts in camp location are indicated between the two scenes. The top scene is a copy of the post land emergence state from figure 4.2. The maintenance of harvesting areas is seen comparing the middle and top scenes.

5.5. Spatial-temporal shifts in dikes and *tuuhiikans*

Figure 5.9 illustrates a series of *tuuhiikans* on the north shore of a shallow bay. The oldest *tuuhiikan*, cut in the 1930s, is situated farthest east. It was last used in the 1980s as hunters noticed geese were flying to the west. Subsequent *tuuhiikans* were cut throughout the 1980s where the geese were seen to be going. Though causality cannot be certain, this chronological shift correlates with the spatial shift westward of the coastal salt marsh due to land emergence. The *tuuhiikan* is attractive to geese but presumably, at some point, shorelines and wetlands change so much that the *tuuhiikan's* attraction is undermined as geese shift their flight paths to more attractive areas. Indeed, when asked why the oldest *tuuhiikan* had been abandoned a senior hunter said it was because they noticed the geese flying to the west. Thus, they cut new *tuuhiikans* there to the west.[137]

Such a spatial shift can again be seen on a second trapline. Here (Fig. 5.10) an old *tuuhiikan* from the 1960s or 1970s was abandoned and new *tuuhiikans* were cut to the west. The marsh complex south of the old *tuuhiikan* is no longer good for hunting[138] due to the rapid rate of coastal change as observed on time series images. Indeed, both figures 5.9 and 5.10 depict very shallow bays with significant river discharge and sedimentation so rapid shoreline movement is not surprising at all.

These *tuuhiikan* patterns illustrate decisions to relocate modification efforts once a critical threshold of change, presumably correlated to the degree of coastal land emergence, is reached. The previously mentioned dike where maintenance is being considered also highlights considerations about shifting modification efforts. Here the consideration is with regard to the largest spatial scale of dike function – goose flight patterns on the coast. As already established this dike dates back many generations, was last maintained in 1992, and has been little used since the late 1990s. One elder trapline user mentioned that he did not think this dike was worth maintaining as the geese had changed their flight paths to the south. He felt it should be recognized that the system had changed in a manner that required relocating landscape modification efforts. The

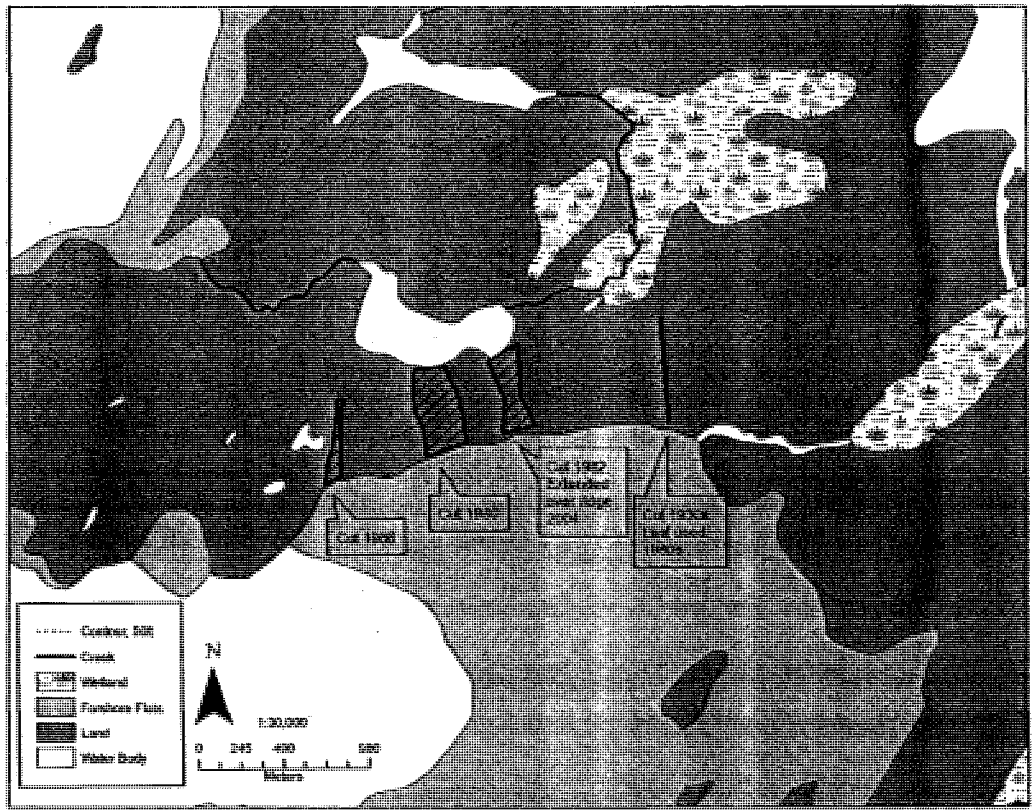

Figure 5.9. Temporal-spatial shifts in *tuuhiikans*. The three *tuuhiikans* cut in the 1980s were delineated from 15 meter panchromatic Landsat imagery. The 2004 expanded *tuuhiikan* was delineated from a hand drawing by a representative senior hunter of the trapline on a 1:15,840 b/w air photo. The *tuuhiikan* cut in the 1930s was sketched by an elder trapline user on a 1:35,000 topographic map. This *tuuhiikan* could not be delineated in grater detail because of poor visibility in remote images.

proposed dike is where they should focus attention he felt.[139] However, the fact that maintenance of the existing dike is being considered illustrates the complexity of management decision making. Decisions such as these are not always straightforward and the tallyman will likely seek the consultation of respected elder trapline users in making a final decision as he did when considering creation of the new dike.

Another elder tallyman on a fourth trapline is also balancing abandoning certain landscape modifications in favour of others. When asked about possible maintenance work on the largest *tuuhiikan* in Wemindji, cut in 1962, the respective elder tallyman

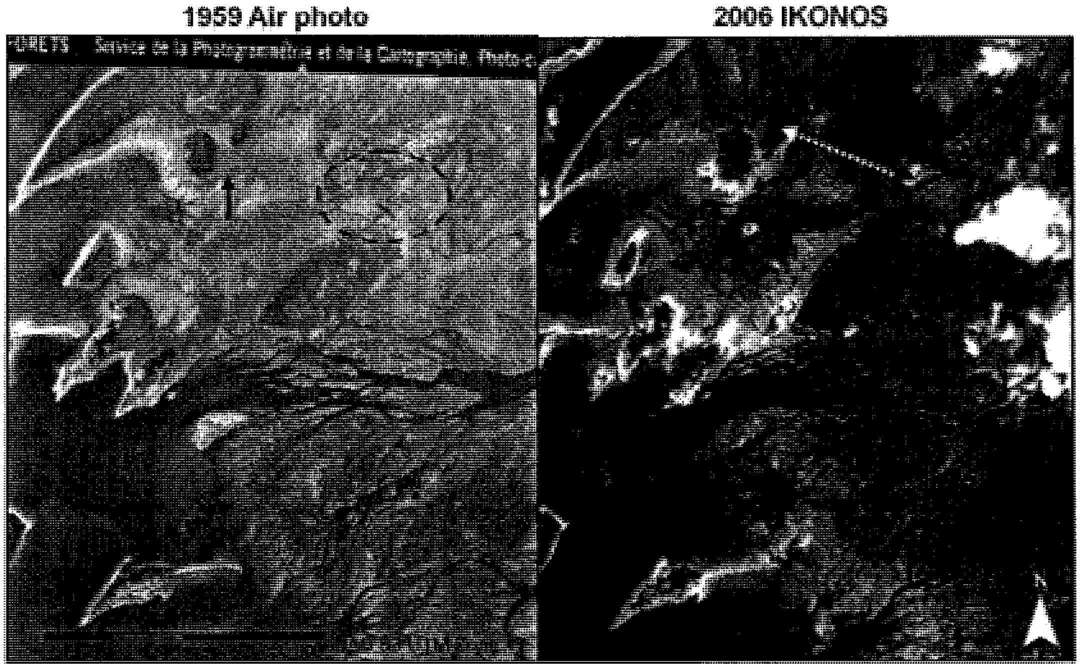

Figure 5.10. Temporal-spatial shifts in *tuuhiikans*. The dashed oval in the 1959 image indicates the location of a *tuuhiikan* cut in the 1960s or 1970s. This area is no longer a good hunting area and four new *tuuhiikans* were cut to the west on the point in the 1980s and are indicated with the dashed arrow in the 2006 image. The rapid rate of shoreline change is visible in these images and can be seen by the significant seaward tree and shrub invasion between what were two small islands indicated with the black arrow. The 1959 air photo was scanned at 6000 dpi and georefrenced to the Ikonos image with a total RMS error of 8.09276m in Arc GIS 9.2.

said, "the only reason I would want to clear them [the *tuuhiikans* in this area of the trapline] again is if there were geese; only if there were geese."[140] Geese would fly through this *tuuhiikan* to an area called *Aanaaschuukaach*, "muddy point." The area was a major hunting location in the 1960s and 1970s. Today the marshes are grown thick with willows and geese fly to *Aanaaschuukaach* much less than they used to.[141] The state of the system has changed so much that this tallyman does not feel it would be worthwhile to continue maintaining *tuuhiikans* in this particular area. He is interested however in experimenting with something new. He, as well as many other elders and tallymen, is interested in tilling certain coastal marshes, removing the dense high marsh vegetation that has developed, and restoring the area to the muddy low marsh that existed when goose numbers were high. They are hoping this will attract geese back to the coast.

5.6. A new experiment – restoration projects

The Wemindji community is starting to experiment with the restoration of marshes – restoration is the term used by the community[142] – on the coast to help manage geese. There are currently two restoration projects being implemented on different traplines. One of these is *Aanaaschuukaach*, "muddy point." "As long as we make the effort to restore the areas, then we will see what happens," said the CTA head who coordinates the projects with the respective tallymen. "Maybe the geese will fly along the coast again like they did in the old days. We'll see what happens; won't know till we do it."[143] Based on this reasoning the projects are being treated as experimental.

The first of these two projects, involving a 40 hectare area, will soon begin. The area is a *minchiichaau*[144] which literally means a "seasonally protected space."[145] Cree hunters exercise great caution not to disturb *minchiichaau* except possibly for one period in the late spring if the season's hunting was poor.[146] If the project is successful in improving goose hunting on the territory the CTA will then move on to the second area, *Aanaaschuukaach*, comprised of 75 hectares and from there to other areas based on project success said the CTA head.[147]

The projects are being approached in two stages. First, cutting back the thick willow growth that has invaded the area; second, bringing in heavy machinery to dig up the dense willow roots to prevent the willows from growing back. The CTA is in the process of establishing if any provincial environmental review processes are required with respect to the second stage.[148]

Ploughing up the marshes is widely talked about and seen as having great potential for maintaining and possibly increasing geese on the coast. Interestingly, even those who said marshes were not dug-up by shovel in the past proposed ploughing as a way to improve goose hunting on the coast.[149] Furthermore using a shovel is seen as unrealistic, due to the energy required. Everyone supported the need for heavy machinery, or in the least, a plough pulled by an ATV.[150]

5.7. Additional recent modification practices – corn and prescribed burnings

Other recent landscape modification practices being implemented along the coast include laying corn and conducting prescribed burnings. Corn has been introduced in recent years by some hunters to attract geese. The objective is to attract lots of geese to an area while letting it rest from hunting pressure. Geese then associate the area as a desirable feeding ground. The hunters try to arrive before geese come to feed. Geese then arrive in small flocks which can be shot in their entirety, avoiding survivors in accordance with proper hutting practices (Scott, 1996). If hunters arrive and a large flock is already feeding hunters will drive them away rather than shoot them. Then the geese will come back over the course of the day in smaller numbers that can be killed again in accordance with proper hunting practice.[151] Interestingly, one senior hunter informed me that hunting with corn is no different from hunting practices before corn use.[152]

Although many informants claim the use of corn is consistent with the fundamentals of Cree hunting, others indicated that corn should not be used because it was not part of their "traditional" ways of hunting.[153] Contrasting views are reflected however in comments like, "I would like to try planting a corn field."[154] Though said in jest, this comment illustrates the active interest some hunters have in experimenting to better manage and harvest geese.

