RESILIENCE TO CAPITALISM, RESILIENCE THROUGH CAPITALISM: INDIGENOUS COMMUNITIES, INDUSTRIALIZATION, AND RADICAL RESILIENCE IN ARCTIC ALASKA.

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Abstract

A large and expanding body of scientific evidence shows that the Arctic is experiencing rapid social-ecological changes. Arctic stewardship is a framework for governance that is based on the principles of resilience thinking and is gaining prominence in both academic and political settings. However, critical scholars have indicted resilience thinking for failing to adequately comprehend the social dimensions of social-ecological systems. Resilience, therefore, remains a problematic theoretical foundation on which to base governance. The aim of this dissertation is to improve resilience thinking so that it can overcome its demonstrated shortcomings and thereby contribute to improved Arctic governance. I propose a novel theoretical framework called *radical resilience*, which integrates conventional resilience thinking with key insights from the political economic theories of certain Marxists and post-Marxists – namely that the capitalist mode of production and consumption is a key driver of ecological degradation and social inequity. Focusing on populations who maintain high degrees of non-capitalist modes of economic activity, I use radical resilience to answer the research question: How is the global capitalist system affecting the social-ecological resilience of Indigenous communities in northern Alaska as the Arctic continues to industrialize? Empirical case studies revolving around the three sectors of industrial activity increasing the fastest in the Arctic – tourism, natural resource extraction, and shipping – show that the relationship between capitalism and the resilience of Indigenous communities is complex and conflicted. While engaging in capitalism challenges traditional values, it is also a key strategy for maintaining adaptive capacity. Rather than calling for local places to 'weather the storm' of change – as resilience has been critiqued for doing – governance should enable local influence over global processes through enhanced bottom-up democracy, or what the resilience literature calls *revolt*.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

Because of climate change and socio-economic globalization, the Arctic is one of the most rapidly changing regions on Earth (Intergovernmental Panel on Climate Change [IPCC], 2014; Larsen, Nilsson, & Young, 2014). The rate of Arctic change raises concerns about the capacity of the region's human and non-human life to adapt and remain resilient over the coming decades (Chapin, Sommerkorn, Robards, & Hillmer-Pegram, 2015; Young, 2012). The resilience of Indigenous communities in northern Alaska is of special interest because many of these communities continue to practice high degrees of non-capitalist economic activities – meaning those in which there is no appropriation of surplus value by one class or group from another – that may offer innovative normative and material alternatives to the environmental degradation and social inequity wrought by the globalization of capitalism (Hunn, 1999). As regional decision makers increasingly embrace resilience thinking as a framework for governing Arctic change, critics of resilience thinking continue to point out its shortcomings (see Biermann, Hillmer-Pegram, Knapp, & Hum, 2016, for a state of the field review of resilience and its detractors). This ideological tension calls for scholarship that attempts to 'fix' resilience thinking in order to create improved governance outcomes in the Arctic, which is the aim of this dissertation. While my reconstruction of resilience thinking is inevitably partial and unfinished, I argue that resilience can be salvaged from its critiques if modifications are made, and that this is worth doing because the power that it wields has potential for bringing about positive social-ecological change.

1.2 Dissertation Methodology

This dissertation improves resilience thinking – meaning the mental logics and related actions that social-ecological resilience theory is producing – and its application to Arctic governance. It does so by answering the main research question: How is the global capitalist system affecting the social-ecological resilience of Indigenous communities in northern Alaska as the Arctic continues to industrialize? To answer this question, I first explore pertinent literature on Arctic environmental, social, and coupled social-ecological change in order to establish the research context. I then review existing scholarship that proposes strategies for using resilience thinking to govern Arctic change *and* research on prominent critiques of resilience thinking. Comparing these two areas of research – resilience and its detractors – demonstrates an ideological tension that I reconcile through the introduction of a novel theoretical framework called radical resilience.

In the subsequent three chapters of this dissertation, I address the main research question through empirical studies of the three industrial sectors increasing the fastest in the Arctic – tourism, natural resource extraction, and shipping. By focusing on rapidly increasing industrial sectors, I provide findings that are relevant to regional decision makers today and in the near future. Moreover, by focusing on issues of pan-Arctic importance, the findings from northern Alaska should prove useful for future comparative studies. The tourism case is focused on the single village of Barrow, Alaska, while the natural resource case pertains to the northern and interior portions of the state, and the shipping case covers the west coast of northern Alaska (Figure 1.1). Research methods used for the case studies include interviews, surveys, participant observation, and document analysis. Further methodological details are provided in each chapter.

The last chapter of this dissertation takes the empirical data from each case study and analyzes it through the radical resilience framework that I introduce below. My final chapter draws specific insights from each case study, and more general conclusions from a comparative examination of the findings, about the relationship between capitalism, non-capitalist modes of production and consumption, and the resilience of Indigenous communities in northern Alaska and the Arctic more broadly. Lastly, I use my findings to make recommendations for improving arctic stewardship and governance in this time of rapid change.

This dissertation makes multiple contributions to the transdisciplinary effort – meaning that which integrates the energy of academic and non-academic stakeholders – to create a thriving arctic community (see Lang et al., 2012). On one hand, each of the three case studies represents a bounded, complete piece of published scholarship about an important aspect of arctic change. The natural resource extraction case, for example, quantifies the extent of existing and plausible future industrial infrastructure in the region and has already been distributed as a technical report to over 500 stakeholders. On the other hand, taken as a single unit, the dissertation presents a coherent and sustained analysis of regional industrial development and the impacts on the livelihoods and cultures of its Indigenous inhabitants. On the theoretical side, this dissertation contributes to the theoretical underpinnings of resilience thinking by building on recent efforts to radicalize resilience in terms of political economy (e.g., Cretney, 2014; Hornborg, 2013; Nelson, 2014).

This dissertation's theoretical work should be of interest to scholars from both resilience thinking and more traditional critical fields of nature-society research, while the factual data compiled in the three case studies can inform applied efforts to manage specific sectors of arctic industrialization. The ultimate goals – and the point of conducting theoretically grounded

research that is empirically tested – is praxis, or the coming together of theory and practice (see Lather, 1986). Ideally, the benefits of balancing capitalist and non-capitalist social-ecological relations that I explore herein will make their way into the lived experiences of the Arctic's human and non-human populations

1.3 Arctic Change

1.3.1 Defining the Arctic

The Arctic. The High North. A region of the world with many identities. Some have viewed it as a space of exploration, scientific research, or geopolitical contention. For many endemic plant and animal species and over 4 million humans (Larsen et al., 2014), it is home. But it is also perceived as a storehouse of natural resources ripe for exploitation. Conservation groups paint it as a nature reserve, unscathed (but threatened) by human activities. It is fair to say that the Arctic may be all of these things and probably more. This dissertation, however, is concerned with the Arctic in terms of the ways it is changing and what those changes mean for human and non-human life there. It is concerned with environmental change, social change, the linkages between the two, and the linkages across spatial scales.

In terms of physical geography, the Arctic has been defined by such features as the presence of permafrost, the extent of sea ice, specific temperature ranges, the northern tree line, and the Arctic Circle – the line of latitude at 66°33' north, above which the sun does not set for 24 hours on the summer solstice. Other definitions of the Arctic are more flexible, such as that used by the Arctic Monitoring and Assessment Program, which includes the High Arctic, the

sub-Arctic, and adjacent marine and terrestrial areas that are relevant to the scope of particular research agendas (Arctic Monitoring and Assessment Programme, n.d.). This dissertation adopts the latter definition of the Arctic because many of the causes and results of Arctic change are spatially fluid and cannot be confined to fixed boundaries. This dissertation is interested in variables (i.e., manifestations of global capitalism and Indigenous communities) that exist primarily within this definition of the Arctic as well.

The heterogeneity of Arctic social and environmental conditions is important to acknowledge when speaking of the entire region as a single unit. There are eight Arctic nations that contain contrasting regions such as the vast coasts in Russian Siberia, the urban centers of northern Scandinavia, the Indigenous villages lining the Northwest Passage, and the industrial oil outposts in northern Alaska. However, having acknowledged heterogeneity in the Arctic and being cautious about overgeneralizations, there are also key traits that distinguish the area as a distinct region. These include an environment marked by extremes in coldness, light, and dark; the presence of unique, highly adapted ecosystems; and internationally recognized Indigenous groups (except in Iceland). There are over 40 Indigenous groups in the Arctic (comprising roughly 10 percent of the population), including: Saami in Finland, Sweden, and Norway; Nenets in Russia; Aleut, Yupik, and Iñupiat Inuit in Alaska; Inuvialuit Inuit in Canada; and Kalaallit Inuit in Greenland (Arctic Centre – University of Lapland, n.d.).

1.3.2 Environmental Changes

The most fundamental physical trait of the Arctic, its coldness, is fading. Climate change is significant in the Arctic (Arctic Climate Impact Assessment [ACIA], 2005; IPCC, 2014). As

the Earth's atmosphere increasingly traps solar radiation because of rising levels of greenhouse gases, global temperatures are forced upward. Polar amplification of global warming, whereby decreasing ice and snow coverage increases absorption of solar radiation, is causing the Arctic to warm at twice the global rate (Walsh, Overland, Groisman, & Rudolf, 2011). Looking back, Arctic temperatures have increased considerably over the past half-decade (Jeffries, Richter-Menge, & Overland, 2013) and, looking forward, are projected to continue warming at a faster rate than the global average, with a 2°C global increase this century and a polar amplification factor of between 2.5 and 4 (IPCC, 2014).

Climate change is causally linked to a series of secondary changes in both the abiotic and biotic environments of the Arctic. Rising temperatures are especially impactful for the cryosphere (Arctic Monitoring and Assessment Programme [AMAP], 2013). Arctic sea ice extent, for example, has declined since the late 1970s and is continuing to decline (Lemke et al., 2007; Stroeve et al., 2012). The average annual minimum Arctic sea ice shrunk from 6.22 million km^2 from 1981-2010 to a record low of 3.41 million km^2 in the summer of 2012 (National Snow and Ice Data Center [NSIDC], 2013). In addition to sea ice extent, it is very likely that central Arctic sea ice thickness has decreased by up to 1 m from 1987 to 1997 (Lemke et al., 2007), and some predict a nearly ice-free Arctic Ocean in the summer by 2040 (e.g., Overland & Wang, 2013). Dramatic changes have also been observed in Arctic snow cover – including a reduction in the presence of snow (Vincent, Laurion, Pienitz, & Walter Anthony, 2012) – and the condition of permafrost – including significant regions of degradations and final thawing in some cases (Molau, 2010). Overall, a continued reduction of snow and ice masses is expected (AMAP, 2013). Other changes to the physical landscape include increasing rates of coastal erosion (caused by rising sea levels, less sea ice, and increased wave action (Barber et al.,

2012), and changes to fresh water systems caused by altered precipitation patterns and permafrost thaw (Callaghan et al., 2013). While there is uncertainty in predictions of future change and spatial variability the changes that have already been observed, it is clear that the physical landscapes and seascapes that have provided the habitat for life in the Arctic for thousands of years are transforming rapidly.

Rising temperatures combined with the landscape transformations associated with cryospheric thaw and melt are already altering some biotic variables and are expected to challenge the adaptive capacities of some species (IPCC, 2014). The polar bear (*Ursus maritimus*) is perhaps the most iconic Arctic species, and a wide range of other wildlife relies on the region as critical habitat, including multiple species of whales, fish, birds, and the terrestrial rangifers caribou and reindeer. Certain marine ecosystems, however, have shifted from being dominated by arctic species to sub-Arctic species (Grebmeier et al., 2006). Other studies link climate change to shifting wildfire regimes and plant communities, and therefore to the potential future range of the caribou who feed on the plants (Gustine et al., 2014). Increased shrubification and a northward advance of the tree line have also been observed (Myers-Smith et al., 2011).

The impacts of climate change on the plants and animals of the Arctic may result in some species losing out, but, other species may be 'winners' as they become able to colonize spaces where conditions were previously unhospitable (IPCC, 2014). While many observed and projected biotic changes are connected to climate change, the Arctic Council stresses that environmental changes are also driven by other factors, such as environmental pollutants, habitat fragmentation, industrial development, and unsustainable harvests (Conservation of Arctic Flora and Fauna [CAFF], 2010). Similar to the changes being observed and predicted in the geophysical environment, arctic biotic change contains many uncertainties and spatial variability

within the region. Nonetheless, there is sound reason for concern that artic ecosystems may soon reach tipping points of transformation, after which there will be no returning to previous states (Arctic Council, 2013).

1.3.3 Social Changes

Demographically, some of the key trends taking place globally are also occurring in the Arctic. Urbanization – where people move away from rural villages to larger hub-communities or cities for work, education, or some other preferred lifestyle opportunity – is an Arctic reality, with disproportionately high rates of younger people and women making the move (Larsen et al., 2014). Rural residents are finding it increasingly difficult to succeed at traditional livelihoods due to environmental changes (Larsen et al., 2014). In addition to urbanization within the Arctic, immigration from outside the region by a widening range of non-Arctic ethnic and cultural populations seeking economic opportunities is increasing, making the Arctic more socially diverse (Larsen et al., 2014). However, after years of rapid growth, the Arctic population is expected to become relatively stable in the near future. Total population growth across the entire region is projected at a very modest 4% over the next two decades, increasing from roughly 4.05 to 4.197 million people, and with Russia exhibiting the most notable decline in arctic population over that period, as rural resident move to non-Arctic urban centers (Larsen et al., 2014).

While the arctic population may be holding steady, the level of industrial activity taking place is on the rise. As consumptions levels in many developing countries around the world are increasing, demand for the fossil fuels – oil and gas – contained in the Arctic geologic subsurface is driving the spread of exploratory and productive activities in marine and terrestrial

environments (Harsem, Eide, & Heen, 2011; Mikkelsen & Langhelle, 2008). However, the collapse of global oil prices in 2014 (see Tokic, 2015), has reduced the economic incentive to develop some arctic reserves – an issue discussed further in Chapter 3. In addition to energy resources, arctic landscapes hold significant quantities of rare minerals, which has led to industrial mining projects in certain areas (Andrew, 2014). While these natural resources are thought to be the most significant driver of increasing industrial activity, at least two other commercial sectors are expected to increase substantially in the near future as corporations seek new opportunities for profit-making: shipping and tourism. When the sea ice conditions permit passage, the Northeast Sea Route (roughly following Russia's arctic coast) is already offering a cheaper transportation route for the movements of some goods from the Pacific to the Atlantic and vise-versa (Liu & Kronbak, 2010). Similarly, the Northwest Passage, through the Canadian Archipelago, is seeing the regular transit of summer cruise ships for the first time in history. If sea ice continues to decline, marine-based industrial activity in the Arctic is expected to keep rising (Protection of the Arctic Marine Environment [PAME], 2009). The presence of industry is a double-edged sword for the Arctic – on one hand it can disturb non-industrial cultural practices and the function of ecosystems but, on the other, it provides the foundation for much of the Arctic's cash economies.

It is the job of arctic political systems, *inter alia*, to balance the negative and positive aspects of development, and to decide how to respond to the threats and opportunities presented by environmental change. At the international level, arctic governance has transitioned from a contentious Cold War period of geopolitical jockeying into a relatively stable era of international peace and cooperation (Nord, 2015). The Arctic Council has emerged as a high level intergovernmental body for the promotion of regional coordination, science, and policy advising.

Despite the lack of any major conflicts, some boundary disputes are ongoing (especially around sovereign control over the outer continental shelves of arctic seas) and Russia continues to aggressively develop their offshore resources. At the national and sub-national levels of governance, several trends have been identified, including: devolution of authority; increasing Indigenous empowerment; challenges in fiscal and human capacity; and continued governance innovation (e.g., co-management of subsistence species) – trends driven largely by Indigenous activism or the desires of national governments to reduce expenditures (Larsen et al., 2014). While arctic governance shows many encouraging trends, significant challenges remain.

Indigenous cultures in the Arctic are also changing, as increasing connectedness to global systems is bringing new livelihood challenges and opportunities to native peoples (Larsen et al., 2014). In contrast to such changes, however, numerous trends suggest that Indigenous populations are increasingly empowered to sustain those aspects of their traditional culture and identity that they find important to the well-being of their communities (Larsen et al., 2014). These trends include: increasing use of Indigenous knowledge (such as native languages in education and ecological knowledge in resource management); higher levels of local participation, control, and ownership in governance; and the emergence of Arctic identities – especially Indigenous identities – as a basis for external political and economic recognition. Of course, all advancements in this area must be viewed in light of the negative cultural impacts caused by centuries of exploitation and marginalization form colonizing governments. While Indigenous arctic groups have successfully blended tradition with modernity on many fronts (Cameron, 2012), concerns remain about human health and safety within northern communities (Larsen et al., 2014). In sum, warming arctic environments are challenging traditional rural livelihoods, while encouraging expanded natural resource development by corporations. At the

same time, globalization is presenting rural communities and immigrants to the Arctic with new economic and cultural opportunities, but mostly in urban areas, leaving rural communities unconnected.

1.3.4 Changes in Coupled Social-Ecological Systems

The environmental and social changes taking place in the Arctic are closely linked in many instances, with causation and influence flowing in both directions. The analysis of relationships between the environment and society has a rich and diverse history in fields such as geography, anthropology, and sociology (Catton & Dunlap, 1978; Dove & Carpenter, 2013; Zimmerer, 2010). Here, however, I specifically use the lens of social-ecological systems to consider arctic change because this particular approach is gaining prominence in the Arctic in both scientific and governance communities (Chapin et al., 2015; Young, 2012). A social-ecological system defines a set of relationships, "in which people depend on resources and services provided by ecosystems, and ecosystem dynamics are influenced, to varying degrees, by human activity" (Chapin, Kofinas, & Folke, 2009, p. 6). It has been explained that, "There are no natural systems without people, nor social systems without nature. Social and ecological systems are truly interdependent and constantly co-evolving" (Stockholm Resilience Centre, 2007). Social-ecological systems exist at all spatial scales and across scales. I will examine the roots of social-ecological systems thinking and associated concepts shortly, but first I will briefly review key research on social-ecological change in the Arctic. While the social-ecological systems lens helps address the complex interactions between human and non-human variables, it must be acknowledged that researchers are responsible for constructing given systems (i.e., deciding what

is included and is excluded from analysis) and that, in this way, social-ecological systems research reflects the normative predilections of researchers (see Lovecraft, 2008, and later section of this chapter).

A key dynamic in arctic social-ecological systems is that climate change is causing environmental transformations that require social adaptation in order for communities and regions to sustain their livelihoods and well-being. In one case from arctic Canada, climate change was shown to alter the spatial and temporal aspects of hunting for an Indigenous subsistence-based community (Berkes & Jolly, 2002). There have also been observed and predicted challenges associated with changing sea ice regimes for Indigenous whale hunters who travel on ice to access whales (e.g., Druckenmiller, Eicken, George, & Brower, 2013). While climate change is creating challenges for subsistence users across the Arctic, it is generally thought to offer opportunities for increased commercial activity, which could potentially bring more cash into the region.

Climate change is not the only driver of social-ecological change. The expansion of industrial activities has been linked to perceived increases in the difficulty of hunting Caribou among Indigenous communities in northern Alaska and Canada (Bali & Kofinas, 2014) and to changes in reindeer herding behavior among the Siberian Nenets (Kumpula, Forbes, Stammler, & Meschtyb, 2012). The degradation of certain arctic marine ecosystems from overfishing combined with increasingly restrictive regulations on local harvesting has been shown to force changes in the social organization of fishery-dependent Sami communities in Norway (Broderstad & Eythorsson, 2014). International law, or lack thereof, and local politics affect the sustainability of polar bear and walrus populations in the Bering Strait (Meek, Lovecraft, Robards, & Kofinas, 2008).

Cases such as these reveal some generalities about change in arctic social-ecological systems. Climate change, an anthropogenic phenomenon, is driving environmental changes that challenge local subsistence users to sustain their livelihoods – the mechanism for this dynamic is that the plants, animals, and landscapes that constitute subsistence resources are transforming. Other pressure on subsistence systems include the environmental impacts of commercial activities (e.g., habitat fragmentation, reduced access, pollution), which are largely expected to be exacerbated by climate change. Commercial activities based on natural resource extraction, also bring Indigenous communities certain economic and social changes associated with greater integration into global markets, which is a central theme explored throughout this dissertation.

