Maps of Risk and Value: A GIS-based Assessment of Cultural Landscape Vulnerability in the Kugmallit Bay Region.

by

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A thesis submitted in conformity with the requirements for the degree of Doctor of Philosophy

Department of Anthropology
University of Toronto

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2018

Abstract

This dissertation is an overview of research which was undertaken to better understand the impacts of climate change on culturally significant locations of the Kugmallit Bay area, in the Inuvialuit Settlement Region and Northwest Territories. Geographic Information System (GIS) methods of ‘grounded visualization’ were employed as a means of assessing numerous factors and combinations of factors related to the vulnerability of culturally significant locations. Vulnerability is conceptualized here as a product of the combined factors of risk and value, which were reviewed in an exploratory manner over multiple rounds of data collection, analysis, reflection and review. The iterative methods of grounded visualization yielded insights and generated further research questions related to the vulnerability of culturally significant locations.

GIS methods have long been used in archaeological research, but with a greater focus on quantitative research applications. This has led many to relegate the powerful visualization capabilities of GIS to the dissemination of results at the end of the research process. However, the capacity of grounded visualization methods to combine qualitative and quantitative information at the analytical level is a powerful and seldom exercised aspect of GIS methods. This application of grounded visualization methods to archaeological research is a first, and their
use in the management of threatened places of cultural significance shows great potential. Their capacity to negotiate the various subjectivities inherent to expressions of value by maintaining contextually important details in the research process makes them a perfect fit for use in value-centred management initiatives.

Heritage value was applied in this project by adopting a ‘cultural landscape’ approach to heritage management. Cultural landscape perspectives promoted the diversity of stakeholder perspectives and the subjective nature of landscape valuations as essential factors in the vulnerability assessment process. Employing a cultural landscape framework in this research allowed the iterative review process to be tailored to aspects of landscape value which extend beyond, yet often interrelate with the material remains of the past which are often the focus of archaeological research. The results of this project have demonstrated the utility of GIS-facilitated grounded visualization methods to the value-based management of cultural landscapes.
Acknowledgments

Many people have contributed to the completion of this thesis, either by directly aiding in various stages of research or through their inspiring conversations and supportive camaraderie. First and foremost I would like to acknowledge the guidance and encouragement of my supervisor, Dr. Max Friesen. Max`s enthusiasm for Arctic archaeological research and the collegial approach he takes to his supervisory role have genuinely inspired me to push the limits of what I thought possible, to be a better scholar and to take the time to savour the unique opportunities and experiences that can come about during field research… even when the pod of belugas you’ve been marvelling over turns out to be a flotilla of driftwood.

I am also indebted to my core committee members, Dr. Lena Morte nsen and Dr. Gary Coupland. Lena`s approach to the anthropology of heritage and value has inspired me from the very beginning of my doctoral studies and I am grateful for her guidance as I muddled my way through the extensive literature on these topics. Gary`s pragmatic approach to scholarship has kept me from going too far off the beaten path, and just knowing that ‘the Dude abides’ has brought ample comfort in the last few years of my PhD. Many thanks as well to my committee members Dr. Genevieve Dewar and Dr. Katherine Patton and my External Appraiser Dr. James Conolly (Trent University) for their insightful discussions and inspiring comments during the dissertation defence.

My understanding of Inuvialuit heritage and governance systems have been greatly improved through discussions with staff of the Inuvialuit Regional Corporation, including Cathy Cockney, Jenn Parrott and Jennifer Lam. Conversations with Dr. Tom Andrews, Dr. Charles Arnold and Glen MacKay have provided tremendous guidance in terms of western Arctic heritage management and its history of practice in the Northwest Territories. My early work on shoreline erosion modelling would have been truly onerous without the assistance of Marcel Fortin and Jordan Hale of the University of Toronto Map and Data Library. My involvement with the Memory, Meaning-Making and Collections Project provided me with a strong appreciation for the tenets of flexibility in heritage research planning, and I am very grateful to everyone involved in that project, especially Dr. Cara Krmopotich, Dr. Lynne Howarth, and Dr. Heather Howard (Bobiwash). I am also extremely grateful for the friendship and guidance of my colleague Dr.
Lesley Howse, which I have benefitted greatly from over the course of both my MSc and PhD level pursuits.

This work has received financial support from the Ontario Graduate Scholarship Program, the Dr Ranbir Singh Khanna Ontario Graduate Scholarship in the Environment; the Northern Scientific Training Program, the University of Toronto School of Graduate Studies Student Travel Grant, The University of Toronto Department of Anthropology Pilot Grant, and the Joseph and Maria Shaw Student Travel Award. Satellite imagery used over the course of this research was provided, free of charge, through a DigitalGlobe Foundation imagery grant. The fieldwork component of this research was facilitated by the Arctic CHAR project, which was supported by the Social Sciences and Humanities Research Council of Canada (grant number 435-2012-0641) and the Polar Continental Shelf Project (grant numbers 60213, 61914, 63315, 62816, 64917).

Beyond the epic tasks of bringing me into this world and rearing me alongside my three siblings, my parents, Sally and Mike O’Rourke, have long encouraged my interests in archaeology. They provided me with a veritable library on the topic as a child, took me to screenings of Indiana Jones films, and provided my first fieldwork experience at the tender age of six through an excavation near the village of Ska-Nah-Doht in the Lower Thames Valley, Ontario. I owe them everything and more.

Lastly I would like to acknowledge the contributions of my partner, Danielle Desmarais. For nearly 20 years she has motivated me, challenged me, helped me perceive the world in new ways, and never let me go a day without smiling. Her contributions to my development as a scholar and a human have been enormous, and the examples she provides by leading a ‘good life’ are numerous and invaluable.

For Danielle. Those who know, will whisper when they see us walking…
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Chapter 1

1 Introduction

1.1 Background

The shorelines of the western Arctic are among the most dynamic coastal regions in North America (Couture et al. 2015; Jones et al. 2008; Walker 1998). Despite the restriction of many coastal processes (erosion, slope failure, and so on) to the relatively short warm-weather season (Pelletier and Medioli 2014, 50; Shiklomanov et al. 2013), the scope and scale of changes they result in can be substantial. While the evolution of western Arctic coasts has taken place more or less continuously since the end of the Late Wisconsinan glacial period, the rates of change and severity of impacts have accelerated in recent decades as a result of anthropogenically-driven climate change (Bennett and Lantz 2014; IPCC 2013).

The Beaufort Sea coast has also been characterized as one of the most susceptible coastlines in all of Canada (Shaw et al. 1998), where the implications of climate change are numerous. Warmer air and water temperatures combined with longer periods of ice-free open-water will yield stronger and more frequent storm events, which in turn can result in greater levels of coastal erosion (Solomon 2005; 2014). Impacts on permafrost stability can influence both the susceptibility of coasts to sea-level rise as a result of ground-subsidence (Shiklomanov et al. 2013), as well as the activation (and reactivation) of highly impactful thaw-slump features (Lantz and Kokelj 2008). Infrastructure developments related to more economically viable resource extraction projects and the exertion of national sovereignty have also been implicated in the potential for more direct human-related Arctic landscape alteration as a result of climate change (AMAP/CAFF/SDWG 2013). In light of these compounding factors, the challenges involved in managing the western Arctic coastal zone will become increasingly difficult in the years ahead.

Green and McFadden (2007) have noted that difficult choices and conflicts are essential aspects of management efforts directed at coastal zones, which they define as nexuses of complex interrelated systems, including socio-economic, ecological and geomorphological systems. In addressing coastal zone management strategies, they define vulnerability as “the discussion within risk analysis of why a physical environment or a community is adversely impacted by a
specific perturbation” (2007, 1027). A particularly interesting aspect of Green and McFadden’s work, from the perspective of heritage management, is related to their positioning of vulnerability with respect to public discourses on the entwined topics of meaning and value. More specifically, their suggestion that vulnerability is related to the question of ‘why’ a specific perturbation is perceived as adverse can be reconfigured to ask ‘how’ adversely impacted regions are considered significant. Thus, changes in the landscape are considered ‘perturbations’ or are seen to have a deleterious effect on the character of that landscape only when it holds some level of value to someone or some group of people.

The vast majority of the people who live in the western Canadian Arctic are Inuvialuit or ‘the real people’ in the Inuvialuktun language (Alunik, Kolausok and Morrison 2003, 1). While related to other Arctic populations from Alaska east to Greenland, Inuvialuit have sought to maintain a distinct identity from their neighbours. Inuvialuit have demonstrated tremendous initiative in defining their place in the rapidly changing Arctic landscape through various means, including negotiating the Western Arctic Claim, referred to more commonly as the Inuvialuit Final Agreement (IFA). The IFA was finalized on June 5th, 1984, thereby establishing the boundaries of the Inuvialuit Settlement Region (ISR), Inuvialuit harvesting and resource rights, and promoting among its principle goals: "the preservation of Inuvialuit cultural identity and values within a changing northern society" (IFA 1984, 1). Change has been a common theme over the span of Inuvialuit history, even beyond the landscape changes taking place throughout the ISR (Lyons 2010). Inuvialuit and their ancestors have encountered numerous episodes of contact, depopulation and migration. These contacts have ultimately lead to a diverse set of influences on the development of Inuvialuit identity (Arnold 2015; Friesen 2013; Lyons 2013), an identity rooted in "... the collective stories, songs, traditions and memories of their long and varied past" (Lyons 2010, 22).

The act of invoking heritage through retrieval, display and performance can play an important part in the establishment and renegotiation of personal and collective identities (Clifford 2004). Despite the conflicts and contradictions which can arise in defining cultural identities (Jofré 2007; Jones 1997; Meskell 2002), communities are largely identified by social and geographic commonalities which are often rooted in ancestral locations and material remains of the past, lending time-depth and notions of authenticity to identity assertions. Adler and Brunning (2008, 50) have suggested that, "shared group identity is not a precisely constituted concept but is rather
a bundle of traditional knowledge, landscapes, specific places, histories, and material culture that a group utilizes to situate itself in the social nexus relative to other identified social groupings.” Given that each element of this 'bundle of influences' is in some way related to aspects of heritage, the potential effects of archaeological/heritage management efforts on Inuvialuit identity and cultural wellbeing can be substantial.

Heritage engagement can positively influence the wellbeing of Indigenous communities through the reinforcement of a shared sense of identity. This sense of unity and community solidarity is established through linkages with a shared past, made possible by community engagements with the various tangible and intangible aspects of heritage (Basu 2008). Pierre Nora (1989, 15) has also made a comment to this effect, noting that "The passage from memory to history has required every social group to redefine its identity through the revitalization of its own history". A key element of Nora's assertion is that in order for meaningful group identity negotiation to continue, ‘social groups’ must be able to engage with heritage on their own terms.

Inuvialuit have conducted oral history and place-names research over the course of various heritage related initiatives going back to the early 1960’s (Cournoyea 1997). Audio recordings made by hundreds of informants provide details on a range of subjects, locations and time periods. Some oral histories have been recorded with the specific goal of preserving Inuvialuit Traditional Knowledge for future generations (Cournoyea 1997). Other recordings were produced through ethnoarchaeological approaches, seeking to address problems of archaeological interpretation by posing questions to Inuvialuit Elders using ethnographic interview methods (Hart 1994; Nagy 1994). Running throughout this impressive collection of oral histories is a central theme, that: “the control the environment had over the people forced the intimate relationship the Inuvialuit have had and still have with the land” (Cournoyea 1997, 11).

Inuvialuit oral histories have been described in terms of two different, though equally valued types of information. The first type involves personal, anecdotal accounts of Inuvialuit life. Historical accounts for all intents and purposes, they are conceptualized according to general notions of temporality, with Ingilraani referring to the distant past, taimani as the recent past and qangma relating to the present day (Cournoyea 1997). The second category of oral histories include descriptive accounts which reflect Inuvialuit worldviews. Such records include stories and legend cycles relating to beings and events which are typically meant to impart moral
lessons and cultural values through their narration. The transmission of these Inuvialuit histories as spoken narratives has been described as the only means by which Ingilraani, taimani, and qangma could be conceptually interlinked in the past, and how meaning was afforded to these concepts of temporality among Inuvialuit prior to European contact (Cournoyea 1997, 11).

Inuvialuit have also been active in a number of archaeological projects (Lyons 2013, 36-39), with the Kitigaaryuit Archaeological Inventory and Mapping Project standing out as the first archaeological research program directed by an Inuvialuit organization (Hart and ISDP 1997, i). This project has contributed to both research and management capacity, and resulted in the expansion of formal Kitigaaryuit site boundaries to more accurately reflect the extent of traditional use areas. This change in the boundaries of Kitigaaryuit was initiated as part of the formal redesignation of the ancestral village as a ‘cultural landscape’ (Hart and ISDP 1997; 1999). By addressing contemporary use areas at Kitigaaryuit and changing its appellation from a ‘National Historic Site’ to a ‘cultural landscape’, the significance of the region was reconfigured to reflect the values ascribed to it by Inuvialuit community members who identify with and drawn meaning from the various combinations of natural and cultural aspects which constitute that landscape.

Cultural landscape approaches to management have developed as a way of addressing the range of meanings and values which come to be ascribed to places by the people who inhabit and engage with them. Cultural landscapes, as a focus of heritage management efforts, have been defined by Tatiana Vakhitova (2015, 217) as:

“a multivalent social phenomenon with tangible and intangible dimensions, spatial, and temporal scales. The cultural landscape approach continues the discourse on heritage values and emphasises the importance of recognition of social value and hence a wider stakeholder participation in the process of heritage management. This approach allows enhancing both intangible and tangible dimensions of cultural heritage and, therefore, encourages a more inclusive consideration of diverse cultural heritage values (encompassing social and environmental categories, e.g. well-being, health).”

One of the many important elements of this definition is the acknowledgement of multiple temporalities in cultural landscape considerations. Rather than privileging the deep past as the
principle focus of attention, cultural landscape approaches to heritage management promote a broad temporal scope which strengthens perspectives of contemporary landscape value through the combination of discrete locations and time periods. Doing so denaturalizes conceptual divisions between past and present which have proven problematic in the practice of publically engaged archaeology-as-heritage (Samuels 2008, p.72), thereby yielding a more holistic accounting of places deemed culturally important across continuums of cultural expression from the past (Ingilraani and taimani) to the present (qangma).

Management frameworks designed to accommodate the holistic perspectives espoused through concepts of cultural landscapes are capable of fostering conservation practices which are directed by the multitudinous expressions of value that come to be ascribed to places of cultural significance. While cultural landscapes need not include material remains of the past (Buggey 1999, 14), such features are often construed as important criteria in formal cultural landscape designation processes. The focus of cultural landscapes on public perceptions of value makes them particularly well suited to the conduct of vulnerability assessments, especially given Green and McFadden’s suggestions regarding the nature of ‘perturbations’ as defined in relation to the values ascribed to places. The diversity of potential cultural landscape manifestations has encouraged their application in numerous heritage management frameworks across a range of governance levels (international, national, regional and local). For example, the Government of Northwest Territories ‘Culture and Heritage Strategic Framework’ (GNWT 2015), and the Northwest Territories guide ‘Living With the Land: A Manual for Documenting Cultural Landscapes in the Northwest Territories’ (GNWT 2007), both promote the mobilization of public notions of value in the designation of cultural landscapes. The role of Value in archaeological/heritage management has been widely acknowledged (Carver 1996; Coningham, Cooper and Pollard 2006; Darvill 1995; Davis and West 2009; Deeben et al. 1999; Graeber 2001; Lipe 1984; Smith 2004; Tainter and Lucas 1983; Welch and Ferris 2014), and Kathryn Samuels (2008, 90) noted in particular that “value points us towards a more engaged and ethical archaeological practice”.

1.2 Project Outline

This dissertation details the efforts made to apply geographic information system (GIS)-facilitated methods of cultural landscape management in the Kugmallit Bay area of the western
Canadian Arctic, within the Inuvialuit Settlement Region and Northwest Territories. This project mobilized numerous sources of spatial information in the assessment of cultural landscape vulnerability, including notions of risk and value developed from the perspectives of two primary stakeholder groups. This included the knowledge of place names shared by Elders from the community of Tuktoyaktuk, as documented in oral histories and published in the book ‘Nuna Aliannaittuq: Beautiful Land’ (Hart 2011). The observations of archaeologists who have worked in the region over the past 60+ years were also applied, using information derived from the archaeological sites database and reports on file with the Northwest Territories Cultural Places Program. The GIS methods of ‘grounded visualization’ developed by LaDonna Knigge and Meghan Cope (2006; 2009) were employed in this research as an effective means of mobilizing both quantitative and contextually rich qualitative sources of information, with the goal of establishing a means of assessing cultural landscape vulnerability which could accommodate the influence of multiple perspectives of risk and value.