Recently people have also started to burn grasses to attract geese. Burning the dead grass promotes growth of new shoots, which in turn attracts geese. For example, while hunting with Cree in late spring a large area of dune grass (*Elymus* spp.) had been burned to attract long-neck geese.[155] Similarly a tallyman discussed his plans to burn a large area of coastal high marsh near his goose hunting camp in the hope that the new shoots will attract geese.[156] However, as with discussions about historic fire use, many individuals cautioned about the dangers of fires getting out of control and expressed no interest in using fire to attract geese.[157] The contemporary use of fire for goose hunting continues to highlight active interests in experimenting to manage geese, and the diversity of management opinions that exist among hunters and tallymen.

5.8. Discussion

Cree have for long invested considerable time and effort in modifying this landscape to improve resource harvesting opportunities as evidenced by the stone weirs and mud dikes that date back as far as anyone remembers: "before the Hudson Bay Company" and "before the Whiteman." During the more recent past landscape modification investments have continued to be extensive based on the number and size of *tuuhiikans* and dikes on Wemindji territory. The creation and maintenance of camps and trails, although not addressed here, provide further evidence of a landscape invested in and modified. Reflecting critically, there are some historic details that remain cloudy about what was done and how much. Fire seems to have played a minor role, while the historic digging up of marshes with shovels is remembered by only a few. Despite this, the overall patterns that emerges from this study includes a diversity of landscape modifications - stone weirs, dikes, *tuhhiikans*, burnings, corn and restoration projects – which confirm Cree's active and extensive agency on this coastal landscape over time.

The design and purpose of these modifications illustrate the depth of Cree observations and understandings of the system in which they live. This knowledge not only allows Cree to harvest resources from advantageous positions on the landscape, but allows Cree to create and/or maintain these places as well. For example, the *tuuhiikan* involves understanding how geese respond to topography and astute observation of how and were they move about on the land. Dikes are not only guided by an understanding of goose behaviour, but a complex understanding of multiple nested scales of ecological interactions. Furthermore dike placement is seen to draw on consultation with multiple elder trapline users as in the example of the proposed new dike. Thus landscape modifications are not taken at a whim, but are intricately choreographed.

At the Wemindji territory scale Cree are actively modifying the landscape and experimenting with new approaches in response to ongoing changes. At the trapline scale however, there is diversity in people's approaches and practices, a reminder that communities are not homogenous (Agrawal and Gibson, 1999). There is certainly diversity between traplines, a robust pattern as traplines were the analytical unit of this study. However, because multiple informants on each trapline were consulted, diversity within traplines is also revealed. Examples include the initial creation of *tuuhiikans* in the 1980s following the death of a former tallyman followed by disapproval of *tuuhiikans* by the current tallyman. Similarly, multiple opinions were documented on one trapline with respect to whether a particular dike should be maintained or not. Yet this diversity of approach and perspective did not result in chaos or ad hoc management. Although apprehensive expressions about the introduction of some new management approaches, such as the use of corn or prescribed burnings, were not uncommon, the dominant trend is a community of hunters and tallymen actively experimenting with new methods of landscape modification. Diverse ideas probably lead to innovation on the one hand and protection of tradition on the other.

The CTA head described the tallyman as sharing ideas, teaching, and learning from one another.[158] Imagine when people first started using *tuuhiikans*. Did *tuuhiikans* start out experimentally on one or two traplines for example, and then spread as people recognized the *tuuhiikan's* advantage in hunting? Were early *tuuhiikans* met with scepticism as one elder tallyman expressed? "No, others did that. People wanted to act like they own the land." Historic discussions by informants around fire certainly were framed as experimentation and this practice is emerging again on the coast. Diversity in landscape modification practices at various scales probably aids in developing new responses to environmental change while being conservative enough to promote wise assimilation given cultural and community desires.

The restoration projects represent an interesting development. Notwithstanding the fact that some informants were unaware of past marsh digging practices, or said they were not practiced, the use of machinery to dig up and overturn marshes parallels overturning marshes with shovels that some informants described. The desire to use heavy machinery and respect for working within the current and established political framework by pursuing the proper environmental permits is powerful. The future is being informed by past practices, present technologies, and socio-political frameworks. Corn use is also an example of a new practice draped over an old one. An advantageous tool, corn, has been catered to traditional hunting approaches. Thus what might be perceived as novel practices are often deeply rooted – consistent and compatible with past practices, but also availing of contemporary opportunities and advantages. This particular phenomenon provides an interesting framing of the idea of learning and consistency in resilient systems (Folke, 2006; Holling, 2001).

My analysis of Cree modifications reveals that increasing resource predictability is the primary goal. The creation of pools or deflectors to funnel fish into natural areas for harvesting is aimed at the creation of predictable locations. Likewise burning grasses creates predictable goose hunting locations by promoting grass shoot growth. Tilling marshes exposes roots and rhizomes, in a sense mimicking goose foraging pressure known to suppress unpalatable salt marsh community development, in turn creating attractive areas for geese and thus more predictable hunting places. The construction of dikes retain or create ponds and wetlands that would otherwise drain as the land uplifts and through ecological relationships at multiple scales results in maintaining desirable hunting locations for seasons, years, and generations. *Tuuhiikans* are also directed to the maintenance of preferred hunting areas over time as trees develop on the maturing landscape and the creation of more predictable locations to hunt. Recent burning practices, corn use, and restoration efforts also hinge around enhancing the attraction of specific areas for geese. These practices are clearly adaptive to living in a dynamic environment. By increasing the predictability by which resources are harvested, an important food source is secured, an important cultural activity is facilitated, and life on the land is enhanced. Yet stepping back from the individual modification site to look at the larger picture reveals an extremely important resource harvesting relationship on the coast.

Cree landscape modification practices illustrate a dynamic between investing in place and opposing environmental change and remaining flexible, willing to move, and to experiment in accordance with environmental change. Cree are clearly dedicated to preserving advantageous hunting locations in opposition to changes driven by coastal uplift in the case of dikes and *tuuhiikans*. There is security in the known – security to procure important subsistence resources and participate in important cultural activities from year to year and generation to generation – and insecurity in the unknown. Of course Cree are not obtuse and clearly recognize where oppositions to change return little benefit. Cree then relocate landscape modification efforts, or experiment with new techniques sometimes leading to different landscape modifications. These dynamics are probably complementary, on the one hand opposing predictable change and variability normal to the system like shoreline movement, subsequent habitat shifts, and uncertainty in goose behaviour and on the other hand remaining attuned to larger changes and experimenting to adapt. There is a balancing act between being reactive to change and actively shaping the coast. This balancing act is an essential aspect of being adapted and securing a future – a place to carry out important economic and cultural activities – in a changing environment.

Cree's landscape modifications for resource harvesting, along with associated harvesting practices, are adaptive, hinged around enhancing aspects of existing ecological relationships to increase resource predictability. This confirms that Cree are not passive in the face of environmental change. There is security in the familiar. People try to maintain known harvesting areas, but still recognize that at some thresholds of environmental change new harvesting places or strategies must be sought. Culturally contextualized however, Cree landscape modifications, in all their consistencies and changes at various scales, are about actively securing the opportunity to pursue important economic and cultural resources for the next year and for the next generation.

Chapter 6: Conclusion

> *"After the flood [...] [t]he creator gave Wesakachak the power, not to create, but to remake the world if only Wesakachak could bring up some earth from underneath the flood waters. Wesakachak, in desperation, turned to the muskrat. Small as he was, the muskrat had a strong heart and he tried very hard. [...] On the third attempt, he dove so deep that he almost drowned. But when he came up, against his breast in his forepaws, he held a piece of the old earth ..."*
>
> (A Moosfactory Cree myth about earth's origins (Berkes, 1999;7). Emphasis is mine).

The old earth is indeed emerging from the waters of James Bay and is one of many changes occurring to the Wemindji coastal environment. At the same time Cree are 'remaking the land': *tapaiitum* – he matches it to his thinking. Cree's active agency in response to the dynamics of ecology and culture in shaping the Wemindji landscape shed light on human-environment relations at the local scale and contribute to wider societal understandings and applications. Through narrative and measure I investigated the ways Wemindji Cree modify their landscape for "bush" resource harvesting, the functioning of these modifications and associated harvesting strategies, and their significance in the human-environment system. While more detailed information is available for the present and recent past, this study extends back some few hundred years. Human-environment relations are explored through two aspects of 'bush' life: camp location decision-making (chapter four) and patterns and processes of creating, maintaining, or enhancing resource harvesting areas (chapter five). Chapters four and five provide irrefutable evidence of human agency on this landscape. Wemindji is not an empty wilderness; rather the land is intimately known, used, and physically modified by Cree.

Tapaiitum – "the land and [tallyman getting] to know one another in a dynamic learning process [leading towards] matching the land to his thinking" (Forrest, 2006:43) – provides an interesting concept for understanding human-environment dynamics in Wemindji. My analysis of Cree landscape modification, which includes camps and modifications for maintenance and/or creation of harvesting areas, exemplifies highly dynamic management approaches which draw on keen observations and interpretations of the surrounding environment. In responding to change, Cree wish to continue and strengthen established management practices and processes. At the same time Cree are remaining open to technologies and opportunities increasingly available to their community as members of a contemporary global society. My research findings, as well the broader aspirations of the Wemindji community with respect to local development and environmental protection (Scott 2004), reflect this dual imperative.

According to Nadasdy (2007), contemporary management paradigms support the view that system-state desirability is user specific. As such, if Cree rights to self-determination are to be respected, local development opportunities and environmental protection frameworks must be framed around local community perspectives and priorities. The Wemindji coast is the product of human agency; thus, discussions about environmental protection must embrace this environment as a landscape intimately known, used, and shaped by Cree. However, conservationists who cling to outmoded myths of pristine wilderness untouched by humans can take solace in the fact that Cree's guiding ethos of respect for the land and sustainable resource-use, framed as taking care of the land so that future generations can hunt, trap, and fish, underpin Wemindji's stewardship of its proposed protected areas (Scott, 2004).

Cree's intimate knowledge of their landscape supports their aspirations for political frameworks that recognize, respect, and strengthen their traditional management practices – namely a culturally appropriate protected area. Who better to manage this land than those who know it best? However, this local management is vulnerable to social changes that reduce access to the land or limit the transmission of knowledge across generations. As this thesis illustrate however, Cree are continually reconfiguring elements of how they access the land, adopting skidoos, ATVs, motorboats, and helicopters and looking to built slipways and roads to continue knowing and using the land in accordance with traditional management in a modern world.

The Wemindji case illustrates that environmental change and people's response to change is often complex and multifaceted. This recognition is a significant contribution to the understanding of northern aboriginal communities' responses to environmental change. In the context of bush camps for example, by responding to one aspect of environmental change Cree at times opt to cope with a less opportune situation regarding another aspect of environmental change. Additionally, camp location decision-making must account for bio-physical gradients, but also accommodate important societal and cultural decision-making components. Flexibility in camp movement has clearly been adaptive to a changing environment. In recent decades though, Cree have been, or in some cases are considering, adopting technologies and investing in infrastructure to avoid moving camp, resulting in new relationships between environmental change and camp location. Decisions to move camp less and invest in transportation technology are likely mutually informed by and drive one another.