1.4 Arctic Stewardship and Resilience

1.4.1 Ecosystem Stewardship Applied to the Arctic

Arctic stewardship (Chapin et al., 2015) is the application of ecosystem or earth stewardship (Chapin et al., 2010; 2011) to the Arctic region. The term 'arctic stewardship' has been used elsewhere in discussions that pertain strictly to the social and legal aspects of arctic change (Young, 2012) but the usage in this dissertation describes a framework that is focused more centrally on social-ecological relations. Ecosystem stewardship was envisioned largely as a response to the call from the Millennium Ecosystem Assessment to combine and apply ecology (as a basis for the conservation of biodiversity) with the United Nations' goals for socio-economic development and human well-being, thus creating "an action-oriented framework intended to foster the social-ecological sustainability of a rapidly changing planet" (Chapin et al.,

2010, p. 241). In identifying the urgent need to apply ecosystem stewardship in the Arctic, Chapin et al., (2015) write,

> The intersection of climate change, resource development, and global socio-economic processes poses major challenges for conservation of species, landscapes, and cultures. Although similar problems occur throughout the planet, they have and will continue to happen most rapidly in the Arctic (p. 2).

The authors identify three key components of stewardship: (1) its dual goals of ecosystem resilience and human well-being, (2) a focus on social and ecological processes and their interactions across scales, and (3) its emphasis on actions that shape the future rather than simply trying to restore the past. The arctic stewardship framework acknowledges the bevy of arctic changes reviewed above.

1.4.2 Resilience Theory and its Application

To understand arctic stewardship at a deeper level – including how it formulates solutions to the problems it acknowledges – resilience thinking must be examined, as it is the foundation of knowledge and theory that ecosystem stewardship is built upon. The concept of resilience emerged in the field of ecology in the 1970s. Innovative thinkers, using insights from mathematics and complex system modeling, rejected notions about ecosystems tending to remain in single equilibrium states, and replaced them with models wherein ecosystems undergo collapses and renewal, and alternate between multiple states via the adaptive cycle (Figure 1.2)

(Gunderson & Holling, 2002). In resilience thinking, systems can collapse and reorganize around the same structures and functions, or reorganize around profoundly different structures and functions, marking a regime shift or transformation. Resilience, then, is defined as the amount of perturbation a system can absorb – through adaptation – before flipping into a different state marked by fundamentally different structures and functions.

While resilience thinking was originally applied to ecosystems, it is now commonly used to frame studies of social-ecological systems. Adger (2000), for example, provides one of the first explorations into this realm by illustrating the interconnections between the ecology of a natural resource, the institutions that govern its use, and the economics of a community that depends on it for their livelihoods. Folke (2006) announced the emergence of resilience as a perspective for social-ecological systems analysis, arguing that many of the principles of ecological resilience translate to social systems. More recently, however, and in response to ongoing concern from social scientists and theorists, resilience thinking has begun to emphasize the difference between natural systems and systems comprised of human beings – with human agency playing a distinguishing role in the latter (see discussion in Arctic Council, 2013).

The panarchy theory of the structure and function of complex systems is central to resilience thinking. Panarchy was named after the Greek god of nature, Pan, and emerged from what Gunderson and Holling (2002) call their quest for a theory of adaptive change. A key innovation of panarchy was to challenge the hierarchical idea of top-down control by contending that systems can be controlled by small-scale, bottom-up adaptations that cascade change upward. Panarchy also introduced the novel concept that complex systems are, in fact, characterized by a series of coupled, scale-specific adaptive cycles (Figure 1.3).

As resilience has grown in use and popularity in a variety of fields, its terminology has overlapped with concepts from research areas such as climate change adaptation, vulnerability studies, and development. Folke et al., (2010) attempt to overcome terminological confusion with resilience by explaining,

> In a nutshell, resilience thinking focuses on three aspects of social-ecological systems (SES): resilience as persistence, adaptability and transformability. Resilience is the tendency of a SES subject to change to remain within a stability domain, continually changing and adapting yet remaining within critical thresholds. Adaptability is a part of resilience. Adaptability is the capacity of a SES to adjust its responses to changing external drivers and internal processes and thereby allow for development within the current stability domain, along the current trajectory. Transformability is the capacity to create new stability domains for development…and cross thresholds into a new development trajectory (p. 1).

The concept of *transition* is similar to adaptation and implies a shift within a current system state that makes that state more preferable without witnessing a shift to a new system state. Transitions, however, are not always adequate and transformability, or "the capacity to create a fundamentally new system," is appropriate when, "ecological, economic, or social structures make the existing system untenable" (Walker, Holling, Carpenter, & Kinzig, 2004). A great deal of resilience research has revolved around the concepts of transformative and adaptive capacities and how to measure and promote them in social-ecological systems.

The concept of adaptive co-management is a governance strategy that emerged from, or co-evolved with, resilience thinking (Plummer & Armitage, 2007). The adaptive part of this framework refers to the capacity of resource managers to adjust their management practices in accordance with changing knowledge about the social-ecological system in order to maintain the system's resilience (or transformative capacity) and thereby keep it in a desirable system state (or guide a transitions to a new system state). Learning is the key facilitator of adaptation, since understanding how management practices interact with changing systems is necessary before practices can be adjusted (Lebel, Grothmann, & Siebenhuner, 2010). The "co" aspect of adaptive co-management explicitly aims to collaborate with stakeholders, both vertically and horizontally, on the formation of management policies, which can help empower resource users (Armitage, Berkes, & Doubleday, 2007). This aspect of co-management is in recognition of the complexity of the social world. It attempts to address the concerns of multiple groups while also drawing ecological knowledge from a wider range of sources than just western science. Adaptive co-management is part of arctic stewardship but arctic stewardship takes a bigger-picture view of guiding social-ecological change (Chapin et al., 2015). Adaptive co-management is a relevant paradigm for social actors in the privileged position of managing social-ecological systems, but its usefulness for those marginalized from power is less clear.

Across the globe, resilience thinking is increasingly applied to the governance of real people and places. The international development community has built resilience toolkits and programs to help communities withstand the shocks caused by global markets and climate change (United Nations Development Programme [UNDP], 2008; US Agency for International Development [USAID], 2012). Other high-level intergovernmental agencies invoking the resilience narrative include the United Nations Panel on Global Sustainability (UNPGS 2012)

and the World Economic Forum (Howell, 2013). Germane to this dissertation is the Arctic Resilience Report being conducted under the auspices of the Arctic Council and led by high-level resilience think tanks. At the time of writing, the final report is underway, but the 2013 interim report (http://arctic-council.org/arr/) provides evidence of cutting-edge resilience thinking applied in the Arctic context and is an example of arctic stewardship in action. As seen below, even this latest version of resilience thinking makes some problematic assumptions. Coinciding with the rise of resilience thinking in research and application has been a critique of its core principles and the ramifications of its application.

1.5 Critiques of Resilience Thinking

1.5.1 Overview

Beginning around 2010, scholars from multiple fields of nature-society research began expressing concern about resilience thinking and the politics it animates due to its incomplete grasp of social phenomenon (e.g., Ahlborg & Nightingale, 2012; Nadasdy, 2007). In 2008 a high-level report called "Re-framing Resilience" (Leach, 2008) articulated the primary problems that social researchers were having with resilience thinking, as well as the responses of prominent resilient thinkers to those issues. New resilience journals have emerged to highlight the shortcomings of earlier research approaches and to better address the social dimensions of resilience (e.g., *Resilience: International Policies, Practices and Discourses*). There have even been books written with the sole goal of deconstructing the resilience 'doctrine' (Evans & Reid, 2014). Many of these critiques are aimed at classical social-ecological resilience thinking, which

was described above. However, critics have also targeted a second realm of resilience thinking. The second realm views resilience not a systemic property, but as a psychological trait that both individuals and communities can possess, and that should be nurtured within communities in preparation for experiencing natural disasters (e.g., Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008). Critiques continue to emerge from multiple corners of the academy but can be organized into three main categories.

The first category is a specific example of the broader post-modern critique of the claim of science to be objective and therefore be the holder of Truth, with a capital T. Theories from intellectual realms such feminism and the philosophy of science argue that no human endeavor can be truly objective or free from value judgments since all thoughts and actions are deeply enmeshed in historical trajectories that presuppose particular ontological and epistemological positions at the exclusion of others, and resilience thinking is no exception. Resilience hails from discrete lineages of western natural science and computer modeling that posit specific and contingent (although hegemonic) worldviews. Criticisms show how the unquestioned culture of resilience thinking has failed to recognize and reflect on its own positionality, inherent normativity and accordant limitations (Cannon & Müller-Mahn, 2010; Cote & Nightingale, 2012; Kirchhoff, Brand, Hoheisel, & Grimm, 2010).

The second category is similar to the first, but instead of issuing the criticism at the culture of resilience thinkers, per se, scholars have pointed out that resilience thinking has historically marginalized important concepts from the social sciences – such as power, agency, difference, and the validity of conflicting knowledge(s) – in the subjects it studies. Turner (2014) points out, "resilience scholars…have continued to embrace systems-modeling perspectives…[and] as a result, resilience adherents, when reaching out to the social

sciences…are attracted to approaches such as ecological economics and rational-choice theory" (p. 619). By privileging modeling approaches to social research, resilience thinking has missed the vast bodies of work on topics such as identity, culture, and justice in the social sciences. Hornborg (2013) puts it succinctly: "resilience discourse generally appears to be ignorant of most of the tenets of modern social science" (p. 118).

1.5.2 Radical Political Economy Critiques

1.5.2.1 Background

The third category of critique, based in theories from radical political economy, is the one I engage most centrally in this dissertation. Radical political economy, in brief, is meant to mean the field of study concerned with the social inequities and environmental harms that are intrinsic to the capitalist mode of production and consumption, and also concerned with the justice-related benefits of doing things differently (Foster 1999, 2002; Harvey, 1982, 1996; O'Connor, 1988; Smith, 1984; Wallerstein, 1979). Often associated with the writings of Marx and Engels, the political left, and socialism, radical political economy encompasses the work of a broad range of theorists and activists, and their critics. Despite the diversity in the field, the central focus of radical political economy can be understood as the nexus of economic relations, social power, and nature, as viewed through a lens that values collective responsibility, a strong interpretation of equality, and a moral obligation to the other.

Marx's theory of historical materialism (1867/1990) rests on the observation that capitalist modes of production divide society into two uneven classes, and the hypothesis that the

labor class (workers) will revolt against the bourgeois class (owners) and cease the means of production when their exploitation becomes intolerable. This dialectical relationship, whereby capitalism contain the seed of its own destruction, forms the first contradiction of capitalism. The second contradiction of capitalism (see O'Connor, 1991) focuses centrally on social-ecological relations (rather than relations between the classes), positing that capitalism sows the seeds of its own destruction through its fundamentally unsustainable relationship with nature, founded on capitalism's imperative for unlimited growth (and unlimited consumption of natural resources) in a limited world. Both contradictions are explored further below.

In the beginning, according to Marx, there was primitive accumulation—a notion that he himself equates to the original sin of capitalism in *Capital Volume I* (1867/1990). Primitive accumulation is the process by which social classes separated, with some individuals forcefully seizing power over the means of production (natural resources and production infrastructure) and other individuals thus being dispossessed from land and capital. The dispossessed, stripped of the means to produce their own subsistence, find themselves with only their labor to sell to the capital class in exchange for the wages they need to live and to feed their families. The capitalists, in turn, are able to sell the commodities the laborers produce, pay the labors the minimum to survive (i.e., social reproduction so that they can keep working), and still extract a profit from the process. Marx calls this profit *surplus value* and the process by which it is generated exploitation. Its maximization is the basic tenant of capitalism. What happens to the humans involved, however, is a profound alienation from themselves, society, and nature. Peet, Robbins, and Watts (2011) describe the process:

> [I]ncreasing [capitalist] socialization binds workers into a more extensive labor process that they do not collectively control…The…labor process loses its inherent meaning as the social production of human existence…The result is a severing of relations: among workers, and between workers and capitalist owners of production systems; between the individual and its species being; between producers and their products; and between producers and the environment on which continued existence nevertheless depends (p. 13).

When workers do not control the products of their own labor and capitalists are unrequired to contribute labor to their own survival, everyone loses touch with the meaning of life, which can only be realized, according to Marx, by working as a free person for the survival of oneself and one's species (thus the mention of species being).

Humans' ontological status as a communal species being is replaced in capitalist social relations by, "competitive individuals each pursing self-interested goals" (Peet et al., 2011, p. 14). The competitive selfishness of capitalism, "becomes an alienated force controlling individuals rather than being controlled by them, so they are forced by competition to do things they already know to be socially and environmentally destructive," (p. 14) according to Peet et al. (2011). Supporters of capitalism leave such externalities as social and environmental damage to the logic of the market to sort out with price signals being the guide, but, as Peet et al. (2011) write, "Market prices do not represent social and environmental costs and long-term consequences at all," and "As a result, market systems are environmentally destructive and socially irresponsible" (p. 14). A contention that is clearly backed up by the state of affairs today by, for example, cheap oil and its ecological and social tolls. Referencing the "energy-intensive,

mechanized, resource-eating, polluting" history of capitalism, Peet et al. (2011) state, "the practical, 'efficient', competitive rationality used every day in capitalism reverses the social and environmental rationality needed to sustain continued social existence in the longer run" (p. 18).

Peet et al. (2011), use Marx's theory of alienation, his critique of markets, and an lengthy examination of anthropogenic climate change to suggest that, "something scarcely credible might indeed be happening: 'normal' production and consumption destroy the natural environment, historical origin and material source of human existence, to the point of collapse" (p. 14). As Peet et al. (2011) catalog the problems,

> Waves of multiple global environmental crises break with particular ferocity on the shores of the popular imagination: destruction of the rain forests, the disappearance of species, pollution from carbon dioxide emissions, melting of the polar ice caps, the poisoning of the seas, the return of nuclear proliferation, global pandemics, massive oil leaks, and the threats of genetically modified organisms are regular staples of the mainstream media (p. 13).

These types of environmental crises are social products. Attempted solutions must therefore be social as well. Again, Peet et al. (2011), summarize:

> The destruction of nature…results from an alienated form of the production of human existence, one that is not democratically controlled, that is organized indirectly through markets, that is based in the self-interested pursuit of profit, and that has to grow to survive. If we want to understand what is happening to the

environment, we have to understand the origins, development, structure and dynamics of capitalism…(p. 15).

In this theory, alienated human beings cannot make environmentally rational decisions because competition drives them do the opposite. "[E]nvironmental degradation is not an unfortunate accident under advanced capitalism," Peet et al. (2011) write, "it is instead a part of the logic of that economic system…of various logics and trajectories of accumulation—and the deadly operation of markets—worked out the land and specific resources" (p. 26). Recently, scholars have been working to incorporate this type of Marxist social-ecological thinking into critiques of resilience thinking.

1.5.2.2 The Critique

The basic critique that radical political economists have levied on resilience thinking, is that resilience is being used as a conceptual tool to create political-environmental subjects that fit into the neoliberal world order (Joseph, 2013; MacKinnon & Derickson, 2013; Nelson, 2014). Neoliberalism is used here to describe a set of mental logics and public policies – brought into prominence in the 1980s by Ronald Regan, Margret Thatcher, and other world leaders – that operate primarily to expand free markets, invigorate privatization, and minimize government intervention in production and distribution of goods and services (except for when the interventions support neoliberal goals), or to promote the reproduction and expansion of a particular form of contemporary capitalism (Castree 2010a, 2010b, 2011; Harvey, 2005). Proponents of neoliberalism, the critique argues, are advancing the resilience paradigm so that

localities exposed to the volatility of global markets and the environmental insecurities brought about by anthropogenic environmental change (associated with capitalist accumulation) will be able to survive on their own and without the aid of public support. Resilience is being used by powerful neoliberal actors to perpetuate a culture of individual and local-scale responsibility within a global system that is inherently unstable and prone to crisis. Resilient communities will not contest neoliberalism, the critique insists, because they can affectively absorb the perturbations it causes through adaptation and transformation.

Neoliberalism can be understood as a hegemonic ideology operating at the global scale in support of capitalism (Gallaher, 2009). In their critique of resilience, MacKinnon and Derickson (2013) contend, "resilient spaces are precisely what capitalism needs – spaces that are periodically reinvented to meet the changing demands of capital accumulation in an increasingly globalized society" (p. 254). By appealing to metaphors of nature and natural systems, resilience thinking naturalizes environmental and social problems that are not actually natural, but rather a result of capitalist production and consumption – one particular and historic way of organizing society. "The effect," they say, "is to naturalize crisis, reasoning with neoliberal discourses which stress the inevitability of globalization" (p. 259) and the environmental crises of climate change. Resilience thinking, in sum, supports neoliberal ideology at the expense of possible alternative modes of political economy that would be less socially and environmentally destructive.

The relationship between global-scale processes of capital accumulation and local communities caught up in the act is central to this line of critique. As MacKinnon and Derickson (2013) write,

> [C]oncern with the resilience of place is misconceived…[It] locates the sources of resilience as lying within the particular scale in question…By contrast, we contend that the processes which shape resilience operate primarily at the scale of [global] capitalist social relations (p. 255).

Devolving responsibility to local places to 'be resilient', they contend, is creating a condition where communities become responsible for adapting to global threats but lack the power to influence the original causes of those threats.

The use of scale in political economic critiques of resilience is similar to early work in political ecology. Blaikie and Brookfield (1987) demonstrate that soil degradation on African farms should not be attributed to local mismanagement, but rather to larger scale capitalist forces that effectively require increased agricultural output from the land. Resilience thinking can learn from their call for 'chains of explanation' when analyzing systems at a single scale. The panarchy model within resilience thinking emphasizes cross-scale interactions, but despite this, resilience scholars have not adequately considered global causes (and solutions) to local problems. The resilience of communities does not preclude mitigation or social change at other levels. To the contrary, the resilience of communities may very well depend on global scale social change.

MacKinnon and Derickson (2013) conclude by stating, "[P]romoting resilience in the face of the urgent crisis of climate change and global recession actually serves to naturalize the ecologically dominant systems of global capitalism" (p. 266). As an alternative, they offer a politics of resourcefulness, which they claim overcomes the shortcomings of resilience by promoting in local places, "genuinely deliberative democratic dialogue to develop…alternative

agendas and…meaningfully challenge existing power relations" (p. 263). This is a promising concept and should definitely be pursued. However, I am interested in taking a slightly different tack. Instead of replacing resilience with an alternative concept, I am interested in 'fixing' resilience by integrating it with radical political economy. Unlike MacKinnon and Derickson (2013), I do not view the two as mutually exclusive. Following recent arguments by Hornborg (2013), Cretney (2014), and Nelson (2014), I contend that resilience can be harnessed to promote radical projects that challenge capitalist ideology. To show how this can work I turn to Gibson-Graham's critique of radical political economy.

1.5.3 Capitalism with a Lower Case 'c'

Gibson-Graham's central argument is that Marxists have inadvertently strengthened capitalism by producing a discourse that presents it as an absolute, all encompassing, inescapable phenomenon – or Capitalism with a capital 'C'. In so doing, the argument goes, Marxists have engendered a situation where the only perceivable alternative to capitalism is a complete and total working-class revolution. The entire social system of the world must be replaced by a whole new system. The problem with this understanding of capitalism is that in light of the failure and fall of many of the world's communist governments, the working class revolution seems like an impossible dream. In turn, Marxists of all stripes have been rendered frustrated and empty handed in terms of 'solutions'. "It is the way capitalism has been 'thought'", Gibson-Graham writes, "that make it so difficult for people to imagine its supersession" (1996, pp 4.)

Gibson-Graham deconstructs the radical political economy discourse on capitalism to show that capitalism is not actually all encompassing and that non-capitalist modes of production

and consumption occur all the time, all over the place, right alongside capitalism. They effectively argue for seeing the economic field of society as a differentiated plane, with multiple types of economic relations coexisting. When one views the situation thus, it becomes clear that a complete and total working-class revolution is not the only viable option for bringing about positive change. One can instead focus on the small day-to-day projects that offer immediate realizations of the benefits of capitalism's alternatives.

At the center of their deconstruction is their understanding of Marx's definition of capitalism. Marx defined capitalism as a system of production and consumption wherein the means of production are controlled by an owning class while the production itself is provided by a laboring class. The value of the work the labors provide is more than they are paid for, which allows the owning class to syphon-off surplus value in the form of profit. It is the appropriation of surplus value (i.e., capital accumulation) *by one entity away from another* that constitutes exploitation and defines capitalism. Gibson-Graham demonstrates instances where this type of exploitation is not occurring: self-employment (where surplus value is appropriated by the laborer); cooperative businesses (where surplus value is appropriated by employee-owners, consumer-owners, and reinvested into the community); and household production (where labor is never transformed into its monetary value form, thus providing no surplus to be appropriated). Gibson-Graham also bring to light the fluidity of economic identities, showing how an individual can be both an exploited laborer at their day job, for example, but an *appropriator* of surplus value through the investment of their retirements funds in the stock market. "Economic sites that have usually been seen as homogenously capitalist," Gibson-Graham explains, "may be re-envisioned as sites of economic difference, where a variety of capitalist and non-capitalist class processes interact" (1996, p. 18).