This research was designed as a component of the Arctic Cultural Heritage at Risk (Arctic CHAR) project, under the direction of Dr. Max Friesen in partnership with the Inuvialuit Cultural Centre (previously the Inuvialuit Cultural Resource Centre). The original goal of this research was to demarcate regions where archaeological sites were most vulnerable to coastal erosion impacts, thereby highlighting areas where subsequent stages of the Arctic CHAR project could focus monitoring and mitigation efforts. While monitoring surveys were continued over the course of the Arctic CHAR project at a number of threatened sites, Arctic CHAR mitigative efforts changed early on to focus primarily on the village of Kuukpak, where erosion was observed to have already impacted the abundant material remains located there.

This change in the overarching Arctic CHAR project necessitated a shift in focus for the vulnerability assessment away from a model of archaeological site vulnerability to a more broadly conceived model of cultural landscape vulnerability, yielding an example of how cooperative/integrative heritage management efforts can be meaningfully pursued in future projects, whether directed through academic research, NWT cultural landscape management frameworks, or Inuvialuit heritage management initiatives. This shift in focus was informed by the ample literature available on the topics of cultural landscapes, particularly as related to their promotion of value in heritage management frameworks (Andrews and Buggey 2008; 2012; Buggey 1999; Fowler 2003; Lazzari 2008; Rössler 2014; Taylor 2012; Teeman 2008; Vakhitova
activist archaeological theory as an approach to socially relevant and culturally appropriate heritage practice (Atalay 2014; Ferguson 2014; Ferris and Welch 2014; Nicholas 2014); and qualitative GIS methods as a means of effectively mobilizing publically sourced notions of risk and value in an iterative, non-reductive and multiscalar fashion (Elwood and Cope 2009; Hacıgüzeller 2012; Knigge and Cope 2006; 2009; Pavlovskaya 2009). This project is outlined in greater detail in the three chapters which follow.

1.3 Chapter Overview

Chapter 2 addresses the efforts made in an early stage of the project to establish an understanding of the historical trajectory of Kugmallit Bay coastal evolution. The historical model of shoreline change was used during preliminary rounds of the iterative vulnerability assessment process to highlight areas where material remains of the past were imminently threatened by erosion, as well as areas of high erosive impact which might benefit from further survey efforts in the absence of known places of cultural significance. The methods employed in developing the model are addressed early in the chapter, including the study area selection process, the sourcing of imagery (satellite and air photo) used to develop the model, the shoreline digitization process and the particular approach taken in calculating rates of change. The results section of the chapter outlines the findings of the model, situating them within the realm of feasibility by comparison to earlier accounts of shoreline change reported in the region. The results of in-field measurements to test the accuracy of the model are also addressed, highlighting an appreciable discrepancy between modelled and observed change rates. The investigation of how this discrepancy came about is then detailed, followed by a discussion of the implications of this finding to similar erosion vulnerability assessments conducted elsewhere.

Chapter 3 details the manner in which qualitative GIS methods of grounded visualization can be employed as a means of promoting the tenets of activist archaeology. The chapter opens with an overview of activist archaeology, highlighting it as one of many approaches which have developed throughout the social sciences in alignment with the greater realm of engaged scholarship. The rise of community mapping and radical cartography in North American Geography is then addressed, as well as the qualitative shift within geographic information science in response to critiques of rampant positivism and uncritical reductionism in human-landscape representations. The early approaches of William Bunge and his commitment to social
justice through applied research are also discussed within the contexts of shifting theoretical trends in North American scholarship. The similar goals and methodological considerations employed in both activist archaeology and qualitative GIS are then considered, highlighting the applicability of qualitative GIS methods in activist archaeological research. The chapter closes with an example of how qualitative GIS methods of grounded visualization have advanced the tenets of activist archaeology in assessing the vulnerability of Inuvialuit cultural landscapes to the impacts of modern climate change in the Kugmallit Bay region.

Chapter 4 continues to address the topic of grounded visualization methods and cultural landscape perspectives on heritage, but with a shift in focus to their combined applicability within management frameworks. The benefits of this approach are demonstrated by reviewing the results of a preliminary iteration of the Kugmallit Bay vulnerability model, which applied notions of risk and value in the identification of threatened areas of cultural significance in a non-hierarchical and recursive fashion. The role of value/significance in cultural landscape designations and management efforts is addressed after a brief introduction, including an overview of the way in which different notions of value have been applied to the ancestral Inuvialuit village of Kitigaaryuit, located in the southern extent of the Kugmallit Bay study area. The methods of grounded visualization are briefly addressed, followed by a series of examples drawn from the results of analysis. These results are organized according to the different spatial scales which were employed during the iterative-recursive analysis, demonstrating the benefits of scalar flexibility in GIS-facilitated management methods. Chapter 4 concludes by summarizing the benefits of combining qualitative and quantitative notions of risk and value to cultural landscape management efforts through grounded visualization methods.

Chapter 5 draws together the findings presented in the preceding three chapters. The implications of grounded visualization methods to the assessment of cultural landscapes vulnerability are addressed with a particular focus on the need to perceive the results not as an ultimate accounting of vulnerability, but as one iteration driven by the subjective nature of a single analyst’s perspectives on different factors and combinations of factors related to various modes of risk and value. Future research directions are also addressed, including the need to engage more substantively with Inuvialuit on the matter of heritage vulnerability and management, the potential for expanding the geographic scope beyond the Kugmallit Bay region, and the prospect of incorporating additional threat factors in the assessment process.
Chapter 2

2 Archaeological Site Vulnerability Modelling: The Influence of High Impact Storm Events on Models of Shoreline Erosion in the Western Canadian Arctic.

Note: This chapter was originally published in the journal: Open Archaeology: Topical Issue on Advances in Arctic Archaeology (2017) Volume 3, Issue 1, pp.1-16. It is used here in accordance with the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 License (Appendix A) as currently displayed at: https://creativecommons.org/licenses/by-nc-nd/4.0/.

Abstract: Much of the Inuvialuit archaeological record is situated along shorelines of the western Canadian Arctic. These coastal sites are at substantial risk of damage due to a number of geomorphological processes at work in the region. The identification of threatened heritage remains is critical in the Mackenzie Delta, where landscape changes are taking place at an increasingly rapid pace. This chapter outlines some preliminary observations from a research program directed toward identifying vulnerable archaeological remains within the Inuvialuit Settlement Region. Coastal erosion rates have been calculated for over 280 km of the Kugmallit Bay shoreline, extending along the eastern shores of Richards Island and neighbouring areas of the Tuktoyaktuk Peninsula. Helicopter surveys conducted during the 2014 field season confirmed that areas exposed to heavy erosive forces in the past continue to erode at alarming rates. Some of the calculated rates, however, have proven far too conservative. An extreme period of erosion at Toker Point in the autumn of 2013 has yielded a prime example of how increasingly volatile weather patterns can influence shoreline erosion models. It has also provided a case with which to demonstrate the value of using more recent, shorter time-interval imagery in assessing impacts to cultural landscapes.

2.1 Introduction

The archaeological record of the Canadian Arctic extends back over 5000 years (Friesen 2016) consisting in some places of extremely well-preserved material remains. The stable layer of permafrost and dry conditions of the polar desert which foster such high levels of preservation are deteriorating at an increasingly rapid rate however, largely on account of warming climate
trends (Anisimov et al. 2007; Blankholm 2009; Lantuit et al. 2011). Shoreline erosion in the western regions of the Canadian Arctic has proven to be a more immediate factor in the loss of cultural materials, due in part to the predominantly marine-focused lifeways and settlement patterns of people who have lived in the region since time immemorial (Alunik, Kolausok and Morrison 2003). This tendency to settle in coastal locations has prompted many northern communities, including Tuktoyaktuk in the Northwest Territories (Johnson et al. 2003) and Shishmaref in Alaska (Mason et al. 2012), to seek new ways of adapting to the unprecedented rates of change taking place there. Understanding the historical trajectory of shoreline change can yield useful insights on where best to focus efforts toward the management of coastally situated cultural landscapes.

The Beaufort Sea coast is characterized as one of the largest areas of high sensitivity shoreline in the circumpolar Arctic (Shaw et al. 1998). As a result, archaeological sites located there are particularly vulnerable to climate related impacts such as permafrost depletion (Smith et al. 2009), backshore thaw slump activation (Lantz and Kokelj 2008), increased severity and frequency of wind events and related storm surges (Pisaric et al. 2011; Small et al. 2011), and shoreline erosion (Solomon 2005). The region is notorious for its powerful northwesterly wind events, which typically increase in strength and frequency in the late autumn prior to freeze-up (Manson and Solomon 2007; Solomon 2005). Studies have shown that storm surges influenced by the severity of fall storms and the duration of open water conditions can have substantial impacts on the rate of shoreline retreat among permafrost and massive-ice laden coastlines (Solomon 2014).

Renewed interest in resource extraction, as well as transoceanic shipping and cruise-ship tourism in the Beaufort Sea area have also been forecast to have a negative impact on coastally situated archaeological sites (AMAP/CAFF/SDWG 2013; Cinq-Mars and Pilon 1991). Given the impacts that changes in prevailing climatic conditions are having on the stability of both modern communities and archaeological sites in the Canadian Arctic, it is imperative that steps be taken quickly to improve our understanding of these impacts and capacities to address them. To this end, I have applied a Geographic Information System (GIS)-based method of identifying vulnerable archaeological remains in the Mackenzie Delta region. This model has been created as part of the Arctic Cultural Heritage at Risk (Arctic CHAR) project; directed by Dr. Max Friesen of the University of Toronto in partnership with the Inuvialuit Cultural Centre.
Over 150 archival air photos and satellite images of the core Arctic CHAR study area have been processed (NAPL 1950; NAPL 1972; MVAP 2007; DigitalGlobe Inc 2013), yielding coastal change rate figures for over 280 km of the Beaufort Sea shoreline. This historical shoreline change model was developed using the ArcMAP software suite versions 10.1 – 10.3 (ESRI Inc) and the Digital Shoreline Analysis System (DSAS), which is an ArcMAP extension developed by the US Geological Survey (USGS 2009). The accuracy of the results has been assessed through ‘ground truthing’ efforts over the course of three field seasons. This process has shown that while the calculated shoreline trends are largely accurate with regard to the modelled versus observed rates of shoreline erosion throughout the core project area, one site in particular has undergone far higher erosion rates than the GIS model predicted. This chapter will outline the likely cause of this discrepancy, thereby demonstrating the value of more recent, shorter time-interval imagery in assessing impacts to cultural landscapes.

2.2 Methods

Erosion modelling efforts were focussed on the Kugmallit Bay region of the Arctic CHAR project area (Fig.1). This region was selected in part due to the abundance of known archaeological sites in the area, but also due to the availability of digital imagery with which to produce the model. While archaeologists have long used aerial photographs in other parts of the world (Bewley and Raczkowski 2002; Crawford 1929), the earliest available imagery of the Beaufort Sea coastline dates to 1950. The Royal Canadian Air Force, the National Research Council and the Department of Mines and Technical Surveys began collaborating in 1924 toward the goal of improving the accuracy of existing Canadian maps. This concerted effort did not extend to the Arctic region until 1945 however, after which three squadrons of aircraft were dedicated to the task of mapping the whole of the Canadian Arctic (Thomas 1950). Despite this tremendous effort, one of the greatest impediments to undertaking coastal change analysis in the Canadian Arctic is the limited nature of available imagery.

Historical air photos were obtained from the Natural Resources Canada National Air Photo Library (NAPL). The University of Toronto Map and Data Library secured 108 air photos in support of this research, which included imagery of the shores of Kugmallit Bay extending from the eastern extent of Richards Island down to the mouth of the East Channel, east to Tuktoyaktuk and north to Toker Point. NAPL imagery was selected for the summers of 1950 (1:40,000 scale)
and 1972 (1:60,000 scale), both of which were scanned at 300 dpi by NAPL staff (NAPL 1950; NAPL 1972). These two periods were selected because of the minimal cloud cover and absence of shorefast ice in the imagery, thereby facilitating more accurate assessments of past shoreline positions.

Figure 1: Arctic CHAR Project study area.

More recent imagery was sourced from the Mackenzie Valley Air Photo (MVAP) project (MVAP 2005). Indian and Northern Affairs Canada initiated the MVAP project to support decision making related to the proposed development of the Mackenzie Valley Gas Pipeline Project. The results of this project have included a more accurate topographic model of the region, consisting of contour interval data as well as a digital elevation model. The project has also yielded over 4500 natural colour digital orthophotos at 1:30,000 scale, all of which have been georectified using differential GPS ground survey controls (Schwarz, Epp and Jasper 2007).
These data have been made freely available to the public through the Northwest Territories Centre for Geomatics data portal (http://www.geomatics.gov.nt.ca/dldsoptions.aspx).

Though not incorporated into the final regional erosion model, a series of satellite images was recently obtained through a DigitalGlobe Foundation imagery grant. The grant provided over 3000 square kilometres of panchromatic (0.5 m resolution) and multispectral (2.0 m resolution) imagery from the GeoEye-1 satellite. This imagery extended over the core erosion modelling area and included a combination of imagery from 2009 and 2013 (DigitalGlobe Inc. 2009; DigitalGlobe Inc. 2013). As discussed further below, this imagery has proven quite useful for refining erosion rate estimates in the vicinity of archaeological remains.

Each of the air photos and satellite images had to be overlain and aligned with each other within the GIS software, using a process referred to as georectification. This process involved importing each of the NAPL and GeoEye-1 images into ArcMap, where geographic control points were assigned to minimize the degree of distortion between each image and a base-layer of reliably aligned control imagery. The spatial accuracy of the MVAP aerial photography led to its use as control imagery for this project. The type of transformation method used in the georectification process determines how the air photo is twisted, rotated and generally deformed to ensure an accurate fit to the control points. In this case, a spline transformation was used which optimized local accuracy near the control points at the expense of region-wide accuracy (ESRI Inc. 2014).

A minimum of ten control points are required to apply a spline transformation to the rectified imagery, though the number of points applied to each image for present purposes varied from 15 to 35 depending on its level of discrepancy with the MVAP control imagery. In order to best apply the locally optimized spline transformation process, control points were first assigned near the four corners of each air photo, essentially tacking it down onto the MVAP imagery. Further points were then assigned along and near the shoreline zone as needed. The degree of error for each batch of control points was checked using a second-order polynomial transformation, yielding an average root mean square value of less than 3.0 m in every case. The rectified images were then inspected individually to ensure adequate closeness of fit along the MVAP shoreline areas, with further control points added where necessary.

With all of the imagery georeferenced, the shoreline digitization process could begin. The DSAS User Guide noted that: "Shoreline positions can reference several different features such as the
vegetation line, the high water line, the low water line, or the wet/dry line... It is strongly recommended that initial data-preparation steps be taken to reference all shoreline vectors to the
same feature (for example, mean high water) before using DSAS to compute change statistics.” (Thieler et al. 2009, 10). In order to accommodate the relatively low resolution of the NAPL air photos, the more readily visible ‘wet-dry’ line was selected as a standardized proxy for overall coastal movement. Shorelines were digitized manually for each time period (Fig. 2) and saved as features in a geodatabase format to facilitate processing in the DSAS ArcMap extension.

It should be noted that the degree of land-water interface visibility varied greatly between time periods covered by the air photos, with the more recent imagery yielding much more confident shoreline positions than the earlier 1950 and 1972 air photos. The highly variable coastal morphology also caused problems in the digitization process. High, shadow casting bluffs and gently sloping, vegetation rich intertidal zones made accurately identifying the wet-dry line all but impossible in some instances. These and other difficulties inherent to erosion modelling in an Arctic setting will be discussed in a forthcoming publication. Suffice it to say however that while there are limitations to this method, the approach does hold merit as a means of producing a generalized model of historical coastal change rates. For examples of similar methods applied in heritage management efforts elsewhere, see also: Radosavljevic et al. (2016), Reeder, Rick and Erlandson (2012) and Robinson et al. (2010).