Cree values weigh heavily in decision-making processes and influence their responses to environmental change. Because environmental change does not constitute a unified driver, but is formed by many elements that individuals or groups of individuals respond to selectively, how and what these actors choose to respond to is contingent upon values and interests. Consideration of these dynamics can help in understanding if and why some environmental changes will be accepted and embraced while other changes are met with significant resistance.

Financial subsidies and cash settlements from hydroelectric development that Cree receive as individuals and as a community are an additional factor playing an important role in the Wemindji system. These financial compensations make options such as constructing a road or purchasing motorboats more available. Whether Cree would invest in efforts to bypass certain environmental changes if they did not have this cash income as part of their livelihood portfolio is important when seeking the transferability of lessons learned in Wemindji. How these factors weigh in is also relevant. For example, does nostalgia for a certain place play a greater role in camp decision-making now that people have the financial means to consider options other than moving?

Cree adaptation to environmental change is characterised by an increasing reliance on technological investments and is part of larger societal changes occurring over the past half century in James Bay. Such shifts are seen in camp location decision-making and in restoration projects. While these investments result in certain changes in practice, from a Cree perspective these changes maintain and perpetuate important cultural and social relationships by facilitating Cree presence on the land. 'Being on the land' is essential to cultural continuity and the transmission of knowledge and practice. Thus, Crees view accommodations which facilitate presence on the land as fundamental rather than compromising. Framed as such, the dynamics between maintenance of tradition and embracing modernity illustrate a resilient system following Wenzel's (1991) work, but possibly one that is becoming, or has become, dependent on capital investment.

The political implication of this shift in social-ecological resilience from dependence on human capital to dependence on financial capital is that Wemindji, as a community, will have to ensure continued injections of capital investment to perpetuate the system. Adaptation requiring financial investment is a pattern throughout the north (Ford *et al.* 2006, 2008; Wenzel, 1991, 1994) and thus lessons from Wemindji are instructive. Given the unsustainable land and resource-uses that dominate Euro-North American cash economies, the impact of continued cash dependencies on northern societies is a concern.

My findings support that Cree resource management has been first and foremost guided by an understanding of local ecology and that Cree core values, contextual to Scott's (1996) and Wenzel's (1991) examples, surrounding people and environment have been perpetuated. This maintenance of tradition has occurred alongside assimilation of many modern technologies and increasing involvement in the wage economy. Such continuity supports that continued economic dependency will neither fundamentally change Cree values nor erase the ecological understandings that support Cree relations with the land. Extreme caution must be taken with this conclusion however. The primary focus of my research was Cree response to environmental change. Because I took a social-ecological systems approach technology and culture played an important role in my conceptualization of the system, however this thesis does not represent a comprehensive analysis of social change in Wemindji. Additionally, social changes, such as increasing involvement in cash economies, are occurring within shorter timescales than many of the ecological changes I have examined. The impact of these changes may not have fully come to light, or if rates of future social change increase their effects may be different from those I have explored.

What my research does comprehensively reveal is a landscape that is not only known and used by Crees but invested-in and modified by them. Cree have long been, and continue to be, active agents of landscape change on the coast. The design and purpose of their landscape modifications reflects an in-depth knowledge of the coastal system: knowledge solidly based on observations and interpretations of the dynamics between animal behaviour, landscape topography, and landscape change. Overall Wemindji is a community of hunters actively modifying the coast to manage resources and experimenting with new practices as they understand and respond to new changes. The diversity in Cree management approaches and practices at the trapline scale further strengthens local institutions of resource management by accommodating innovation and experimentation while also remaining conservative enough to promote wise assimilation at the community level. At times Cree are availing of contemporary opportunities and advantages, but these are woven and often reintegrated with traditional practices. Cree landscape modifications for resource harvesting and their associated practices are intended to increase resource predictability. These modifications are clearly adaptive in a dynamic and changing environment. However, successful resource management is more nuanced than simply creating, maintaining, or enhancing specific resource harvesting areas. Cree are harmonizing investments in and commitments to place – by resisting, opposing, or delaying environmental change – with their ability to remain flexible, willing to move and to experiment in accordance with change. This dual response is complementary, opposing predictable change and variability normal to the system, such as shoreline movement, subsequent habitat shifts, and uncertainty in goose behaviour, while remaining attuned and open to experimentation with respect to larger or novel changes expressed through thresholds of shoreline movement over longer time periods that overwhelm the effectiveness of dikes or *tuuhiikans*, or major changes, such as Canada goose migration patterns. These responses also illustrate coping with and/or adapting to changes at various temporal scales and provide another indication of the resilience of Cree's local management approach.

The interaction between camps and resource harvesting areas also illustrates the interplay between investment in place and openness to relocating as responses to environmental changes. The landscape is changing and relocation is part of an overall adaptation strategy – a way of living in a changing landscape (chapter four). Simultaneously, Cree are maintaining and enhancing prime harvesting areas (chapter five). Thus, harmonizing relationships between camp location, maintenance, or relocation and landscape modifications for resource harvesting add yet another dimension to complex decision-making in this dynamic social-ecological system (Fig. 6.1). While my research has addressed the relationships between camp location decision-making and investment in resource harvesting areas though landscape modification, the extent to which these factors influence each other should be the subject of future work.

Striking the balance between resisting change and being flexible in response to change is at the core of a resilient system. This lesson should inform human-environment relations in mainstream society. The design of sustainable and resilient management systems based on these complementary yet opposing strategies raises challenging

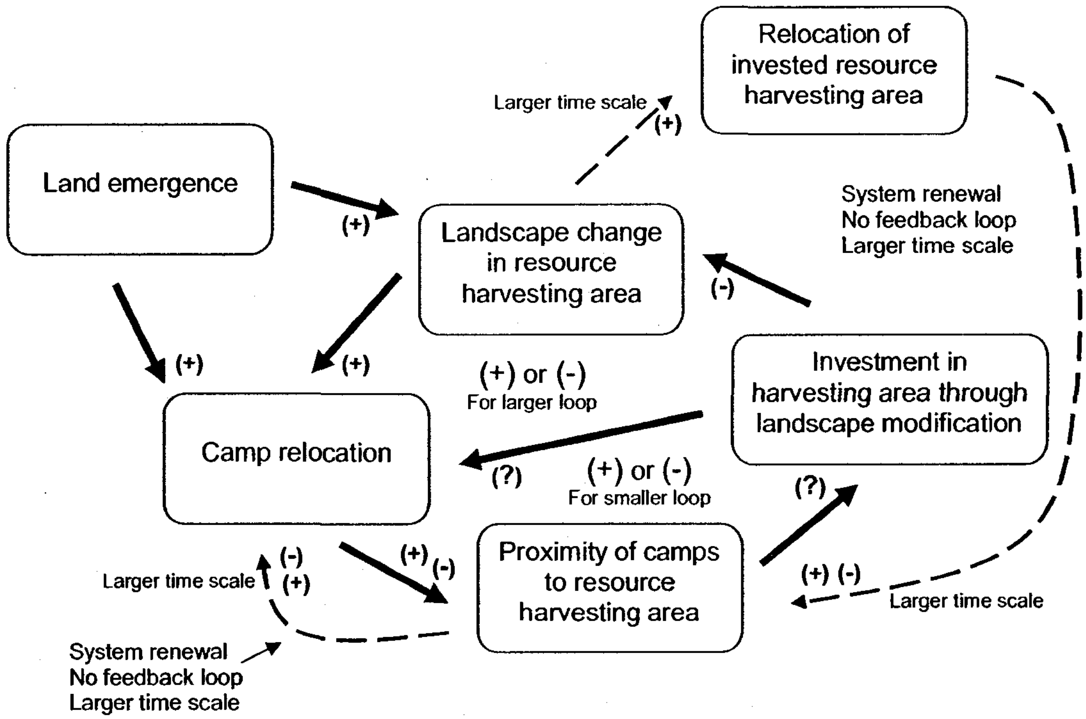

Figure 6.1. Feedback diagram depicting interactions between camp location decision-making and landscape modification for resource harvesting. Solid arrows and dashed arrows represent two different temporal scales with the latter being larger. Dashed arrows and solid arrows do not create closed feedback loops because of their different scales. Rather the dashed arrows indicate that at some level of landscape change, as discussed in chapter five, resource harvesting areas that have been invested in through landscape modification are relocated. This relocation would renew the process of landscape change as produced though land emergence in the harvesting area. Question marks next to arrows indicate unknown relationships between the two parameters and are grounds for future research. Plus signs indicate a positive relationship, or a direct relationship of increase or decrease between one parameter and the parameters it influences. Negative signs indicate a negative relationship, or an opposite relationship of increase or decrease between one parameter and the parameters it influences. Where both positive and negative signs are presented the interactions are cases specific as discussed in chapters four and five.

questions however. Can the balancing point between opposing change and remaining flexible be identified and then maintained? How much can the balance fluctuate without becoming unstable? Is there only one balancing point; and if so, how do we know when it changes? All these questions are difficult to answer. However, perhaps simply entering any management framework with questions about balancing investment and relocation, or action and reaction, may lead to case-specific insights important for the management issue at hand.

The question then becomes, *what ought to be the relationship of humans to the earth*? Culturally contextualized Wemindji Cree's landscape modification is an active endeavour to secure opportunities to pursue important economic and cultural resources. While some human-environment relations change it is the larger human-human-environment relationship that is important and facilitated: the opportunity to hunt, the opportunity to give gifts of bush food, and the opportunity to learn from one's elders for the next year and for the next generation.

South of Wemindji, in Euro-North American society, we need to seriously rethink our relationship with the earth. We are not striking the balance between opposing environmental change and remaining flexible. We fight rivers. We armour coasts. We divert water and manufacture climates. We remake the entirety of what surrounds us. We are increasingly producing a world that cannot support healthy people and healthy communities. Instead, as we remake the world, we need to allow the land to influence our thinking more; *tapaiitum* embodies this way of living. Changing our perceptions of how we see the world around us is probably the hardest task related to issues of global, regional, and local environmental change. Therefore we need to change our perceptions and actions. If we fail to take up this challenge what will be left for the next year? What will be left for the next generation?

Literature Cited

Abraham, K.F., R.L. Jefferies, and R.T. Alisaukas. 2005. The dynamics of landscape change and snow geese in mid-continent North America. *Global Change Biology*. 11:841-855.

Adger, W.N. 2006. Vulnerability. *Global Environmental Change*. 16:268-281.

Agrawal, A., and C. Gibson. 1999. Enchantment and disenchantment: the role of communities in natural resource conservation. *World Development*. 27(4):629-649.

Andrews, J.T. 1970. Present and postglacial rates of uplift for glaciated northern and eastern North America derived from postglacial uplift curves. *Canadian Journal of Earth Sciences*. 7(1):703-715.

Armitage, D., F. Berkes and N. Doublday (eds.). 2007. *Adaptive Co-Management: Collaboration, Learning and Multi-level Governance*. Vancouver: UBC Press.

Bates, P. 2007. Inuit and Scientific Philosophies about Planning, Prediction, and Uncertainty. *Arctic Anthropology*. 44(2):87-100.

Battista, J.R. 1977. The holistic paradigm and general systems theory. *General Systems*. 22:65-71.

Begin, Y., D. Berube, and M. Gregoire. 1993. Downward Migration of Coastal Conifers as a Response to Recent Land Emergence in Eastern Hudson-Bay, Quebec. *Quaternary Research* 40(1):81-88.