Similar approaches to studying alternatives to capitalism include work on moral economies (Scott, 1977), Buddhist economics (Schumacher, 1973), and sharing (Gold, 2004). In sum, alternatives to capitalism can be viewed as those processes of production and consumption of goods and services—and the social-ecological relations the processes intimate—wherein the driving force is not the maximization of capital accumulation by an elite class of owners, but rather the maximization of social-ecological well-being through an equitable distribution of the products of human labor.

Pulling away from Gibson-Graham and returning the purposes of this dissertation, an important question emerges. If capitalism's alternatives are still predicated on the production of surplus value through the exploitation of labor (humans) and raw materials (non-human environments), do these modes of economy offer any real promise for remedying the social and environmental impacts of capitalism and thereby contributing to the of resilience of Indigenous communities in the Arctic? On the social front, it is relatively straight forward to see how alternative modes of production/consumption and distribution enhance social justice and equity—surplus value is distributed equitably among many rather than horded by a few. Similarly, on the environmental side, we know that communally owned natural resources can be sustainably managed (Ostrom, 1990). By replacing *profit maximization* with *equitable well-being* as the key driver of economies (Figure 1.4), alternatives to capitalism make room for decisions that are more ecologically sound than those determined by capitalist logic.

1.5.4 Resilience and Capitalism: Reconsidering the Relationship

Resilience thinking, I contend, is a site of economic differentiation because its application supports both capitalist and non-capitalist modes of production and consumption. Radical political economists have critiqued it as a homogenously capitalist project, but the evidence suggests otherwise. Take for example the previously mentioned Arctic Resilience Report. Although still in draft form, much of the report appears to be a manifestation of neoliberal logic aimed at bringing new places into capitalist modes of production. A table on page 75, for example, summarizes the risks and opportunities for arctic investment as defined by Lloyds Bank. In contrast, other parts of the report are explicitly critical of capitalism, such as the case study of Norwegian reindeer herders that identifies the "imposition of global market capitalism" (p. 32) as a key factor in eroding Indigenous knowledge. Consider also the recent article on arctic stewardship cited earlier (Chapin et al., 2015). A quote from Pope Francis opens the article and addresses the globe's growing economic disparities, the defenselessness of nature to increased profits, and the problems of a "deified market" (p. 207). These resilience thinkers recognize the link between capitalism, ecological degradation, and social inequity.

Resilience thinking may be predominately friendly to capitalism, but it is not completely so. It may be more accurate to say that resilience thinking, as a whole, is conflicted about its stance on capitalism. Thus we must avoid the pitfall Gibson-Graham showed Marxists to have fallen into. We need not replace resilience *in toto* with another concept, but instead work to grow the non-capitalist options that exist within resilience thinking currently. To do this, resilience thinking needs to integrate concepts from radical political economy. This will help resilience thinkers understand more clearly than they currently do capitalisms implications and alternatives,

how capitalism interacts with non-capitalist modes of production and consumption, and what this means for applying resilience thinking in specific locations.

1.6 Radical Resilience: A New Framework for Steering Arctic Change

The theoretical framework of radical resilience retains many of resilience thinking's core concepts and metaphors. The unit of study is still social-ecological systems, as defined by researchers. Systems are still described in terms of their persistence, adaptability, and transformability. Models such as the adaptive cycle and panarchy are still utilized to conceptualize change over space and time. The difference in radical resilience is that it brings into resilience research and politics an epistemological lineage that explicitly questions the ideology of neoliberal capitalism – it brings a type of skepticism or criticality around exploitative systems of production and consumption that resilience thinking has largely lacked. In radical resilience, the relationship between capitalism and social-ecological systems becomes a subject to study and evaluations, rather than an assumed, or naturalized, structure of the system. To achieve these goals, radical resilience must use vocabulary from radical political economy to shape its research questions.

A quote from Robbins (2004) exemplifies the type of vocabulary that resilience needs to incorporate to become more radical. He writes, "No explanation of environmental change is complete…without serious attention to who profits from changes in control over resources, and without exploring who takes what from whom" (p. 75). While environmental change is obviously within the purview of resilience thinking, it would be very surprising for a resilience scholar to write about social agents *taking* or *profiting* from one another in the way that Robbins

uses the terms. When resilience thinkers want to indicate that something is wrong with a system, they tend to use terms such as *undesirable system state* and *lock-in trap*, but these terms obscure the human agency that is ultimately responsible for the condition being analyzed. This issue goes back to the critique discussed earlier about resilience thinking's tendency to naturalize processes that lead to social inequity and environmental degradation that are actually caused by human choice, and therefore avoidable.

Turner (2014) attributes resilience's hesitancy to think critically about the social dimension of social-ecological systems to its claim to objectivity. He writes, "Ecologists may feel that as biophysical scientists they escape the 'bias' that plagues much of social science"; but Turner expresses skepticism in that claim when he adds, "[T]he choice of the appropriate parameter become particularly difficult and dare I say, normative, for open socio-ecological systems" (p. 620). Turner also suggests that the human struggle, pain, and injustice that is endured by some groups as social-ecological systems adapt and transform, are abstracted and largely ignored in resilience-based modeling. This unwillingness to engage difficult topics, Turner continues, has led to a "disturbing voyeurism – coming too close, for many social scientists, to social Darwinism" (p. 621). Turner's criticism suggests a need for academic resilience thinking to overcome its normative reluctance. Table 1.1 presents the contrasting approaches to social-ecological systems and the resultant outcomes of three schools of thought – capitalism, conventional resilience thinking, and radical resilience.

Radical resilience, drawing on Marxism, posits that the social inequity inherent in capitalism is something that society has a moral obligation to avoid (Harvey, 1982, 1996; Smith, 1984). Drawing on eco-Marxism, radical resilience posits that society also has a moral obligation to avoid the unsustainable environmental degradation caused by capitalism (Foster 1999, 2002;

O'Connor, 1988). However, tempered by post-Marxist theory (Gibson-Graham, 1996), radical resilience is not purely anti-capitalist, but instead seeks to explore the relationship between capitalist and non-capitalist values and material outcomes and analyze what this means for the resilience of social-ecological systems. Under radical resilience, society has a moral obligation to provide care for other human and non-human lifeforms. A radical resilience research agenda includes the following questions (which I return to in the dissertation's Conclusion):

- What are the key social-ecological dynamics of the given system?
- Who benefits from the arrangement, at what scale, and how much?
- Who suffers from the arrangement, at what scale, and how much?
- Is power equitably distributed in this arrangement?
- In this context, what should be made resilient to what and for whom?

Having proposed this framework for understanding and steering Arctic change, the next three chapters of this dissertation present empirical studies of existing and possible future industrialization processes in northern Alaska, focusing respectively on the three sectors of tourism, natural resource extraction, and shipping. In the Conclusion I interpret the case study data through the lens of radical resilience to address the main research question: How is the global capitalist system affecting the social-ecological resilience of Indigenous communities in northern Alaska as the Arctic continues to industrialize?

1.7 References

Adger, W. N. (2000). Social and ecological resilience: are they related? *Progress in Human Geography, 24*(3), 347-364. doi:10.1191/030913200701540465

Ahlborg, H., & Nightingale, A. J. (2012). Mismatch between scales of knowledge in Nepalese forestry: Epistemology, power, and policy implications. *Ecology and Society, 17*(4). doi:10.5751/ES-05171-170416

Andrew, R. (2014). *Socio-economic drivers of change in the Arctic.* (AMAP technical report No. 9). Oslo: Arctic Monitoring and Assessment Programme.

Arctic Centre – University of Lapland. (n.d.). Arctic Indigenous peoples. Retrieved from http://www.arcticcentre.org/EN/communications/arcticregion/Arctic-Indigenous-Peoples

Arctic Climate Impact Assessment. (2005). Future climate change: Modeling and scenarios for the Arctic. In C. Symon, L. Arris, & B. Heal (Eds.), *Arctic climate impact assessment overview report* (pp. 100-150). Cambridge: Cambridge University Press.

Arctic Council. (2013). *Arctic resilience interim report 2013*. Stockholm: Stockholm Environment Institute and Stockholm Resilience Centre.

Arctic Monitoring and Assessment Programme. (n.d.). Geographical Coverage. Retrieved from http://www.amap.no/about/geographical-coverage

Arctic Monitoring and Assessment Programme.(2013). *Arctic climate issues 2011: changes in Arctic snow, water, ice and permafrost*. Retrieved from http://www.amap.no/documents/doc/arctic-climate-issues-2011-changes-in-arctic-snow-water-ice-and-permafrost/129

Armitage, D., Berkes, F., & Doubleday, N. (Eds.). (2007). *Adaptive co-management*. Vancouver, Canada: UBC Press.

Bali, A., & Kofinas, G. P. (2014). Voices of the Caribou people: a participatory videography method to document and share local knowledge from the North American human–Rangifer systems. *Ecology and Society, 19*, 16. http://dx.doi.org/10.5751/ES-06327-190216

Barber, D. G., Asplin, M. G., Papakyriakou, T. N., Miller, L., Else, B. G., Iacozza, J., . . . Ferguson, S. (2012). Consequences of change and variability in sea ice on marine ecosystem and biogeochemical processes during the 2007–2008 Canadian International Polar Year program. *Climatic Change, 115*(1), 135-159. doi:10.1007/s10584-012-0482-9

Berkes, F., & Jolly, D. (2002). Adapting to climate change: social-ecological resilience in a Canadian western Arctic community. *Conservation Ecology, 5*(2), 18-32. http://www.consecol.org/vol5/iss2/art18/

Biermann, M., Hillmer-Pegram, K., Knapp, C., & Hum, R. E. (2016). Approaching a critical turn? A content analysis of the politics of resilience in key bodies of resilience literature. *Resilience: International Policies, Practices and Discourses, 4*(2), 59-78. doi:10.1080/21693293.2015.1094170

Blaikie, P., & Brookfield, H. (1987). *Land degradation and society*. New York, NY: Methuen.

Broderstad, E. G., & Eythórsson, E. (2014). Resilient communities? Collapse and recovery of a social-ecological system in Arctic Norway. *Ecology and Society, 19*(3). doi:10.5751/ES-06533-190301

Cannon, T., & Müller-Mahn, D. (2010). Vulnerability, resilience and development discourses in context of climate change. *Natural Hazards, 55*(3), 621-635. doi:10.1007/s11069-010-9499-4

Chapin, F. S., Carpenter, S. R., Kofinas, G. P., Folke, C., Abel, N., Clark, W. C., . . . Swanson, F. J. (2010). Ecosystem stewardship: sustainability strategies for a rapidly changing planet. *Trends in Ecology and Evolution, 25*(4), 241-249. doi:10.1007/s11069-010-9499-4

Chapin, F., Kofinas, G.P., & Folke, C. (Eds.). (2009). *Principles of ecosystem stewardship: Resilience-based natural resource management in a changing world*: New York, NY: Springer Press.

Chapin, F. S., Power, M. E., Pickett, S. T., Freitag, A., Reynolds, J. A., Jackson, R. B., . . . Power, A. G. (2011). Earth stewardship: Science for action to sustain the human-earth system. *Ecosphere, 2*(8), 1-20. doi:10.1890/ES11-00166.1

Chapin, F. S., Sommerkorn, M., Robards, M. D., & Hillmer-Pegram, K. (2015). Ecosystem stewardship: A resilience framework for arctic conservation. *Global Environmental Change, 34*, 207-217. doi:10.1016/j.gloenvcha.2015.07.003

Callaghan, T. V., Jonasson, C., Thierfelder, T., Yang, Z., Hedenås, H., Johansson, M., . . . Sloan, V. L. (2013). Ecosystem change and stability over multiple decades in the Swedish subarctic: Complex processes and multiple drivers. *Philosophical Transactions of the Royal Society of London B: Biological Sciences, 368*(1624). doi:10.1098/rstb.2012.0488

Cameron, E. S. (2012). Securing Indigenous politics: A critique of the vulnerability and adaptation approach to the human dimensions of climate change in the Canadian Arctic. *Global Environmental Change, 22*(1), 103-114. doi:10.1016/j.gloenvcha.2011.11.004

Castree, N. (2010a). Neoliberalism and the biophysical environment 1: What 'neoliberalism' is, and what difference nature makes to it. *Geography Compass, 4*(12), 1725-1733. doi:10.1111/j.1749-8198.2010.00405.x

Castree, N. (2010b). Neoliberalism and the biophysical environment 2: Theorising the neoliberalisation of nature. *Geography Compass, 4*(12), 1734-1746. doi:10.1111/j.1749-8198.2010.00407.x

Castree, N. (2011). Neoliberalism and the biophysical environment 3: putting theory into practice. *Geography Compass, 5*(1), 35-49. doi:10.1111/j.1749-8198.2010.00406.x

Catton Jr, W. R., & Dunlap, R. E. (1978). Environmental sociology: a new paradigm. *The American Sociologist*, 41-49. http://www.jstor.org/stable/27702311

Conservation of Arctic Flora and Fauna (2010). *Arctic biodiversity trends 2010: Selected indicators of change*. CAFF International Secretariat, Akureyri, Iceland. Retrieved from http://www.arcticbiodiversity.is/

Cote, M., & Nightingale, A. J. (2012). Resilience thinking meets social theory: Situating social change in socio-ecological systems (SES) research. *Progress in Human Geography, 36*(4), 475-489. doi:10.1177/0309132511425708

Cretney, R. (2014). Resilience for Whom? Emerging Critical Geographies of Socio-ecological Resilience. *Geography Compass*, *8*(9), 627-640. doi:10.1111/gec3.12154

Dove, M. R., & Carpenter, C. (2013). *Environmental anthropology: A historical reader*. Malden, MA: Blackwell Press.

Druckenmiller, M. L., Eicken, H., George, J. C., & Brower, L. (2013). Trails to the whale: reflections of change and choice on an Iñupiat icescape at Barrow, Alaska. *Polar Geography, 36*(1-2), 5-29. doi:10.1080/1088937X.2012.724459

Evans, B., & Reid, J. (2014). *Resilient life: The art of living dangerously*. Malden, MA: Polity Press.

Folke, C. (2006). Resilience: The emergence of a perspective for social-ecological systems analyses. *Global Environmental Change-Human and Policy Dimensions, 16*(3), 253-267. doi:10.1016/j.gloenvcha.2006.04.002

Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., & Rockström, J. (2010). Resilience thinking: integrating resilience, adaptability and transformability. *Ecology and Society, 15*(4), 20. http://www.ecologyandsociety.org/vol15/iss4/art20/

Foster, J. B. (1999). *The vulnerable planet: A short economic history of the environment*. Canada: Monthly Review Press.

Foster, J. B. (2002). *Ecology against capitalism*. Canada: Monthly Review Press.

Gallaher, C. (2009). Neoliberalism. In C. Gallaher, C. Dahlman, M. Gilmartin, A. Mountz & P. Shirlow (Eds.), *Key concepts in political geography*. London: Sage Press.

Gibson-Graham, J. K. (1996). *The end of capitalism (as we knew it): A feminist critique of political economy*. Oxford: Blackwell Press.

Gold, L. (2004). *The sharing economy: Solidarity networks transforming globalisation*. Burlington, VT: Gower Press.

Grebmeier, J. M., Overland, J. E., Moore, S. E., Farley, E. V., Carmack, E. C., Cooper, L. W., ... McNutt, S. L. (2006). A major ecosystem shift in the northern Bering Sea. *Science, 311*(5766), 1461-1464. DOI:10.1126/science.1121365

Gunderson, L. H., & Holling, C. S. (2002). *Panarchy: understanding transformations in systems of humans and nature.* Washington DC: Island Press.

Gustine, D. D., Brinkman, T. J., Lindgren, M. A., Schmidt, J. I., Rupp, T. S., & Adams, L. G. (2014). Climate-driven effects of fire on winter habitat for caribou in the Alaskan-Yukon Arctic. *PLOS One, 9*(7). http://dx.doi.org/10.1371/journal.pone.0100588

Harsem, Ø., Eide, A., & Heen, K. (2011). Factors influencing future oil and gas prospects in the Arctic. *Energy policy, 39*(12), 8037-8045. doi:10.1016/j.enpol.2011.09.058

Harvey, D. (1982). *The limits to capital*. Oxford: University of Chicago Press.

Harvey, D. (1996). *Justice, nature and the geography of difference*. Oxford: Blackwell Publishing.

Harvey, D. (2005). *A brief history of neoliberalism*. Oxford: Oxford University Press.

Hornborg, A. (2013). Revelations of resilience: From the ideological disarmament of disaster to the revolutionary implications of (p)anarchy. *Resilience: International Policies, Practices and Discourses, 1*(2), 116-129. doi:10.1080/21693293.2013.797661

Howell, L. (2013) *Global risk report 2013.* Geneva: World Economic Forum. Retrieved from http://www3.weforum.org/docs/WEF_GlobalRisks_Report_2013.pdf.

Hunn, E. S. (1999). The value of subsistence for the future of the world. In V. D. Nazarea (Ed.), *Ethnoecology: Situated knowledge/located lives* (pp. 23-36). Tucson, AZ: University of Arizona Press.

Intergovernmental Panel on Climate Change, Stocker, T., and Working Group I. (2014). *Climate change 2013: The physical science basis: Working Group I contribution to the fifth assessment report of the Intergovernmental Panel on Climate Change.* Retrieved from http://www.ipcc.ch/report/ar5/wg1/

Jeffries, M., Richter-Menge, J., & Overland, J. (2013). *Arctic Report Card.* Retrieved from http://www.arctic.noaa.gov/report13/ArcticReportCard_full_report.pdf

Joseph, J. (2013). Resilience as embedded neoliberalism: a governmentality approach. *Resilience: International Policies, Practices and Discourses, 1*(1), 38-52. doi:10.1080/21693293.2013.765741

Kirchhoff, T., Brand, F. S., Hoheisel, D., & Grimm, V. (2010). The one-sidedness and cultural bias of the resilience approach. *Gaia-Ecological Perspectives for Science and Society, 19*(1), 25-32. http://www.researchgate.net/publication/258375101

Kumpula, T., Forbes, B. C., Stammler, F., & Meschtyb, N. (2012). Dynamics of a coupled system: Multi-resolution remote sensing in assessing social-ecological responses during 25 Years of gas field development in arctic Russia. *Remote Sensing, 4*(4), 1046-1068. doi:10.3390/rs4041046

Lang, D. J., Wiek, A., Bergmann, M., Stauffacher, M., Martens, P., Moll, P., . . . Thomas, C. J. (2012). Transdisciplinary research in sustainability science: Practice, principles, and challenges. *Sustainability Science, 7*(1), 25-43. doi:10.1007/s11625-011-0149-x

Larsen, J. N., Nilsson, A., & Young, O. (Eds.). (2014). *Arctic Human Development Report II.* Denmark: Nordic Council of Ministers.

Lather, P. (1986). Research as praxis. *Harvard Educational Review, 56*(3), 257-278. http://dx.doi.org/10.17763/haer.56.3.bj2h231877069482

Leach, M. (2008). *Re-framing resilience: A symposium report* (STEPS Working Paper 13). Brighton: STEPS Centre.

Lebel, L., Grothmann, T., & Siebenhuner, B. (2010). The role of social learning in adaptiveness: Insights from water management. *International Environmental Agreements-Politics Law and Economics, 10*(4), 333-353. DOI:10.1007/s10784-010-9142-6

Lemke, P., Ren, J., Alley, R. B., Allison, I., Carrasco, J., Flato, G., . . . Thomas, R. H. (2007). Observations: Changes in snow, ice and frozen ground. In S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. Averyt, M. Tignor & H. Miller (Eds.), *Climate change 2007: The physical science basis; summary for policymakers, technical summary and frequently asked questions. Part of the Working Group I contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 337-384). Retrieved from https://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter4.pdf

Liu, M., & Kronbak, J. (2010). The potential economic viability of using the Northern Sea Route (NSR) as an alternative route between Asia and Europe. *Journal of Transport Geography, 18*(3), 434-444. doi:10.1016/j.jtrangeo.2009.08.004

Lovecraft, A. L. (2008). Climate change and arctic cases: A normative exploration of social-ecological system analysis. In S. Vanderheiden (Ed.), *Political theory and global climate change* (pp. 91-120). Cambridge, MA: MIT Press.