The DSAS software was used to generate a series of transects oriented perpendicular to the coast in 10 m intervals. These transects were then plotted over the digitized shoreline positions to calculate change rates from each transect interval of known length and temporal span, as seen in the ‘Rates’ section of Figure 2. The software can accommodate a range of different statistical methods to describe trends in the shoreline change data. The end point rate (EPR), which accounts for change between the oldest and youngest shoreline positions, is attractive as a straightforward measure of change. Its usefulness in this particular study was limited however due to its inability to account for changes between erosional and depositional shoreline trends through time. The abundant sources of sediment in the region and strong coastal processes with which to transport them have led to the frequent formation and removal of ephemeral coastal features throughout the study area, such as sand spits and barrier islands (Peletier and Medioli 2014). The linear regression rate (LRR) was ultimately selected for its ability to incorporate all three shoreline positional datasets, and thereby its capacity for accommodating changes in shoreline trend (Thieler et al. 2009). The LRR was calculated for the entire study area (Fig. 3), spanning the 54 year period covered by the NAPL and MVAP imagery.
2.3 Results

The results of the shoreline change analysis can be seen in Figure 4. Linear transects were clipped to the length of the shoreline change envelope and then colour coded according to LRR values in metres per year. Positive LRR values resulted from coastlines with depositional trends, as can be seen at the tip of Topkak Spit in the inset map. Shorelines dominated by erosional trends yielded negative LRR values, as was the case throughout much of the study area. Shoreline trends from all 25620 transects within the study area yielded an average annual LRR of -0.62 m/a. This erosional trend and change rate for the region as a whole align with observations made by Solomon (2005), who noted that the primary forcing mechanisms behind erosion of the Beaufort Sea Coastline are long term sea level rise and periodic storms.
The differential nature of shoreline change taking place along the Beaufort Sea coast has been noted by a number of researchers (Harper, Reimer and Collins 1985; Solomon 2005). As seen in Figure 4, areas like the mouth of the East Channel which are sheltered from strong northwesterly winds typically exhibit lower erosive rates and a higher frequency of depositional trends. Areas with higher erosive rates tended to have a northwesterly exposure, such as Toker Point, Beluga Point, an area referred to as Imnaqpaaluk or ‘Melting Bluffs’ by Tuktoyaktuk Elders (Hart 2011), and a 4 km long stretch of shoreline west of Canyanek Inlet. The susceptibility of these areas to storm impacts is compounded by their setting among ice-rich, low elevation regions of fine grained lacustrine sediments (Pelletier and Medioli 2014).

In order to test the accuracy of coastal change rate calculations, an area with known archaeological sites was required which exhibited high rates of erosion. Toker Point, in the far eastern extent of the study area (Fig 5), was selected for this purpose. A line of surveyor stakes...
was established during the 2013 Arctic CHAR field season. The stakes were set perpendicular to the average strike of the shoreline at 2 m, 10 m, 20 m and 30 m distances to facilitate monitoring over the course of subsequent survey visits. Because of the high energy nature of this exposed coast (Fig. 6), stakes could not be placed at the wet-dry line. This restriction led to measurements being taken from the active edge of the eroding backshore area in the years to follow, under the assumption that rates of change would be roughly equivalent.

Figure 5: Toker Point shoreline positions (Inset: monitoring stake locations).

Following the 2013 field season, shoreline change rate calculations for the Toker Point area were bolstered by the inclusion of a fourth shoreline position. Using the methods previously outlined, the 2009 shoreline was digitized from GeoEye-1 imagery and a new set of LRR-based shoreline trends were calculated. This revised model yielded average LRR values of -1.46 m/a for the Toker Point area overall, -3.70 m/a for the eastern extent of the region, and -4.27 m/a for the 10 transects closest to the monitoring stakes (Fig. 7). The persistence of this historical erosion rate
into recent years can be seen in the Figure 7 inset map. The position of the 2m stake placed in 2013 is roughly 17 m from the active shoreline visible in the 2009 imagery, indicating an average annual loss of 4.25 m/a over four years at that shoreline position.

Figure 6: Eroding shoreline near monitoring stakes at Toker Point.

Upon returning to Toker Point in 2014, there appeared to have been very little shoreline movement over the course of the 2013 storm season, as the stake nearest the shoreline was still relatively close to the edge. Upon closer inspection however, it became clear that what was originally mistaken for the 2 m stake was in fact the 10 m stake. The shoreline at Toker Point (Fig. 8), had receded roughly 8.5 m over the course of a single year, far exceeding even the highest calculated retreat rates for the area. While some level of discrepancy between modelled and observed rates was anticipated for the first set of monitoring surveys, this magnitude of difference was assumed to reflect that the model had failed in some way. After returning from the field, the model was reassessed to determine whether or not such a large discrepancy could be attributable to an error in the methods employed.
In light of the susceptibility of the LRR statistic to outlier effects and thereby its tendency to underestimate rates of change compared to other statistical methods (Thieler et al. 2009), the EPR values for all Toker Point transects were calculated. EPR rates were all very similar to their respective LRR values for the Toker Point region overall, as well as the eastern extent of Toker Point and from transects near the monitoring stakes (Table 1). Thus, it would appear that the type of statistic used was not a factor in the underestimated erosion calculations in this particular instance; perhaps on account of the relative abundance of heavily erosive shoreline trends which influenced the extent of regional averages.

<table>
<thead>
<tr>
<th>Zone</th>
<th>LRR (m/a)</th>
<th>East LRR (m/a)</th>
<th>Stake LRR (m/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toker Point</td>
<td>-1.43</td>
<td>-3.70</td>
<td>-4.27</td>
</tr>
<tr>
<td>East Toker Point</td>
<td>-1.46</td>
<td>-3.70</td>
<td>-4.17</td>
</tr>
</tbody>
</table>

Table 1: Average erosion rate calculations for different zones within the study area.
Figure 8: Toker Point shoreline positions observed during 2013 and 2014 field seasons.

Another possible factor behind the low modelled rate estimates was the conflation of all three time periods into a single LRR statistic. Calculating EPR values for each time interval individually would allow for the assessment of change over individual time periods, possibly yielding insights as to the cause of the low erosion estimate. To determine whether Toker Point erosion rates had changed over each of the three time periods, EPR values were calculated for
the 1950 – 1972, 1972 – 2004, and 2004 – 2009 intervals individually (Fig. 9). These calculations demonstrated that the average rates of erosion acting on the east Toker Point shoreline appear to have decreased over time. It should be noted however that much like the overall study area, erosion rates do vary considerably throughout the Toker Point shoreline zone. It should also be noted that these spatially prescribed trends do show a marked level of variation from time period to time period, and that the spacing of individual time periods was not equal.

Figure 9: End point rate (EPR) calculations for three time periods at east Toker Point.

The EPR Erosion rates directly in front of the monitoring stakes appear to have increased during the 1972-2004 time periods, but decrease again during 2004-2009 (Fig. 10). Less than 100 m east of the stakes however, an ice-rich, elevated landform had been heavily eroded over the 2004-2009 time span. This 200 m length of shoreline receded at an average rate of -7.04 m/a (EPR) over five years. On comparing the losses visible in the imagery, the erosion appears to have followed the outline of the elevated, ice-rich landform between 2004 and 2009. If this pattern
continues, the erosion of this landform could ultimately lead to the breaching of two nearby lakes and the exposure of still more of the landform to wave action and storm surges. Should current rates persist, the entire length of the raised landform will be removed within 25 years.

While this localised erosion event does not explain the 8.5 m of shoreline loss seen at the monitoring stakes in 2014, it does demonstrate that such losses are possible under the right conditions. Given that such high rates of erosion can occur in the eastern Toker Point region, the possibility remained that discrepancies in modelled versus observed rates may be related to shortcomings in the method when accounting for occasional extreme erosive events. Changes in the spatial extent of erosive impacts are linked to geological, cyrological and geomorphological conditions at any given location, as evident in preferential erosion of the ice rich landform in Figure 10. Changes through time however are most commonly attributed to long-term fluctuations in storminess and the duration of open water conditions (Solomon 2005). Winds exceeding 50 km/h have been correlated with pronounced periods of shoreline erosion within the study area (Manson and Solomon 2007), while shorefast ice which limits the erosive impact of waves typically persists in the Beaufort Sea from October through to June (Solomon 2005). In order to determine if Toker Point experienced an unusually active storm season during the autumn of 2013, wind speed and directional data from the nearest weather monitoring station at Tuktoyaktuk was obtained from Environment Canada’s online climate data archives (http://climate.weather.gc.ca/).

The number of days with wind speeds in excess of 50km/h can be seen in Figure 11. Despite the two years with missing data, the region clearly experienced a series of closely spaced high wind episodes in 2013; a trend which continued into the first half of 2014 as well. Of the 123 wind events that took place in 2013, 105 (85%) were out of the northwest. Assuming that shorefast ice is present from October through until June, 28 of the northwesterly high wind events took place
Figure 10: Recent erosion rates at east Toker Point, showing higher rates associated with exposed ground ice.
Figure 11: Chart of high (>50 km/h) wind speed events near Tuktoyaktuk.

during open-water conditions. 20 of these open water-related wind events occurred after the 2013 survey took place, eight of which involved speeds in excess of 60 km/h, and two others exceeded 90 km/h. A further 12 days with northwesterly winds exceeding 50 km/h took place in the open-water period of 2014, prior to survey efforts in August of that year. Thus, 32 out of the possible 120 ice free days between survey trips to the Toker Point region involved potentially impactful storm events. In order to determine if high water levels accompanied the open-water wind events, tidal gauge records from offshore buoys near Tuktoyaktuk were obtained from the Fisheries and Oceans Canada – Drifting Buoys website (http://isdm-gdsi.gc.ca/isdm-gdsi/drib-bder/index-eng.htm). Much of the buoy data was missing for the 2013 and 2014 period, but high water levels, defined by an increase of 1.25 m above chart datum over a period of no less than one hour (Manson and Solomon 2007), accompanied all of the 2013 wind events from June through October. Several other high water levels from 2013 appear to correlate with wind events that took place as late as mid-November, possibly hinting at a longer period of open water than usual for 2013.
2.4 Discussion

Shoreline erosion has received a great deal of attention from geographers, geologists, engineers and public planners. For example, Shaw et al. (1998) developed a coastal sensitivity index based on observations derived from 1:50K topographic maps. The ranked variables they developed were applied to shoreline regions throughout the circumpolar Arctic in order to determine relative levels of erosion risk. The ability to accurately project such retreat rates into the future can be hindered by a number of processes however, including the fact that such events often take place in a nonlinear fashion. For example, periods of erosion may be followed by periods of stability due to the deposition of protective aprons of eroded material at the base of coastal bluffs (Shaw et al. 1998). While it is possible to predict future trends by accounting for numerous compounding factors, the irregular patterning of natural erosive processes overall can complicate efforts. This is especially true in an Arctic setting, where unique factors such as the activation of backshore thaw slumps can completely invalidate predicted rates over the course of a single warm season.

The Extreme period of erosion at Toker Point between survey visits in 2013 and 2014 has provided a prime example of how increasingly volatile weather patterns can influence the reliability of shoreline erosion models. Understanding the historical trajectory of shoreline change can yield useful insights on where best to direct heritage management efforts. Understanding the weaknesses of historical shoreline change methods is just as critical, however, in achieving reasonable insights which can be reliably applied to said management efforts. Factors such as choice of statistical methods or the manner in which shoreline positional data are processed can have implications for the reliability of results generated. In this instance, checking the accuracy of the model resulted in the recognition of a particularly impactful storm season, and the realization that such influences may be all but invisible without access to annual imagery supplements or concerted ground truthing efforts.

The Toker Point monitoring stakes had been removed between the 2014 and 2015 survey seasons, making it difficult to further assess the quality of shoreline change calculations in the area. Patterned ground in the vicinity of the monitoring stakes allowed for the extrapolation of the 2015 shoreline position from photographs (Fig. 12). The 2014/2015 storm season inflicted 4.5 metres of coastal retreat in front of the monitoring stakes, thereby corroborating the
Figure 12: 2015 shoreline position at Toker Point.

originally calculated erosion rate of -4.27 m/a, and further highlighting the insular nature of the 2013/2014 storm impacts.
From this review of shoreline erosion calculations at Toker Point, it has been demonstrated that using aggregated time periods can yield useful results for generalized, region-wide overviews of historical shoreline change rates. However, the inclusion of further recent imagery and thereby shorter intervals of analysis can result in more nuanced models of shoreline change in the direct vicinity of known archaeological remains. Current forecasts have predicted changes in the seasonality of erosion forcing mechanisms, such that protracted open water periods coincide more often with strong autumn/winter storm events (Manson and Solomon 2007). Thus, the ability to detect sporadic, high-impact erosion events can be of tremendous use to cultural landscape management initiatives both now and in the future.
Chapter 3

3 The Map is Not the Territory: Applying Qualitative GIS in the Practice of Activist Archaeology

Note: The final, definitive version of this chapter has been published in the Journal of Social Archaeology, Volume 18, Issue 2, pp. 149-173, June 2018 by SAGE Publications Ltd, All rights reserved. © Michael John Edward O’Rourke. https://doi.org/10.1177/1469605318758406. The earlier version used here has been applied in accordance with the Journal Contributor’s Publishing Agreement (Appendix B).

Abstract: In response to concerns regarding the social relevance of North American archaeology, it has been suggested that the tenets of ‘activist scholarship’ can provide a framework for a more publically engaged archaeological discipline. Maps have long been employed in the public dissemination of archaeological research results, but they can also play a role in enhancing public participation in heritage management initiatives. This article outlines how the goals of activist archaeology can be achieved through the mobilization of qualitative GIS practices, with an example of how 'grounded visualization' methods were employed in assessing the vulnerability of Inuvialuit cultural landscapes to the impacts of modern climate change.

3.1 Introduction

It has been suggested that the value of archaeology to the public is in part reflected by the degree to which the results of archaeological research are incorporated into contemporary perspectives of the past (Flatman 2012, 291; Lipe 1984, 1-2; Samuels 2008, 87). Bruce Trigger (1984, 368) noted, however, that the public value of archaeological research was not solely in the contribution of objective, factual portrayals of the past, but in the interests of people living in the present seeking a greater connectivity with the past. Trigger (2008, 187) also noted that the nature of this value can vary greatly from context to context; a situation which would eventually result in the profusion of 'alternative' archaeologies, including critical, collaborative and Indigenous archaeologies, among others. A somewhat recent alternative approach, termed ‘activist archaeology’, has been developed specifically to address the heritage-related needs of the public in a methodologically rigorous and collaborative fashion. The tenets of activist
research, as a form of engaged scholarship (Hale 2008), have been promoted as a means of extending the utility of archaeology to the public in more meaningful ways.

In North American archaeological contexts, concerns over ‘meaningful research’ and ‘social relevance’ have been raised about the discipline in general, and particularly as related to Indigenous heritage perspectives (Atalay 2006; LaSalle 2010; McNiven and Russell 2005). That said, archaeologists possess a range of skills capable of yielding results which can be employed by descendant communities to support a variety of objectives, including the development of ancestral narratives and cultural curricula (Atalay 2006, 300-301; 2008, 32-35; Yellowhorn 2015, 245-246). The focus of activist scholarship on collaboratively addressing the needs of the public has promoted its use in archaeology as a means of improving the relevance of research methods and results to descendant community heritage programmes.

As powerful tools in portraying the results of our work, maps can play a critical role in extending the results of archaeological research to the public. Maps and Geographic Information Systems (GIS) have also been critiqued, however, for their perceived positivistic underpinnings and the Western scientific concepts of space they employ (Harley 1989; Pickles 1995). Such concerns have been cited in suggesting the poor fit of GIS mapping practices with Indigenous epistemologies (Rundstrom 1995). While certainly a valid concern given the historical associations of cartographic enterprises with the disenfranchisement of North American Indigenous peoples, such is not always the case (Brody 1988; Duerden and Kuhn 1996; Rundstrom 1991; Tobias 2010).