Bell, R. 1897. Recent explorations to the south of Hudson Bay. *The Geographical Journal*. 10(1):1-17.

Benessaiah, K., A. Bennett, S. Boyce, E. Crawford, V. Demers, M. Forrest, E. Lagace, C. Lemoine, C. Peloquin, J. Sayles, S. Schiff, and K. Scott. 2003. *AA-Wiichaautuwiihkw: creating a culturally appropriate watershed and marine coastal protected area in Paakumshumwaau (Old Factory) Wemindji, James Bay, Quebec*. Undergraduate Thesis. McGill School of Environment, McGill University. Canada.

Berkes, F. 1986. Common property resources and hunting territories. *Anthropologica*. 28(1-2):145-163.

Berkes, F. 1988. The intrinsic difficulty of predicting impacts: lessons from the James Bay hydro project. *Environmental Impact Assessment Review*. 8:201-220.

Berkes, F. 1999. Sacred Ecology: Traditional Ecological Knowledge and Resource Management. Philadelphia: Tyler and Francis.

Berkes, F. and C. Folke (eds.). 1998a. *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience.* Cambridge: Cambridge University Press.

Berkes, F. and D. Jolly 2002. Adapting to climate change: Social-ecological resilience in a Canadian Western Arctic community. Conservation Ecology 5(2):18. [online] URL: http://www.ecologyandsociety.org/vol5/iss2/art18/

Berkes, F. and I. J. Davidson-Hunt. 2006. Biodiversity, traditional management systems, and cultural landscapes: examples from the boreal forest of Canada. *International Social Science Journal.* 58(1):35-47.

Berkes, F. R. Huebert, H. Fast, M. Manseau, and A. Diduck (eds.). 2005. *Breaking Ice: Renewable Resource Management in the Canadian North.* Calgary: University of Calgary Press.

Berkes, F., and C. Folk. 1998b. Linking social and ecological systems for resilience and sustainability. In: F. Berkes and C. Folke (eds.), *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience.* Cambridge: Cambridge University Press. Pp. 1-29.

Berkes, F., J. Colding and C. Folke (eds). 2003a. *Navigating Social-Ecological Systems: Building Resiliance for Complexity and Change.* Cambridge: Cambridge University Press.

Berkes, F., J. Colding and C. Folke. 2003b. Introduction. In: F. Berkes, J. Colding and C. Folke (eds.), *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change.* Cambridge: Cambridge University Press. Pp.1-29.

Bernard, R.H. 2006. *Research Methods in Anthropology: Qualitative and Quantitative Approaches.* 4th Ed. Lanham, MD: AltaMira Press.

Berryman, N., J. Burt, J. Fortier, E. Lotter, B. Mackay, C. Paquin, A. Quock, M. Stock, C. Wellen. 2004. *Creating a culturally appropriate protected area in Paakumshumwaau (Old Factory), James Bay, Quebec.* Undergraduate Thesis. McGill School of Environment, McGill University. Canada.

Birks, H., H.J.B. Birks, P.E. Kaland, and D. Moe (eds). 1988. *The Cultural Landscape; Past, Present and Future.* Cambridge: Cambridge University Press.

Bishop, C.A., and T. Morantz. 1986. Preface. *Anthropologica.* 28(1-2):7-9.

Brody. H. 2000. *The Other Side of Eden: Hunters, Farmers and the Shaping of the World.* Vancouver: Douglas and McIntyre.

Bussiéres, V. 2005. *Towards a culturally-appropriate locally-managed protected area for the James Bay Cree of Wemindji, Northern Quebec.* Masters thesis. Department of Geography, Planning and Environment. Concordia University. Montreal, Quebec, Canada.

Butlin R.A., and N. Roberts (eds). 1995. *Ecological Relations in Historical Times: Human Impact and Adaptation.* Cambridge: Blackwell.

Butzer, K.W. 1989. Cultural ecology. In: G.Gaile and C. Willmott (eds.), *Geography in America.* Columbus: Merrill Publishing C. Pp. 192-208.

Callicott, J.B. 1991. The wilderness idea revisited: the sustainable development alternative. *The Environmental Professional.* 13:235-247.

Callicott, J.B. 1994. A critique of and alternative to the wilderness idea. *Wild Earth.* 4(4):54-59.

Callicott, J.B., and M.P. Nelson (eds). 1998. *The Great New Wilderness Debate.* Athens: University of Georgia Press.

Chapin III, F.S., G. Peterson, F. Berkes, T.V. Callaghan, P. Angelstam, M. Apps, C. Beler, Y. Bergeron, A.-S. Crepin, K. Danell, T. Elmqvist, C. Folke, B. Forbes, N. Fresco, G. Juday, A. Shvidenko, and G. Whiteman. 2004. Resilience and vulnerability of northern regions to social and environmental change. *Ambio.* 33(6):344-349.

Colding, J., T. Elqvist and P. Olsson. 2003. Living with disturbance: building resilience in social-ecological systems. In: F. Berkes, J. Colding and C. Folke (eds.), *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change.* Cambridge: Cambridge University Press. Pp. 163-185.

CRA (Cree Regional Authority). 2005. *Workshop on migratory birds data collection in Eeyou Istchee: Sharing Knowledge.* Proceedings of workshop held in Wemindji. February 8-9 2005.

Cree Nation of Wemindji. 2006. Wemindji Community Profile. Accessed 01 August 2008 on line at: http://www.wemindji-nation.qc.ca/CommunityProfile2006v4.pdf.

Cree Nation of Wemindji. 2008. Cree Nation of Wemindji Home Page. Accessed 01 August 2008 online at: http://www.wemindji-nation.qc.ca/.

Cronon, W. 1983. *Changes in the Land; Indians, Colonists, and the Ecology of New England.* New York: Hill and Wang.

Cronon, W. 1995. The Trouble with Wilderness; or, Getting Back to the Wrong Nature. In: W. Cronon (ed), *Uncommon Ground: Toward Reinventing Nature.* W.W. New York: Norton and Company. Pp. 69-90.

Cruikshank, J. 2005. *Do Glaciers Listen? Local Knowledge, Colonial Encounters, and Social Imagination.* Vancouver: UBC Press.

CurranW.T., and H.A. Calkins. 1917. *In Canada's Wonderful Northland.* New York: G.P. Putnam and sons.

CWS. 2005. Canadian Wildlife Service Waterfowl Committee. *Population Status of Migratory Game Birds in Canada (and Regulation Proposals for Overabundant Species): November 2005.* CWS Migr. Birds Regul. Rep. No. 16.

Davidson-Hunt, I. 2003. *Journeys, Plants and Dreams: Adaptive Learning and Social-Ecological Resilience.* Doctoral Dissertation. Natural Resource Institute, The University of Manitoba. Winnipeg, Manitoba, Canada.

Davidson-Hunt, I. and F. Berkes. 2003. Nature and Society through the lens of resilience: towards a human-in-ecosystem perspective. In: F. Berkes, J. Colding and C. Folke (eds.), *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change.* Cambridge: Cambridge University Press. Pp. 53-82.

Davis, A., and J.R. Wagner. 2003. Who knows? On the importance of identifying "experts" when researching local ecological knowledge. *Human Ecology.* 31(3):463-489.

Davis, R., J. Whalen and B. Neis. 2006. From orders to borders: towards a sustainable co-managed lobster fishery in Bonavista Bay, Newfoundland. *Human Ecology.* 34:851-867.

Denevan, W. 1983. Adaptation, variation and cultural geography. *The professional Geographer.* 35(4):399-406.

Denevan, W. 1992. The pristine myth: the landscape of the Americas in 1492. *Annals of the Association of American Geographers.* 82:369-385.

Denton, D. 2001. *A Visit in Time: Ancient Places, Archaeology and Stories from the Elders of Wemindji.* Nemaska, Québec: Cree Regional Authority.

Desbiens, C. 2004. Producing north and south: a political geography of hydro development in Quebec. *The Canadian Geographer.* 48(2):101-118.

Dignard, N., R. Lalumière, A. Reed, M. and Julien. 1991. *Habitats of the northeast coast of James Bay*. Occasional Paper No. 70. Ottawa, Ont.: Canadian Wildlife Services.

Dionne, W.H. 1980. An outline of the eastern James Bay coastal environments. In S.B. McCann (ed), *The Coastlines of Canada*. Geological Survey of Canada. Paper 80-10: 311-388.

Doolittle, W.E. 2000. *Cultivated Landscapes of Native North America*. New York: Oxford University Press.

Dowsley, M and G. Wenzel. 2008. "The time of the most polar bears": a co-management conflict in Nunavut. *Arctic*. 61(2):177-189.

Duerden, F. 2004. Translating climate change impacts at the community level. *Arctic*. 57(2):204-212.

Egan, D., and E.A. Howell. 2005. (eds.). *The Historical Ecology Handbook: A Restorationist's Guide to Reference Ecosystems*. Washington: Island Press.

Ellen, R. 1982. *Environment, Subsistence and Systems: the Ecology of Small-scale Social Formations*. Cambridge: Cambridge University Press.

Ellen, R. 1988. Persistence and change in the relationship between anthropology and human geography. *Progress in Human Geography*. 12(2):229-262.

Ellis, S. C. 2004. Meaningful Consideration? A Review of Traditional Knowledge in Environmental Decision Making. *Arctic*. 58(1):66-77.

Feit, H. 2007. Myths of the ecological whitemen: histories, science, and rights in North American-Native American relations. *Native Americans and the Environment: Perspectives on the Ecological Indian*. M.E. Harkin and D.R. Lewis (eds.), Nebraska: University of Nebraska Press.. Pp. 52-94.

Feit, H.A. 1987. Waswanipi Cree management of land and wildlife: Cree ethno-ecology revisited. In: B.A. Cox (ed.), *Native people, native lands: Canadian Indians, Inuit and Metis*. Ottawa: Carleton University Press. Pp. 75-91.

Fienup-Riorden, A. 1999. *Yaqulget quailun pilartat* (what the birds do): Yup'ik Eskimo understanding of geese and those who study them. *Arctic*. 52(1):1-22.

Flannery, R. 1995. Ellen Smallboy: Glimpses of a Cree Woman's Life. Montreal: McGill-Queens University Press.

Folke, C. 2006. Resilience: the emergence of a perspective for social-ecological systems. *Global Climate Chang*. 16:253-267.

Ford, J.D., B. Smit, J. Wandel, and J. MacDonald. 2006. Vulnerability to climate change in Igloolik, Nunavut: what we can learn from the past and present. *Polar Record.* 42(221):127-138.

Ford, J.D., B. Smit, J. Wandel, M. Allurut, K. Shappa, H. Ittusariuats, and K. Qrunnuts. 2008. Climate change in the Arctic: current and future vulnerability in two Inuit communities in Canada. *The Geographic Journal.* 174(1):45-62.

Forrest, M. 2006. *Stewardship as partnership: a comparative study of positive human-environment relationships in East Cree and suburban Montreal communities.* Master's thesis. Department of Geography. McGill University. Montreal, Quebec, Canada.

Frances, D., and T. Morantz. 1983. *Partners in Fur: A History of the Fur Trade in Eastern James Bay 1600-1870.* Montreal: McGill Queens University Press.

Gallopin, G.C. 2006. Linkages between vulnerability, resilience, and adaptive capacity. *Global Environmental Change.* 16:293-303.

Gantcheff, G., R.J. McGormack, and A. Coulture. 1982. Environmental Studies: James Bay Territory: 1970-1977 Summery Report. Presented by the Agreement Coordinating Committee. Part VII.