MacKinnon, D., & Derickson, K. D. (2013). From resilience to resourcefulness: A critique of resilience policy and activism. *Progress in Human Geography, 37*(2), 253-270. doi:10.1177/0309132512454775

Marx, K. (1867/1990). *Capital: A critique of political economy. Volume 1.* London: Penguin.

Meek, C. L., Lovecraft, A. L., Robards, M. D., & Kofinas, G. P. (2008). Building resilience through interlocal relations: Case studies of polar bear and walrus management in the Bering Strait. *Marine Policy, 32*(6), 1080-1089. doi:10.1016/j.marpol.2008.03.003

Mikkelsen, A. & Langhelle, O. (Eds.). (2008). *Arctic oil and gas: Sustainability at risk?* New York, NY: Routledge Press.

Molau, U. (2010). Long-term impacts of observed and induced climate change on tussock tundra near its southern limit in northern Sweden. *Plant Ecology and Diversity, 3*(1), 29-34. doi:10.1080/17550874.2010.487548

Myers-Smith, I. H., Forbes, B. C., Wilmking, M., Hallinger, M., Lantz, T., Blok, D., . . . Lévesque, E. (2011). Shrub expansion in tundra ecosystems: dynamics, impacts and research priorities. *Environmental Research Letters, 6*(4), 1-15. doi:10.1088/1748-9326/6/4/045509

Nadasdy, P. (2007). Adaptive co-management and the gospel of resilience. In D. Armitage, F. Berkes, & N. Doubleday (Eds.), *Adaptive co-management: collaboration, learning and multi-level governance* (pp. 208-227). Vancouver: UBC Press.

National Snow and Ice Data Center. (2013). Arctic Sea Ice Reaches Lowest Extent for 2013. Retrieved from http://nsidc.org/arcticseaicenews/2013/09/draft-arctic-sea-ice-reaches-lowest-extent-for-2013/

Nelson, S. H. (2014). Resilience and the neoliberal counter-revolution: from ecologies of control to production of the common. *Resilience: International Policies, Practices and Discourses, 2*(1), 1-17. doi:10.1080/21693293.2014.872456

Nord, D. C. (2015). The Challenge of governance in the Arctic: Now and in the future. In B. Evengard, J. N. Larsen & O. Paasche (Eds.), *The New Arctic* (pp. 303-314). New York, NY: Springer Press.

Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. F., & Pfefferbaum, R. L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American Journal of Community Psychology, 41*(1-2), 127-150. doi:10.1007/s10464-007-9156-6

O'Connor, J. (1988). Capitalism, nature, socialism a theoretical introduction. *Capitalism Nature Socialism, 1*(1), 11-38. doi:10.1080/10455758809358356

O'Connor, J. (1991). On the two contradictions of capitalism. *Capitalism Nature Socialism, 2*(3), 107-109. doi:10.1080/10455759109358463

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge: Cambridge University Press.

Overland, J. E., & Wang, M. (2013). When will the summer Arctic be nearly ice free? *Geographical Research Letters*. *40*(10), 2097-2101. doi:10.1002/grl.50316

Peet, R., Robbins, P., & Watts, M. (2011). *Global political ecology*. New York, NY: Routledge.

Plummer, R., & Armitage, D. (2007). A resilience-based framework for evaluating adaptive co-management: Linking ecology, economics and society in a complex world. *Ecological Economics, 61*(1), 62-74. doi:10.1016/j.ecolecon.2006.09.025

Protection of the Arctic Marine Environment (2009) *Arctic marine shipping assessment 2009 report*. Retrieved from http://www.pame.is/index.php/projects/arctic-marine-shipping/amsa/amsa-2009-report.

Robbins, P. (2004). *Political ecology: A critical introduction*. Malden, MA: Blackwell Publishing.

Schumacher, E. F. (1973). *Small is beautiful: A study of economics as if people mattered*. New York, NY: Harper and Row Press.

Scott, J. C. (1977). *The moral economy of the peasant: Rebellion and subsistence in Southeast Asia*. New Haven, CT Yale University Press.

Smith, N. (1984). *Uneven development: Nature capital and production of space*. Cambridge, MA: Basil Blackwell.

Stockholm Resilience Centre. (2007). Social-Ecological Systems. Retrieved from http://www.stockholmresilience.org/21/research/what-is-resilience/research-background/research-framework/social-ecological-systems.html

Stroeve, J. C., Kattsov, V., Barrett, A., Serreze, M., Pavlova, T., Holland, M., & Meier, W. N. (2012). Trends in Arctic sea ice extent from CMIP5, CMIP3 and observations. *Geophysical Research Letters, 39*(16). doi:10.1029/2012GL052676

Tokic, D. (2015). The 2014 oil bust: Causes and consequences. *Energy Policy*, *85*, 162-169. doi:10.1016/j.enpol.2015.06.005

Turner, M. D. (2014). Political ecology I: An alliance with resilience? *Progress in Human Geography, 38*(4), 616-623. doi:10.1177/0309132513502770

United Nations Development Programme, United Nations Environment Programme, World Bank, et al. (2008). *World resources 2008: Roots of resilience—growing the wealth of the poor.* Washington, DC: World Resource Institute.

United Nations Panel on Global Sustainability. (2012). *Resilient people, resilient planet: A future worth choosing.* New York, NY: United Nations.

US Agency for International Development. (2012). *Building resilience to recurrent crisis: USAID policy and program guidance.* Washington, DC: USAID.

Vincent, W. F., Laurion, I., Pienitz, R., & Walter Anthony, K. M. (2012). Climate impacts on arctic lake ecosystems. In C. R. Goldman, M. Kumagai & R. D. Robarts (Eds.), *Climatic change and global warming of inland waters: Impacts and mitigation for ecosystems and societies* (pp. 27-42).

Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. (2004). Resilience, adaptability and transformability in social--ecological systems. *Ecology and Society, 9*(2), 5. http://www.ecologyandsociety.org/vol9/iss2/art5/

Wallerstein, I. (1979). *The capitalist world-economy: Essays by Immanuel Wallerstein* Cambridge: Cambridge University Press.

Walsh, J. E., Overland, J. E., Groisman, P. Y., & Rudolf, B. (2011). Ongoing climate change in the Arctic. *Ambio, 40*(1), 6-16. doi:10.1007/s13280-011-0211-z

Young, O. R. (2012). Arctic stewardship: Maintaining regional resilience in an era of global change. *Ethics and International Affairs, 26*(4), 407-420. http://dx.doi.org/10.1017/S0892679412000585

Zimmerer, K. S. (2010). Retrospective on nature–society geography: Tracing trajectories (1911–2010) and reflecting on translations. *Annals of the Association of American Geographers, 100*(5), 1076-1094. doi:10.1080/00045608.2010.523343

Table 1.1 Contrasting social-ecological approaches and outcomes of capitalism, conventional resilience thinking, and radical resilience.

	Capitalism	**Conventional resilience thinking**	**Radical resilience**
Approach to social-ecological systems	• Exploit social-ecological systems to maximum efficiency for profit maximization and infinite growth	• Guide local-scale social-ecological systems into states that resilience thinkers deem desirable but in a manner that embraces capitalism as a natural systemic property	• Expects that capitalism will have environmentally and socially harmful impacts on communities • Promote community empowerment over global-scale social-ecological processes
Social-ecological outcomes	• Environmental degradation and possible catastrophic transformation of the global climate system • Social inequity and alienation from social-ecological meaning	• Local-scale ecosystems system are propped-up against or transformed to accept the consumption and pollution of capitalism • Local-scale social-systems (i.e., communities) remain in an exploited and alienated state	• Communities acquire greater sovereignty over their own social-ecological resources • Environmental degradation and social alienation are reduced as non-local resource exploitation is minimized

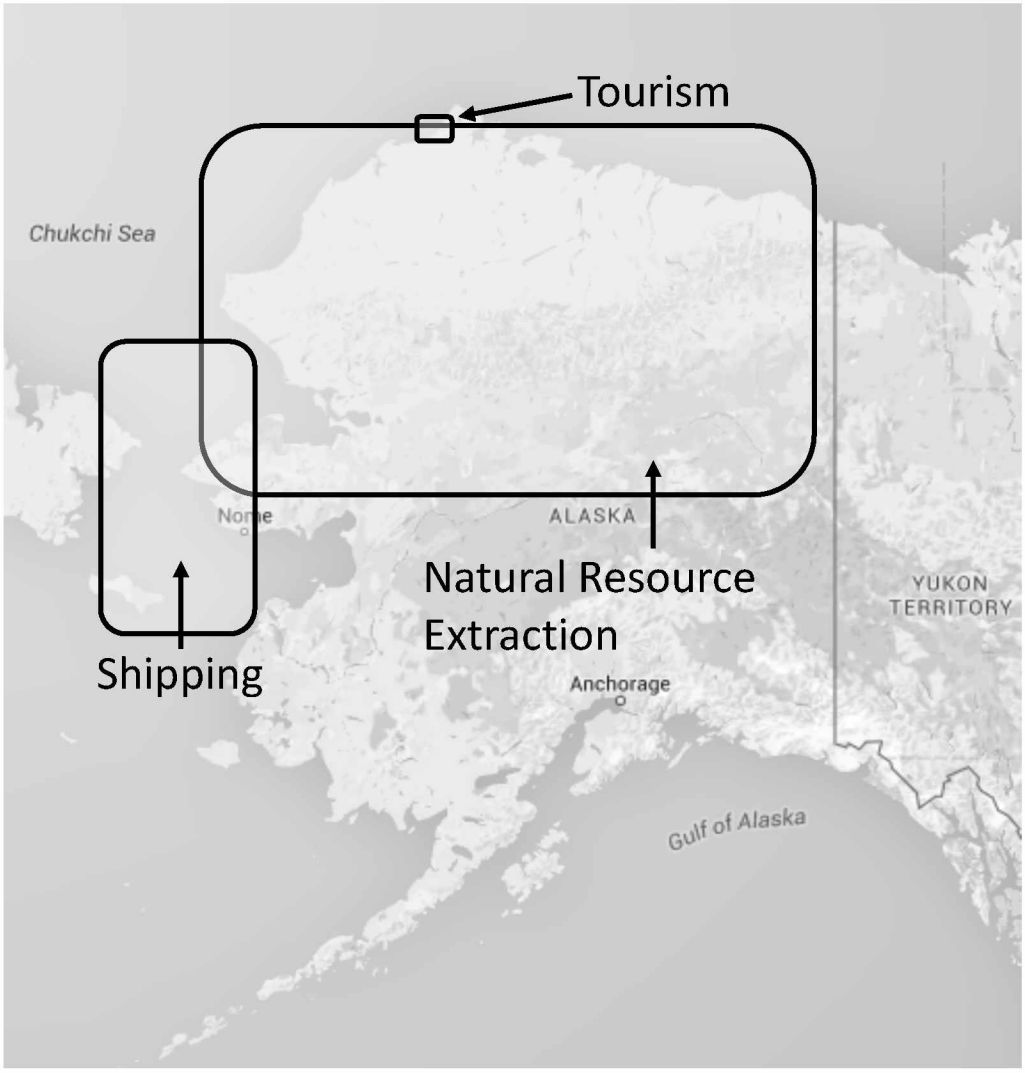

Figure 1.1 The geographic scope of each of the three case studies from northern Alaska.

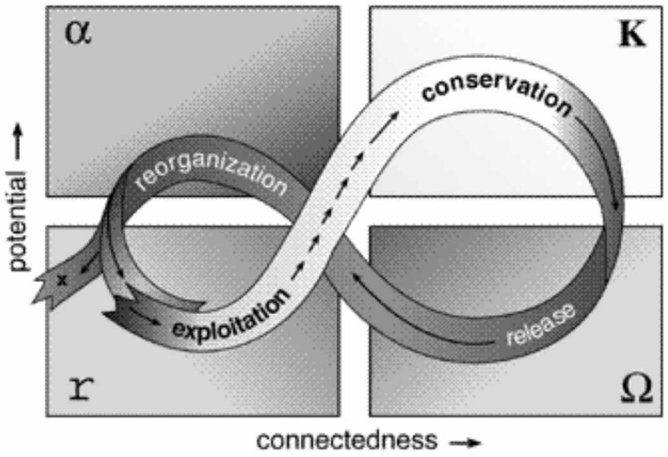

Figure 1.2 Resilience thinking's adaptive-cycle model of change in systems. A system in the exploitation phase (r), is just getting started – drawing on its resource base to increase its potential and internal connectedness (e.g., a forest just beginning to grow). As the system builds in complexity, it reaches the conservation phase (K), where maximum resources are contained within (e.g., an old growth forest). When a complex system collapses, it enters the release phase (Ω) where its resources are redistributed to the environment (e.g., a major forest fire). Following release, systems enter a reorganization phase (α), where resources can become mobilized around the same, or fundamentally different, structures and functions (e.g., the same type of forest re-growing vs. a different ecosystem emerging). Source: Gunderson & Holling, 2002.

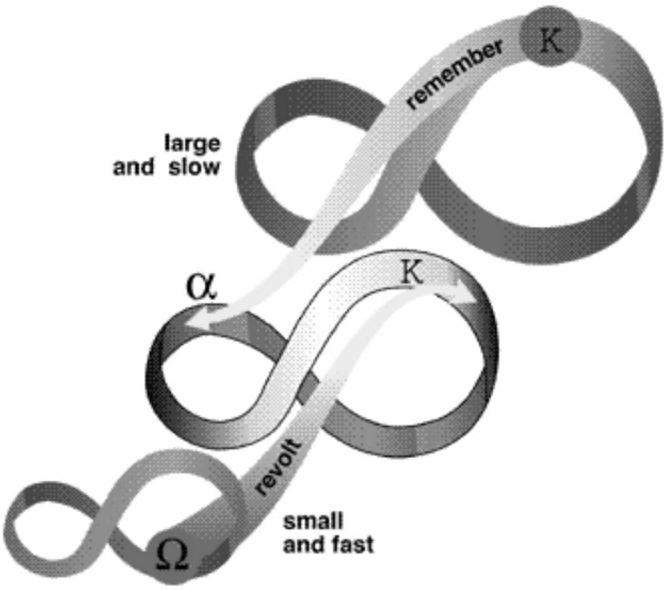

Figure 1.3 Resilience thinking's panarchy model of cross-scale change in systems. Source: Gunderson & Holling, 2002.

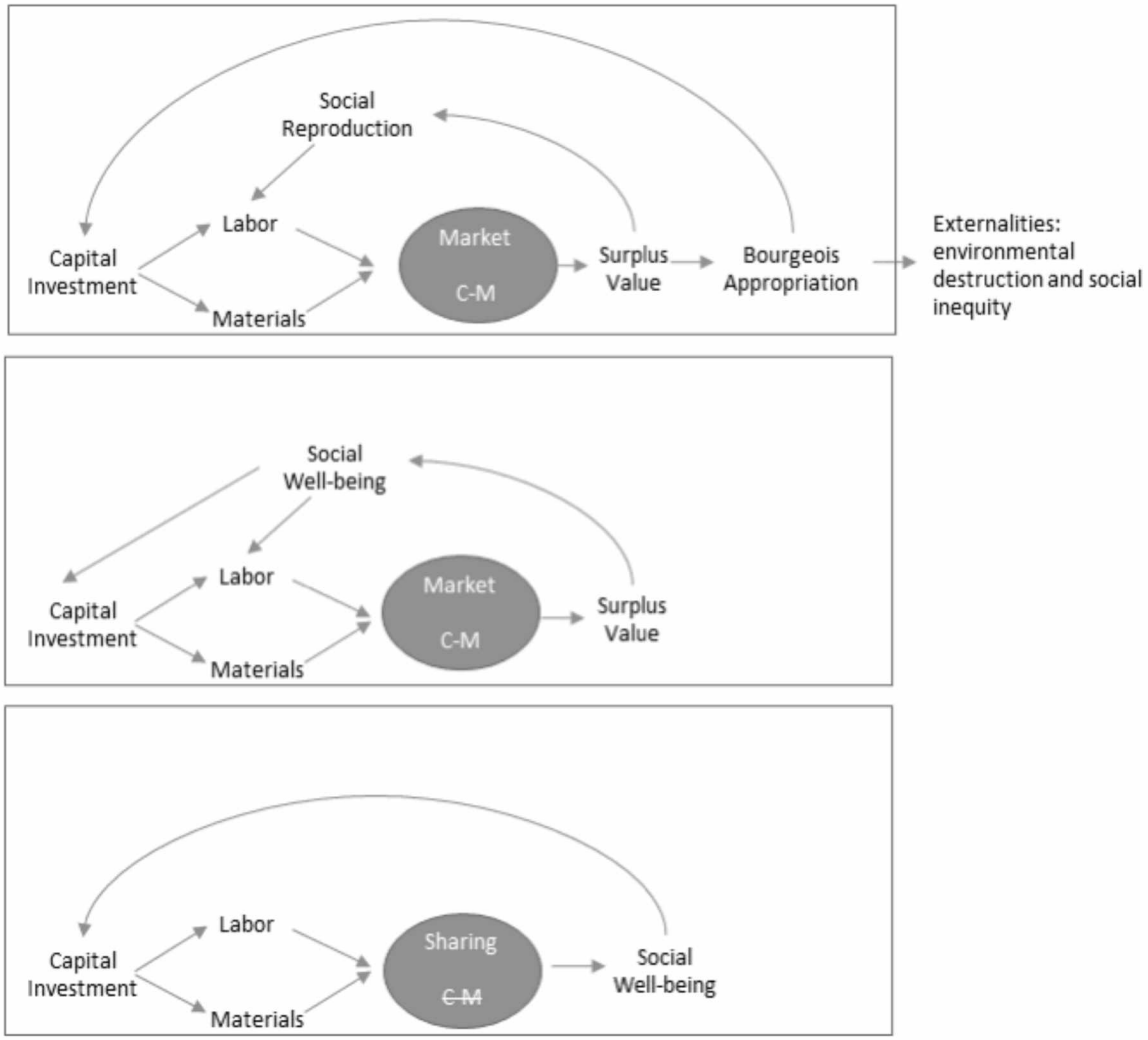

Figure 1.4 Three different models of economic activity. The top model depicts a capitalist economy, where capital is invested into labor and materials for the purpose of producing a commodity (C), which is exchanged in a market for money (M). Surplus value is derived from this process and controlled by the bourgeois, who minimize the amount spent on social reproduction in order to maximize the amount they are able to appropriate. The appropriated share can then be reinvested to produce more commodities (M-C-M) and continue the cycle, or horded, or spent on the extravagances of the mega-rich. In order to maximize bourgeois appropriation, the so called 'externalities' of environmental destruction and social inequity are assured. In the middle model, capital is again invested in labor and materials to produce a commodity that is exchanged for money in a market, but this time the surplus value is not appropriated by the bourgeois, but rather spent on social well-being, perhaps through redistribution by the state or through direct control by labor. Reinvestment in the cycle can occur once social well-being is adequately addressed, but maximizing the appropriation of surplus value is not the driving force. Accordingly, negative externalities can be minimized. The bottom model represents a non-market economy, where labor and materials combine to produce a consumable good or service that is shared for the well-being of society, and never commodified or exchanged for money. In such a system, there may not be much surplus value and it is rather the social well-being that is reinvested to keep the system going. All three model of economics occur simultaneously and interact with one another.

CHAPTER 2: INTEGRATING INDIGENOUS VALUES WITH CAPITALISM THROUGH TOURISM: ALASKAN EXPERIENCES AND OUTSTANDING ISSUES [1]

Abstract: Radical theories from political economy assert that capitalism is founded on the creation and appropriation of surplus value through exploiting human labor and nature. Such exploitative social and social-ecological relations are generally understood as contradictory to Indigenous worldviews, which tend to emphasize community wellbeing and environmental reciprocity over maximizing private accumulation. Enter tourism, tantalizing in its promise as a 'silver bullet' for Indigenous sustainable development. When done 'right', tourism can generate capitalist economic activity without drastically damaging cultural and ecological systems. This study examines spaces of confluence and divergence in Barrow, Alaska between current tourism and the values of its Indigenous people, the Iñupiat. It considers the scenario of increased tourism in the future and identifies local visions for expanding tourism in a culturally appropriate manner. Key ideas for future development include increasing regulation of cruise ship tourists and enhancing capacity to host high-end tourists. The study reveals conflicting views about using subsistence hunting, fishing and whaling activities as tourism attractions, and concludes that the ability of leaders in Barrow to support Indigenous values through tourism highlights an opportunity and need for a research agenda focused on exploring the relationship between capitalism and its alternatives within tourism destinations.