This article outlines how the goals of activist archaeology can be achieved through the cartographic practices espoused by ‘radical geography’ and ‘qualitative GIS’. I open with an overview of activist archaeology, situating the approach within the greater realm of engaged scholarship which has developed throughout the social sciences. I then address the rise of community mapping and radical cartography in North American geography, highlighting the early approaches of William Bunge in promoting social justice initiatives through applied research. This is followed by an overview of the applicability of qualitative GIS in activist archaeological research. The chapter closes with an example of how qualitative GIS methods of 'grounded visualization' have advanced the tenets of activist archaeology in assessing the vulnerability of Inuvialuit cultural landscapes to the impacts of modern climate change.
3.2 Activist Archaeology

Activist scholarship has been promoted as a collaborative research process which is governed by the needs of the public. It is intended to be a pragmatic approach to research, carried out specifically to solve problems of public import (Checker and Fishman 2004; Hale 2008). The public utility of research findings requires the generation of results which participants in the research process can value according to their own perspectives and use according to their own needs (Hale 2008, 4). Methodological rigour has been promoted as a key aspect of activist scholarship which can promote greater public utility in regulatory/legislative settings by generating readily defensible results. Adherence to well developed methods can also expose research to hermeneutic cycles of action and reflection, thereby revealing the situated nature of research questions and practices which can develop through the conduct of collaborative research (Hale 2008, 13). In so doing, the tensions which may arise through the practice of activist research can be more readily recognized and addressed, thereby generating findings which more adequately represent the goals of community research partners.

The tenets of activist research have been employed in archaeology to improve the utility and relevance of the discipline to the public. Sonya Atalay (2014) has defined activist archaeology as collaborative research conducted on heritage-related subject matter deemed relevant to descendant communities. While Hale (2008, 4) defined activist research as a collaboration between scholars and “people who are struggling to better their lives”, Atalay broadened the scope of engagement to include a variety of publics, with the caveat that archaeological methods must be considered valid modes of knowledge creation by everyone involved (2014, 51). She distinguished ‘activist archaeology’ from ‘applied anthropology’ as an approach which specifically promotes the democratization of knowledge production, rather than merely reframing the results of archaeological inquiry to suit a public need (Atalay 2014, 52). Both the practices and products of activist archaeological research become matters of public participation, scrutiny, critique and utilization.

Activist archaeology has been described as a means of broadening our methods and theories to promote greater engagements with a range of cultural heritage aspects (Nicholas 2014), whether they be tangible materials and landscapes; intangible stories and practices; or as Ferris and Welch suggest (2014, 224), “the people and communities today who draw meaning, identity,
vitality and even sustenance from heritage places and things”. Proponents of activist archaeology seek to promote the strength of archaeological methods as tools of inquiry in service to the "needs and interests of non-archaeological communities” (Atalay et al. 2014, 11). The pursuit of a shared understanding of the past through the foregrounding of public heritage interests requires acknowledgement of the multivocality and epistemological diversity behind the potential range of public heritage valuations which may take place. The conduct of low-impact archaeological research undertaken as part of the Kashaya Pomo Interpretive Trail Project (Gonzalez 2016) is a prime example of how archaeological research can be tailored to respectfully meet the needs of descendant communities seeking a more culturally appropriate heritage management process.

A number of authors have highlighted the utility of rigorous research practices when addressing public heritage needs (Atalay 2014; Ferguson 2014). In outlining the importance of methodological rigour to activist scholarship, Hale specifically noted how important it is that “…the activist scholar has concrete and potentially useful research skills to bring to the table” (2008, 8). Given the important role that heritage can play in the social, political and economic realms in which the public may seek to mobilize archaeological research results (Atalay 2014, 51-52; Ferguson 2014, 248; Martindale 2014; McGuire 2008), activist scholars must employ rigorous research methods capable of generating results which will resist scrutiny (Hale 2008, 9-11). This aspect of activist research requires that matters of 'valid' forms of knowledge be consciously addressed such that multiple ways of understanding are brought together in a non-hierarchical manner, giving equal footing to different perspectives and sources of information.

The results of activist research are meant to support, without overshadowing, descendant community narratives of ancestral lifeways. Such approaches should be conducted in a framework of ‘positioned objectivity’ (Hale 2008, 13), and ‘virtue ethics’ (Colwell-Chanthaphonh and Ferguson 2004, 17) which can accommodate the meaningful and respectful combination of epistemologically diverse sources of knowledge. Such combinations, referred to by Sonya Atalay (2012, 27) as ‘braided knowledge’, can be employed in the development of more holistic and publically relevant understandings of the past. Conducting community-based heritage research in a rigorous fashion can also influence public perceptions of archaeological practice. The consideration shown to material remains through the careful application of Western scientific methods can be perceived as an expression of respect, both for objects and places of
ancestral reverence, as well as for the ancestors associated with them (Atalay 2014, 53-54; O’Rourke 2016, 70).

By remaining accountable to both scholarly rigor and public utility, activist archaeologists must remain cognizant of both the design of viable research programmes and the meaningful dissemination of results. This latter point regarding the products of archaeological inquiry is of critical importance to discussions of social relevance in research. In outlining reciprocity as an ethic for community-based research, Maiter et al. (2008) noted that researchers often gather information from communities, but provide little in return. Reciprocal knowledge sharing practices can promote an open forum for the creation and maintenance of equality in social relationships among research collaborators (Maiter et al 2008; Meskell 2010). Engaging in open, reciprocal communication early in the research process also allows the needs of community collaborators and researchers alike to be made explicit, needs which can then be woven into the research goals as the project takes shape.

As powerful tools in the visualization of human-landscape interrelatedness, maps are capable of distilling complex patterns into readily discernible images. This capacity for distillation of research results has promoted their use in the dissemination of archaeological research results to a broad range of publics (Conolly and Lake 2006; Evans et al. 2007). The process of ‘counter-mapping’ in particular is a cartographic technique capable of subverting dominant narratives and “meeting ostensibly progressive political goals” (Hodgson and Schroeder 2002, 80). Counter-mapping practices are commonly associated with Indigenous cartographic efforts (Rundstrom 2009, 314), and have proven to be a particularly valuable approach to community-based heritage mapping endeavours. This can be seen in their application to better illustrate the place of Native and African American people who have been largely overlooked in historical narratives (Matthews, Alemy and Hudzik 2016), and providing dissonant or contrary perspectives as a means of offsetting sanctioned heritage discourses (Schofield 2014, 205).

3.3 Community Based Mapping and Radical Cartography

The kinds of 'alternative’ approaches which have flourished in archaeology have parallels in the existential angst which developed within the discipline of geography as well. Responses from the geographic community to these anxieties also mirror the kinds of reactions that have taken place within archaeology, particularly through a shift to greater community involvement. Community-
based mapping initiatives, while more common in recent years, certainly aren't new. One geographer in particular who plied his craft in the 1960's and 1970's facilitated a number of remarkable community mapping projects which were developed specifically to meet public needs.

William Bunge is a name indelibly linked with the practice of 'radical geography' (Akatiff 2016). Bunge made enormous contributions to the practice of community cartography and the promotion of academic research in the pursuit of social justice through the use of maps. His approach to Radical Geography is best seen in his efforts with the 'Detroit Geographical Expedition and Institute' (Bunge 1971), wherein Bunge applied his skills toward the investigation of inner-city social justice issues by joining geographers with members of the Detroit African American community to develop a series of what he termed 'oughtness maps'. These maps were meant to visually represent the experiences and aspirations of Detroit residents, displaying both the way things are and the way residents believed things ought to be.

A particularly interesting series of maps were developed during Bunge's Toronto Geographic Expedition. The first map (Bunge and Bordessa 1975, 154, Fig.72) displays the location of nearly 200 First Nations’ ancestral sites in the Toronto region. The second map (Bunge and Bordessa 1975, 154, Fig.73) displays the dispersed nature of Indigenous populations in the same area as of 1971. This set of maps highlights the contraction of contemporary Indigenous land-use patterns over time, as well as the largely invisible nature of past land-use practices in modern times. The conscious omission of ancestral sites from publically accessible maps is typically mandated by government policies to protect material remains from undocumented collecting. While a laudable goal in many contexts, the obfuscation of site locations can also prove problematic to the promotion of public heritage engagements; a topic I address further below.

It has been suggested that Bunge’s expeditions were precursors for the kinds of Public Participatory GIS mapping projects that would come later, in which academics collaborate with community groups to achieve specific goals using mapping techniques normally reserved for specialists (Goodchild 2008, 7-12). While certainly a radical, Bunge was very much a quantitative geographer. His first major publication, ‘Theoretical Geography’ (Bunge 1962), has been described as an essential contribution to early spatial-quantitative methods (Cox 2001, 71) which paved the way for subsequent efforts at applying cartographic approaches to human
problem-solving. Such overarching theoretical trends can also be seen in the gradual adoption of positivistic, empirical approaches to problem-solving as espoused by the Processual (New Archaeology) school of archaeological theory which came to the fore in the 1980's (Trigger 2006). A further commonality between both ‘The New Archaeology’ and ‘The New Geography’ is the extent to which they have both been critiqued by postmodernist scholars.

GIS research methods were becoming more common in North American geography departments just as postmodernism was taking root (Rundstrom 1991, 2). As a result, GIS became a prime target for fervent debate. Clark Akatiff, a contemporary of William Bunge and fellow pioneer of Radical Geography, has described how radicalism in geography has changed since the 1960’s. He noted that a degree of radicalism remained following the nation-wide purge of ‘Lefties’ from American academic institutions during the 1970’s and 1980’s, but it manifested in a more “academic and scholarly direction, with less involvement in people’s struggles.” (2016, 265). This, he posited, was the beginning of critical theory in Geography. Critical theory has been described as a framework for thinking about research that illuminates and deconstructs inadequacies in the knowledge creation process. Such inadequacies can arise from the promotion of particular worldviews or situated perspectives, and as such are often implicated in disparate power relations which may manifest between the practitioners and subjects of research (Held 1980).

Nadine Schuurman (2000, 570) portrayed critiques of GIS as occurring over the course of three waves which she categorized according to a spectrum of discourses between GIS practitioners and social theorists from open antagonism to constructive cooperation. Two of the more common critiques of GIS methods have included their strong capacity for mobilizing quantitative methods, and thus the perception that GIS naturalizes positivistic epistemologies at the expense of all others; as well as their reductive approach to human-landscape relatedness which tends to produce knowledge through the analysis of “… ever smaller constituent parts as if it [the world] were a machine having its components described mechanically” (Rundstrom 1995, 47).

The debates regarding positivism were among the first and most common to be levelled against GIS practitioners (Hacigüzeller 2012, 246; Schuurman 2000, 571). Perceptions of GIS as a neutral tool of spatial analysis have since been heartily countered however (Chrisman 2005, 25; Pavlovskaya 2009, 18-24; Pickles 1995, 3-4). The view of the map as a social construct with the
potential for expressions of power/knowledge (Harley 1989; Wood 1992) is now widely held. The very ontological security of GIS as a positivistic method is further challenged when the role of the person(s) interpreting the map is acknowledged as a factor in the transmission of spatial information which can change each time a map is viewed (Kitchin and Dodge 2007, 335). For example, whereas archaeologists may perceive a map displaying the abundance of sites which have undergone archaeological sampling as an expression of conservation efforts and the availability of research collections, non-archaeologist members of descendant communities may see the map as portraying a loss of heritage related to the removal of ancestral materials from their original contexts.

While the second point of critique relating to matters of GIS representationality is certainly valid, the same can be said about all mapping exercises. The reductionist aspects of cartographic representations are well demonstrated through Alfred Korzybsky’s axiom, ‘the map is not the territory’. While this statement may seem patently obvious, a full recognition of its message is sometimes overlooked. When Korzybski remarked that 'the map is not the territory, the word is not the thing defined', he intended to illustrate that representations of phenomena, such as maps of places, can influence the way we conceptualize those phenomena and yet are limited in their capacity to portray phenomena in their entirety. Korzybski did not intend to suggest that abstractions of reality are useless, however, having also stated that: “A map is not the territory it represents, but, if correct, it has a similar structure to the territory, which accounts for its usefulness” (Korzybski 1958, 58). Maps are, by their very nature, incomplete metaphors of reality. Such metaphors ‘selectively’ represent a mere fraction of the information available about any given place. As Rundstrom (1991, 6) points out, “maps fail if they are too inclusive”. Given this essential aspect of maps, it is critical that the elements we choose to include in them reflect the needs of the intended audience. Doing so will improve the likelihood that the maps we produce will be meaningful to the public we seek to engage with, or as Korzybski suggested - make our maps ‘correct’ and therefore ‘useful’.

3.4 Qualitative GIS and Activist Archaeology

Detractors of critical theory have noted that despite the sound philosophical foundation of critical approaches, the inward focus of the philosophy has proven to be its greatest weakness. Such perspectives mirror comments by Akatiff (2016) when he suggested that 'critical' projects tend to
produce insightful perspectives on research methods, but can fall short of yielding meaningful results beyond the academy. A similar skeptical perspective on the shift from radical to critical geographic theory has been addressed by Noel Castree (2000, 955), who noted that:

"... the current vitality of the geographical (read 'critical') Left in the academy correlates with its detachment from 'real world' political constituencies"...

"Rather than worrying over their apparent failure to connect with constituencies 'out there', it is argued that geographical Leftists need to recapture something of the radical geography spirit of action and engagement in order to contest changes occurring 'in here'".

To appropriately mobilize GIS in their research, archaeologists must be willing to engage with more than just the methods of computer-assisted spatial analysis. The responsible use of GIS also necessitates recognition of the theory-laden nature of GIS research, and thereby an understanding of the strengths and limitations of the technology in addressing archaeological research topics of relevance to the public (Conolly and Lake 2006, 10; Llobera 2012, 500-501; Millhauser and Morehart 2016, 248-251). Piraye Hacıgüzeller (2012, 346) has commented on the need for archaeologists who employ GIS methods to engage more fully with GIS theory. In outlining the history of critical GIS, Hacıgüzeller commented on the variety of approaches which have evolved from critiques of GIS, including participatory GIS, feminist GIS, and qualitative GIS. She further noted that these approaches were still waiting to be assessed for their applicability in archaeological research (Hacıgüzeller 2012, 249).

Qualitative GIS is a means of working with spatial information which developed in response to the critical geographies of the 1990’s (Elwood and Cope 2009, 1). This approach to GIS is largely predicated on the notion that GIS has been misconstrued as an exclusively quantitative technology (Pavlovskaya 2009, 30). Qualitative GIS has sought to reposition GIS as more than just a tool for spatial analysis, but rather as a set of socially situated practices and related theoretical frameworks that are capable of incorporating a diverse range of qualitative and quantitative information types. When combined, such syntheses are capable of yielding more humanistic representations of place (Pavlovskaya 2009, 31). The theoretical positioning and methodological approaches of qualitative GIS are well developed to address the kinds of research undertaken by activist archaeologists, particularly with regard to the process of
‘braiding’ knowledge. In outlining different approaches to activist research, Hale (2008) specifically suggested that activist scholars should enlist qualitative research methods as a means of ensuring the voices of people who actively participate in the research process are maintained within their respective contexts, rather than reduced to sound bites which conveniently address topics of inquiry.

The strength of qualitative GIS in developing visual representations of human-landscape relationships is well demonstrated in the approach taken by Elizabeth Middleton (2010), who compiled qualitative and quantitative spatial data toward the goal of empowering non-treaty California Indians in “protecting cultural resources and for asserting the significance of Maidu participation in environmental stewardship” (Middleton 2010, 363). She approached this goal by employing hyperlinks within GIS map layers which connected individual map features to documents containing ethnographically sourced contextual information. This combination yielded a visual representation of place-making dialogues which could be used by community groups as a ‘tool of liberatory research’. By promoting greater levels of public engagement in GIS research, qualitative GIS practitioners have sought to advance matters of social justice as a core aspect of their research, in a similar manner to the Radical Cartographers of the 1960’s, as well as activist scholars more recently.