Godin, G. 1974. The tides in Eastern and Western James Bay. *Arctic.* 27:104-110.

Gomez-Pompa, A. and A. Kauss. 1992. Taming the wilderness Myth. *BioScience.* 42(2):271-279.

Handa, I.T., R. Harmsen and R.L. Jefferies. 2002. Patterns of vegetation change and the recovery potential of degraded areas in coastal marsh systems of the Hudson Bay Lowlands. *Journal of Ecology.* 90:86-99.

Hardy, L. 1982. Le Wisconsinien Supérieur à l'est de la Baie James (Québec). *Le Naturaliste Canadien.* 109:333-351.

Harkin, M.E., and D.R. Lewis (eds.). 2007. *Native Americans and the Environment: Perspectives on the Ecological Indian.* Nebraska: University of Nebraska Press.

Hass, G. 2002. *The Canada Goose: Branta Canadensis Atlantic Flyway Resident Population.* Hadley, Massachusetts: United States Fish and Wildlife Service, Migratory Birds.

Hayeur, G. 2001. *Summary of Knowledge Acquired in Northern Environments from 1970 to 2000.* Montreal: Hydro Quebec.

Hik, D.S., R.L. Jefferies and A.R.E. Sinclair. 1992. Foraging by geese, isostatic uplift and asymmetry in the development of salt-marsh plant communities. *The Journal of Ecology*. 80(3):395-406.

Hillaire-Marcel, C. 1980. Multiple component postglacial emergence, eastern Hudson Bay, Canada. In: N.A. Morner (ed.), *Earth Rheology, Isostasy and Eustasy.* Toronto: John Wiley and Sons. Pp. 215-230.

Holling, C.S. 2001. Understanding the complexity of economic, ecological and social systems. *Ecosystems*. 4(5):390-405.

Hydro-Quebec. 2004. Eastmain-1-A powerhouse and Rupert Diversion: Environmental Impact Statement. Montreal: Hydro-Québec Production.

IPCC. 2007. *Climate change 2007 synthesis report: an assessment of the Intergovernmental Panel on Climate Change*. Valencia, Spain: Intergovernmental Panel on Climate Change.

Jolly, D., F. Berkes, J. Castleden, T. Nichols and The Community of Sachs Harbour. 2002. We can't predict the weather like we used to Inuvialuit observations of cliate change, Sachs Harbour. In: I. Krubnik and D. Jolly (eds.), *The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change.* Fairbanks, Alaska: Arctic Research Consortium of the United States. Pp. 92-125.

Kates, R.W., B.L. Turner II, and W.C. Clark. 1990. The Great Transformation. In: B.L Turner II, W.C. Clark, R.W. Kates, J.F. Richards, J.T. Mathews, and W.B. Meyer (eds.), *The Earth as Transformed by Human Action: Global and Regional Changes in the Biosphere over the past 300 years*. Cambridge: Cambridge University Press. Pp. 1-17.

Kemp, W. 1971. The flow of energy in a hunting society. *Scientific American.* 224(3):104-115.

Kretch, S. 1999. *The Ecological Indian: Myth and History.* W.W. Norton & Company. New York.

Kretch, S. 2007. Afterward. In: Harkin, M.E., and D.R. Lewis (eds.), *Native Americans and the Environment: Perspectives on the Ecological Indian.* Nebraska: University of Nebraska Press. Pp. 341-353.

Krubnik, I., and D. Jolly (eds). 2002. *The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change*. Fairbanks, Alaska: Arctic Research Consortium of the United States.

Kump, L.R., J.F. Kasting, and R.G. Crane. 1999. *The Earth System.* New Jersey: Prentice Hall.

Laidler, G.J. 2006. Inuit and scientific perspectives on the relationship between see ice and climate change: the ideal complement? *Climate change.* 78:407-444.

Laidler, G.J., and P. Elee. 2007. Human geographies of sea ice: freeze/thaw processes around Cape Dorset, Nunavut, Canada. *Polar Record.* 44(228):51-76.

Lajeunesse, P. and M. Allard. 2003. Late Quaternary Deglaciation, Glaciomarine Sedimentation and Glacioisostatic Recovery in the Rivière Nastapoka Area, Eastern Hudson Bay, Northern Québec. *Géographie Physique et Quaternaire* 57(1):65-83.

Liverman, D.M. 1999. Geography and the global environment. *Annals of the Association of American Geographers.* 89(1):107-120.

Loo, T. 2006. *States of Nature: Conserving Canada's Wildlife in the Twentieth Century.* Vancouver: UBC Press.

Low, A.P. 1896. Report on explorations in the Labrador Peninsula along the East Main, Koksoak, Hamilton, Manicuagan and portions of other rivers in 1892-93-94-95. Ottawa: S. E. Dawson.

M.A. 2005. *Ecosystems and Human Well-being: Synthesis.* Millennium Ecosystem Assessment. Washington, DC: Island Press.

Manning, T.H. 1951. Remarks on the tidal and driftwood strand lines along the east coast of James Bay. *Arctic.* 4:122-130.

Martini, I. P. 1986. Coastal features of Canadian inland seas. In: I.P. Martini (ed.), *Canadian Inland Seas.* New York: Elsevier. Pp. 117-142.

McCay, B.J. 1978. Systems ecology, people ecology and the anthropology of fishing communities. *Human Ecology.* 6(4):397-422.

McCay, B.J. 2008. An intellectual history of ecological anthropology. In: B.B. Walters, B.J. McCay, P. West, and S. Lees (eds.), *Against the Grain: The Vayda Tradition in Human Ecology and Ecological Anthropology.* Maryland: AltaMira Press. Pp. 11-26.

McDonald, M., L. Arragutainaq, and Z. Novalinga. 1997. *Voices from the Bay: Traditional Ecological Knowledge of Inuit and Cree in the Hudson Bay Bioregion.* Ottawa: Canadian Arctic Resources Committee and the Environmental Committee of Municipality of Sanikiluaq.

McNeill, J.R. 2003. Observations on the nature and culture of environmental history. *History and Theory.* 42:5-43.

Meier, D. 2004. Man and the environment in the marsh area of Schleswig-Holstein from roman until the late medieval times. *Quaternary International*. 112:55-69.

Merchant, C. 1990. The realm of social relationship: production, reproduction, and gender in environmental transformations. In: B.L. Turner, W.C. Clark, R.W. Kates, J.F. Richards, J.T. Mathews and W.B. Mayer (eds.), *The Earth as Transformed by Human Action: Global and Regional Changes in the Biosphere over the Past 300 Years*. New York: Cambridge University Press. Pp. 673-684.

Miner, J. 1923. *Jack Miner and the Birds: and Some Things I Know About Nature*. Toronto: The Ryerson Press.

Miner, J. 1929. *Jack Miner on Current Topics*. Toronto: The Ryerson Press.

Miner, J. 1969. *Wield Goose Jack: The Autobiography of Jack Miner; Jack Miner, His Life and Religion*. Kingsville, Ontario: The Jack Minor Migratory Bird Foundation.

Ministère de l'Envionment du Quebec. 2003. *Natural Heritage Conservation Act 2002, R.S.Q., c. C-61.01*. Accessed 07 August 2008 on line at: http://www2.publicationsduquebec.gouv.qc.ca/dynamicSearch/telecharge.php?type=2&file=/C_61_01/C61_01_A.htm.

Mitchell, B. and J. Brown. 2003. Stewardship and protected areas in a global context: coping with change and fostering civil society. In: B.A. Minteer and R.E. Manning (eds.), *Reconstruction Conservation: Finding Common Ground*. Washington: Island Press. Pp. 297-312.

Moore. L. 2007. Cree seeking no-mining area in James Bay. Reserve meets Quebec's criteria: McGill researcher. *The Gazette*. Montreal. 23 February. Pp.B1,B6.

Morantz, T. 1983. *An Ethnohistoric Study of Eastern James Bay Cree Social Organization, 1700-1850*. National Museum of Man Mercury Series. Ottawa: National Museum of Canada.

Morantz, T. 1984. Economic and social accommodations of the James Bay Inlanders to the fur trade. In: S. Krech (ed.), *The Sub arctic Fur Trade: Native Economics and Social Adaptations*. Vancouver: University of British Colombia Press. Pp. 55-79.

Morantz, T. 1986. Historical perspective on family hunting territories. In eastern James Bay. *Anthropoligica*. 28 (1-2):65-91.

Morantz, T. 2002. *The White Man's Gonna Getcha: The Colonial Challenge to the Crees in Quebec*. Montreal: McGill-Queen's Press.

Mulrennan, M.E. and C.H. Scott. 2005. Co-management – an attainable partnership? Two cases from James Bay, Northern Quebec and Torres Strait, North Queensland. *Anthropologica*. 47(2):197-213.

Mulrennan, M.E., and C.H. Scott. 2001. Aboriginal rights and interests in Canadian northern seas. In: C. H. Scott (ed.), *Aboriginal Autonomy and Development in Northern Quebec and Labrador*. Vancouver: University of British Columbia Press.

Mulvihill, P.R., D.C. Baker and W.R. Morrison. 2001. A conceptual framework for environmental history in Canada's north. *Environment and History*. 6(4):611-626.

Nabhan, G.P. 1995. Cultural parallax in viewing North American habitats. In: M.E. Soule and G. Lease; *Reinventing Nature? Responses to Postmodern Deconstruction*. Washington: Island Press. Pg. 87-101.

Nadasdy, P. 2005. Transcending the debate over he ecological noble Indian: indigenous peoples and environmentalism. *Ethnohistory*. 52(2):291-331.

Nadasdy, P. 2007. Adaptive co-management and the gospel of resilience. D. Armitage, F. Berkes and N. Doubleday (eds.), *Adaptive Co-management: Collaboration, Learning and Multi-level governance*. Vancouver: UBC Press. Pp. 208-227.

Nash, R. 1967. *Wilderness and the American Mind*. New Haven: Yale University Press.

Natcher, D.C., O. Huntington, S. Trainor, H.P. Huntington, L. DeWild, S. Rupp, F.S. and Chapin III. 2007. Factors contributing to the cultural and spatial variability of landscape burning by native peoples of Interior Alaska. *Ecology and Society*. 12(1): [Online] URL:http://www.ecologyandsociety.org/vol12/issue1/art7/.

Nelson, R. 1969. *Hunters of the Northern Ice*. Chicago: Aldine.

Nichols, T., F. Berkes, D. Jolly, N.B. Snow, and The Community of Sachs Harbour. 2004. Climate change and sea ice: local observations from the Canadian western arctic. *Arctic*. 57(1):65-79.

Nietschmann, B. 1973. *Between Land and Water: The Subsistence Ecology of the Miskito Indians*. New York: Seminar Press.

Ogilvie, W. 1891. Report of exploratory survey to Hudson's Bay. Ottawa: Department of the Interior.

Olsson, P., C. Folke, and F. Berkes. 2004. Adaptive comanagement for building resilience in social-ecological systems. *Environmental Management*. 34(1):75-90.

Parks Canada. 2006. Parks Canada Guiding Principles and Operational Policies. Part II – Activity Policies: National Parks Policy. Accessed 04 August 2008 on line at: http://www.pc.gc.ca/docs/pc/poli/princip/sec2/part2a4_e.asp. Last Updated October 24 2006.

Peacock, S. L. and N. J. Turner. 2000. "Just like a garden": traditional resource management and biodiversity conservation on the Interior Plateau of British Columbia. In: P. Minnies and W. Elisens (eds.), *Biodiversity and Native North America*. Norman, Oklahoma: University of Oklahoma Press. Pp. 133–179.