Keywords: *Indigenous capitalism, Marx, Iñupiaq values, Alaska tourism, Arctic tourism, Arctic development, critical theory*

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[1] Hillmer-Pegram, K. (2016). Integrating Indigenous values with capitalism through tourism: Alaskan experiences and outstanding issues. *Journal of Sustainable Tourism*, 1-17. doi:10.1080/09669582.2016.1182536

2.1 Introduction

The political leadership of Barrow—a primarily Indigenous coastal community located in the US Arctic at the northernmost point of Alaska—wants to develop more tourism in order to diversify their oil dependent economy. This desire is laid out in *Soaring to the Future: Barrow Comprehensive Plan 2015-2035*, an official planning document recently completed collaboratively by the major local governing bodies of Barrow for the purpose of providing a unified direction for future development (North Slope Borough [NSB], 2014). The plan goes into detail describing a vision for the next two decades for tourism in Barrow, demonstrated by a selection of quotes:

- Expand tourism opportunities, including the need for additional visitor accommodations; and encourage additional commercial enterprises, such as restaurants and coffee shops (p. 7).
- Strengths identified by Barrow residents were:…Tourism, specifically wildlife and birding as a tourist attraction (p. 8).
- Strengthen the local community through tourism development…Expand tourism activities…develop feasible Eco-tourism…Research tourist preferences…Develop a website (p. 144).
- Opportunities:…Culturally influenced tourism (p. 265).

While the parties involved with the creation of the comprehensive plan (i.e., regional municipal governments, Native governments, and Native corporations – all of which are

explained further later) would not claim that it represents the views of every individual in Barrow, the plan nonetheless presents a clear and nuanced intention to increase tourism and its related businesses. The plan is likely to be implementable given the political clout of the authoring parties.

From a theoretical framework based on the paradigm of sustainable tourism (Bramwell, 2011; Bramwell & Lane, 1993; Butler, 1999; Clarke, 1997; Farrell & Twining-Ward, 2005; Hunter, 1995, 1997; Jamal & Camargo, 2014; Liu, 2003; Lu & Nepal, 2009; Müller, 1994; Sharpley, 2000), Barrow's goals for tourism development appear positive—a locally-led, community-vetted effort to promote economic diversification through tourism, in a manner that is environmentally and culturally sensitive. However, theoretical insights derived from research on Indigenous tourism (Butler & Hinch, 2007; Bunten, 2008, 2010, 2011; Honey, 1999; Johnston, 2000, 2006; Notzke, 1999; Robinson, 1999; Sofield, 1993; Turner, Berkes, & Turner, 2012; Zeppel, 2006) and from research taking a radical political economy approach to tourism (Bianchi, 2009, 2011; Britton, 1982a, 1991; Mosedale, 2011; Shepherd, 2002; Weaver, 2013), on the other hand, would likely advise a cautionary approach to tourism development. These latter realms of theory contend that tourism, especially in Indigenous communities where close ties to local ecosystems have been identified by the communities as culturally essential, can lead to undesirable impacts and outcomes if processes of development are dominated by outside forces and subjected to the global economic imperative for profit maximization through social-ecological commoditization.

Given the apparent tension between the need for sustainable economic development in the US Arctic on the one hand and the risks that are known to be associated with tourism development on the other hand, what should be made of the expressed desire of Barrow's

political leadership, which is primarily Indigenous, to expand tourism in their community? What do they know that makes them confident that they can avoid the common pitfalls of tourism? What lessons can be drawn from the Barrow case for the field of sustainable tourism?

To address these questions, this study is contextualized by presenting a social-ecological overview of Barrow, Alaska. Three areas of related but distinct tourism studies literature—sustainable tourism, Indigenous tourism, and the radical political economy of tourism—are then reviewed to build a theoretical framework for the Barrow study. Bunten's work on Indigenous capitalism through tourism (2008, 2010, 2011) emerges as a key theoretical concept. Study methods and findings are discussed. In conclusion, the implications of this case within the broader geographic context of Alaska and within the broader theoretical context of sustainable tourism are considered. It is argued that Barrow's apparent capacity to channel the forces of global capitalism into less-exploitative, community-oriented goals points towards the need for further research in the area of capitalism's alternatives (Gibson-Graham, 1996) in tourism destinations.

2.1.1 Overview of Barrow, Alaska

The community of Barrow was named after Sir John Barrow, (1764-1848), a British statesman, but the location is the homeland of the Iñupiat, an Indigenous Inuit ethnic group who have lived in the region for thousands of years. In Iñupiaq, the location is called Ukpeaġvik, which means a place to hunt snowy owls.[2] The afore mentioned comprehensive plan explains,

[2] Iñupiaq is the adjective form of Iñupiat (a plural noun) and also the name of the native language. The spelling with a 'q' is used for the singular form of the noun as well.

"Iñupiat translates as the real people…[who] have relied on their intimate knowledge of the environment and values of sharing and cooperation…Subsistence hunting, fishing and whaling traditions remain an integral way of life in Barrow" (p. 16). The 2010 US Census reports the population of Barrow at 4,974, with around 65% being Iñupiat. Hence, while Barrow is undoubtedly an Iñupiat community in terms of cultural authority, it is clearly not strictly Iñupiat. The prominence of subsistence activities, especially whaling, cannot be over stated. The comprehensive plan explains, "The bowhead whale is the foundation of the Iñupiat people" (p. 157).

Governance in Barrow is divided between multiple entities. There are two regional bodies: the North Slope Borough (an Indigenously created subdivision of the State of Alaska) and the Iñupiat Community of the Arctic Slope (a federally recognized tribal government). There are also two governments specific to Barrow: the City of Barrow (an Alaska first class city) and the Native Village of Barrow (a federally recognized tribal government). The North Slope Borough (NSB) possesses authority to tax oil and gas infrastructure on Borough land. The extensive oil and gas activity in the region, emanating from the Prudhoe Bay facility, has led to NSB establishing a substantial (although largely one-dimensional) revenue stream for public services. High quality water, sewer, and energy systems, as well as quality schools, public safety, health, wildlife management, and cultural programs, have resulted from this arrangement.

Two Native corporations also influence Barrow governance: Arctic Slope Regional Corporation (ASRC) and Ukpeaġvik Iñupiat Corporation (UIC). These Native corporations, along with hundreds more, were formed along regional and village boundaries by the Alaska Native Claims Settle Act of 1971 (ANCSA). ANCSA was motivated by the federal desire to construction an intrastate oil pipeline, which required clear land title, and served as Congress'

action to settle ongoing Indigenous land claims in the state. While some Alaska Natives vehemently opposed the settlement, many were in favor. The highly effective political action of Native activists resulted in over 44 million acres of land and nearly $1 billion being transferred to Alaska Natives. For-profit Native corporations were established to administer those assets and Alaska's Indigenous people were enrolled as shareholders in their associated village and regional corporations. A major difference between regional and village corporations is the terms of their land rights, whereby the former possesses title to the subsurface while the latter is restricted to surface ownership. In Barrow, ASRC (the regional for-profit corporation, serving about 11,000 shareholders), has profited directly from oil and gas production, while UIC (the village corporations, serving over 2,500 shareholders) owns key tracts of surface land in and around Barrow.

Environmentally, Barrow is located in low-lying, coastal tundra underlain by permafrost and marked by numerous lakes and swampy areas. Being treeless, cold, and dry, the environment is classified as Arctic desert. Winters are long, dark, and snow covered with temperatures regularly dropping to below -40° F, with strong winds and frozen landscapes. Within these conditions, human and non-human life thrives. Marine, terrestrial, and avian animal species are multitudinous and include polar bears (*Ursus maritimus*). While Iñupiat remain closely linked to the natural environment though subsistence, the natural environment throughout the Arctic is rapidly changing as the effects of anthropogenic climate warming play-out in particular places (Arctic Climate Impact Assessment [ACIA], 2005; Arctic Monitoring and Assessment Programme [AMAP], 2013; Intergovernmental Panel on Climate Change [IPCC], 2014). In Barrow, currently observable impacts include thawing permafrost (which threatens built infrastructure) and reduced sea ice (which impacts spring whaling and hastens coastal erosion).

Tourism in Barrow takes place within this context of rapid social-ecological change at local to pan-Arctic scales. Given this context, it is necessary to develop a theoretical framework with which to examine tourism in Barrow.

2.2 Theoretical Framework

2.2.1 Sustainable Tourism

The academic discussion of sustainable tourism began over 40 years ago (see Bramwell & Lane, 1993), with the increasingly recognized fundamental contention that tourism should be conducted in an environmentally sustainable manner to align with the goals identified for sustainable development in the United Nation's report Our Common Future (World Commission on Environment and Development [WCED], 1987). The document, known as the Brundtland Report, states, "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Sustainable tourism, then, must also conform to these ambitious yet vague guidelines. While a detailed recounting of the evolution of the sustainable tourism concept is not required here since it has been provided elsewhere (Buckley, 2012; Butler, 1999; Liu, 2003; Lu & Nepal, 2009) it is worth reviewing some of the main points and recent directions of the field.

Since the beginning of sustainable tourism research, there has been healthy debate about a) the definition of sustainability, b) the proper relationship between sustainable tourism and sustainable development, and c) whether or not sustainability is actually achievable within the tourism sector. Müller (1994) effectively argues for definitional flexibility and warns against the

search for a perfect sustainability formula. Hunter (1995) points out two problems with early sustainable tourism research: it over emphasizes tourism's environmental impacts while ignoring its social impacts, and it focuses on sustaining particular tourism activities while ignoring the ostensibly more important goals of sustainable development. Sustainable tourism should be understood as a spectrum that varies depending on a given location's relative stage of socio-economic development, Hunter later argues (1997).

Liu (2003) provides a milestone in sustainable tourism research by summarizing the key research that came before, pointing out its shortcomings, and recommending six directions for the future. His recommendations integrate the advances that had taken place within sustainable development during the previous decades into the sustainable tourism research-agenda. These are, "the nature of tourism demand, the nature of tourism resources, the imperative of intra-generational equity, the role of tourism in promoting socio-cultural progress, the measurement of sustainability, and forms of sustainable development" (p. 459). Lu and Nepal (2009) provide a state-of-the-field review (as represented by *Journal of Sustainable Tourism*), which shows that the topics described above and topics broached earlier, were still being pursued at that time.

While today's sustainable tourism research is varied in topic, theoretical approach, and researchers' disciplinary backgrounds, key themes include: the need to integrate complex systems thinking and resilience approaches into tourism studies (Farrell & Twining-Ward, 2005; Hillmer-Pegram, 2014), the usefulness of the sustainable livelihoods concept for tourism studies (Tao & Wall, 2009), the impacts of climate change on the effort to advance sustainable tourism (Weaver, 2011), and the importance of studying tourism through the theoretical lenses of justice and ethics (Jamal & Camargo, 2014). Many of these themes correspond with parallel discussions taking place in the field of sustainable development and continue to expand the field. Bramwell

and Lane (2015) suggest that an important area for future research is the motivations of sustainable tourism scholars themselves, as this will help explain the field's diversity. In the next two sections, I draw on literature from Indigenous tourism and the radical political economy of tourism in an attempt to develop a critical framework for sustainable Indigenous tourism.

2.2.2 Indigenous Tourism

Indigenous tourism studies can be viewed as a sub-category of the sustainable tourism field; one that integrates insights from Indigenous studies, anthropology, and critical development studies. The work reviewed below advances discussions about sustainable tourism in key ways: it has brought colonialism and its legacy of exploitation to the forefront of analysis; it has forced questions about the commoditization of Indigenous cultures within tourism development frameworks; it has explored the relationship between Indigenous peoples, the ecosystems from which they draw subsistence, and tourism; and it repeatedly drives homes the necessity for Indigenous control of Indigenous tourism. When these lessons are applied, the power to determine how tourism development is done is transferred from international organizations and the global tourism industry to the Indigenous communities experiencing tourism. Critical development studies calls this empowerment, while Indigenous people might call it self-determination.

An academic discussion about Indigenous tourism began around the same time the academic discussion about sustainable tourism began (Smith, 1989). While the two streams of literature have run parallel-but-separately at times, they have overlapped and directly engaged each other as well. Sofield (1993), addresses one of the major critical themes in Indigenous

tourism, namely the social injustices that result when outside forces use existing power asymmetries to control tourism development in Indigenous communities. His South Pacific case study shows how colonial interventions included tourism development that used "imported models imposed from above," whereby, "Little account was taken of prevailing traditional values and practices" (p. 729).

Other scholars have presented even stronger critiques of the Indigenous tourism industry, such as Johnston (2000), who contends, "The tourism industry, especially ecotourism, is arguably the prime force today threatening Indigenous homelands and cultures" (p. 89). In that article and elsewhere (Johnston, 2006), the author reveals the darker side of the growing eco/Indigenous tourism trend, such as its position in the global capitalist tourism-system and the tendency of outside interests to be the main profiteers. Indigenous rights, especially to land and intellectual property, are central to her proposed solution and constitute another major theme in Indigenous tourism research.

The relationship between Indigenous tourism and ecotourism is explored in many studies. Turner et al. (2012), present the case of the Gitga'at First Nation near Hartley Bay in Canada, which is considering developing tourism around its subsistence activities, especially fishing. Fennell (2008) presents an opposing perspective on the relationship between Indigenous people and ecotourism, suggesting that "there may be serious philosophical and operational problems inherent in packaging aboriginal ecotours as having a superior environmental ethic" (p. 129). These studies, and others (e.g., Butler & Hinch, 2007; Honey, 1999), demonstrate the commonly perceived relationship between Indigenous people and their local ecosystems—usually around subsistence—that often comes to the surface during tourism development processes.

A useful level of conceptual clarity about Indigenous tourism is provided by Zeppel (2006). Drawing on authoritative sources, she distinguishes between Indigenous-controlled tourism and Indigenous-themed tourism and offers six key features of the former:

- tourism connected with Indigenous culture, values and traditions
- tourism products owned and operated by Indigenous people
- tourism based on Indigenous land and cultural identity, controlled from within by Indigenous groups
- tourism which includes Indigenous habitat, heritage, history, and handicrafts
- typically involves small tourism businesses owned by tribes or families and
- tourism focused on Indigenous knowledge of culture and nature. (p. 9)

These key features emphasize Indigenous-controlled tourism, thereby integrating many of the insights from critical research, and do not unnecessarily conflate Indigenous tourism with ecotourism (although they do include nature-based tourism as part of the definition).

2.2.3 Radical Political Economy of Tourism

A third stream of literature—the radical political economy of tourism—makes additional critical contributions to my framework for sustainable Indigenous tourism. Arguments emerging from this area run contrary to many from traditional sustainable tourism literature. Sustainable tourism, working under the logic of sustainable development, largely views socio-economic globalization and the spread of market economies as positive occurrences, focusing on their

potential for poverty alleviation and enhanced living conditions. Radical political economy, on the other hand, understands capitalism to be an unacceptably destructive mode of producing and consuming goods and services, and generally considers globalization to be highly problematic (e.g., Peet, Robbins, & Watts, 2011).

Radical political economy is underlain by Karl Marx's theory of capitalism (see the discussion in Chapter 1, section 1.5.2.1 of this dissertation for a further definition and explanation of capitalism). An expansive world of theory has developed from the basic foundations of Marxism, as has a world of theory critiquing it. Interestingly, however, only a small number of tourism scholars have centrally engaged Marxism. Bianchi (2009, 2011) is a principal figure in this area. His work argues for approaches to tourism studies that are based in historical materialism—Marx's name for his theory of social change—and that "scrutinize the logics of state power and the increasingly liberalized modes of capital accumulation in tourism" (2009, p. 498). Bianchi criticizes neo-liberalism within the tourism sector, meaning the set of policies and ideologies that advance the spread of capitalism around the world today.

Bianchi's work builds on Britton (1982a, 1991), who is largely regarded as the first radical political economic tourism scholar. The 2011 volume edited by Mosedale, entitled Political Economy of Tourism: A Critical Perspective, has been described as "an homage to…Britton, [whose] efforts…to locate tourism within the broader context of capitalist accumulation…[has] had deep and lasting influence" (Mair, 2012, p. 1276). A key take away from the radical political economy of tourism is that research focusing solely on the cultural, performative, and representative aspects of the tourism encounter—which was a trend in anthropological tourism studies that Bianchi (2009) critiqued—is insufficient because it overlooks the material foundations of the phenomenon. A radical political economic approach to

sustainable tourism returns to the Marxist basics of looking at financial flows (money) and governance structures (power) and analyzing whether they promote social equity or the continued exploitation of labor and land by capitalists. This approach is reinforced by Büscher and Fletcher (2016), who describe the capital accumulation of modern tourism as "structural violence".

2.2.4 A Framework for Critical Indigenous Sustainable Tourism

Indigenous tourism under Indigenous control is an admirable achievement. However, radical political economy raises questions about the socio-cultural impacts that even this type of tourism has on Indigenous communities. Tourism, after all, is fundamentally a market-based, commodity-driven activity, subject to the exploitative imperatives of capitalism. Does engaging in capitalism transform Indigenous people from communal to selfish? How do Indigenous capitalists reconcile their position? Indigenous person and tourism scholar Alexis Bunten pursues such questions.

Bunten (2008) argues for the normative acceptability of an Indigenous commodified persona within the tourism industry. Her paper responds to the criticism that Indigenous persons inevitably compromise their cultural integrity and psychological wellbeing when they work as tour guides of their own heritage—a narrative that Bunten shows persists in some circles, both Indigenous and academic, but that is ultimately counterproductive to positive change. She writes:

> Rather than viewing the Native guide under a rubric of melancholia and seeing him as powerless to act within the dominant, globalized political economy that

> governs tourism, one can understand the guide as someone who exercises control over his self-presentation. (p. 392).

Bunten merges theories about tourism's discourses and representations with concerns from radical political economy about who profits from labor and commodity production. In her vision, Indigenous tourism workers can use the tools of representation to achieve economic gains.

Bunten (2010, 2011) examines larger questions about the resilience of Indigenous cultures to forces of capitalistic tourism. She presents a vision of how Indigenous people can embed capitalist activities in their own values:

> We should be paying attention to the ways in which commodifying Indigenous resources, including landscapes, foods, stories, songs, dances, and worldviews, upholds family values, spiritual beliefs, cultural knowledge, and pride (Bunten, 2010, p. 305).

Bunten provides the framework for analyzing whether Indigenous-controlled tourism is successful. That is, by asking whether its political economy supports traditional cultural values, as defined internally. Armed with Bunten's theoretical work on Indigenous capitalism through tourism, I turn to the case study, asking: How does tourism in Barrow converge and diverge with Iñupiaq values and how might this change in the future?

2.3 Barrow Case Study

2.3.1 Methods

A primarily qualitative mixed-methods approach with three data sources was employed. The first source was an intensive two-week period of onsite participatory observation and stakeholder interviews in January 2015. During this period, I stayed in local hotels, visited Barrow's tourism attractions, hired local tour guides, and conducted semi-structured interviews with key participants in the industry. I traveled through the community exclusively on foot and collected observational data through extensive note taking, photography, and by collecting tourism-related media, such as informational pamphlets, visitor maps, and advertisement fliers.

Earlier site visits had been conducted in March 2013 and May 2013 to establish contacts and collect reconnaissance data, such as the type and location of tourism infrastructure. During the main fieldwork period, I asked the contacts to identify interviewees based on a) being affiliated with the tourism industry and b) being willing to talk to researchers. Interviews with five individuals were audio recorded and transcribed. These interviews were between 37 and 87 minutes long. Eleven other individuals were interviewed but not recorded because of interviewee preference or logistical constraints. Data from the non-recoded interviews were captured through note-taking. The non-recorded interviews ranged from short conversation to hour-long discussions.

Interviewees included hotel employees of various position, independent tour guides, local-government officials, and handicraft artisans. Interviews occurred either at the interviewee's place of employment or in public meeting spaces. Because interviewees had

different relationships to the tourism industry, different sets of questions were developed for each interview. Questions centered around four topics: 1) the facts of tourism in Barrow—Who? What? When? And Where?; 2) their perceptions of the current relationship between tourism and Indigenous culture in Barrow; 3) how they envision tourism changing over time; and 4) how they would like to see tourism develop in Barrow.

Second, data were gathered at a three-day scenario workshop in Barrow during February 2015. The workshop was part of a National Science Foundation funded project in which my research group facilitated over thirty local leaders to envision sustainable healthy communities in northern Alaska by the year 2040 (see: iarc.uaf.edu/en/NX2020/current-projects/NASP/). The scenarios were holistic in scope and provided important contextual information about culture, politics, and power in the region. Tourism related data from the workshop were recorded through observational note taking and by photographing the large sheets of butcher paper that participants wrote on during certain activities. Workshop participants were surveyed (n = 29) about four key questions regarding tourism development in the region: 1) Would they like to see more tourism?; 2) Is tourism currently being done in a way that is consistent with Iñupiaq values?; 3) Could tourism provide good jobs for local residents?; and 4) Could more tourism cause problems? Survey responses were recorded with a five-point Likert scale and analyzed using descriptive statistics.