While activist archaeology and qualitative GIS developed independently within their respective disciplines, they share a number of similarities which promote their parallel use in guiding the conduct of GIS-focussed heritage research. Both developed from critical theoretical roots which highlighted the situated perspectives behind allegedly ‘neutral’ scientific frameworks which preceded them. Both approaches promote collaborative community research partnerships, ensuring that the needs of the community have a place in the research questions being asked and the results being generated. Lastly, both advocate for an equal weighting of different forms of knowledge. Such policies foster inclusive research practices which acknowledge the legitimacy of multiple epistemologies, are capable of integrating a diversity of information types, and address the potential for power dynamics which may manifest through community-based research (Nadasdy 1999). The following section illustrates how these commonalities can align in practice, specifically through the application of qualitative GIS methods of ‘grounded visualization’ (Knigge and Cope 2006) in addressing changes to important cultural locations.
within the Kugmallit Bay area of the Inuvialuit Settlement Region (ISR) and Northwest Territories (NWT), Canada.

### 3.5 Vulnerable Cultural Landscapes of Kugmallit Bay

A research programme directed toward the identification of vulnerable cultural landscapes has been undertaken within the Kugmallit Bay area of the ISR (Fig. 13). This project was conducted as part of the Arctic Cultural Heritage at Risk (Arctic CHAR) project, directed by Prof. Max Friesen at the University of Toronto in partnership with the Inuvialuit Cultural Centre (ICC) (Friesen 2015). The Beaufort Sea region contains some of the highest sensitivity shorelines in the circumpolar Arctic (Shaw et al. 1998), and coastal erosion has proven to be a substantial factor in the loss of cultural materials there. For the purposes of this project, vulnerability was assessed according to two primary factors: risk and value. By better understanding the historical trajectory of shoreline change, management efforts can be more effectively directed to areas in imminent need of attention. At the same time, by establishing management strategies which incorporate notions of value ascribed to cultural landscapes by the people who identify with and draw meaning from them, a more socially relevant management process can result.

Archaeological management programmes are routinely tasked with maximizing the efficacy of limited public funds in protecting the material remains of the past. The abundance of sites and paucity of available resources require difficult choices to be made about which sites should be protected/documentated and which should be left to decay, decisions which are often based on some notion of site significance. These decisions are at the core of heritage management regimes (Germann and Spurling 1985; Samuels 2008), and have historically been made by archaeologists who employ a particular mode of valuation in the designation of site significance. Archaeologists have tended to promote aspects of informational value in site management efforts, as related to the potential for new discoveries and the chance to ’fill in the gaps’ of fragmentary culture histories (Lipe 1984). While new information about past lifeways can yield a more nuanced and thereby valued heritage experience to some, there are numerous other ways in which the past can come to be deemed significant (Carver 1996; Lipe 1984; Samuels 2008). Descendant communities in particular may ascribe aspects of informational value, as well as
social, aesthetic and/or spiritual significance to ancestral materials and landscapes (Anawak 1989; Thorley 2002). Recent approaches to archaeological site management, couched in anthropological notions of significance and multivocality, have highlighted the diversity of heritage valuations possible when the perspectives of multiple ‘stakeholder’ groups are engaged with (Samuels 2008; Smith 2004).

Site vulnerability was assessed through the methods of ‘grounded visualization’ proposed by LaDonna Knigge and Meghan Cope (2006). Grounded visualization, one of a variety of
approaches to qualitative GIS practice, involves the integration of grounded theory methods employed in qualitative research with visualization techniques typically used in quantitative GIS projects (Knigge and Cope 2006, 2024). Grounded visualization techniques offer a methodologically rigorous approach to the exploration of integrated spatial data and ethnographic information (Knigge and Cope 2009). Kugmallit Bay heritage vulnerability was determined through the analysis of several different information types, sources and scales which were employed in concert to better understand the way in which measures of risk overlap with and relate to places ascribed with a broad typology of values. When combined and reviewed using the iterative techniques of grounded visualization, these factors contributed to the identification of several regions where important cultural locations are at elevated risk of damage.

The risk component of the model was developed by calculating historical rates of shoreline change from a series of aerial photographs (Fig. 14). The methods used have been detailed elsewhere (O’Rourke 2017), but generally involved aligning 108 aerial photographs which were used to digitize roughly 280 km of historical shoreline positions. These shoreline positions were then used to calculate coastal change rates using the Digital Shoreline Analysis System, an extension developed by the US Geological Survey (USGS 2009) for the ArcGIS software suite, versions 10.1 – 10.3 (ESRI Inc). The modelled rates were verified over the course of four Arctic CHAR Project survey visits, using a series of surveyor stakes driven into the ground perpendicular to the shoreline to monitor on-site erosion rates (O’Rourke 2017, 6-7).

The value component of the model was developed from two primary sources of information: NWT archaeological site records and place names discussed by Inuvialuit Elders. Spatial data pertaining to archaeological sites were derived from the inventory of known archaeological locations maintained by the Prince of Wales Northern Heritage Centre (PWNHC). Notions of archaeological site value were determined based on a combination of qualitative information recorded within the sites database, as derived from permit reports on file with the PWNHC. In a few cases, comments regarding the importance of a site were recorded by the principle investigator, some of which reflected the perspectives of Inuvialuit who took part in the site documentation process. Where such comments were lacking, site significance was assigned according to the potential for informational value (Lipe 1984, 6) which could be derived from
the remains present. The potential for new discoveries and knowledge generation at each site was based on the type and complexity of the site, as well as the last recorded condition of the site. For example, large complex village sites were deemed more significant from an informational perspective than small lithic scatters, as were sites which were still largely intact rather than fragmentary sites that have been subjected to marked attrition through time. While problematic in that the particular value assigned to any given archaeological site may vary from one
researcher to the next, this approach was deemed the most viable for the sake of assessing the significance of sites from a generalized archaeological perspective.

The second source of value-related information was derived from Inuvialuit place names which were documented in the book ‘Nuna Aliannaittuq: Beautiful Land’ (Hart 2011). This gazetteer of Inuvialuit place names was developed from knowledge of the Beaufort region shared by Elders from the community of Tuktoyaktuk. The locations of 317 named places were digitized into a spatial dataset, while contextual details about each place name were transcribed into the associated database. Each location included a record of the accepted Inuvialuktun place name spelling, the English translation and interpretation of the name by Tuktoyaktuk Elders, the names of Elders who contributed to the interpretation, and the page reference from Nuna Aliannaittuq. Many locations included further details of relevance to the vulnerability model, including mention of ancestral remains, past land-use practices, and changes observed in the physical landscape. Through consultation with staff of the Inuvialuit Joint Secretariat (IJS), the governing body responsible for providing technical support to Inuvialuit agencies like the Game Council and Environmental Impact Assessment Review Board, further information regarding productive animal habitat and subsistence related activities such as hunting, trapping and fishing were also transcribed into the GIS dataset. This spatial information was compiled to facilitate an upcoming study of Inuvialuit harvesting practices and to incorporate the valuation of local ecology (cf. Millhauser and Morehart 2016, 262) into the assessment of cultural landscape vulnerability.

Inuvialuit place names contributed to the assessment of landscape value across three scales of analysis (O’Rourke 2018b). The importance of the Kugmallit Bay area as a whole was illustrated at the regional scale by the high density of place names located there. Intermediate scales of analysis facilitated by the use of a 10km x 10km grid system (discussed further below) highlighted the cultural importance of the east side of the Kugmallit Bay area, both in terms of the abundance of named places as well as the profusion of named places specifically associated with ancestral use. At the individual site level of analysis, place names described a number of culturally significant locations, providing important contextual details to the determination of landscape vulnerability.

The vulnerability assessment was conducted to align with the conservationist values espoused by the Inuvialuit Final Agreement (IFA 1984, 1), which foregrounds the need to “preserve
Inuvialuit cultural identity and values within a changing northern society”. The community principles and goals detailed in the Inuvik and Tuktoyaktuk Community Conservation Plans (IICCP 2008, 18; TCCP 2008, 17), and the Inuvialuit Regional Corporation’s Strategic Plan 2016 – 2019 (IRC 2016) have also provided justification for a conservationist ethos in this project. While this research has identified vulnerable cultural landscapes in the Kugmallit Bay area using combined archaeological and community-sourced notions of significance, I have made the conscious decision to avoid proposing specific management responses for regions at risk. Rather than assuming the problematic stance of ‘expert’ in making management recommendations (Ferris and Welch 2014, 219), I have opted to instead generate results which align with activist perspectives on research utility, yielding information which can be employed by Inuvialuit community members and governance agencies according to their specific needs.

Since the signing of the Inuvialuit Final Agreement, the management of Inuvialuit ancestral materials has fallen within the purview of Canadian federal and territorial governance agencies (Lyons 2013, 37-39). While neither the Inuvialuit Final Agreement nor the Community Consultation Plans explicitly address Inuvialuit management of archaeological/ancestral materials, these remains of the past are important aspects of Inuvialuit heritage and their disposition matters to the Inuvialuit people (Hart and Cockney 1998). As noted by Audla and Smith (2014, 120), “It is at best naïve—and at worst, highly paternalistic—to discount the efforts and the capacity of Inuit residents of the Arctic to envision and develop solutions to meet the intensifying pressures faced in their homelands.” The signing of the Inuvialuit Self-Government Agreement in Principle in July 2015 was a significant step toward the establishment of a formal Inuvialuit Government, which would have the authority to develop laws and provide services related to those laws (IRC 2017a). While it remains to be seen if Inuvialuit self-governance will result in heritage legislation, there is still great utility to this vulnerability research in informing the Inuvialuit public of threatened ancestral landscapes and promoting greater community dialogue on the topic of heritage management.

The need for Inuvialuit community perspectives on heritage value, culturally significant places and heritage management have been expressed in a number of forums, including academic publications (Radosavljevic et al. 2016, 13), and reports by international agencies such as the Arctic Council (AMAP/CAFF/SDWG 2013, 101-113). That said, Inuvialuit perspectives regarding the management of ancestral sites have been documented over the course of projects
such as the Inuvialuit Settlement Region – Traditional Knowledge Report (ICC/TCC/ACC 2006) and the Kitigaaryuit Inventory and Mapping Project (Hart 1997; 1999). Recommendations have included: working with community elders and youths to locate and document sites, the complete avoidance of burial sites both out of respect for the deceased and to ‘let nature take its course’, the need for erosion assessments at coastal sites, and the need for more community input in general. Such recommendations are scattered across a number of different sources however, and in some instances only relate to particular locations or contexts.

The Research and Support Services (RSS) office is a newly established branch of the Inuvialuit Regional Corporation which coordinates research initiatives taking place within the ISR (IRC 2017b). The RSS office has initiated the Traditional and Local Knowledge Coordination Project, which involves the compilation of all known Inuvialuit areas of cultural significance into a comprehensive database and associated digital map. This Inuvialuit-controlled spatial information will contribute to a broad range of heritage and lands management initiatives, and will act as a baseline of knowledge in the conduct of future place names research projects (IRC 2017b, 16). In working with the RSS office and the IJS, I have been able to tailor my research methods and results to meet the needs of the Inuvialuit governance system.

Numerous GIS datasets created in the process of developing the vulnerability model have been shared with the IJS (Table 2). Rather than waiting until the research program was completed, each dataset was released as soon as it was compiled. Additionally, given the nature of the place names information digitized from the Nuna Aliannaittuq publication (Hart 2011), formal control over that particular GIS dataset has been transferred to the IJS. It should be noted, however, that the archaeological sites inventory proved challenging when preparing research results for sharing with the IJS. Restrictions on the display of site locations at scales greater than 1:2 million (based on NWT regulations) necessitated the creation of a more generalized overview of the archaeological site inventory. An arbitrary grid of 10km x 10km square areas was draped over the study area and used to organize observations recorded in the archaeological sites database into regionalized parcels of information (For example, see Fig. 15). Information compiled for each grid area included: the number of sites present, the variety of site types identified, the condition of known sites, the factors behind any listed impacts, as well as the number of sites from which archaeological samples have been collected. Further, given the significance of burial locations to the Inuvialuit people (ICC/TCC/ACC 2006; Hart and Cockney 1998), the quantity of
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2) Shoreline change rate transect shapefiles (10m intervals). | Self-generated from archival air photos, using the ArcGIS extension: DSAS (USGS, 2009).                                               |
| Inuvialuit ‘Special Area’ use intensity data.     | ‘Heat map’ polygon shapefile reflecting the degree of overlap in recorded areas of special significance. | Generated from Inuvialuit Community Conservation Plan GIS data (accessed through the Inuvialuit Environmental Impact Screening Committee website). |
| Flood potential data.                            | Elevation polygon shapefiles (1m increments) reflecting regions of inundation potential. | Derived from Mackenzie Valley Air Photo Project elevation contour data (MVAP, 2005).                                                   |
| Inuvialuit Settlement Region – regional group divisions. | Boundary shapefiles for each of the six Inuvialuit regional groups. | Individual settlement regions digitized from Natural Resources Canada ‘Aboriginal Lands’ data set. Divisions were based on descriptions of regional borders provided in the Inuvialuit Final Agreement (IFA, 1984). |
| Nuna Aliannaittuq place names data.              | Place names shapefile consisting of point based locations and contextual details pertaining to each. | Locations and contextual details were digitized and transcribed from the publication – ‘Nuna Aliannaittuq: Beautiful Land’ (Hart, 2011). |
| Ethnocultural group data.                        | Boundary shapefiles related to different historical delineations of Inuvialuit cultural groupings. | Outlines were digitized from different socio-territorial groups discussed in ‘Across Time and Tundra’ (Alunik et al, 2003).               |
| Archaeological site overview grid.               | Grid shapefile of the Kugmallit Bay study area incorporating archaeological site details generalized to the grid-square area. Positional accuracy of archaeological sites was reduced to the grid-level in order to meet the requirements of the NWT Archaeological Sites Data Base licence agreement. | Generalized archaeological site information was derived from the NWT Archaeological Sites Data Base (PWNHC 2016). |

Table 2: Spatial datasets generated and transmitted to the IJS during the cultural landscape vulnerability study.
burial sites was also specifically addressed. This grid-based approach to publically mobilizing archaeological site information was supplemented by an interesting result of the grounded visualization methods employed. When comparing the site inventory with Tuktoyaktuk Elders’ place name details, numerous locations had corresponding entries in both sources of information, including many of the more prominent village locations. As a result of this correspondence, I

Figure 15: Map displaying percent of known sites which have been impacted by both archaeological and undocumented collection.
was able braid the two sources of information through my analysis of cultural landscape vulnerability and generate results which adhere to the stipulations of my data access licence.

When discussing how to produce materials for the public dissemination of research findings, staff of the ICC suggested that maps are a tremendously effective medium for circulating information among the Inuvialuit. That said, I was cautioned that maps should be a stepping stone to heritage engagement. It was suggested that maps of ancestral landscapes should be created to inspire people to go out on the land and experience the material manifestations of the past, while they still exist. ICC staff also noted that while online content being administered by the IJS is good for getting youths interested, digital is not always the preferred medium for community engagement. Some members of the community may want to learn more about Inuvialuit cultural landscapes, but are lacking reliable internet access or just aren’t interested in accessing information electronically. As a result, I have produced a number of conventional maps which will be circulated among the Hunters and Trappers Committees in the communities of Tuktoyaktuk and Inuvik. One has been prepared in a manner similar to Canadian federal government National Topographic System (NTS) maps sheets, using standardized topographic symbology and formatted to fold-up into a comparable ‘backpack-sized’ hiking map. Another series of 14 smaller maps, organized according to the arbitrary 10km x 10km grid used in my analysis (Fig 16), include a lengthy description of both archaeological and ancestral sites on the back of each sheet, thereby incorporating contextual details from the archaeological site inventory for each grid area, while maintaining a focus on the ancestral sites identified by Inuvialuit Elders.

3.6 Conclusions

Activist scholarship has provided an effective framework for the design and implementation of archaeological research which is focussed on addressing the needs of the public in more meaningful ways. Qualitative GIS methods, and grounded visualization in particular, can make significant contributions to the practice of activist archaeology due to both their capacity for reflexively ‘braiding’ different forms of knowledge, as well as their strength in visually representing a range of human-landscape relationships in a publically accessible format. This project has been conducted according to the tenets of activist scholarship to meet the needs of the Inuvialuit community, both in the topics I have addressed and the results I have generated. I have
Figure 16: Sample grid map produced for the public dissemination of research results.

employed qualitative GIS methods to assess a diverse array of spatial information in creating the vulnerability model, facilitating the application of community perspectives in developing results which might be considered ‘useful’ and therefore ‘correct’ by Korzybski’s standards. While the incorporation of my research results into the Inuvialuit Traditional and Local Knowledge Coordination Project is an exciting outcome, I have also come to appreciate that the digital nature of my work can limit the extent of my public engagements. Whereupon the race to embrace novel technologies within the discipline can potentially extend the products of
archaeological research to new audiences, it is important to consider how these technologies can also potentially exclude groups or individuals.