Pearce, T.D., B. Smith, F. Duerden, F. Kataoyak, A. Goose, R. Inuktalik, J. Ford and J. Wandel. 2006. Travel routes, harvesting and climate change in Uluhaktok, Canada. *Northern Research Forum Open Meeting – The Borderless North*. Oulu, Finland and Lulea, Sweeden. Pp. 148-155.

Peloquin, C. 2006. *Variability, Change and Continuity in Social-Ecological Systems: Insights from James Bay Cree Cultural Ecology*. Master's Thesis. Natural Resource Institute, The University of Manitoba. Winnipeg, Manitoba, Canada.

Peltier, W.R., and J.T. Andrews. 1983. Glacial geology and glacial isostasy of the Hudson Bay region. In: D.E. Smith and A.G. Andrews (eds.), *Shorelines and Isostasy*. London: Academic Press. Pp. 285-320.

Phillips, A. 2005. Landscape as a meeting ground: Category V Protected Landscapes/Seascapes and World Heritage Cultural Landscapes. In: N. Mitchell, M. Beresford and J. Brown (eds.), *The Protected Landscape Approach: Linking Nature, Culture and Community*. Gland: IUCN – The World Conservation Union.

Plumwood, V. 1998. Wilderness skepticisim and wilderness dualism. In: J.B. Callicott, and M.P. Nelson (eds.), *The Great New Wilderness Debate*. Athens: University of Georgia Press. Pg. 652-690.

Plumwood, V. 2006. The concept of a cultural landscape: nature, culture and agency in the land. *Ethics and the Environment*. 11(2):115-150.

Poly-Geo Inc. and D. Goyette. 2003. *Technical Descriptions and Cost Evaluation of Wemindji Projects Submitted to the Apatisiiwin Board of Directors Progress Report – May 28, 2003*. Montreal.

Pratt, K.L. 1994. "They never ask the people": Native views about the Nunivak wilderness. In: E.S. Burch Jr. and L.J. Ellanna (eds.), *Key Issues in Hunter-Gatherer Research*. Oxford: Berg. Pp. 333-355.

Preston, R.J. 1986. Introduction: reflections on territory. *Anthropologica*. 28(1-2):11-17.

Reed, A., R. Benoit, R. Lalumière, and M. Julien. 1996. *Goose use of the coastal habitats of northeastern James Bay*. Ottawa: Canadian Wildlife Service, Environment Canada.

Reed, A.J. 1991. Subsistence harvesting of waterfowl in northern Quebec: goose hunting and the James Bay Cree. In: *Transactions of the 56th North American Wildlife and Natural Resource Conference*. Pp. 344-349.

Robbins, P. 2004. *Political Ecology*. Massachusetts: Blackwell Publishing.

Roberts, N. and R.A. Butlin. 1995. Ecological relations in historical times: an introduction. In: R.A. Butlin and N. Roberts (eds.); *Ecological Relations in Historical Times: Human Impact and Adaptation*. Cambridge: Blackwell. Pp. 1-14.

Roue, M. 2003. US environmental NGOs and the Cree. An unnatural alliance for the preservation of nature? *International Social Science Journal*. 178:619-628.

Sandlos, J. 2001. From the outside looking in: aesthetics, politics and wildlife conservation in the Canadian north. *Environment and History*. 6(4):6-31.

Scoones, I. 1999. New ecology and the social sciences: what prospects for a fruitful engagement? *Annual Review of Anthropology*. 28:479-507.

Scott, C.H. 1983. *The semiotics of material life among Wemindji Cree hunters*. Doctoral Dissertation. McGill University. Montreal, Quebec, Canada.

Scott, C.H. 1986. Hunting territories, hunting bosses and communal production among coastal James Bay Cree. *Anthropoligica*. 28 (1-2):163-173.

Scott, C.H. 1987. The socio-economic significance of waterfowl among Canada's Aboriginal Cree: Native use and local management. In: A.W. Dimond and E.L. Fillon (eds.), *The Value of Birds*. ICBP Technical Publication, No. 6. Cambridge: International Counsel for Bird Preservation.

Scott, C.H. 1988. Property, practice and aboriginal rights among Quebec Cree hunters. In: T. Ingold, D. Riches and J. Woodburn (eds.), *Hunters and Gatherers, Vol 2 Property, Power and Ideology*. Oxford: Berg Publishers Limited. Pp. 35-51.

Scott, C.H. 1996. Science for the west, myth for the rest? The case of James Bay Cree knowledge construction. In: L. Nader (ed.), Naked Science: Anthropology inquiry into Boundaries, Power, and Knowledge. London: Rutledge. Pp. 69-86.

Scott, C.H. 2004. Protected Area Creation, Culture and Development at the Cree Community of Wemindji, James Bay, Quebec. SSHRC-CURA Grant Application.

Scott, C.H., and H.A. Feit. 1992. *Income Security for Cree Hunters: Ecological. Social and Economic Effects*. McGill Program in the Anthropology of Development Monograph Series.

Simpson I.A., A.J. Dugmore, A. Thomson, and O. Vesteinsson. 2001. Crossing the thresholds: human ecology and historic patterns of landscape degradation. *Catena*. 42:175-192.

Smit, B. and J. Wandel. 2006. Adaptation, adaptive capacity and vulnerability. *Global Environmental Change*. 16:282-292.

SOTRAC (Societe des Travaux de correction du Coplex la Grand) 1980. *Annual Report 1980*. Montreal.

Tanner, A. 1986. The new hunting territory debate: and introduction to some unsolved issues. *Anthropologica*. 28(1-2):19-36.

Tengo, M. and M. Hammer. 2003. Managing practices for building adaptive capacity: a case from northern Tanzania. In: F. Berkes, J. Colding and C. Folke (eds.), *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Cambridge: Cambridge University Press. Pp. 132-162.

Theriault, G. 1994. *Trespassing in God's Country: Sixty Years of Flying in Northern Canada*. E.T. Pasco (ed.), Chapleau Ontario: Treeline Publishing.

Turner II, B.L. 2002a. Contested identities: human-environment geography and disciplinary implications in a restructuring academy. *Annals of the Association of American Geographers*. 92:52-74.

Turner II, B.L., R.E. Kasperson, P.A. Matson, J.J. McCarthy, R.W. Corell, L. Christensen, N. Eckley, J.X. Kasperson, A. Luers, M.L. Martello, C. Polsky, A. Pulsipher, and A. Schiller. 2003. A framework for vulnerability analysis in sustainability science. Proceedings of the National Academy of Sciences of the United States of America 100(14):8074–8079.

Turner II, B.L., W.C. Clark, R.W. Kates, J.F. Richards, J.T. Mathews, and W.B. Meyer (eds.), *The Earth as Transformed by Human Action: Global and Regional Changes in the Biosphere over the past 300 years*. Cambridge: Cambridge University Press.

Turner, N. J., M. B. Ignace, and R. Ignace. 2000. Traditional ecological knowledge and wisdom of aboriginal peoples in British Columbia. *Ecological Applications*. 10(5):1275-1287.

Turner, N.J., I.J. Davidson-Hunt, and O'Flaherty. 2003. Living on the edge: ecological and cultural edges as sources of diversity for social-ecological resilience. *Human Ecology*. 31(3):439-461.

United States, Congress. 1964. The Wilderness Act. Public Law 88-577 (78 Statues 890). 88th Congress. Second Session.

Usher, P.J. 2000. Traditional ecological knowledge in environmental impact assessment. *Arctic*. 53(3):183-193.

Usher. P.J. 2002. Inuvialuit use of the Beaufort Sea and its Resources, 1960-2000. *Arctic*. 55(1):18-28.

Vale, T.R. 2002. The pre-European landscape of the United States: pristine or humanized? In: T. Vale (ed); *Fire, Native Peoples, and the Natural Landscape*. Washington, D.C.: Island Press. Pp. 1-39.

van Mors, I., and Y. Begin. 1993. Shoreline shrub population extension in response to recent isostatic rebound in eastern Hudson Bay, Quebec, Canada. *Arctic and Alpine Research*. 25(1):15-23.

Vayda , A.P. and R.A. Rappaport. 1968. Ecology, culture and non-culture. In: J.A. Clifton (ed.), Introduction to Cultural Anthropology: Essays in the Scope and Methods of the Science of Man. Boston: Houghton-Mifflin Company. Pp. 479-497.

Vayda, A.P., and B.J. McCay. 1975. New directions in ecology and ecological anthropology. *Annual Review of Anthropology*. 4:293-306.

Viles, H. 2005. A divided discipline? In: N. Castree, A. Rogers, and D. Sherman (eds.); *Questioning Geography*. Massachusetts: Blackwell Publishing Ltd. Pp. 26-38.

Walker, C.J., C.S. Hollings, S.R. Carpenter, A.P. Keinzig. 2004. Resilience, adaptability and transformability in social-ecological systems. *Ecology and Society* 9(2):5. [online] URL http://www.ecologyandsociety.org/vol9/iss2/art5/.

Wenzel, G. 1991. *Animal Rights Human Rights: Ecology, Economy and Ideology in the Canadian Arctic*. Toronto: University of Toronto Press.

Wenzel, G. 1994. Recent change in Inuit summer residence patterning at Clyde River east Baffin Island. E.S. Burch Jr. and L.J. Ellanna (eds.), *Key Issues in Hunter-Gather Research*. Oxford: Berg. Pp. 289-308.

Wenzel, G. 1999. Traditional ecological knowledge and Inuit: reflection on TEK research and ethics. *Arctic*. 52(2):113-124.

Wenzel, G. 2004. From TEK to IQ: Inuit Quajimajatuqangit and Inuit cultural ecology. *Artic Anthropology*. 41(2):238-250.

White, R. 1980. *Land Use, Environment and Social Change: The Shaping of Island County, Washington*. Seattle: University of Washington Press.

White, R. 1995. *The Organic Machine: Remaking of the Columbia River*. New York: Hill and Wang.

Zimmerer, K. S. 1994. Human geography and the "new ecology": the prospect and promise of integration. *Annals of the Association of American Geographers*. 84(1):108-125.

Appendix A: Ethnographic source information

Information is presented by two digit informant code followed by the interview or participation date.