Third, internet-based research was conducted to collect quantitative tourism data about visitors to Barrow. Internet sources included reports from the Alaska Visitors Statistics Program (available through the State of Alaska website), and a study that quantified past and projected future enplanements at Barrow's airport (PDC Inc., 2013). Once all the data were collected, triangulation was utilized to compare the multiple sources (i.e., notes, photographs, and tourism

media from the field; interview transcripts; notes and photographs from the workshops; workshop survey data; and internet data). Through systematic comparison, emergent themes were identified about tourism in Barrow today, the relationship between tourism and Iñupiaq values, how tourism might change in the future, and what local stakeholders would like to see done. Each theme is discussed in turn in the Findings and Discussion section below.

Additional fieldwork during the summer—which is the height of tourism season—would be beneficial to further test the findings discussed below and for developing a more highly nuanced understanding of the complex power dynamics that underline the community's decision making processes around tourism. Nonetheless the methods outlined above provide sufficient data to describe Barrow's tourism industry and adequately address the key research question in a meaningful manner.

2.3.2 Findings and Discussion

2.3.2.1 Iñupiaq Values

The first step in analyzing the convergences and divergences between tourism and Iñupiaq values in Barrow is to establish what is meant by Iñupiaq values. Iñupiaq values are codified and appear as written lists. Participants at the workshop explained that the purpose of creating these lists is to establish and promote a common set of historically-rooted cultural values that are central to Iñupiat identities. Lists are constructed by different community groups, usually through deliberative discussion, and vary slightly from one another. Moreover, the values are somewhat flexible in terms of interpretation. Nonetheless, different lists present the same general

themes and have been integrated into the mission and statements of Iñupiaq organization—such as the regional and village corporations—and are widely available online to the public. For the purposes of this article, I draw on the 12 core values utilized by NSB, as this is a manageable list that is posted in many public spaces throughout Barrow (Table 2.1). Iñupiaq values are generally community-oriented and differ significantly from the individualistic, hyper-rational, and ceaselessly ambitious values of capitalism, which makes it somewhat surprising that local Indigenous leadership has expressed the desire to increase tourism – a capitalistic phenomenon.

During the workshop, participants were asked to identify and rank factors that affected the health and sustainability of their communities by allocating ten small round stickers to pieces of paper displaying different options. From a grouping of 46 wide-ranging factors, Iñupiaq Values and Transmission and Recognition of Traditional Knowledge were voted to the top by a wide margin. This result, as well as the discussions that took place about these factors, suggests a widespread and explicit agreement that the maintenance and practice of these values are essential to the wellbeing of communities in northern Alaska, including Barrow.

2.3.2.2 Tourism in Barrow

The second step in analyzing the convergences and divergences between tourism and Iñupiaq values in Barrow is to understand what tourism currently entails. Quantifying tourism in Barrow is an inexact science. The State of Alaska conducts regular surveys of visitors to the state, which are somewhat helpful in building a picture of Barrow's tourism. During the 12 month period from October 2013 to September 2014, total visitor spending in the state was estimated at $1.83 billion, with around 1% (or $25 million with rounding) taking place in the Far

North—a vast area encompassing Barrow and numerous other small rural communities (McDowell Group, 2015). Similarly, total visitor industry-related employment in Alaska was estimated at 38,700 jobs with around 1% (or 300 jobs with rounding) being contributed in the Far North (McDowell Group, 2015).

Visitor volume in Alaska has hovered just below 2 million visitors per year in the recent past (McDowell Group, 2015) and, while the number for the Far North is not provided, it could be estimated at 1% (or around 20,000 visitors per year) based on the estimates of other metrics. This estimate is not unreasonable given enplanement data from Barrow's airport. Enplanement numbers have shown a steady increase from just over 35,000 individuals in 2003 to nearly 45,000 enplanements in 2012 (PDC Inc., 2013). Enplanements include both visitors and local residents traveling through the airport. Barrow is not accessible by land (except via ice-road and snow machine in the winter) but multiple interviewees explained that visitors are increasingly arriving via ship. While numerical estimates are not available for ship-borne visitors, interview and internet data reveal multiple incidents every summer of both large cruise ships and small private vessels making port calls in Barrow, although the total number of ship-borne visitors is perhaps two orders of magnitude less than those traveling by air. A local government official reported, "We do get tourism ships up here…seven are so far scheduled to come to Barrow this summer." Clearly, there are significant numbers of visitors coming and going on a regular basis.

Interview and observational data reveal that the attractions drawing tourists to Barrow are many and span the categories of nature/geographic tourism, Indigenous-cultural tourism, and western-historical tourism (Table 2.2). Birding is a major draw, as a hotel employee emphasized, "We have a lot of birding groups, a lot of birders!" Motorized terrestrial tours are offered by independent operators and by one hotel, and are generally marketed as either 'comprehensive

tours' or 'wildlife photography tours'. The handicraft industry is well developed, with artisans selling their wares at multiple locations and, as one hotel employee mentioned, through social media. There are tour businesses located in the southern portion of Alaska (in the cities of Fairbanks and Anchorage) that run tours to Barrow. Built photo opportunities include a sign reading 'Welcome to Barrow, Top of the World', a whalebone arch with traditional whaling boats, and a memorial for American humorist Will Rogers and his pilot Wiley Post, whose small aircraft crashed in Barrow in 1935. Barrow currently has three hotels, with a total of 105 rooms. Other tourism-related infrastructure includes six restaurants, three grocery stores, a furrier that sells souvenirs, a post office, a hospital, a bank, abundant taxis, and one espresso shop. Quantifying the number of visitors and their motivations more closely is an important area for future research that would provide currently-lacking baseline data.

2.3.2.3 Spaces of Confluence and Divergence

The largest hotel in Barrow is the Top of the World Hotel—a newly constructed, 70 room facility, owned and operated by ASRC. The hotel supports Iñupiaq values in two key ways. First, because ASRC is a Native corporation, the profits derived from the operation of the hotel are redistributed to Iñupiat via their status as corporate shareholders. It stands to reason that this income source helps Native individuals finance cultural activities, such as subsistence, which require the use of money to buy supplies (see Nuttall et al., 2009, for an authoritative discussion of Arctic mixed economies). Through this redistribution of surplus value, Barrow has managed to avoid major drawbacks of tourism development that Bianchi (2009, 2011) and Britton (1982a, 1991) warned about—the extraction of profits by outside interests. This hotel is unquestionably

not a foreign chain dropping into an exotic destination to maximize profits. With much of the profit going directly back to community residents, I contend that the largest hotel in Barrow is more like a social cooperative than a conventional private corporation.

Second, Top of the World Hotel has taken extensive steps to promote education about Iñupiaq culture. A non-Iñupiaq hotel employee explained, "One of the values that is really prevalent up here is the sharing, the generosity, the authenticity. They share their culture." The hotel's efforts include: offering a van tour of Barrow with an Iñupiaq guide; giving its restaurant an Iñupiaq name (Niġġivikput, meaning our place to eat); having a section in its visitors' guide called 'Our Alaska Native Heritage'; collaborating with Iñupiaq dancers to support paid performances for guests; and implementing a photographic story telling strategy in the hotel. The common spaces of the hotel are adorned with photographic collages of Iñupiat performing cultural activities (Figure 2.1). The collages overlap historic and contemporary photos to communicate that the Iñupiat identity is rooted in the past but firmly established in the present as well, I was told. These type of tourism activities are examples of ways that Barrow's Iñupiat control their Indigenous commodified persona, to invoke Bunten's concept (2008).

The capacity of the Barrow's Iñupiat to control their own cultural representation within tourism is further evidenced by the Iñupiat Heritage Center, a museum and community center funded by NSB. The main exhibit is called 'The People of Whaling', and presents material artifacts from historic and contemporary Iñupiat life, which range from a sealskin whaling boat to a mesh basketball jersey (Barrow's high school mascot is the Whalers). The museum explains each of the 12 core Iñupiaq values and includes a life-size replica of a bowhead whale. Additional museum themes include the diversity of local wildlife, the Iñupiat struggle for self-governance, the importance of elders, and promotion of traditional handicrafts—all themes that

resonate with specific Iñupiaq values. It is my interpretation that the museum is an example of Indigenous capitalism (i.e., NSB's taxation of oil and gas infrastructure) being channeled into the promotion of cultural values through the education of visitors.

Cultural festivals constitute another space of confluence between Indigenous values and capitalism through tourism, as evidenced by tourism media and interviews. The official visitor's guide to Barrow—a map and informational brochure available for free throughout the community—encourages visitors to attend three different festivals throughout the year, including Nalukataq in in June, which marks the end of spring whaling with food sharing and a blanket toss. A hotel employee explained that, "Nalukataq is open to the community and [the organizers are] very generous. In fact, they encourage me to bring our tourists." She suggested that the festivals provide opportunities to showoff aspects of Indigenous culture that bring pride. This suggests that Iñupiaq festivals have retained their cultural authenticity, while simultaneously serving as tourism attractions. Capitalism has not turned them into reified commodities, which corresponds with previous literature on the subject (e.g., Cohen, 1988).

Handicrafts are a key feature in some definitions of Indigenous tourism (Smith, Butler, & Hinch, 1996) and are prevalent in Barrow. The Iñupiat Heritage Center contains a handicraft workshop and provides community members with equipment to fashion their items. Handicrafts are sold directly from the workshop by the artisans, and also at other locations around town. Handicrafts are primarily made from animal parts (e.g., whale baleen, walrus ivory, fur) that the artisans collect or purchase from Native hunters. The handicraft market within Barrow provides an opportunity for direct transfer of cash from visitors to artisans, and is open to any Native person wishing to participate, I was told. The handicraft trade allows an opportunity for self-employment, which counteracts the tendency within capitalistic tourism of employee

exploitation by the owning class (Bianchi, 2009, 2011; Britton, 1982a, 1991). In interviews, artisans spoke frequently of learning their craft from their elders. In this way, tourism-supported handicrafts enhance the transmission of cultural knowledge.

However, the number of jobs provided for Iñupiat through Barrow's tourism industry is miniscule compared to the number of jobs offered by the main employers—local government and Native corporations. As a government official put it, "No one needs to do tourism." Moreover, tourism-related employment and other financial benefits are split between Indigenous and non-Indigenous persons (such as taxi drivers that also serve as tour guides and the owners of non-Native hotels and retreatants). Research suggests that non-Indigenous tourism entrepreneurs in Barrow can create resentment among Native residents, and therefore mark a key space of divergence between capitalism and Iñupiaq values.

While some Indigenous leaders expressed ambivalence towards tourists, viewing them as slightly annoying but tolerable due to their limited numbers, others expressed frustration about tour companies based outside of Barrow bringing people into town, utilizing the community's resources, and leaving quickly, without benefits flowing to Native stakeholders. "It's not a great advantage financially to have people come up in the morning and leave in the afternoon," suggested an interviewee. Other concerns expressed by interviewees included non-guided tourists violating residents' privacy (e.g., by peeking through windows). Instances such as these show how the profit-seeking imperative of the global tourism system conflicts with Iñupiaq values in as far as it drives external entrepreneurs to capitalize on the resources that Indigenous residents view as their own—wildlife, infrastructure, public space—thereby causing community tension and unease.

The most important space of divergence between capitalism and Iñupiaq values within the tourism sector is the potentially conflicting relationship with subsistence hunting, fishing and whaling, which Iñupiat identify as the cornerstone of their culture (NSB, 2014). One interviewee related a story about Duck Camp—a road-accessible area outside of Barrow where Iñupiat stay in hunting cabins to harvest migratory fowl with shotguns. This location is also one of the best places for birding tourists to see the avian species they have traveled long distances to check-off their viewing lists. Birders have been brought to tears, I was told, as they watched certain species blown from the sky for traditional Indigenous uses. One Iñupiaq woman lamented that when tourists come to subsistence spaces, "They act like they own the place." Iñupiat have fought long legal battles to maintain their traditional subsistence harvest, often against misguided conservationists. The ability to draw subsistence directly from the environment through one's own labor (to control the means of production) is a significant alternative to capitalism, but negative attention brought to such activities—like that potentially generated by disgruntled tourists—could pose a threat to these rights.

In this line of reasoning, one Indigenous guide explained that he would never consider developing tours that revolved around subsistence activities, since subsistence rights are politically contingent. It is too important, in other words, to mix-up with tourism. Also, while Iñupiat might work in tourism, they tend to prioritize their time for subsistence hunting. A self-employed Iñupiat tour guide explained:

> Being the only guide for my company, I didn't have any time to go out hunting, I only went out once the whole summer because I was so busy…because there were so many tourists coming up here. It can interfere.

While the guide quoted above is resistant to mixing tourism and subsistence, other local tourism entrepreneurs are eager to do exactly that, under the belief that exposing tourists to traditional hunting, fishing, and gathering activities will actually help to build allies (rather than enemies) in the struggle to maintain subsistence rights.

This viewpoint corresponds with studies from Arctic Canada that portray the political and economic benefits associated with Indigenous subsistence tourism (Notzke, 1999; Turner et al., 2012). A local government official described his vision:

> They would bring small groups of tourists up to spend a week to ten days at a traditional subsistence hunting camp…the way we've done it for thousands of years…we've got a handful [of hunters] that are willing to do that.

Within Barrow, attitudes towards subsistence-based tourism, and tourism development more broadly, are heterogeneous. Out of the 29 community leaders surveyed at the workshop, six disagreed and one strongly disagreed that tourism is being done in a way that is consistent with Iñupiaq values. Similarly, seven agreed and four strongly agreed that more tourism would cause problems in the community. While this is a minority of a non-representative sample, it, along with the interview data presented above, suggests that there is reason to be concerned about the divergences between tourism and Iñupiaq values now and in the future.

Barrow's Iñupiat have a strong vision for perpetuating their values, hard-won land rights, and a long history of successfully engaging in capitalism through other avenues than tourism (e.g., through oil and gas development and, before that, interactions with Yankee whalers and

Russian fur traders). These three traits, combined with a buffering from mass tourism created by geographic distance and environmental conditions, has allowed tourism to develop in Barrow in a relatively benign manner to date, I argue. It makes sense, then, that the Indigenous leadership of the community is seeking more tourism development, even if there are mixed feelings about it in the community.

2.3.2.4 Future Considerations

Barrow's tourism industry exists in a context of broader pan-Arctic change. Related to the projected changes of environmental warming and increased industrial activity, is an expectation of more arctic tourism—especially marine-based tourism (Fay & Karlsdottir, 2011; Hall & Saarinen, 2010; Maher et al., 2014; Protection of the Arctic Marine Environment [PAME], 2009). Given this projection, along with Barrow's expressed desire to expand its tourism activities, it is important to ask: How can the drawbacks of tourism in Barrow (e.g., external profiteers, tourism/subsistence conflict) be minimized and the benefits (e.g., Indigenous revenue, cultural empowerment) be maximized? While a clear community consensus in terms of visions for future development was not identified, a set of ideas emerged that may be useful for planning.

One of the keys to advancing sustainable Indigenous tourism development in Barrow appears to be the expansion of Iñupiat capacity for, and interest in, working in tourism. One interviewee emphasized that training to work as a tour guide is largely an on-the-job occurrence. Thus, opportunities for tourism apprenticeships might be effective for getting more Iñupiat involved, he suggested (see Weiler & Ham, 2002). From the workshop survey, 12 of 29 local

leaders strongly agreed that tourism could provide good jobs for local residents (while six strongly disagreed and eight felt neutral). One hotel employee explained, "We've had a handful of the students from the high school do on the job training here." Training could also occur through Ilisaġvik College, a tribal two-year institution located in Barrow. The college offers vocational training in other fields, but lacks specific options for individuals interested in pursuing tourism and hospitality training. In addition to workforce training, local leaders expressed a need for a designated tourism-promotion entity within local government, which could coordinate local efforts and advertise Barrow as a destination. Having Iñupiat in these key positions, or non-Iñupiat who adequately comprehend Iñupiaq values, would help assure that training and advertising were done in a culturally beneficial manner and avoided exploiting the labor force.

Cruise ships are a central topic for the future, as the projected increase in tourism is expected to be mostly marine based (PAME, 2009). Management of cruise tourists, I was told, currently takes place largely by accident. Large ships carrying hundreds of passengers anchor offshore and ferry guests into Barrow on small boats. Cruisers spend the day wandering around town attempting to participate in tourist activities (eating, shopping, exploring, and taking photographs) in a largely uncoordinated and self-led manner. However, things are starting to change. One government official informed me, "Whoever is on these cruise ships, that's not a cheap ticket…We [get] nothing from it financially, but I've been…thinking about what a fair price would be for coming into town. Twenty, thirty bucks…[a] landing fee or something like that." There is an opportunity here for increased local revenue, through both the implementation of a landing fee and the development of associated businesses, that would correspond with the vision laid out in Barrow's comprehensive plan.

A local government official offered a vision for attracting higher-end, longer-stay clientele. His goal is to enhance Barrow's global social capital by offering curated tours that emphasize Barrow's unique historic and Arctic qualities, with educated guides who can, "Tell them the story behind the story, and the story behind that, [to] add some time depth to what they're seeing at the moment." The interviewee worries that Barrow's appearance, with broken down vehicles and abandoned buildings, may give visitors less-than-favorable interpretations of its residents. Helping visitors appreciate Barrow requires an educational element that addresses processes colonialism, Indigenous social-ecological adaptation, and the complexities of living above the Arctic Circle, he stated. This type of tourism, according to the interviewee, could help Barrow's residents—especially its youth—see more clearly the value in their own cultural traditions by having visitors reflect back an appreciation for it.

These discussions beg a more general question about Barrow's tourism carrying capacity and about how many tourists might be too many. A local government official explained, "UIC Village Corporation…is…planning to build a new hotel…and it's going to have more rooms than Top of the World." While Barrow may be a long way away from reaching its maximum tourist threshold, identifying what that point is now is highly advised. However, as one government official stated, "Mass tourism could be an issue, but people here are not slow to resolve problems." Moreover, it appears likely that future tourism development will occur largely under Iñupiat control, as coordination among Iñupiaq organizations in the region is on the rise. An interviewee described the recent creation of The Voice of the Arctic Iñupiat, a non-profit organization comprised of 27 Native entities for the expressed purpose of representing Indigenous perspectives at federal and international forums. Local determination, however, will

continue to be counterbalanced by the forces of global capitalism, including the tendencies of external entities to exploit Barrow's tourism resources.

Theorists of globalization have linked the presence of multinational corporations (MNCs) to certain impacts on host regions – including both advantages and disadvantages. MacKinnon and Cumbers (2011) identify the following potential disadvantages: development increasingly dependent on foreign control; economy linked to narrow development trajectory; disruption/destruction of local culture/society; and jobs often low skilled and routine. Tourism MNCs – such as cruise ship companies, international hotel chains, and international tour operators – must be monitored as they expand their 'production facilities' within in Barrow. Although tourism 'production facilities' – such as landscapes, heritage cites, and cultural encounters – are structurally different than traditional MNC factories and offices, the potential for negative impacts on host communities still exists (see Britton, 1982b).

2.4 Conclusion

Bunten's concept of Indigenous capitalism through tourism (2008, 2010, 2011) and Zeppel's six criteria of Indigenous-controlled tourism (2006) show that Indigenous tourism should be considered sustainable when its political economy supports traditional cultural values. The benefit of this definition is that it admits that tourism can turn people, places, and nature into commodities for market-based consumption, but suggests that this is not necessarily a bad thing if the process is Indigenously controlled for Indigenous benefit. When capitalistic tourism is thoroughly enmeshed in community-oriented values, its exploitative nature is reduced, social-ecological alienation is minimized, and positive change (i.e., sustainable development) can

occur. Triangulated evidence from fieldwork, workshops, and internet research show this is largely the case with tourism in Barrow, Alaska. However, there are important spaces of divergence between tourism and Iñupiaq values, such as the presence of non-Indigenous tourism operators in the community and conflicts between tourism and subsistence. Data show that Iñupiat have heterogeneous perceptions of current tourism in Barrow and different ideas about how it should develop in the future.