In the case of my own work in the ISR, it is critical that the maps I have created, be they digital or not, not turn into the ‘final result’ of my research. Rather, it is my hope that the vulnerability model will encourage greater community awareness of the threats facing the cultural landscapes of Kugmallit Bay and promote further community dialogue on the topic of heritage value and management. While the initial phase of research is now complete, I have been invited to volunteer with the RSS office in support of their Traditional and Local Knowledge Coordination Project. This opportunity has already led to the development of a supplementary research project which will build on current research findings to engage a broader range of contemporary Inuvialuit perspectives on cultural landscape vulnerability and management practice.

It is also my hope that the maps produced through this research will advance the desires of ICC staff by encouraging Inuvialuit to go out and experience ancestral landscapes for themselves. If a goal of heritage management strategies is to increase the value of the past to the people of the present, then we must make every effort to ensure that the results of our work are relevant to the public we seek to engage with, while being mindful of the unintended exclusions which may result from our methods. The map, after all, is not the territory, and coastally situated material remains of the past will continue to be removed from the lived landscape in the decades ahead. By iteratively applying qualitative GIS methods through activist archaeological research projects, while remaining aware of Korzybski’s cautionary axiom regarding the selective nature of cartographic representations, the heritage management perspectives of descendant communities can be addressed in a meaningful and culturally appropriate fashion.
Chapter 4

4 Risk and Value: Grounded Visualization Methods and the Assessment of Cultural Landscape Vulnerability in the Canadian Arctic

Note: This chapter is derived in part from an article published in World Archaeology (2018) copyright Taylor & Francis, available online: http://www.tandfonline.com DOI:10.1080/00438243.2018.1459205. The content of this chapter has been applied in accordance with section 4, subsection viii of the ‘Assignment of Copyright: Terms and Conditions’ (Appendix C).

Abstract: Cultural landscapes are an effective means of conceptualizing the heritage character of the lived landscape, an approach which has been applied in heritage management programmes around the world. A central aspect of cultural landscape management efforts is their particular attention to the kinds of value which are ascribed to places of cultural importance. This article outlines one iteration of a cultural landscape vulnerability model developed for the Kugmallit Bay area of the Inuvialuit Settlement Region and Northwest Territories, Canada. Notions of risk and value were applied in the determination of threatened places of cultural importance by employing the GIS-facilitated method of ‘grounded visualization’. It is argued here that grounded visualization provides a robust approach to cultural landscape management given its capacity to address qualitative and quantitative accounts of risk and value from a range of sources in a non-hierarchical, flexible and iterative fashion.

4.1 Introduction

The management of culturally significant places has developed throughout the 20th century into a substantial field of academic inquiry, as well as a topic of international tension and a profitable industry mandated by heritage legislation and policy (Brown 2014; Buggey 1999; Coningham Cooper and Pollard 2006; La Salle 2013; Rössler 2014; Tano 2014; Tveit 2006). Over the past 70 years, formalized heritage conservation strategies have been developed in response to periods of elevated risk, including armed conflicts, the threat of nuclear devastation, heightened anxieties over environmental degradation and, more recently, changes in prevailing climate patterns. Some of the most profound climate related impacts are currently taking place in the circumpolar Arctic
(Blankholm 2009; Lantz and Kokelj 2008; Melling et al. 2012; NOAA 2017), where cumulative effect models are still being developed and sometimes substantially revised as new lines of evidence become available.

The Arctic shores of North America have acted as foci of human activity for millennia, as demonstrated by the coastal orientation of many ancestral and contemporary Inupiat, Inuvialuit and Inuit communities (Alunik, Kolausok and Morrison 2003; Fitzhugh 2016). The marine-focused lifeways of many northern communities has put town-sites, ancestral remains and other culturally important areas at risk of damage or complete removal as a result of climate change related impacts. These shorelines have long been subjected to constant reshaping by coastal processes, but changes in the timing and intensity of these processes have been observed in many areas of the Arctic, particularly in relation to prolonged periods of warmer weather. This has led to the establishment of various international, national, sub-regional and local management frameworks designed to address the implications of changes taking place throughout the Arctic.

As noted by Sonya Atalay (2006, 280-281), long before the development of heritage management legislation, Indigenous communities have acted as stewards of their own cultural patrimony in a manner befitting their specific cultural needs. Inuvialuit of the Western Canadian Arctic have secured rights to lands and resources within the Inuvialuit Settlement Region through the signing of the Inuvialuit Final Agreement in 1984. This comprehensive land claim, the first modern land claim agreement in the Northwest Territories, formalized Inuvialuit land-use and management rights and established ‘measures to preserve Inuvialuit cultural identity and values within a changing northern society’ (IFA 1984, 1). Inuvialuit have been active in the excavation, documentation and interpretation of ancestral materials through a range of collaborative ventures (Lyons 2013, 36-39). The Kitigaaryuit Archaeological Inventory and Mapping (KAIM) Project, the first archaeological research program to be directed by an Inuvialuit organization (Hart and ISDP 1997, i), is a prime example of a community-directed collaborative heritage project which has produced substantial results in terms of both research and management capacity. Among the numerous results of the KAIM Project were the expansion of formal Kitigaaryuit site boundaries to more accurately reflect the extent of traditional use areas, and the change of designation from a National Historic Site to a ‘cultural landscape’ (Hart and ISDP 1997; 1999).
Figure 17: Map of Kugmallit Bay and Arctic CHAR study areas.

The Arctic Cultural Heritage at Risk (Arctic CHAR) project has been developed by Dr. Max Friesen of the University of Toronto in partnership with the Inuvialuit Cultural Centre (Friesen 2015). The project was established to assess and mitigate the impacts of climate change on the archaeological record of the Mackenzie Delta region in the Northwest Territories, Canada. An assessment of cultural landscape vulnerability was conducted as a component of the Arctic CHAR project to determine the regional patterning of threats to the stability of important cultural areas within the Kugmallit Bay region (Figure 17). This assessment resulted in the creation of a preliminary vulnerability model which applied notions of risk and value developed from the
perspectives of multiple stakeholder groups. The cultural landscape vulnerability assessment was conducted to align with the goals and recommendations of the KAIM Project, particularly in the adoption of a ‘cultural landscape’ perspective on heritage management. This article outlines the results of the preliminary vulnerability model and provides an example of the utility of grounded visualization techniques in heritage management frameworks by applying notions of risk and value toward the identification of threatened cultural landscapes in a non-hierarchical and iterative fashion.

4.2 Cultural Landscapes and Values-Based Management

Cultural landscapes were first legally recognised in Article 1 of the 1992 World Heritage Convention, where they were defined as the “combined works of nature and man” (Fowler 2003, 22). While nebulous, such definitions reflect the diversity of potential locales which may come to be deemed significant. The Northwest Territories Cultural Places Program has described cultural landscapes in terms of the interrelatedness of people and places, and further distinguishes ‘Aboriginal cultural landscapes’ based on the particular manner in which Indigenous lifeways are embedded in the land in terms of social, economic, cultural and spiritual aspects (GNWT 2007). Aboriginal cultural landscapes are also defined by the Canadian federal parks agency as:

“... a place valued by an Aboriginal group (or groups) because of their long and complex relationship with that land. It expresses their unity with the natural and spiritual environment. It embodies their traditional knowledge of spirits, places, land uses, and ecology. Material remains of the association may be prominent, but will often be minimal or absent” (Parks Canada n.d. a).

Such perspectives on Indigenous cultural landscapes have led to their recognition as more than mere dots on a map, but rather as “living landscapes that Indigenous people identify as fundamentally important to their cultural heritage” (Andrews and Buggey 2008, 65). Cultural landscapes can exist across a range of temporal and spatial scales, consisting of both tangible and intangible aspects of heritage which “enables a more comprehensive view on the interrelations of cultural heritage with other social and environmental categories and enhances the understanding of different values of cultural heritage” (Vakhitova 2015, 217).
Values-based heritage management involves applying the multitudinous ways in which different stakeholder groups attribute notions of significance to various aspects of heritage (McClelland et al. 2013), whether defined as materials, landscapes, practices, knowledge or otherwise. The role of value in heritage management, and cultural landscapes approaches to heritage management in particular, has been widely acknowledged. Numerous scholars have provided perspectives on both the applicability of value in assessing ancestral materials and landscapes for heritage significance, as well the deleterious manner in which value has been co-opted to promote particular worldviews at the expense of others (Carver 1996; Coningham Cooper and Pollard 2006; Darvill 1995; Davis 2009; Deeben et al. 1999; Lipe 1984; Samuels 2008; Smith 2004; Tainter and Lucas 1983).

Such values are typically applied through policy and legislative frameworks as a means of determining how to most effectively manage heritage in its various expressions. The Government of the Northwest Territories for example, stipulates that: “Significant archaeological resources on Commissioner's Lands and Federal Lands will be identified, protected, preserved, documented and interpreted” (GNWT 1997, 7). Canadian federal legislation also mobilizes value judgements in managing cultural resources within the Northwest Territories through the Mackenzie Valley Resource Management Act, which defines heritage resources in a similar fashion as, “archaeological or historic sites, burial sites, artefacts and other objects of historical, cultural or religious significance, and historical or cultural records” (Government of Canada 1998, 3). In order to further illustrate the potential breadth of significance concepts and their application to the values-based management of cultural landscapes, an overview of different stakeholder perspectives on the village site of Kitigaaryuit is provided below.

Kitigaaryuit is one of five sites of significance included on the Inuvialuit Regional Corporation’s Heritage Sites listing (IRC n.d.). The village was formally recognised as a Canadian National Historic Site on 19 June, 1978, and was listed on the Canadian Register of Historic Places (CRHP) on 30 December, 2009 (Parks Canada n.d. b). This process required the development of a formal ‘Statement of Significance’, which included a description of the site, an outline of the ‘heritage value’ of the location, and a listing of its ‘character defining qualities’. Through the KAIM Project, the Inuvialuit Social Development Program has sought to “...promote an interest and pride in the Kitigaaryuit cultural history and contemporary hunting and camping lifestyles” (Hart and Cockney 1998, 171).
Archaeologists have regarded Kitigaaryuit as an important location in terms of the knowledge which can be gleaned from the ample material remains of past lifeways which still exist there (McGhee 1974). The ‘heritage values’ listed for Kitigaaryuit in the CRHP include the fact that it has been continuously occupied for over 500 years, it is the largest ‘traditional Inuit community’ in Arctic Canada, and numerous material remains are still visible at the site (Parks Canada n.d. b). In terms of Inuvialuit notions of value, the village of Kitigaaryuit has had both positive and negative sentiments associated with it. As a place where epidemic disease took the lives of so many family members, people who moved away from the village in the early 1900’s regarded it as a place of sadness (Hart and Cockney 1998). Subsequent generations, including Elders living in nearby communities today have come to value Kitigaaryuit as a material reflection of the way things were in the past, from a time when “the culture and language were strong, meaning that it was where the ancient way of life was lived” (Hart and Cockney 1998, 165).

The valuing of a venerable past manifested through the remains at Kitigaaryuit was at least in part related to the loss of knowledgeable Elders to epidemic outbreaks c. 1900 (Hart and ISDP 1997). The documentation of past ways of life, both through oral histories shared by Elders and the archaeological investigation of material remains, was regarded as an important goal of the KAIM Project. While this mode of valuation appears similar to the kinds of informational value ascribed by archaeologists, this particular mode of learning could be seen as extending into social, spiritual and existential aspects of value as well: social value as related to intergenerational connectivities which manifest through the sharing of knowledge; spiritual value in the relational ties to the place of Kitigaaryuit as the final resting place of so many ancestors; and existential value, relating to the fact that the village still stands, that past ways of life still exist there in material form, and that Inuvialuit are playing an active role in the management of such an important place (cf., Darvill 1995).

The influence of Inuvialuit ancestral remains on perceptions of the lived landscape can be seen in the contextual details of the Inuvialuit place name Qikiqtaryuuyaq (‘Big Bad Island’), as documented in ‘Nuna Aliannaittuq: Beautiful land’ (Hart 2011). While the negative connotations behind the name 'Big Bad Island' were not addressed by contemporary informants, they did note that “The remains of houses several hundred years old show that Qikiqtaryuuyaq was a good place to live for part of the year” (Hart 2011, 133). Such comments imply that awareness of ancestral remains present in an area (in this case, the remains of driftwood houses) can contribute
to the experience of the landscape as a whole, and in particular to its character as a ‘good place’. While a more nuanced treatment of the complex topic of heritage value is beyond the scope of this article, further details regarding the application of value/significance in the Kugmallit Bay vulnerability model have been addressed elsewhere (O’Rourke 2018a).

4.3 Grounded Visualization Methods

The designation of heritage significance is an integral aspect of many lands management frameworks, but the application of such notions in the active practice of heritage management, when decisions take place regarding how best to mitigate against loss of material remains of the past, can prove quite difficult. The active, contextual and in some cases personal and emotionally charged nature of heritage value has complicated its application in vulnerability assessments. For example, a GIS-based model of archaeological site vulnerability in the Santa Barbara Channel region relied on the synthesis of a range of quantitative measures to determine levels of risk to coastally situated archaeological remains. The study’s authors noted however that while significant archaeological sites are protected by state law, ‘the designation of ‘significance’ for many archaeological sites may be difficult and the enforcement of such decisions strains local and county budgets” (Reeder, Rick and Erlandson 2012, 190).

Notions of value are typically expressed in heritage management frameworks as context-rich accounts detailing the singular nature of important locations, such as the Statements of Significance required for inclusion on the Canadian Register of Historic Places. As a result, the information used in heritage management decision making processes is often qualitative in nature. The conversion of value sentiments into resource management metrics is a possible avenue to take, and one that is easily facilitated by GIS techniques. However, the quantification of heritage value can be problematic given the reductive nature of such approaches which tend to produce more easily manageable, but less contextually rich or meaningful results.

The assessment of cultural landscape vulnerability in the Kugmallit Bay area was facilitated by the method of ‘grounded visualization’ proposed by LaDonna Knigge and Meghan Cope (2006). This GIS-facilitated analytical approach has been promoted as a means of addressing diverse types, scales and sources of spatial information in a flexible, recursive and methodologically robust fashion. A more thorough accounting of grounded visualization methods is provided by
Knigge and Cope (2006; 2009), and its viability in applying notions of value in the promotion of activist archaeological research goals has also been addressed elsewhere (O’Rourke 2018a).

By applying grounded visualization methods, ethnographic and documentary details were assembled from a range of archival sources, coded into more manageable formats, and classified using GIS software to establish categories of risk and value for subsequent stages of analysis. These coded sets of information were combined with other kinds of spatially prescribed data sources (surficial geology units, topography/elevation, and so on.) to recursively investigate patterns, themes and disjunctions between the various sources of information in what Knigge and Cope (2006, 2021) refer to as a ‘messy and fluid’ process. Doing so maintained much of the contextual detail related through the qualitative narrative accounts of risk and value, resulting in a preliminary model of cultural landscape vulnerability which has identified several regions where important cultural locations are at elevated risk of damage.

4.4 Grounded Visualization Results

Knigge and Cope (2009) have highlighted the particular utility of grounded visualization methods for multiscalar analysis of mixed information types. The results detailed below have been organized according to the three scales of analysis undertaken over the course of the Kugmallit Bay cultural landscape vulnerability assessment. By developing multiple representations of the compiled risk and value information across different scales of analysis, the assessment of patterns and incongruities between the various combinations of factors could be undertaken in an exploratory and recursive manner. The maps that follow are not intended to be ‘final’ representations of cultural landscape vulnerability. Rather, in accordance with the iterative-recursive nature of grounded visualization techniques (Knigge and Cope 2006, 2035), they are meant to be viewed as one possible combination of particular risk and value factors, yielding an example of grounded visualization results which can be applied in heritage management decision making processes.