Chapter 4 source information

[1] M.M., 23 June 2007.
[2] Y.K., 02 Aug 2007.
[3] T.O., 03 Aug 2007.
[4] U.F., 27 June 2007.
[5] U.F., 27 June 2007; G.F., 27 June 2007.
[6] U.F., 20 June 2007; M.M., 23 June 2007; M.C., 18 July 2007; H.Y., 25 July 2007; T.O., 20 Aug 2006; Y.K., 02 Aug 2007; I.I., 13 Aug 2007.
[7] Quote: U.F., 27 June 2007. Sites: U.F., 27 June 2007; H.Y., 05 Aug 2006.
[8] H.Y., 05 Aug 2006.
[9] M.C., 19 July 2007.
[10] U.F., 20 June 2007; T.O., 02 Aug 2007; I.Q., 13 Aug 2007.
[11] H.Y., 25 July 2007.
[12] B.V., 04 June 2007.
[13] U.F., 27 June 2007.
[14] U.F., 20 June 2007.
[15] I.Q., 13 Aug 2007.
[16] G.F., 20 June 2007.
[17] J.Q., 11 June 2007; L.E., 20 June 2007; G.F., 20 June 2007; M.M., 23 June 2007; G.U., 28 June 2007; S.C., 03 July 2007; H.Y., 25 July 2007; Y.K., 02 Aug 2007; D.Q., 13 Aug 2007; I.Q., 13 Aug 2007.
[18] L.E., 20 June 2007; U.F, 20 June 2007, 31 July 2007; G.U., 28 June 2007; S.C., 03 July 2007, 05 July 2007; H.Y., 25 July 2007.
[19] A.B., 16 February 2008.
[20] M.M., 17 June 2007.
[21] G.F., 20 June 2007; G.U., 28 June 2007; H.Y., 25 July 2007.
[22] G.F., 20 June 2007; G.U., 28 June 2007.
[23] L.E., 20 June 2007; U.F., 20 June 2007, 31 July 2007; G.U., 28 June 2007; H.Y, 25 July 2007. T.O., 04 Aug 2007; S.C., 12 Aug 2007; G.F., 20 June 2007.
[24] G.F., 20 June 2007
[25] M.., 29 July 2006.
[26] H.Y., 25 July 2007.
[27] Y.K., 02 Aug 2007.
[28] N.I., 26 June 2007.
[29] L.E., 20 June 2007, 26 June 2007, 10 Aug 2007; U.F., 20 June 2007; G.U., 28 June 2007; , I.I., 05 July 2007; X.D., 19 July 2007; H.Y., 25 July 2007.
[30] L.E., 26 June 2007; U.F., 20 June 2007; T.O., 03 Aug 2007; G.U., 28 June 2007; I.I., 05 July 2007.
[31] Soft snow: L.E., 20 June 2007, 26 June 2007, 10 Aug 2007; U.F., 20 June 2007; G.U., 28 June 2007; I.I., 05 July 2007; X.D., 19 July 2007; H.Y., 25 July 2007. Skidoo: T.O., 03 Aug 2007; L.E., 20 June 2007, 10 Aug 2007.
[32] M.M., 17 June 2007; L.E., 20 June 2007; U.F., 20 June 2007; S.C., 05 June 2007. X.D., 19 July 2007; H.Y., 25 July 2007; G.U., 28 June 2007; Y.K., 02 Aug 2007.
[33] S.C., 05 June 2007.
[34] M.C., 19 July 2007; X.D., 19 July 2007.
[35] H.Y., 07 Aug 2007.
[36] M.C., 24 July 2006; B.V., 04 July 2007; F.R./T.W., 07 March 2008; Y.K., 02 Aug 2007; T.O., 02 Aug 2007, 03 Aug 2007.
[37] M.M., 23 June 2007; N.I., 25 June 2007.
[38] M.M., 07 July 2007.
[39] M.M., 23 June 2007.
[40] N.I., 12 Aug 2006.
[41] H.Y., 01 Aug 2006, 06 Aug 2006; T.O., 21 Aug 2007.
[42] U.F., 30 July 2006.
[43] X.D., 19 July 2007.
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[45] H.Y., 08 Aug 2006.
[46] M.C., 06 Aug 2006.
[47] G.U., 28 June 2007, 10 Aug 2007.
[48] D.Q., 13 Aug 2007.
[49] H.Y., 03 Aug 2006.
[50] S.C., 05 July 2007.
[51] M.C., 01 July 2007; Participant obs. 2003, 2005, 2006, 2007.
[52] Participant obs. 07 to 25 June 2007.
[53] T.O., 02 Aug 2007.
[54] X.D., 19 July 2007.
[55] X.D., 19 July 2007.
[56] T.O., 19 Aug 2006.
[57] M.M., 29 July, 2006, 23 June 2007; N.I., 23 April, 2008.
[58] M.C., 08 Aug 2007.
[59] M.C., 18 July 2007, 08 Aug 2007.
[60] T.O, 02 Aug 2007.

[61] Camp rotation: M.M., 29 July 2006; B.V., 04 July 2007. Muskrat hunting: M.M., 29 July 2006; N.I., 23 April 2008.
[62] B.V., 04 July 2007.
[63] L.E., 20 June 2007.
[64] L.E., 20, June 2007.
[65] I.Q., 12 Aug 2007.
[66] I.Q., 12 Aug 2007.
[67] D.Q., 12 Aug 2007.
[68] H.Y., 25 July 2007.
[69] H.Y., 07 Aug 2007.
[70] M.C., 19 July 2007.
[71] M.C., 08 Aug 2007
[72] M.C., 01 July 2007, 22 July 2007, 08 Aug 2007.
[73] N.I., 25 July 2007.
[74] M.M., 26 July 2006, 11 Aug 2007; N.I., 11 Aug 2007.
[75] L.E., 15 Aug 2006, 10 Aug 2007.

Chapter 5 source information

[76]G.U., 15 Aug 2006; D.E., 17 Aug 2007.
[77] D.E., 15 July 2007; Y.K., 02 Aug 2007.
[78] D.E., 15 July 2007; Y.K., 02 Aug 2007.
[79] D.E., 17 Aug 2007.
[80] D.E., 15 July 2007, 17 Aug 2007.
[81] U.F., 27 June 2007.
[82] H.Y., 25 July 2007.
[83] M.M., 17 June 2007.
[84] M.M., 29 July 2006, 17 June 2007; U.F., 30 July 2006, 20 June 2007; Y.K., 02 Aug 2007.
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[86] G.U., 24 July 2006; H.Y., 25 July 2006.
[87] M.M., 07 July 2007.
[88] G.U., 28 June 2007.
[89] S.C., 05 July 2007.
[90] M.C., 18 July 2007.
[91] U.F. 31 July 2007; Y.K., 02 Aug 2007; T.O., 02 Aug 2007; H.Y., 07 Aug 2007; I.Q., 13 Aug 2007; D.E. 17 Aug 2007.
[92] H.Y., 07 Aug 2007; I.Q., 13 Aug 2007; D.E., 17 Aug 2007.
[93] D.E., 17 Aug 2007.
[94] G.F., 31 July 2007; U.F., 31 July 2007; Y.K., 02 Aug 2007.
[95] X.D., 19 July 2007.
[96] B.V., 04 June 2007.
[97] M.M., 17 June 2007.
[98] S.C., 03 July 2007.
[99] H.Y., 07 Aug 2007; M.M., 17 Jun 2007; M.C., 08 Aug 2007.
[100] M.M., 17 Jun 2007; H.Y., 25 July 2007, 07 Aug 2007; M.C., 08 Aug 2007; D.Q., 13 Aug 2007.
[101] N.I., 25 June 2007.
[102] M.M., 07 July 2007.
[103] M.C., 18 July 2007.
[104] N.I., 22 June 2007. M.C., 08 Aug 2007; Participant obs. Jun 2007.
[105] E.K., 24 Aug 2006.
[106] A.B., 23 Aug 2006.
[107] T.O., 02 Aug 2007.
[108] M.C., 18 July 2007.
[109] M.C., 18 July 2007, 02 Aug 2007
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[112] M.M., 23 June 2007.
[113] H.Y., 25 July 2007.
[114] N.I., 13 June 2007
[115] F.R., 07 March 2008.
[116] N.I., 13 June 2007; M.C., 18 July 2007; I.Q., 13 Aug 2007.
[117] S.C., 03 July 2007; T.O., 19 Aug 2006; I.Q., 13 Aug 2007.
[118] M.M., 17 June 2007, 13 June 2007; N.I., 23 June 2007; T.O., 19 Aug 2006, 02 Aug, 2007 S.C., 03 July 2007; I.Q., 13 Aug 2007; G.F., 24 Feb 2007, 25 Feb 2007.
[119] N.I., 23 June 2007.
[120] N.I.,13 Jun 2007, 23 June 2007; M.M., 17 June 2007, 23 June 2007; U.F., 20 June 2007; S.C., 03 July 2007; T.O., 02 Aug, 2007.
[121] N.I., 13 Jun 2007.
[122] M.M., 23 June 2007; N.I., 23 June 2007; G.F., 25 Feb 2008.
[123] G.F., 24 Feb 2007, 25 Feb 2007.
[124] H.Y., 07 Aug 2006.
[125] H.Y., 07 Aug 2006.
[126] M.M. 17 Jun 2007.
[127] J.Q., 11 June 2007; L.E., 20 June 2007; G.F., 20 June 2007; M.M., 23 June 2007; G.U., 28 June 2007; S.C., 03 July 2007; H.Y., 25 July 2007; Y.K., 02 Aug 2007; D.Q., 13 Aug 2007; I.Q., 13 Aug 2007.
[128] L.E., 20 June 2007; U.F, 20 June 2007, 31 July 2007; G.U., 28 June 2007; S.C., 03 July 2007, 05 July 2007; H.Y., 25 July 2007.
[129] U.F., 20 Jun 2007.
[130] N.I., 22 Jun 2007.
[131] N.I., 12 Aug 2006, 13 June 2007.
[132] M.C., 08 Aug 2007.
[133] S.C., 03 July 2007.
[134] U.F., 20 June 2007.
[135] S.C., 03 July 2007.
[136] M.M., 17 June 2007.
[137] G.F., 24 Feb 2008, 25 Feb 2008.
[138] G.U., 24 July 2006; I.Q., 27 July 2006.
[139] H.Y., 17 July 2007.

[140] S.C., 12 Aug 2007.
[141] S.C., 03 July 2007, 12 Aug 2007.
[142] A.B., 30 July 2007.
[143] A.B., 30 July 2007.
[144] N.I., 22 June 2007; A.B., 30 July 2007
[145] A.B., 16 Feb 2008.
[146] N.I., 22 Jun 2007.
[147] A.B., 30 July 2007.
[148] A.B., 30 July 2007.
[149] U.F., 20 June 2007; G.U., 28 June 2007; H.Y., 25 July 2007; A.B., 30 July 2007; U.F., 31 July 2007; Y.K., 02 Aug 2007.
[150] M.M., 29 July 2006, 17 June 2007; U.F., 30 July 2006, 20 June 2007; Y.K., 02 Aug 2007; G.U., 24 July 2006; H.Y., 25 July 2006; A.B., 30 July 2007.
[151] N.I., 13 June 2007; Participant obs. June 2006.
[152] N.I., 13 June 2007.
[153] H.Y., 25 July 2007; T.O., 03 Aug 2007.
[154] G.F., 31 July 2007.
[155] Participant obs. 09 July 2007.
[156] M.C., 18 July 2007.
[157] G.F., 31 July 2007; U.F., 31 July 2007; Y.K., 02 Aug 2007.
[158] A.B., 30 July 2007.