While a highly nuanced account of the power dynamics within Barrow around tourism decision making is beyond the scope of this article, it is an important area for future research. As Zeppel (2006) suggests, Indigenous-controlled tourism, "Typically involves small tourism businesses owned by tribes" (p. 9). Interestingly, Barrow's primary tourism infrastructure is not owned by tribes, but rather by Native corporations and the local borough. This may be an important distinction given the historic competition for power between different Indigenous governing bodies and their beneficiaries within this region. Mason (2002), for example, contends that the creation of Native corporations in Alaska led to the emergence of an Indigenous bourgeoisie, which might signal the dominance of capitalist values over communal ones. More research, however, is needed to determine whether this pertains to tourism in Barrow.

The findings of this study must be considered within the larger context of tourism in Alaska. The conflict between tourism and subsistence in Barrow demonstrated in this study mirrors findings from other parts of the state. Cerveny (2004, 2007) provides rich ethnographic studies of socio-cultural impacts caused by increasing cruise tourism in southeast Alaska, emphasizing the need to coordinate tourism planning among different scales of government. The State of Alaska pushes hard for expanding tourism, she demonstrates, but this does not always correspond with the desires of particular communities. Moreover, Robards and Lovecraft (2010)

show that Indigenous commodification of handicrafts in Alaska is actually limited by laws created at the federal level, demonstrating a need for further research on local tourism and cross-scale governance. In Barrow, the socio-cultural impacts of tourism have been smaller than in Cervery's studies because there are significantly fewer tourists. However, Barrow, and other communities in northern Alaska may have important lessons to learn from southeast Alaska as the US Arctic becomes increasingly accessible to cruise ship consumers. Barrow will need to proactively manage future tourism development to assure that visitor numbers and activities remain under local control and do not create inordinate impacts on Iñupiaq ways of life. The many heterogeneous voices in the community—of which this study has presents a few—must be respected. And they may benefit from learning more about how other Indigenous communities are working to secure their cultural values through tourism (see for example the issues surrounding tourism and Indigenous languages in Whitney-Squire, 2016).

On the theoretical side, this study demonstrates that radical political economy, channeled through the lens of Indigenous tourism, can make a contribution to the field of sustainable tourism studies proper. Sustainable tourism studies has been hesitant to engage radical political economy, I suggest, because its parent-paradigm of sustainable development is based on the principles of neoliberal capitalism, preventing it from mixing well with Marxism. But cases like Barrow (and this will be to the chagrin of hardcore Marxists) show that capitalism and its alternatives (e.g., social cooperatives, subsistence, self-employment, cultural empowerment) can coexist harmoniously in the same space and time. Through colonial processes of land control, Barrow's Iñupiat were essentially forced to adopt capitalism as a means of supporting communal Indigenous values. While this is no small task, they have embraced the challenge presented by Indigenous capitalism (Figure 2.2) and have been remarkably successful due to their own

political acumen and strong commitment to communal Iñupiaq values. They have been mostly successful to date in developing Indigenous sustainable tourism while maintaining what Marxists call their communal species being (Peet et al., 2011), in other words.

Within the field of geography, Gibson-Graham drew attention to the condition in which capitalism and its alternatives co-exists in their famous work *The End of Capitalism (as we knew it): A Feminist Critique of Political Economy.* Gibson-Graham writes:

> Economic sites that have usually been seen as homogeneously capitalist may be re-envisioned as sites of economic difference, where a variety of capitalist and non-capitalist class processes interact (p. 18).

Future research in sustainable tourism studies ought to draw on Gibson-Graham and other similar theorists to develop new directions of inquiry into non-capitalists economies and their relationships with tourism. Indeed, the future of sustainable tourism might lie in understanding and promoting not only alternative tourism under a capitalistic model, but methods of organizing the production and consumption of tourism's goods and services that are actually alternative to, but coexistent with, capitalism.

While there may be work taking place in this area, it would benefit from greater integration with Marxism and its critics. Such a research direction would help overcome the shortcomings of conventional capitalist development strategies, which radical political economy make so evident but are still prevalent in mainstream sustainable development thinking, while not out rightly rejecting the capitalistic realities of the current global system. Bunten's work on

Indigenous capitalism though tourism is moving in this direction, as is other tourism research (e.g., Weaver, 2013), all of which is promising.

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2.5 References

Arctic Climate Impact Assessment. (2005). Future climate change: Modeling and scenarios for the Arctic. In C. Symon, L. Arris, & B. Heal (Eds.), *Arctic climate impact assessment overview report* (pp. 100-150). Cambridge: Cambridge University Press.

Arctic Monitoring and Assessment Programme. (2013). *Arctic climate issues 2011: Changes in arctic snow, water, ice and permafrost*. Retrieved from http://www.amap.no/documents/doc/arctic-climate-issues-2011-changes-in-arctic-snow-water-ice-and-permafrost/129

Bianchi, R. V. (2009). The 'critical turn' in tourism studies: A radical critique. *Tourism Geographies, 11*(4), 484-504. doi:10.1080/14616680903262653

Bianchi, R. V. (2011). Tourism, capitalism and Marxist political economy. In J. T. Mosedale (Ed.), *Political economy of tourism: A critical perspective* (pp. 17-37). London: Routledge.

Bramwell, B. (2011). Governance, the state and sustainable tourism: A political economy approach. *Journal of Sustainable Tourism, 19*(4-5), 459-477. doi:10.1080/09669582.2011.576765

Bramwell, B., & Lane, B. (1993). Sustainable tourism: An evolving global approach. *Journal of Sustainable Tourism, 1*(1), 1-5. doi:10.1080/09669589309450696

Bramwell, B., & Lane, B. (2015). What drives research on sustainable tourism? *Journal of Sustainable Tourism, 23*(1), 1-3. doi:10.1080/09669582.2014.970407

Britton, S. G. (1991). Tourism, capital, and place - Towards a critical geography of tourism. *Environment and Planning D-Society and Space, 9*(4), 451-478. doi:10.1068/d090451

Britton, S. G. (1982a). The political economy of tourism in the third-world. *Annals of Tourism Research, 9*(3), 331-358. doi:10.1007/s11769-006-0203-2

Britton, S. G. (1982b). International tourism and multinational corporations in the Pacific: The case of Fiji. In M. Taylor & N. Thrift (Eds.), *The geography of multinationals* (pp. 252-274). London: Croom Helm Ltd.

Buckley, R. (2012). Sustainable tourism: Research and reality. *Annals of Tourism Research, 39*(2), 528-546. doi:10.1016/j.annals.2012.02.003

Bunten, A. C. (2008). Sharing culture or selling out? Developing the commodified persona in the heritage industry. *American Ethnologist, 35*(3), 380-395. doi:10.1111/j.1548-1425.2008.00041.x

Bunten, A. C. (2010). More like ourselves: Indigenous capitalism through tourism. *The American Indian Quarterly, 34*(3), 285-311. doi:10.1353/aiq.0.0119

Bunten, A. C. (2011). A call for attention to Indigenous capitalism. *New Proposals: Journal of Marxism and Interdisciplinary Inquiry 5*(1), 60-71. Retrieved from http://ojs.library.ubc.ca/index.php/newproposals/index

Büscher, B. & Fletcher, R. (2016). Destructive creation: Capital accumulation and the structural violence of tourism. *Journal of Sustainable Tourism*, doi:10.1080/09669582.2016.1159214

Butler, R. W. (1999). Sustainable tourism: A state-of-the-art review. *Tourism Geographies, 1*(1), 7-25. doi:10.1080/14616689908721291

Butler, R., & Hinch, T. (2007). *Tourism and Indigenous peoples: Issues and implications*. London: Routledge.

Cerveny, L. K. (2004). *Preliminary research findings from a study of the socio-cultural effects of tourism in Haines, Alaska*. Gen. Tech. Rep. PNW-GTR-612. Portland, OR: US Forest Service.

Cerveny, L. K. (2007). *Sociocultural effects of tourism in Hoonah, Alaska*. Gen. Tech. Rep. PNW-GTR-734. Portland, OR: US Forest Service.

Clarke, J. (1997). A framework of approaches to sustainable tourism. *Journal of Sustainable Tourism, 5*(3), 224-233. doi:10.1080/09669580802582480

Cohen, E. (1988). Authenticity and commoditization in tourism. *Annals of Tourism Research, 15*(3), 371-386. doi:10.1016/0160-7383(88)90028-X

Farrell, B. H., & Twining-Ward, L. (2005). Seven steps towards sustainability: Tourism in the context of new knowledge. *Journal of Sustainable Tourism 13*(2), 109-122. doi:10.1080/09669580508668481

Fay, G., & Karlsdottir, A. (2011). Social indicators for arctic tourism: Observing trends and assessing data. *Polar Geography, 34*(1-2), 63-86. doi:10.1080/1088937X.2011.585779

Fennell, D. A. (2008). Ecotourism and the myth of Indigenous stewardship. *Journal of Sustainable Tourism, 16*(2), 129-149. doi:10.2167/jost736.0

Gibson-Graham, J. K. (1996). *The end of capitalism (as we knew it): A feminist critique of political economy*. Oxford: Blackwell.

Hall, C. M., & Saarinen, J. (Eds.). (2010). *Tourism and change in Polar Regions: climate, environment and experience*. New York: Routledge.

Hillmer-Pegram, K. C. (2014). Understanding the resilience of dive tourism to complex change. *Tourism Geographies, 16*(4), 598-614. doi:10.1080/14616688.2013.851268

Honey, M. (1999). *Ecotourism and sustainable development: Who owns paradise?* Washington D.C.: Island Press.

Hunter, C. J. (1995). On the need to re-conceptualise sustainable tourism development. *Journal of Sustainable Tourism, 3*(3), 155-165. doi:10.1080/09669589509510720

Hunter, C. J. (1997). Sustainable tourism as an adaptive paradigm. *Annals of Tourism Research, 24*(4), 850-867. doi:10.1016/S0160-7383(97)00036-4

Intergovernmental Panel on Climate Change, Stocker, T., and Working Group I (2014). *Climate change 2013: The physical science basis: Working Group I contribution to the fifth assessment report of the Intergovernmental Panel on Climate Change.* Retrieved from http://www.ipcc.ch/report/ar5/wg1/

Jamal, T., & Camargo, B. A. (2014). Sustainable tourism, justice and an ethic of care: Toward the just destination. *Journal of Sustainable Tourism, 22*(1), 11-30. doi:10.1080/09669582.2013.786084

Johnston, A. (2000). Indigenous peoples and ecotourism: Bringing Indigenous knowledge and rights into the sustainability equation. *Tourism Recreation Research, 25*(2), 89-96. doi:0.1080/02508281.2000.11014914

Johnston, A. M. (2006). *Is the sacred for sale? Tourism and Indigenous peoples.* New York, NY: Earthscan.

Liu, Z. (2003). Sustainable tourism development: A critique. *Journal of Sustainable Tourism, 11*(6), 459-475. doi:10.1080/09669580308667216

Lu, J., & Nepal, S. K. (2009). Sustainable tourism research: An analysis of papers published in the Journal of Sustainable Tourism. *Journal of Sustainable Tourism, 17*(1), 5-16. doi:10.1080/09669580802582480

MacKinnon, D., & Cumbers, A. (2011). *Introduction to economic geography: Globalization, uneven development and place*. Abingdon: Routledge Press.

Maher, P. T., Gelter, H., Hillmer-Pegram, K., Hovgaard, G., Hull, J., Jóhannesson, G. ó., . . . Rantala, O. (2014). Arctic tourism: Realities and possibilities In L. Heininen (Ed.), *Arctic yearbook 2014: Scholarly articles, section II: Regional economy and property*. Retrieved from: http://www.arcticyearbook.com

Mair, H. (2012). Political economy of tourism: A critical perspective. *Publications in Review/Annals of Tourism Research, 39*, 1276-1277. doi:10.1016/j.annals.2012.01.008

Marx, K. (1867/1990). *Capital: A critique of political economy volume 1*. London: Penguin.

Mason, A. (2002). The rise of an Alaskan Native bourgeoisie. *Études/Inuit/Studies, 26*(2), 5-22. doi:10.7202/007643ar

McDowell Group. (2015). *Economic impact of Alaska's visitor industry 2013-2014 update*. Retrieved from http://commerce.state.ak.us/dnn/Portals/6/pub/TourismResearch/AVSP/2013_2014/Vis%20Industry%20Impacts%202013_14%203_24.pdf.

Mosedale, J. (Ed.). (2011). *Political economy of tourism*. London: Routledge.

Müller, H. (1994). The thorny path to sustainable tourism development. *Journal of Sustainable Tourism, 2*(3), 131-136. doi:10.1080/09669589409510690

North Slope Borough. (2014). *Soaring to the future: Barrow comprehensive plan 2015-2035*. [Final Draft]. Retrieved from: http://www.north-slope.org/assets/images/uploads/Barrow_Comp_Plan_March_2015_FINAL.pdf

Notzke, C. (1999). Indigenous tourism development in the arctic. *Annals of Tourism Research, 26*(1), 55-76. doi:10.1016/S0160-7383(98)00047-4

Nuttall, M., Berkes, F., Forbes, B., Kofinas, G., Vlassova, T., & Wenzel, G. (2005). Section 12.2.2.: Mixed economies in the Arctic. In *Arctic climate impact assessment*. New York, NY: Cambridge.

PDC Inc. Engineers. (2013). Chapter 3: Forecast of aviation activity. In *Wiley Post/Will Rogers Memorial Airport master plan update draft*. Fairbanks, AK: State of Alaska.

Peet, R., Robbins, P., & Watts, M. (2011). *Global political ecology*. New York, NY: Routledge.

Protection of the Arctic Marine Environment. (2009). *Arctic Council arctic marine shipping assessment 2009 report*. Retrieved from http://www.pame.is/index.php/projects/arctic-marine-shipping/amsa

Robards, M. D., & Lovecraft, A. L. (2010). Evaluating comanagement for social-ecological fit: Indigenous priorities and agency mandates for Pacific Walrus. *Policy Studies Journal, 38*(2), 257-279. doi:10.1111/j.1541-0072.2010.00361.x

Robinson, M. (1999). Collaboration and cultural consent: Refocusing sustainable tourism. *Journal of Sustainable Tourism, 7*(3-4), 379-397. doi:10.1080/09669589908667345

Sharpley, R. (2000). Tourism and sustainable development: Exploring the theoretical divide. *Journal of Sustainable Tourism, 8*(1), 1-19. doi:10.1080/09669580008667346

Shepherd, R. (2002). Commodification, culture and tourism. *Tourist studies, 2*(2), 183-201. doi:10.1177/146879702761936653

Smith, V. L. (1989). Eskimo tourism: Micro-models and marginal men. In V. L. Smith (Ed.), *Hosts and guests: The anthropology of tourism, Second Edition*. Philadelphia, PA: University of Pennsylvania Press.

Smith, V. L., Butler, R., & Hinch, T. (1996). Indigenous tourism: The four Hs. In R. Butler & T. Hinch (Eds.), *Tourism and Indigenous peoples.* (pp. 283-307). London: Routledge.

Sofield, T. H. B. (1993). Indigenous tourism development. *Annals of Tourism Research, 20*(4), 729-750. doi:10.1016/0160-7383(93)90094-J

Tao, T. C. H., & Wall, G. (2009). Tourism as a sustainable livelihood strategy. *Tourism Management, 30*(1), 90-98. doi:10.1016/j.tourman.2008.03.009

Turner, K. L., Berkes, F., & Turner, N. J. (2012). Indigenous perspectives on ecotourism development: A British Columbia case study. *Journal of Enterprising Communities: People and Places in the Global Economy, 6*(3), 213-229. doi:http://dx.doi.org/10.1108/17506201211258397

US Census Bureau. (2010). *2010 Decennial Census.* Retrieve on June 1, 2015 from: http://www.census.gov

Weaver, D. B. (2011). Can sustainable tourism survive climate change? *Journal of Sustainable Tourism, 19*(1), 5-15. doi:0.1080/09669582.2010.536242

Weaver, D. B. (2013). Asymmetrical dialectics of sustainable tourism: Toward enlightened mass tourism. *Journal of Travel Research, 53*(2), 131-140. doi:10.1177/0047287513491335

Weiler, B. & Ham, S.H. (2002). Tour guide training: A model for sustainable capacity building in developing countries. *Journal of Sustainable Tourism*, *10*(1), 52-69. doi:10.1080/09669580208667152

Whitney-Squire, K. (2016). Sustaining local language relationships through Indigenous community-based tourism initiatives. *Journal of Sustainable Tourism.* doi:10.1080/09669582.2015.1091466.

World Commission on Environment and Development. (1987). *The Brundtland report*. Oxford: Oxford University Press.

Zeppel, H. (2006). *Indigenous ecotourism: Sustainable development and management*. Oxford: CABI.

Table 2.1 This list of Iñupiaq values appears in public spaces around Barrow and has been adopted by Iñupiaq organizations.

12 Core Iñupiaq Values (Source: NSB, UIC)
Avoidance of Conflict
Compassion
Cooperation
Family and Kinship
Sharing
Respect for Nature
Love and Respect of Elder and One Another
Humility
Humor
Hunting Traditions
Knowledge of Language
Spirituality

Table 2.2 Tourism attractions in Barrow.

General category	Specific examples
Nature/geographic tourism	Wildlife viewing and photography (e.g., polar bear, birding)
	Aurora Borealis viewing
	Arctic Ocean/Arctic Circle/extreme latitude/top of the world
Indigenous-cultural tourism	Public Iñupiaq festivals (e.g., spring whaling festival)
	Iñupiaq Heritage Center
	Whale bone arch and archeological sites
Western-historical tourism	Military and scientific sites (e.g., DEW line radar stations)
	Wiley Post/Will Rogers airplane-crash memorials
	Historic western buildings (e.g., whaling station, church)

Figure 2.1 An example of the Iñupiat photo-collages that adorn the walls of Top of the World Hotel.

Figure 2.2 An ASRC poster displayed at the Iñupiat Heritage Center celebrating Indigenous capitalism.

CHAPTER 3: MAPPING INDUSTRIAL INFRASTRUCTURE IN THE US ARCTIC TO SUPPORT COMMUNITY WELLBEING [1]

Abstract: Over the last decades, economic and political forces from inside and outside of the Arctic have driven the construction and expansion of industrial infrastructure—for oil and gas production, mining, and commercial transportation—in the US Arctic. While economic mechanisms within the state have allowed native corporations, regional boroughs, and certain communities to benefit from industrial development, negative environmental and social impacts have also been conditions of production. This article reviews the social-ecological context of industrial development in the US Arctic and establishes linkages between industrial infrastructure and community wellbeing. Linkages are described in terms of benefits and harms in the three areas of social, environmental, and economic impacts. Through a novel synthesis existing of data, the article demonstrates that industrial development possess the potential to continue producing benefits and harms for communities in the US Arctic well into the future. If development unfolds in the manner described in official environmental assessments, the footprint of physical infrastructure would increase by nearly 50 percent. Quantitative and qualitative infrastructure data are presented and mapped for three timeframes (existing, planned, and proposed) and for four terrestrial and two marine sub-regions of US Arctic. A regional overview is also provided. As the plausible future expansion of industrial infrastructure is significant, so is the need to establish political and economic institutions that assure equitable procedural processes and distributional outcomes of benefits and harms. This would promote a US Arctic

[1] Hillmer-Pegram, K., & Walker, N. Mapping Industrial Infrastructure in the US Arctic to Support Community Wellbeing. Prepared for submission in *Polar Geography*.

that is not only economically profitable, but also ecologically sustainable, socially just, and focused on the wellbeing of its communities.

Keywords: *climate change, extractive industries, Indigenous rights, sustainable development*

3.1 Introduction

3.1.1 The Social-Ecological Context of Industrial Infrastructure

In this chapter, the term *US Arctic* indicates a specific region of the state of Alaska and of the state and federal waters that lie primarily within the Arctic Circle (66°33′ north latitude), but that also extend southward along the west coast of Alaska to Norton Sound, and inland in the northwest region of the state. The definition of the US Arctic used here is similar to the definitions used by international and national scientific entities, such as the Arctic Council's Arctic Monitoring and Assessment Program and the US Arctic Research Commission. Alaska constitutes the entire geographic extent of the US in the Arctic. In terms of the natural environment, the US Arctic is made up of multiple ecoregions, or "large areas of land and waters containing vegetation communities that share species and ecological dynamics, environmental conditions, and interactions" (Alaska Department of Fish and Game [ADFG], 2006, p. 26). Ecoregions in the US Arctic range from Polar Arctic Tundra in the far north, to Subarctic Tundra in the coastal west, to Boreal Forest in the interior areas of the region. The marine ecosystems of the Beaufort Sea, Chukchi Sea, and Bering Strait are also part of the US Arctic as defined here. Many regional ecosystems are in relatively pristine condition compared to other parts of the world, partly because industrial human activities in the Arctic have been historically restricted by harsh environmental conditions.