4.4.1 Small Scale (‘Region Level’) Vulnerability Analysis

Small-scale assessments of risk were not addressed during this project, but the Beaufort Sea region has been identified as the largest area of sea-level rise susceptibility in the Canadian Arctic (Shaw et al. 1998, 371). While limited in detail, ‘zoomed out’ perspectives on landscape
significance can provide useful insights for regional modes of analysis. The Arctic Council’s report: ‘Arctic Marine Shipping Assessment IIc’ (AMAP/CAFF/SDWG 2013, 106) for example, approached the potential impact of sea vessel traffic on Canadian archaeological sites by assessing ‘areas of heightened cultural significance’ which were determined entirely from the density of known archaeological sites. When assessing the greater Arctic CHAR project area at such small scales, the importance of the Kugmallt Bay region became quite evident.

Figure 18: Regional scale heat maps of landscape significance at Kugmallit Bay.
First and foremost, the town of Tuktoyaktuk is located along the east shore of Kugmallit Bay (Figure 17). Tuktoyaktuk is an important Inuvialuit regional centre with a deep history of occupation. The density of named places documented in the publication ‘Nuna Aliannaittuq’ (Hart 2011) (Figure 18a) demonstrates the importance of the Kugmallit Bay area to contemporary Inuvialuit, as attested to through living history and recent memory of Elders from the community of Tuktoyaktuk. Site densities derived from the archaeological site inventory (PWNHC 2016) (Figure 18b) also highlight the importance of the Kugmallit Bay area in the past, as seen in the abundance of Inuvialuit ancestral sites documented throughout the region. The significance of Kugmallit Bay as an ecologically rich area is also reflected in the density of Inuvialuit land-use (Figure 18c) depicted in the overlap of seasonal subsistence practices recorded in the Inuvialuit Community Consultation Plans (IICCP 2008; TCCP 2008).

4.4.2 Intermediate Scale (‘Grid-Level’) Vulnerability Analysis

Both risk and value were addressed at intermediate scales by employing a grid-based system of 10km by 10km regions which was draped over the Kugmallit Bay study area. This grid facilitated the assessment of trends in the prepared datasets, which provided insights into more regionalized patterns within and between the risk and value related information. This approach also contributed to the iterative grounded visualization methods by highlighting areas of interest to scrutinize for further details in subsequent assessments of site-level information, as discussed further below.

Risk was addressed by compiling observations related to the taphonomic integrity of archaeological sites (Figure 19a) as well as any mention of landscape change (coastal erosion, mud flows, stream siltation, and so on) in the Nuna Aliannaittuq place name details (Figure 19b). Potential shoreline erosion impacts were also incorporated into the vulnerability assessment by applying the model of Kugmallit Bay shoreline change produced during an earlier stage of the research process. The methods employed in developing the shoreline change model have been detailed elsewhere (O’Rourke 2017), while applications of shoreline erosion modelling in other heritage management contexts can be found in Jones et al. (2008), Radosavljevic et al. (2015), Reeder, Rick and Erlandson (2012) and Robinson et al. (2010). The shoreline change model contributed two primary risk factors at intermediate scales of analysis. The first factor was the average rate of shoreline change within each grid area (Figure 19c), as represented by the mean
linear regression rate (LRR) in metres per year (m/a). The second factor was the proportion of modelled shorelines within each grid area with erosion rates greater than two metres per year (m/a) (Figure 19d). Both of these measures were based on average change rates calculated over the 54 year period addressed by the shoreline change model.

Figure 19: Intermediate-scale (‘Grid Level’) maps of different risk factors.

The first steps in the intermediate scale approach to cultural landscape value involved determining the relative abundance of archaeological sites (Figure 20a), and the abundance of Inuvialuit place names (Figure 20b) in each grid area. These variables were further refined to
assess the relative abundance of archaeological sites when relatively minor sites, such as isolated lithic scatters, were removed from the inventory (Figure 20c), as well as the number of Inuvialuit place names which refer to ancestral use and material remains specifically (Figure 20d).

Particular attention was also paid to the abundance of grave sites recorded in the archaeological site inventory as a factor in landscape valuation (not shown), due to a request made by the Tuktoyaktuk Hunters and Trappers Committee for the Arctic CHAR project to assess the condition of burial sites specifically.

Figure 20: Intermediate-scale (‘Grid Level’) maps of different value factors.
The spatial information was reclassified and symbolized a variety of ways through several rounds of recursive analysis in order to assess the quality and utility of the different representations that resulted. Each of the grid-level risk and value factors was ultimately symbolized into four categories, which were determined in the GIS software using equal-interval or Jenks (natural breaks) classification methods (Conolly and Lake 2006, 142) depending on the range of values present for each factor. The decision to use four categories was made to assist with the visual review of spatial patterns in the different maps, as well as to facilitate the synthesis of all risk and value factors into a comprehensive intermediate-scale vulnerability model. This involved the reclassification of all risk and value factors into a scale from 1 to 4, according to the category present in each of the grid areas. These values were normalized to 100% to allow their comparison across a range of information types, sources and data volumes. Normalized values were then combined in various ways, examples of which can be seen in Figures 21a through 21f, yielding a series of graphical representations of the combined risk and value characteristics for all of the Kugmallit Bay grid areas. It should be noted that the various factors employed in this analysis were applied in a non-hierarchical fashion, with equal weight given to all factors when assessing the vulnerability of Kugmallit Bay cultural landscapes.

The combined risk factors displayed in Figure 5e reflect shoreline erosion, taphonomic site integrity, and Inuvialuit place names which refer to landscape change. The regions of greatest risk were identified as grid areas D8 and F5, followed by F6 and F7. These areas have been affected by notoriously strong northwesterly storm events observed in the region (Small, Atallah and Gyakum 2011), which have had a substantial impact on the landscape and cultural materials present there. The combined value factors in Figure 5f identify grid areas D4, D8, F4 and F6 as significant areas, which are clearly representative of two distinct accountings of heritage landscape value (archaeological and Inuvialuit) as seen in Figures 21b and 21d respectively. Archaeological site information tended to highlight areas of Richards Island on the west side of Kugmallit Bay, as well as the mouth of the East Channel region as important cultural locations, whereas the Inuvialuit place names information, while still concentrating on the mouth of the East Channel, demonstrated a greater level of value placed along the Beaufort Sea coast of the Tuktoyaktuk Peninsula in the eastern extent of Kugmallit Bay. While the reason for such differential valuing of the Kugmallit Bay landscape is beyond the scope of this research, it may reflect a greater concentration of contemporary Inuvialuit land-use in proximity to the town of
Figure 21: Intermediate-scale ('Grid Level') maps of combined risk and value factors.
Tuktoyaktuk. This and other avenues of research resulting from the grounded visualization methods will be addressed in future rounds of recursive analysis to take place with members of the Inuvialuit community.

The intermediate-scale vulnerability model displayed in Figure 22 was developed from the combination of these particular risk and value measures. This resulted in the development of one possible iteration of the cultural landscape vulnerability model which accounts for contextually rich perspectives on landscape risk and value, related in part by the people who live in the region and draw meaning from the ancestral remains present there. Based on this particular iteration of grounded visualization methods, the primary regions of intermediate-scale vulnerability were found to be the D8, F4 and F6 grid areas, followed by areas F5 and F7 to a slightly lesser degree.

![Relative Vulnerability of Kugmallit Bay Cultural Landscapes](image)

**Figure 22:** Intermediate-scale (‘Grid Level’) map of Kugmallit Bay vulnerability.
4.4.3 Large Scale (‘Site Level’) Vulnerability Analysis

The review of site-level aspects of cultural landscape vulnerability took place over numerous stages, as a result of new information being secured and in response to questions which arose during intermediate-scale review sessions. For example, documented site conditions were reviewed for all 123 archaeological sites in order to generate intermediate-scale results capable of complementing the grid-based representation of Inuvialuit ancestral place name conditions. Doing so also led to an accounting of the specific kinds of impacts documented at archaeological sites. While this information proved too complex for incorporation into the more generalized grid-based analysis, details on the nature of specific risks assessed on a site-by-site basis provided important context when reviewing the results of grid-level and site-level patterns in combination. It should also be noted that observations from individual site-levels of analysis generated further questions which were addressed at the grid-level of review, resulting in the iterative assessment of intermediate-scale and large-scale information in search of possible explanations for patterns observed in each. While difficult to address in their entirety, the results of the individual place name and archaeological site evaluations yielded a number of noteworthy observations which are outlined below.

4.4.3.1 Trends in Site Type

While all 77 place names within the bounds of the Kugmallit Bay study area were assessed for their potential contribution to landscape valuation, place names referring to ancestral land-use practices or specific ancestral material remains (18 in total) were regarded as particularly significant in this review process. Another important site type were the ten ancestral villages documented in disparate locations throughout Kugmallit Bay, many of which appear in both the archaeological site inventory and Inuvialuit place names. Particular note was made of these locations, including Kitigaaryuit, on account of the broad typology of values which can be ascribed to them by a range of stakeholder groups.

Of the 123 known archaeological sites in the Kugmallit Bay study area, 47 (38%) are either dedicated burial grounds or include one or more graves in their description, which included many of the village areas. These sites were regarded as particularly significant from a cultural
landscape perspective, and their location was addressed at both the grid-level and site-level of analysis. 37 of the known sites (30%) consisted of ephemeral scatters of wood, bone or lithic materials. While such remains contribute to our understanding of broader patterns of past land-use and may be of particular interest to descendant communities and/or specialist branches of archaeological research, they are relatively limited in terms of informational value or visual impact on the experienced landscape. As a result, they were considered to a lesser extent when assessing notions of cultural landscape value at the site level, with one notable exception addressed below.

Three archaeological sites, including a small camp area, a cairn structure and an isolated lithic scatter were attributed to the early ‘Paleo-Inuit’ occupational phase. Such early sites are uncommon in the western Arctic, likely owing to a long history of shoreline erosion actively removing older costally situated sites throughout the area (Friesen 2013, 53). From an archaeological perspective, because of their rarity and thereby potential contribution to improved understanding of early human habitation in the region, these sites were highlighted as significant.

4.4.3.2 Trends in Site Condition

Details pertaining to the condition of culturally significant locations were ‘coded’ from notes made in the archaeological site inventory and Nuna Aliannaittuq place names, resulting in a four-tiered scale of taphonomic integrity (stable, disturbed, heavily disturbed and missing). The process of coding information from the archaeological site inventory which has been recorded over the span of 60 years proved challenging at times, demanding further explorations of contextual details to justify coding decisions. For example, the terms ‘largely intact’ and ‘slightly disturbed’ were frequently used to describe the state of archaeological sites in the territorial inventory. These kinds of ambiguities required numerous forays into the site notes in order to more confidently assign the site to one of the coded condition categories. Site conditions were also assessed and updated over the course of Arctic CHAR project regional surveys (Figure 23), which addressed a number of locations that have been lost since first being added to the site inventory. In total, 14 sites (11%) were in ‘stable’ condition, 79 (64%) were ‘disturbed’, 24 (19%) had been ‘heavily disturbed’, and five (4%) were recorded as ‘missing’, with one site lacking condition details.
Figure 23: Arctic CHAR project team approaching the village of Kitigaaryuit during survey efforts in 2013.

4.4.3.3 Trends in Impact Factors

The 19 different impact categories developed through the coding process (Table 3) combined to yield a total of 32 different kinds of site disturbance classifications. Erosion had by far the greatest impact on culturally significant locations, with 52% of archaeological sites and 28% of ancestral place names having been impacted by some form of erosion. After employing the general category of ‘erosion’ early in the recursive review process, further sub-categories (coastal, aeolian, fluvial, and so on) were developed from archaeological site details when available, thereby improving the interpretation of spatial trends among threatened cultural locations.

One implication of this more detailed level of coding practice was related to an incongruity identified between the extent of historical shoreline erosion impacts and the abundance of eroding archaeological sites. A large number of eroding sites were situated along the west shores
of Kugmallit Bay on Richards Island, where coastal erosion is minimal owing to the sheltered nature of the shoreline from northwesterly storm events. When the erosion impacts were re-coded to incorporate further details, it became evident that the majority (59%) of sites recorded as eroding on Richards Island were related to wind deflation (aeolian erosion), rather than shoreline retreat. Another interesting result of reviewing site-level impact factors in combination with other spatial datasets was the correlation observed between a site threatened by the expansion of dune fields and an area of shoreline progradation. The site was regarded as stable in terms of shoreline erosion potential, owing to the expansion of a large sandspit in front of the village site. However, when site condition was assessed at this particular location and the threat of dune expansion was accounted for, the potential influence of windswept sands on the stability of cultural remains situated downwind from depositional shorelines was realised. Thus it was determined that both retreating and advancing shorelines in the Beaufort Sea region can potentially impact the stability of material remains of the past.

<table>
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<td>Unable to Relocate</td>
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</table>

Table 3: Coded categories of Kugmallit Bay impact types
4.4.3.4  Trends in Erosion Risk

Of the 123 known archaeological sites in the Kugmallit Bay study area, 69 are within 200m of the contemporary shoreline, 47 of which are located near actively eroding coastal areas. In total, 15 archaeological sites were found to be vulnerable to shoreline erosion within the next 100 years, five of which are at risk within the next 20 years. Eight of these imminently threatened sites consist of burial features, five of which are already documented as having been impacted by erosion. 14 of the 18 documented place names referring to ancestral use are within 200m of the shore, though a number of these locations have already been lost to coastal erosion. Of the remaining threatened Inuvialuit ancestral locations, all but one correspond with archaeological sites that are also identified as threatened.

It should be noted that the determination of erosion risk for individual named places and archaeological sites relied on the problematic ‘dot on a map’ record of site location. The Kitigaaryuit Archaeological Inventory and Mapping (KAIM) Project addressed this limited representation of such a culturally important place by systematically surveying and mapping material remains in the vicinity of the Kitigaaryuit cultural landscape. Project team members documented a wide range of materials and features, from evidence of contemporary hunting and camping activities to ancestral sod house remains and the decades-old archaeological excavation trenches still visibly cutting through them (Hart 1997; 1999). In order to improve the quality of future vulnerability model iterations, a more detailed record of the extent and layout of Kugmallit Bay cultural landscapes will be required.

4.5  Conclusions

“Practicing archaeology in today’s world requires dealing with a range of interests, often in the spirit of compromise and negotiation, and a willingness to respect other legitimate points of view. The past certainly does not serve only one purpose or one group of stakeholders” (Hollowell-Zimmer 2006, 69).

The above quote reflects recent trends in archaeological practice to engage more meaningfully with the public on matters of heritage significance. Welch and Ferris (2014, 94) have suggested that the discipline is approaching a ‘critical juncture’ with regard to its ongoing development into a more sustainable and socially relevant practice. They have recommended a greater focus on
mobilizing non-archaeological values as one of several substantial shifts in archaeological practice which will need to be made in order to promote greater levels of sustainability from within the discipline. This application of grounded visualization methods has promoted a flexible approach to cultural landscape vulnerability, accommodating an iterative and exploratory assessment of different scales of qualitative and quantitative information, including both archaeological and community-based perspectives on heritage value.

An effort has been made throughout this project to engage Inuvialuit heritage ideals by employing cultural landscape perspectives on heritage management which are capable of incorporating tangible and intangible aspects of contemporary and ancestral landscape valuation, as well as the perspectives on heritage value and management developed through the KAIM Project (Hart and ISDP 1997; 1999). An example of this effort can be seen in the development of site impact factors which were used to visualize levels of risk. While some Inuvialuit participants on the KAIM Project valued the information derived from archaeological research, apprehension was expressed about archaeological collecting practices which remove material remains from the region. When sites or materials are lost to erosion, the impact is noted in the archaeological site inventory under the ‘Condition’ field of the database. However, when archaeologists remove materials, only an inventory accession number gets recorded under the ‘Collections’ field. Given that the site inventory does not reflect archaeological sampling as an impact on the integrity of cultural landscapes, akin to the manner in which the KAIM Project accounted for slumped archaeological excavation units, the category: ‘Human Activity – Archaeological Sampling’ was introduced to the vulnerability model process as a condition factor in order to reflect the perspectives of some Inuvialuit community members.