Appendix B. Details of *tuuhiikan* measurements

Trapline	Angle	Topography	Cut date	Last maintenance	Area (ha)	Width (m)	Length (m)	Method & materials GT = "ground-truthed"
A	S-N	Large headland containing many lakes and marshes. Situated on ridge, dropping down to coastal lake and marsh complex (S-N).	Time immemorial	Late 50s, and again in 2003.	3.00	230.00	370	Poly-Geo Inc. and Goyette (2003). GT
A	SE-NW	Large headland containing many lakes and marshes. Runs over ridge (E-W). Water bodies N and S, but not directly abutting.	Will cut in future	n/a	n/a	n/a	n/a	n/a
B	SE-NW	Seaward end of headland. 1 of 4 on headland. Runs over east side of ridge (E-W), shore to shore (S-N).	1981 / 1982	No data	2.73	100 to 150	250	1m pan IKONOS. 1:3,000. GT
B	SE-NW	Seaward end of headland. 2 of 4 on headland. Runs over middle of ridge (E-W), shore to shore (S-N).	1982	2006. Had not cleared for a few years.	4.37	130 to 230	300	1m pan IKONOS. 1:3,000. GT
B	SE-NW	Middle of headland. 3 of 4 on headland. Runs between two ridges (E-W) from shore to shore (S-N).	1982 late spring	2003	3.50	115 to 150	250 to 300	1m pan IKONOS. 1:3,000. GT
B	SE-NW	Start of headland. 4 of 4 on headland. Runs over ridge from marsh to marsh (S-N)	1982	Informant did not remember.	5.89	130 to 150	415	1m pan IKONOS. 1:3,000. GT
B	S-N or SE-NW	Old marsh complex to south. Runs over ridge to north.	After moved to WJ, cut w/ axe.	No data	No data	No data	No data	No data
C	SE-NW	Large bulbous headland. 1of two in area. Runs from coastal lake and marsh complex in middle of headland to top of ridge (S-N).	1990	Never	2.83	100 to 110	280	10m pan SPOT. 1:5,000. GT
C	SE-NW	Large bulbous headland. 2 of 2 in area. Runs from coastal lake and marsh complex in middle of headland to along the east of ridge (S-N).	1960s	Never	1.01	30 to 50	300	10m pan SPOT. 1:5,000. GT
C	SE-NW	North shore of bay. Western 1 of 2 in area. Over low ridge. Runs form shore to marsh complex (S-N).	Mid 90s	Never, but needs to be done soon.	11.99	100 to 260	790	10m pan SPOT. 1:5,000. GT
C	SE-NW	North shore of bay. Eastern 2 of 2 in area. Over low ridge. Runs form shore to marsh complex (S-N).	Early 90s	Never	4.02	50 to 70	665	10m pan SPOT. 1:5,000.GT
D	SE-NNW	North shore of bay w/ shallow water and large expanses of tidal flat and marsh. 3 of 6 on north shore. Runs over east side of ridge from top down into valley (E-W), from shore to lake (S-N).	1980	Never	10.89	230 to 240	470	15m pan Landsat. 1:5,000. GT

D	SE-NW	North shore of bay w/ shallow water and large expanses of tidal flat and marsh. 2 of 6 on north shore. Lower lying area (E-W). Runs from shore to lake (S-N).	1982	2004. extended north to lake.	6.17	90 to 200	430	Derived from hand drawing on air photo. GT
D	SE-NW	North shore of bay w/ shallow water and large expanses of tidal flat and marsh. Landward (east) most 1 of 6 Runs through valley (E-W) from an estuary to wetland (S-N).	1930s	No data. Last used 1980s.	No data	No data	No data	No data
D	S-NNE	North shore of bay w/ shallow water and large expanses of tidal flat and marsh. 4 of 6 on north shore. Runs over west side of ridge (E-W) from shore inland towards lake/wetland (S-N).	1988	No data	2.24	30-80	450	15m pan Landsat. 1:5,000.
D		On western tip of island with lots of marsh to SE and shallow bay to NW.	1930s, 40s or 50s	No data	0.34	40 to 45	80	R1255_208 air photo. Digtz at 1:3,000
D	SE-NW	On large island with lots of marsh to SE, and shallow bay to NW. Low topography. Runs from marsh to bay (S-N)	1981 or 1982	No data	2.03	60 to 110	260	15m pan Landsat. 1:5,000. GT
D		North shore of bay w/ shallow water and large expanses of tidal flat and marsh. 5 of 6 on north shore. Area burnt in mid 80s destroying *tuuhiikan*.	1940s	No data	n/a	n/a	n/a	n/a
D		North shore of bay w/ shallow water and large expanses of tidal flat and marsh. 6 of 6 on north shore (western most). Area burnt in mid 80s destroying *tuuhiikan*.	1979	No data	n/a	n/a	n/a	n/a
E	SE-N	North shore of small estuary. Western 1 of 2 in area. Round headland. Narrow bays to N and S. Top of steep ridge.	Early 80s	Informant was not sure.	1.10	70 to 100	150	10m pan SPOT. 1:5,000. GT
E	SE-NW	North shore of small estuary. Eastern 2 of 2 in area. Round headland. Narrow bays to N and S. Low lying area. Runs form Estuary to marsh (S-N).There is a goose pond in middle.	2003	Never	7.50	50 to 80	400	Poly-Geo Inc. and Goyette (2003) GT
F	S-N	Headland. Runs over ridge (E-W) from marsh to shore (S-N).	Before 1958	Around 2000 (5-10yrs ago).	7.27	70 to 160	615	15m pan Landsat. 1:5,000.
F	No Data	No data	Before 1958	No data	No data	No data	No data	No data
F	S-N	North shore of cove. Low lying area. Runs from shoreline to small wetland and pond (S-N).	1970s, but was smaller	Late 1980s. Made bigger.	4.00	130	345	15m pan Landsat. 1:5,000. GT
F	SEE-NWW	Former island joined to mainland by marsh complex from coastal uplift. Low area. Runs between to marshes.	After 1958	2001	0.36	30	150	15m pan Landsat. 1:5,000.

F	SE-NW	Former island surrounded by marsh development do to coastal uplift. Low are. Runs from cove and marsh to marsh (SE-NW). Thinner area of land.	Grandfather's time	No data	2.30	110 to 160	240	Poly-Geo Inc. and Goyette (2003)
G	SSE-NNW	Western end (seaward) of peninsula. Western most 1 of 5 on peninsula. Small, just on top of hill. Just to west of highest point.	1985	No data	3.88	150 to 200	220	15m pan Landsat. 1:5,000. GT
G	SE-NW	Long thin peninsula. 3 of 5 on peninsula. Runs over ridge but higher contours to E and W. Runs from shore to shore (S-N)	No Data	No data	5.41	50 to 60	1,100	15m pan Landsat. 1:5,000.
G	S-N	Long thin peninsula. 2 of 5 on peninsula. Runs over middle of hour glass shaped ridge (E-W). Points to W and E are one contour interval higher. Runs shore to shore (S-N).	1962	Never	32.16	270 to 370	1,050	15m pan Landsat. 1:5,000. GT
G	SE-NW	Long thin peninsula. 4 of 5 on peninsula. On eastern side of ridge. Runs form pond in middle of peninsula to shore (S-N).	2004 to 2005	No data	3.70	160 to 190	290	Poly-Geo Inc. and Goyette (2003). GT
G	SE-NW	Headland. Seaward end , west of highest point. Runs from shore to top of hill (S-N)	Before 1958	Late 1990s	0.60	55 to 70	100	10m pan SPOT. 1:5,000. GT

Note: trapline codes have no relationship to spatial arrangement of traplines.

Appendix C: Pronunciation of Cree terms

"ch" in Cree sounds like "j" or "z" in English

"ii" in Cree sounds like "ē" in English

"k" in Cree sounds like "g" or "c" in English

"p" in Cree sounds like "b" in English

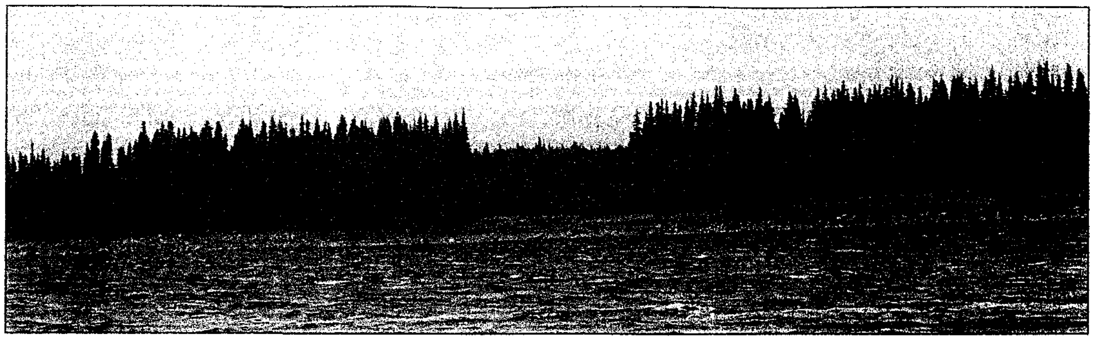
"t" in Cree sounds like "d" in English

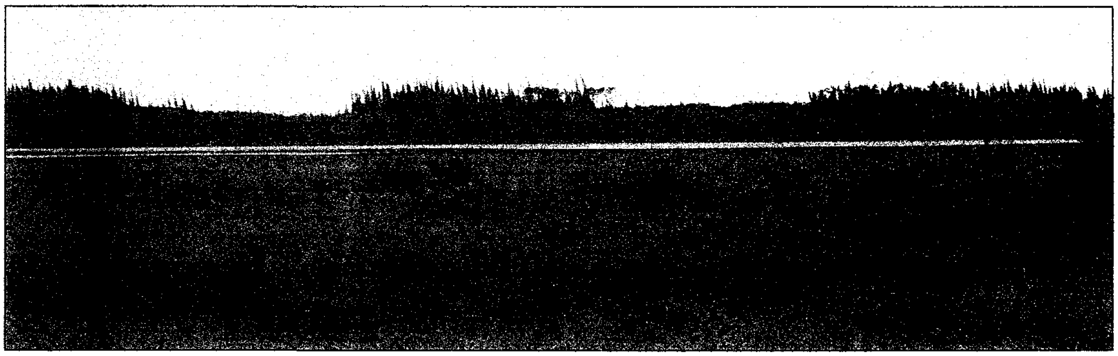
Vowels used in Cree: a, aa, e, i, ii, u, uu.

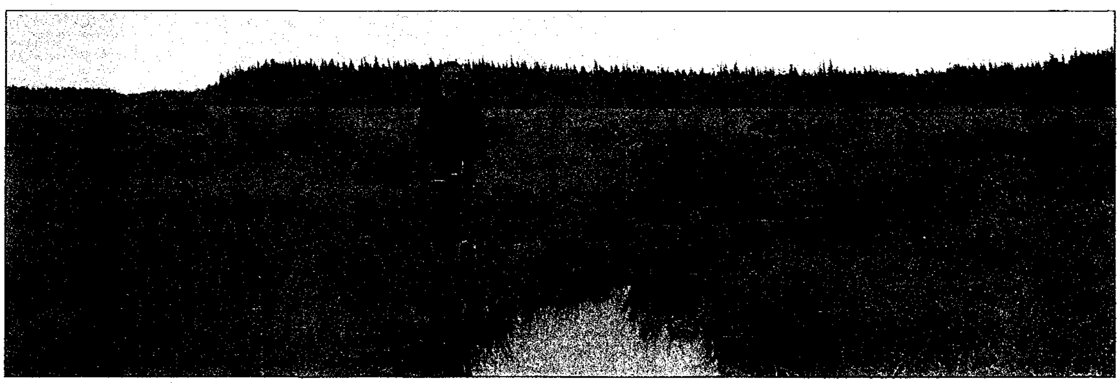
Consonants used in Cree: ch, h, k, l, m, sh, n, p, r, s, t.

Semi-vowels used in Cree: w, y.

Appendix D: Resource harvesting images







From top to bottom:
Plate D.1. A small *tuuhiikan*. Photo: J. Sayles, July 2007.
Plate D.2. Prescribed burning on coastal island. Photo: J. Sayles, June 2007.
Plate D.3. Two large *tuuhiikans*. Coloured flags in the foreground mark a dike. Photo: J. Sayles, July 2007.
Plate D.4. A large dike. Photo: J. Sayles, July 2007.

From top to bottom:
Plate D.5. Hunter by a dike and pond. Photo: J. Sayles, June 2007.
Plate D.6. Father and son late spring goose hunting. Photo: J. Sayles, June 2007.
Plate D.7. Arriving at a fish camp. Photo: F. Pendea, July 2007.
(Left) Plate D.8. Checking a fish net. Photo: J. Sayles, July 2007.
(Right) Plate D.9. Checking a fish net. Photo: J. Sayles, July 2007.