The iterative nature of grounded visualization methods was of tremendous value to the conduct of this vulnerability study, which accommodated the incorporation of new information as it became available over the course of the project. The recursive analytical approach of grounded visualization makes it particularly applicable to projects which are intended to take place over protracted periods of time, a characteristic which makes its application to cultural landscape management frameworks an attractive option. Grounded visualization methods can also be usefully applied in conjunction with ethnocartographic or ‘map-interview’ programs, to promote greater levels of public participation in the vulnerability assessment process through the documentation and application of qualitative, context-rich community heritage perspectives.
Supplementary research building from this vulnerability model is already being planned with the Research and Support Services division of the Inuvialuit Regional Corporation and the Prince of Wales Northern Heritage Centre. Plans for this project involve developing a typology of heritage value from a diverse cross section of the Inuvialuit community, the documentation of further details about known Inuvialuit place names, and the recording of additional locations of cultural significance for inclusion in the Inuvialuit Traditional and Local Knowledge Catalogue.

This project has demonstrated that the recursiveness, flexibility and capacity of grounded visualization methods to address mixed qualitative and quantitative information across a range of scales can be tremendously useful to the values-based management of cultural landscapes. The model of Kugmallit Bay vulnerability was not developed to demarcate specific cultural landscapes, or to provide an ultimate accounting of cultural landscape vulnerability. Rather, it was developed as a first step in what will hopefully result in a long series of cultural landscape vulnerability model iterations which will be further developed in collaboration with Inuvialuit governance agencies and community members.
Chapter 5

5 Conclusions

5.1 Synthesis and Implications of Research Results

Given the increasingly alarming nature of climate change forecasts and the cumulative effects these changes will have on the stability of culturally significant locations throughout the Inuvialuit Settlement Region and Northwest Territories, it is vital that management initiatives are informed by a rigorous understanding of the risks and values associated with those locations. In order to improve our understanding of the vulnerability of culturally significant locations to climate-driven ‘perturbations’, a research method will be required which is capable of combining accurate and reliable sources of quantitative information about the physical landscape and the processes acting on it, with the subjective and contextually rich expressions of value that are so commonly acknowledged as essential to archaeological/cultural/heritage management systems. If vulnerability is to be assessed at large regional scales, as would be the case in the Inuvialuit Settlement Region and Northwest Territories, the method would need to be capable of utilizing multiple sets of potentially vast spatial information, which could be readily applied in a variety of combinations and scales. In order for such a method to remain current and reliable as a means of informing management programmes, it would need to accommodate the inclusion of diverse information types from a range of sources as they are made available, which in turn would require that they be viable as an open-ended and recursively iterative process.

The research outlined in this dissertation has demonstrated the viability of GIS-facilitated methods of grounded visualization in addressing these needs. These methods have also proven useful in promoting the tenets of activist archaeology through their capacity to mobilize qualitative accounts of heritage value related by descendant communities as well as (or potentially instead of) archaeologists, thereby promoting the development of more socially relevant and culturally appropriate management strategies. That these methods are also capable of assessing such qualitative accounts in combination with other more quantitative sources of information, such as historical models of shoreline change, makes their application in the development of a rigorous method of vulnerability assessment even more useful to the public with whom activist scholars seek to engage.
By leveraging the capacity of grounded visualization to iteratively address diverse sources of information across multiple scales of analysis in an exploratory and non-hierarchical fashion, long-term heritage management efforts can be informed by the various subjectivities inherent to personal and collectively held concepts of risk and value as they change through time, and without privileging one perspective at the expense of others. The intermingling of qualitative and quantitative accounts in assessing heritage vulnerability not only strengthens management capacity by enabling the simultaneous review of multiple stakeholder perspectives, it improves the social relevance of heritage management efforts by explicitly incorporating publically held notions of heritage value within the management decision-making process. Given the critiques of Laurajane Smith (2004) regarding the privileged place of archaeological notions of value in the management of Indigenous heritage, the potential for meaningful applications of descendant community perspectives on ancestral places and materials makes grounded visualization a powerful tool in the management of Inuvialuit cultural landscapes, as well as locations deemed culturally significant by Indigenous communities elsewhere.

While caution has been recommended when applying GIS methods in matters of Indigenous governance, the often cited problems of representationality in mapping endeavours are hardly foreign concepts to Indigenous peoples. The sentiment behind "The Map is Not the Territory" is expressed by Jean Briggs (2012, cited in Armitage and Kilburn 2015, 93) when discussing the perspectives of Alaskan Elder Raymond Neakok:

"... the words in a dictionary are dead. In order to understand what cold means, you have to know that cold inland and cold on the sea are two different things. And you have to know what to do about it, how to treat it in order to know how to use the concept in your life before you can be said to understand it. Words in the dictionary don’t help you. That’s right, that’s the way they think not only about language but about any kind of knowledge. It doesn’t do to read it in a book."

When knowledge (all knowledge) is framed in such a manner, the claims of critical scholars that cartographic/GIS research methods will mislead community members, distort or co-opt their understandings of the world and limit epistemological diversity, tend to take on a paternalistic tone. This is especially true in the case of Inuvialuit, who have established GIS capacity within the Inuvialuit Regional Corporation’s governance system as a means of managing spatial arrangements.
information and guiding land-management initiatives, as well as providing a platform through the Inuvialuit Online Atlas which can inform community members about Inuvialuit lands. Indigenous people are well aware that knowledge obtained without the benefit of direct personal experience is limited, but certainly not useless. Such notions are expressed by Robert Rundstrom (1991), who framed Indigenous mapping in terms of the distinctions between 'inscribing' and 'incorporating' cultural practices put forward by Paul Connerton (1989, 72-73; in Rundstrom 1991, 3):

"Incorporating cultures traditionally use oral communication and other performance-based modes (e.g., dance, drawing in sand) to transmit all sorts of meaningful information. The actions, lasting hours or days, carry greater meaning than any object they produce. Inscribed cultures hold and fix meaningful information years after humans have stopped informing, and typically must do so by means of some object. Finally, it is worth noting that one practice or the other is used pre-eminently, not exclusively."

Rather than generating ‘fixed texts’ which delineate discrete sites as targets of mitigative efforts, the goal of this research was to demonstrate a method of assessing cultural landscape vulnerability which facilitates a continuous and collaborative process of map development and review through the application of different perspectives on heritage value and risk, yielding observations which can inform cultural landscape management initiatives. The perspectives on vulnerability which resulted from this research were couched in the author’s own situated worldview, informed by his personal epistemological and ontological persuasions, which in turn reflect his educational background, research interests, vocational history, gender, ethnicity, political leanings and so forth. While a series of maps have been produced which reflect these situated perspectives, they are not meant to be used in directing the management of Inuvialuit cultural landscapes, and their omission as figures from this dissertation was a conscious decision.

Here again it is important to note, given the recursive nature of grounded visualization methods and the acknowledgement that all research can be construed as social practice, that there can be no ‘ultimate’ map of cultural landscape vulnerability. As mentioned at the close of Chapter 4, the results of this analysis reflect but one iteration of what will hopefully become a series of map and GIS-facilitated assessments of threatened places of cultural significance. The results of these
multiple, community-driven iterations could conceivably result in the identification of Inuvialuit cultural landscapes which would contribute to Inuvialuit and Territorial management programmes, perhaps even leading to the formal designation of cultural landscapes by Inuvialuit governance agencies, as was the case with the village of Kitigaaryuit. As noted by Knigge and Cope (2006, 2029), “The recognition of methodological approaches as socially and politically laden means that they can be used in diverse ways, ranging from (un)consciously oppressive to critically engaged and potentially empowering”. Thus, the key to ensuring that future iterations of the Kugmallit Bay vulnerability assessment process are conducted in a critically engaged and empowering manner rests in their application through partnerships with Inuvialuit.

5.2 Future Research Directions

Over the course of this project, the iterative rounds of data collection, analysis, review and reflection have generated a number of questions which could potentially improve our understanding of Kugmallit Bay cultural landscape vulnerability through subsequent applications of grounded visualization methods. An example can be found in Chapter 4, which highlighted two distinct accountings of landscape value, one by archaeologists on the west shores of Kugmallit Bay and the other by Inuvialuit along the eastern shorelines. As mentioned, an exploration of this discrepancy in valuation measures was beyond the scope of the current project. However, investigation of this and other contradictory and/or conspicuously complimentary findings could result in an improved understanding of cultural landscape vulnerability, and possibly even contribute to discourses on the nature of heritage valuation among different stakeholder groups. Beyond these questions of the data and the pursuit of further insights as to the nature of cultural landscape vulnerability made possible by the iterative analytical methods, a number of directions to take with the application of shoreline modelling and grounded visualization methods have also come to light over the course of this research, as discussed further below.

5.2.1 More Substantive Engagements with Inuvialuit

The research outlined above was effective in identifying areas of cultural significance threatened by the impacts of climate change throughout Kugmallit Bay. However, while reliance on archival place name information related by Tuktoyaktuk Elders was useful in establishing a baseline of understanding, much more can be done to further engage a broader range of
contemporary Inuvialuit perspectives on cultural landscape value and management practice. In further developing this grounded visualization approach to vulnerability assessment, the application of ethnocartographic methods, particularly those advanced by Terry Tobias (2010), could be applied over a series of community meetings and individual interviews to document Inuvialuit perspectives on documented place names, to record still further places of significance, to investigate the multitudinous ways in which material remains of the past and locations of ancestral reverence are valued by Inuvialuit, and to solicit public perspectives regarding the culturally appropriate management of Inuvialuit cultural landscapes.

Additionally, ethnocartographic research methods could be specifically adapted to effectively place interview participants in the role of grounded visualization analysts, further promoting the level of public engagement in the management process. This could be accomplished by planning for a series of iterative map viewing sessions with the same set of study participants, promoting the documentation of a suite of different perspectives on cultural landscape value and risk which are based on diverse combinations of information, using different scales of maps and different modes of data visualization in the manner employed by the author over the course of this research. Doing so would necessitate the development of a system of conducting and documenting the ethnocartographic process which maintains contextual details underlying individual analytical practices, yielding perspectives on cultural landscape vulnerability which are rooted in the multiple subjectivities brought to the process by the various participants/analysts, and thereby contributing to rigorous and well-informed management strategies.

As mentioned at the end of Chapters 3 and 4, plans are being developed with the Research and Support Services division of the Inuvialuit Regional Corporation and the Prince of Wales Northern Heritage Centre to pursue a number of these directions for future research, including a coordinated review of all known Inuvialuit place names, a series of community meetings and interviews to promote public discourse on heritage related topics, and a season of community-directed fieldwork at a threatened location of cultural significance. It is my sincere hope that these plans come to fruition, fostering further iterations of the vulnerability assessment process which reflect more contemporary and diverse Inuvialuit perspectives.
5.2.2 Improvement of Shoreline Erosion Modelling

As discussed in Chapter 2, the impacts of climate change on the intensity of coastal processes will necessitate better access to more regular time-interval imagery if shoreline change assessments are to proceed in a reliably informed manner. The development of a coarse-grained regional model of shoreline change was useful in highlighting areas of cultural significance in need of closer examination in light of heightened erosion risk, as well as areas of high erosive impact lacking previously documented areas of cultural significance which might benefit from further community consultation and/or survey efforts. However, more fine-grained assessments of shoreline change focused on known areas of cultural significance will require better sources of imagery with which to develop higher resolution perspectives on shoreline change. The increase in availability and decrease in cost of satellite imagery over time may address this need, as could the prospect of Smallsat technology (Turner 2016, 5) providing ‘continuous coverage’ imagery of Arctic regions in the years ahead.

While the application of desktop methods in this research proved useful, such methods should not be construed as justification for a wholesale replacement of in-field assessments. Management efforts in the Inuvialuit Settlement Region and the Northwest Territories can be exceedingly expensive, particularly given the vastness of regions in need of monitoring. That said, the level of detail possible and the capacity to gauge more nuanced aspects of threat and value through on-site assessments cannot be understated (cf. Westley 2018). One possible solution to this situation could be the development of a ‘citizen science’ approach to monitoring (Silvertown 2009), wherein members of the Inuvialuit community document changes to known locations of cultural significance while out conducting various activities on the land. Observed impacts and areas of concern could then be reported to the Inuvialuit Land Administration, Inuvialuit Cultural Centre and/or the NWT Cultural Places Program. Such an approach would encourage greater levels of Inuvialuit participation in the management of cultural landscapes, and thereby further promote heritage valuation within the Inuvialuit community, following Samuels’ suggestion (2008, 91) that: “value is action-oriented (a verb, not a noun), and therefore embedded in practice. Specifically, value is produced through actions that engage with temporal relationships via material heritage.”
5.2.3 Expansion of Methods to Address Other Impacts and Regions

As an example of the utility of grounded visualization methods in cultural landscape vulnerability assessments, this project concentrated on addressing the most pressing impact of coastal erosion and was focussed on the abundant areas of cultural significance within the Kugmallit Bay region. Given the demonstrated effectiveness of this approach, it would seem feasible to extend the model to address other areas beyond Kugmallit Bay, and to incorporate additional threats to the stability of cultural landscapes. Because grounded visualization methods can accommodate the incorporation of new information through subsequent rounds of analysis, the expansion of the vulnerability assessment to investigate the influence of other risk factors should be easily manageable.

As displayed in Table 3, there are numerous other factors already known to be acting on the integrity of recorded archaeological sites which could be pursued through future iterations of vulnerability assessment. The impact of Aeolian erosion in particular has influenced many known archaeological sites, resulting in ‘blow-outs’ on prominent areas of high elevation which can expose buried materials to the elements and lead to their scouring by wind-blown sediments. Also addressed in chapter 4 was the observed correlation between dune field expansion and locations situated downwind of expanding shoreline areas. While perhaps not as pressing an issue as shoreline erosion, the expansion of dune sands can negatively influence soil-stabilizing vegetation and lead to increased depths of permafrost active layers. Both expanding dune fields and ‘blow-outs’, as well as other features like backshore thaw slumps (mentioned in Chapter 2) can be observed from aerial photography, drone and/or satellite imagery. As they all present some form of disturbance which can be represented as a shifting linear boundary when viewed from above, their propagation can be measured in the GIS software using the same methods employed in modelling historical rates of shoreline erosion.

5.2.4 Investigate Potential Concomitant Nature of Risk and Value

During the very early stages of this project, an issue with the conceptualization of vulnerability as a combination of risk and value was identified. The issue was ultimately set aside for future investigation, but it could be very useful to engage with different stakeholder perceptions regarding the potential concomitant nature of risk and value. As mentioned in Chapter 4, anxieties the over the ‘loss of heritage’ have routinely been associated with periods of global
crisis, which bring about the development, or re-development of existing management frameworks to address new perspectives on current threats. Along these same lines of thought, William Lipe (1984, 1) noted that “It is only with the acceleration of the pace of manufacture and discard, and of the rate at which our landscapes are being changed, that we have become explicitly concerned with the loss of cultural continuity and contrast brought about by too rapid a change in our cultural environments, both built and natural”. Thus, given the implications for a sense of loss on the manner in which we perceive the world and conduct ourselves in it, how might the knowledge of a looming threat influence the value ascribed to areas at risk by different stakeholder groups? Does the imperilment of known cultural landscapes and in-situ ancestral materials influence the level of significance they are afforded, and how might this correlation effect vulnerability models rooted in notions of risk and value?

5.3 Conclusions

This research has yielded a case study which demonstrates how cooperative/integrative heritage management efforts which are guided by an activist research ethos and informed by the perspectives of different stakeholders, can be applied at various levels of governance through the application of grounded visualization methods. The maps and spatial data generated over the course of this research are not intended to be read as texts which 'impart knowledge’, but as dynamic sources of information which are meant to be engaged with across a range of combinations and scales by people of different backgrounds interpreting the information according to their own subjective worldviews, yielding a range of perspectives which can inform management strategies. Doing so acknowledges that Inuvialuit perspectives and desires are essential aspects of Inuvialuit cultural landscape management efforts. Such heuristic and exploratory engagements with spatial information can promote greater levels of public discourse on the topic of cultural landscape change, encouraging still greater levels of public participation in community-based heritage initiatives and increasing the likelihood that management decisions will reflect the interests of the public on behalf of whom they are made. While the need for proactive management strategies in light of climate-related impacts is great, the design and implementation of new approaches must take place in a culturally appropriate manner, driven by the perspectives of multiple stakeholders if the results of management efforts are to hold any level of social relevance.
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Appendix A

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