Non-industrial human settlements in the US Arctic can be conceptualized as a smattering of small hardy communities, or villages, in a vast and sparsely developed environment.[2] The location of the communities today was influenced by the US government's forced settlement policies of the early 20th century, which attempted to settle Indigenous populations that were largely migratory at permanent sites. The US Arctic is the homeland of multiple Alaska Native peoples, including speakers of the Koyukon, Tanana, and Gwich'in languages in the interior areas of the region, speakers of Iñupiaq in the coastal and northern areas, and speakers of two types of Yupik in the Bering Strait area (Holton, 2014). The four census areas that are fully or partially within the US Arctic are home to over 30,000 people (US Census Bureau, 2013) distributed between 36 communities. The Alaska Native population of the four census areas ranges between 53% and 80% (US Census Bureau, 2013).

To varying degrees, these communities continue to draw portions of their livelihoods directly from local ecosystems, are largely dependent on imported fuels for energy, and strive to balance traditional cultural values with what is commonly referred to as modernization. A 2013 federal report explains that:

> Reliance on subsistence approaches—hunting, fishing, and gathering of plants—is widespread in the US Arctic. Subsistence harvesting is not simply about calories and nutrition; it is culturally significant for Alaska Natives and other rural residents (Clement, Bengtson, & Kelly, 2013, p. 14).

[2]While it is imperative to avoid essentializing small arctic communities as overly 'local', 'rural', or 'native' since they are actually demographically heterogeneous and modern in many ways (Cameron, 2012), some general description of the communities is helpful for unfamiliar readers.

In addition to the resources acquired through subsistence activities, residents of the US Arctic also depend on the regional commercial economy for financial resources. In fact, money is required to conduct subsistence activities because of the need to purchase, maintain, and fuel expensive equipment, such as four-wheelers and snow machines (Brinkman et al., 2014). Modern hunting rifles and ammunition are another substantial expense associated with subsistence.

Industrialized natural resource extraction, mainly for out-of-state markets, is the main source of activity for the US Arctic's commercial economy. The report cited above explains:

> Revenue, employment, and personal income from…industrial activities can improve the quality of life for local residents and support the ability of state and local governments to provide public services to communities (Clement et al., 2013, p. 15).

Striking a sustainable balance between subsistence-based life-ways and the industrial economy has been identified as a key goal for future planning in the US Arctic (Clement et al., 2013). However, regional stakeholders have differing opinions about how to achieve a sustainable balance and how to define that term. Clement et al. (2013) identify six key stakeholder categories in the US Arctic (Table 3.1); within these categories, stakeholder opinions "reveal examples of both convergent and divergent views" (Clement et al. 2013, p. 34), about what the future of the region should look like.

Moreover, there is concern throughout the Arctic about which stakeholders have power over development processes and which are marginalized (e.g., Young, 2012). Negotiations about

whether and how to pursue additional industrial development in the US Arctic, and about how to distribute the risks and benefits between stakeholders are ongoing and can be observed in government offices, community centers, and courtrooms across the region. These negotiations are taking place in an atmosphere marked by rapid arctic change, both environmentally and socially.[3] Clement et al. (2013) provides a succinct summary of Arctic change:

> The US Arctic is experiencing rapid, sustained change, and those changes are expected to continue into the coming decades due to climate change, resource extraction, and increasing human activities. Terrestrial, freshwater, and marine ecosystems as well as broader environmental, cultural, and economic trends in the Arctic will be affected (p. 8).

When these changes are considered alongside the sometimes divergent opinions of stakeholders in the US Arctic, the need for an approach to industrial development that focuses on community wellbeing becomes apparent. Without it, a sustainable balance between subsistence-based life-ways and the regional commercial economy marked by industrial activity may not be achieved.

3.1.2 Linkages between Industrial Infrastructure and Community Wellbeing

Oil and gas activities negatively impact the environment in numerous ways (National Research Council [NRC], 2003). Major environmental impact vectors from terrestrial and marine activities include:

[3] For a more in-depth discussion of Arctic change than is possible here, see e.g., Arctic Climate Impact Assessment [ACIA], 2004 and Larsen et al., 2014.

- expulsion of waste materials into the environment during well drilling
- industrial air pollution during all phases of development and operations
- release of environmental toxins from oil spills and leaks
- vegetation destruction from infrastructure
- permanent fragmentation of animal habitat by infrastructure
- disruption of animal behavior during all phases of development and operations (including acoustic pollution during seismic exploration)

Scientific studies have been documenting the environmental impacts of oil and gas activities in the US Arctic for decades, especially on caribou—a keystone species in the ecosystem and a primary subsistence species. Murphy and Curatolo (1987) show that oil and gas infrastructure in northern Alaska, especially roads with traffic, significantly alters the activity patterns of caribou, causing them increased energetic stress. Similar findings were reported by Dyer, O'Neill, Wasel, and Boutin (2001), who document caribou avoidance distance of up to 1000 m for industrial infrastructure in northern Canada. The presence of oil and gas infrastructure is also known to negatively influence the reproductive success of some nesting birds on the central Arctic slope (Liebezeit et al., 2009).

Walker et al. (1987) demonstrated that the total vegetative area disturbed by oil and gas activities far exceeds the physical footprint of the infrastructure because of the delayed reactions from the natural environment and because of cumulative impacts, or the fact that the aggregate whole of various impacts is greater than the sum of its individual parts. Cumulative impacts were also reported by Nellemann and Cameron (1998), who found that caribou calves and females were more prone to avoiding infrastructure than were adult males in the Prudhoe Bay area.

Oil and gas activities are also known to impact the marine environment. Reeves, Ljungblad, and Clarke (1984) highlight the need to prevent the disruption of migrating bowhead whales in the Beaufort Sea that is caused by acoustic seismic surveys. This need is also addressed by Moore et al. (2012), who argue for a cumulative impact approach to assessing the detrimental effects of acoustic surveys in the Arctic; an approach based on aggregate sounds fields and acoustic habitats rather than on isolated activities, as is the current norm for the survey permitting process.

In addition to noise pollution, Alter, Simmonds, and Brandon (2010) identify ship strikes of whales as a major environmental impact caused by increased industrial activity in marine environments, including the expansion of oil and gas activities in the Arctic. Grant and Briggs (2002) showed that the large piles of toxic drill cuttings lying beneath many North Sea oil and gas platforms cause appreciable ecological damage to benthic communities. Assessments of the environmental impacts from the Deepwater Horizon blowout in the Gulf of Mexico can give an impression of what a similar catastrophic disaster could mean for Arctic Alaska. Williams et al. (2011), for example, contend that the cetacean mortalities directly attributed to the spill could be up to 50 times greater than the observed number of carcasses, which would bump the number from 101 to 5,050.

Oil and gas activities in the US Arctic do not impact only the environment but also the thousands of people who live near oil and gas infrastructure. As of 2010, Alaska's North Slope Borough, which almost covers the entire study area, was home to nearly 8,000 people in eight Native villages, with over 76% of the population being Alaska Native (Shepro, Maas, Callaway, McAnich, & Bergerson, 2010). The ability to draw resources from the natural environment plays an important role in the physical and mental health of many villages today (Kruse, 1991). Some

villages acquire up to 50% of their caloric intake from subsistence (ADFG, 2000). The impacts of oil and gas activities on the US Arctic's environment translate into social impacts through the disturbance of the animal and plant species that underpin subsistence.

In addition to the disturbance of subsistence species, the social impacts of oil and gas activities are experienced through other vectors. For example, Wernham (2007) interviews Alaska Natives who live inside the boundaries of NPR-A to explore the likely impacts of expanded oil and gas infrastructure on their health. The findings (Table 3.2) underscore the connections between the social impacts that government agencies such as the Bureau of Land Management (BLM) predicts will accompany expanded oil and gas infrastructure (columns 1-5) and additional health impacts that governmental impact statements have largely failed to recognize because they are less direct (column 6).

Some of the social impacts of oil and gas development in the US Arctic, however, are positive. Namely, oil and gas development is the main source of revenue for the North Slope Borough and this income allows for the provision of many important social services in the region (Shepro et al., 2010). The Borough gains revenue predominately through the taxes and levies that it places on oil and gas companies, and not though the employment of Alaska Natives. Only 20 out of several thousand oil and gas industry employees on the North Slope were residents of the North Slope Borough in 2010, however (Shepro et al., 2010).

Scientific studies documenting the psychological impacts to Native Alaskans of the 1989 Exxon Valdez oil spill are indicative of the potential social impacts of a major oil and gas disaster in Arctic Alaska's OCS. Dyer (1993), for example, shows that the oil spill and subsequent cleanup efforts disrupted communal control of local natural resources and lead to reported declines of subsistence activities, sharing, and social support networks (amounting to

what the author calls *tradition loss*). Palinkas, Downs, Petterson, & Russell (1993) demonstrates that exposure to the oil spill event was incrementally correlated with increased levels of depression in Alaska Natives and that the effects were stronger in Natives than in non-natives, indicating a cultural sensitivity to such industrial exposure.

But how do these impacts connect to community wellbeing specifically? Wellbeing is a notoriously difficult and contentious concept to define. However, for the purposes of this article, the definition used by the Millennium Ecosystem Assessment (MEA) is considered sufficient. The MEA holds that individual wellbeing consists of levels of security, basic materials, health, and social relations that combine to give people freedom of choice and action in terms of what they value doing and being (MEA, 2005). This definition of individual wellbeing can be scaled-up to the community level to suggest that a community possesses wellbeing when it can determine its own fate and its residents are safe, healthy, and relatively happy. Past actions imposed on communities in the US Arctic—such as forced settlement, mandatory Western schooling, and Christian missionization—can be interpreted as having decreased community wellbeing in several ways. Communities had their freedom of choice in what they value doing and being taken away, sometimes violently, by more powerful external organizations with opposing agendas. While the struggles of communities to regain control over their own fates have been successful to a significant degree, certain colonial legacies persist today as unavoidable daily realities. It is in this post-colonial context where the influence of industrial infrastructure on community wellbeing must be considered.

Industrial infrastructure in the US Arctic, in a strict sense, consists of human-made structures that support the production and consumption of natural resources (e.g., roads, pipelines, ports, airstrips, wells, buildings). In a more general sense, however, a single piece of

physical infrastructure on the land or in the sea indicates a significant series of actions that proceeded the construction of the given structure, and other actions that will come later in time. A drill platform, for example, indicates that industrial exploration was carried out in that location and that the findings indicated acceptable profit potential for the entities that constructed the infrastructure. Also, the permitting phases of construction (including baseline studies of ecological and social impacts) were carried out successfully, as were process of public input and political deliberations. Construction, which includes numerous vehicular trips for the transportation of materials and workers, occurred as well. Thinking of the future, the drill platform will have a limited lifespan, the length of which is determined by the characteristics of the resources it is accessing, and will then require a series of reclamation activities.

When assessing the influence of industrial infrastructure on community wellbeing, the entire timeline of activities (past, present, and future) indicated by the presence of a structure must be considered. Taking this into account and integrating it with the insights of the studies cited at the beginning of this section, it becomes possible to establish key examples of social, environmental, and economic benefits and harms of industrial infrastructure to communities (Table 3.3). In the sections that follow, existing, planned, and proposed infrastructure in the US Arctic is presented and then, in the conclusion, suggestions for maximizing the benefits of potential future infrastructure and minimizing the harms for communities are offered.

3.2 Methods

In order to inform the discussion about integrated planning of industrial development in the US Arctic, it is necessary to construct a comprehensive, nuanced, and (where possible)

quantified picture of what exists and what may plausibly occur. To achieve this goal, the authors examined relevant documents and extracted pertinent data about industrial activities by adapting tables, text, and maps from the original sources cited throughout this article. Whenever possible, government planning documents—such as environmental impact statements, development permits, and other official reports—were used, as these sources are the most impartial and widely accepted quantifications and qualitative descriptions of industrial infrastructure and operations that are publicly available. Research was carried out in 2013-2014 and then updated in late 2015.

Until now the quantification of existing, planned, and proposed infrastructure in the US Arctic was largely piecemeal. To bridge the gaps in the existing data and build a regional synthesis, other sources were utilized when needed (e.g., the 2003 NRC report). Extensive efforts were taken to ensure the validity of all the sources used, including cross-referencing with other sources and expert consultation. In addition to the citation of all sources, explanations of the data presented in this article are provided as needed in the main text.

Many of the source documents synthesized here present different types of infrastructure and operations (e.g., number of gravel pads versus number of facilities) and use different units of accounting (e.g., miles of pipeline corridor versus total acreage disturbed by pipeline) because of the requirements of different regulatory agencies and the methods of previous studies. While this can complicate comparisons among sub-regions and time frames, the synthesis section provides data in a more comparable format. All maps were made using a combination of publicly available data layers, geo-referenced data layers that were created specifically for this project from official sources, and the data holdings of Audubon Alaska.

The decision to divide the data into sub-regions before synthesis was made because existing accounting has largely been done in accordance with these smaller political boundaries.

The sub-regions used are: Central North Slope and state waters; National Petroleum Reserve-Alaska; Chukchi Sea Outer Continental Shelf; Beaufort Sea Outer Continental Shelf; Arctic National Wildlife Refuge; and Northwest Coastal and Interior Alaska (Figure 3.1).

3.2.1 Definition of Key Terms

This study uses industrial and commercial interchangeably to reference natural resource extraction that is primarily oriented toward exporting resources out of the US Arctic. Infrastructure is used to describe human-made structures that appear in the landscapes and seascapes of the US Arctic and stem from oil and gas or other industrial activities. Infrastructure includes buildings, roads, gravel islands, docks, causeways, airstrips, pipelines, power lines, wells, mines, and landfills. As a complement to infrastructure, this study uses operations to describe the industrial human activities that commonly accompany the construction and use of oil and gas and other industrial infrastructure, such as the trips made by trucks, tundra vehicles, fixed-wing aircraft, helicopters, and various types of ships.

Commercial transportation comprises two areas of content. The first is the movement of natural resources for the primary purpose of export to non-regional markets. Examples include piping of oil from northern Alaska to ports in the south and potential trucking and shipping of coal or minerals from open-pit mines in western Alaska to distant markets. The second content area includes major conveyances of goods and materials—as distinct from day-to-day operations—that support industrial operations in the US Arctic, as well as maritime traffic that is primarily in support of industrial operations and that passes through the waters of the US Arctic.

This study uses existing infrastructure to mean industrial structures that have already been built and operations that have already occurred as of the time of writing. Planned infrastructure is a relatively narrow category and describes industrial structures and activities that have entered the initial permitting or development phase or are likely to occur within the next one to two years, but have not yet been completed. Proposed infrastructure defines those industrial structures and activities that neither exist today nor have entered the initial permitting phase, but have been quantitatively or qualitatively described in federal or state government planning documents and could plausibly occur in the future given current knowledge of industrial development trends.

3.3 Industrial Infrastructure in the US Arctic's Sub-Regions

3.3.1 Central North Slope and State Waters

Private companies began exploring the oil and gas production potential of the US Arctic in the early 1920s. The first development to successfully produce commercial quantities of oil in the region was at the Central North Slope's Prudhoe Bay field, which was discovered in 1968 and went online in 1977 following the completion of the Trans-Alaska Pipeline System (TAPS) (NRC, 2003) (Figure 3.2).[4] The completion of TAPS was a necessary precondition for successful production in the region because it allowed for the economically efficient transport of oil from

[4] Following the definitions used by the State of Alaska's Division of Oil and Gas, this article uses "field" to describe subterranean accumulations of oil and gas that consist of one or more pools, and "Unit" to describe the legally defined oil and gas activity areas that consist of one or more fields. Lease tracts and infrastructure and operations occur outside of Units as well as within them.

the far north of the state to the ice-free port of Valdez in the south. Construction of the Dalton Highway was another infrastructure project that preceded North Slope oil and gas production. The highway, completed in 1974, is 414 miles long and runs from the Elliot Highway north of Fairbanks to the industrial support center of Deadhorse, adjacent to the Prudhoe Bay field (Bureau of Land Management [BLM], 2013a). The Dalton Highway, along with the construction of a major jet airport at Deadhorse, provided access to previously remote and roadless portions of Alaska and allowed the construction of TAPS and much of the oil and gas infrastructure on the North Slope. Oil and gas infrastructure in the Central North Slope and state waters sub-region expanded steadily from the initial development at Prudhoe Bay as additional commercially viable fields were discovered (Table 3.4).

A 2003 report by the US National Research Council (NRC) quantified infrastructure supporting oil and gas production on the North Slope (NRC, 2003). In 2014, the NRC numbers were updated to include estimates of North Slope infrastructure as recent as 2011 (Raynolds et al., 2014) (Table 3.5). Infrastructure and operations associated with oil and gas activities in the Central North Slope and state waters sub-region for projects that have been brought into production since 2011 have not been quantified. Nor have data about the exploration activities that have occurred in the sub-region been quantified.

The NRC and the follow up study did not tabulate the number of wells that have been drilled on the North Slope. However, the Alaska Oil and Gas Conservation Commission (AOGCC), which maintains the state's well database, reports that as of March 2011 there were 6,011 wells on the terrestrial portion of the Central North Slope and 35 wells in state waters (Alaska Department of Administration [ADA], 2013). These numbers include all well types (e.g., exploration, production, injection).

In 2012, the US Army Corps of Engineers Alaska District (USACE) completed an environmental impact statement (EIS) (USACE, 2012a) and issued an activity permit (USACE, 2012b) for the development of a planned hydrocarbon production facility at the Point Thomson field in the eastern portion of the Central North Slope. Taken together, the EIS and the permit present an estimate of some of the infrastructure and operations required for the development and production phases of Point Thomson (Table 3.6). Reports in late 2015 indicate that the Point Thompson development has nearly reached completion and that the facility will be ready to come online in 2016 (Alaska Department of Natural Resources [ADNR], 2013a; DeMarban, 2015).

There are many ongoing seismic explorations, incremental expansions of existing developments, and new developments in satellite areas of currently producing fields planned in the Central North Slope. Such relatively small developments and operations are difficult to track in detail, in part because they do not trigger major federal impact assessments. A recent North Slope Oil and Gas Activity Map (ADNR, 2013b), however, provides some data about such planned infrastructure in this sub-region (Table 3.7).

Oil and gas companies recently began exploring the potential of the Central North Slope to produce commercially viable oil and gas from formations of subterranean shale rock. Producing oil and gas from shale requires different techniques, infrastructure, and operations than production from the more conventional oil and gas fields in the Central North Slope. Hydraulic fracturing, commonly referred to as "fracking," is the primary technique for extracting oil and gas from shale. If shale production proves viable on the North Slope and fracking becomes a common activity in the region, it could trigger an expansion of industrial infrastructure and operations. In 2012 the US Geological Survey (USGS) completed an estimate

of recoverable oil and gas contained in the shale rocks of the Central North Slope and NPR-A (USGS, 2012). However, a 2014 article from the oil and gas industry publication Petroleum News concludes that "the feasibility of Alaska shale oil development remains an unknown" (Bailey, 2014, p. 1).

Since the 1970s, stakeholders such as State of Alaska government agencies, US government agencies, and private companies have been proposing development plans to build a natural gas pipeline and processing facilities that could bring the North Slope's gas reserves to market in an economically viable manner.[5] While nothing has been built to date, the State of Alaska's current administration appears to support the construction of a pipeline (Associated Press, 2015). A report from the Alaska Natural Gas Transportation Projects Office of the Federal Coordinator (OFC) presents the main proposals that have recently emerged for commercializing the gas on Alaska's North Slope (OFC, 2013) (Table 3.8). The infrastructure and operations associated with proposed natural gas projects and shale oil and gas activities could fall within the boundaries of both the Central North Slope and of other sub-regions of the US Arctic.

3.3.2 National Petroleum Reserve–Alaska

Despite its name, the National Petroleum Reserve-Alaska (NPR-A) has seen relatively little oil and gas infrastructure and operations compared to the Central North Slope and state waters sub-region (Figure 3.3). AOGCC reports that there were 122 hydrocarbon wells (of all

[5] Natural gas must be piped at a low temperature because of its physical properties, while oil must be piped at a higher temperature so it flows readily. Thus, the existing TAPS cannot be used to transport economically viable quantities of natural gas and a dedicated gas pipeline or trucking operation would be required for production (OFC, 2013).

types combined) in NPR-A as of March 2011 (ADA, 2013). However, BLM reports that 136 test holes were drilled in NPR-A before official leasing began in 1982. These older wells are known as legacy wells (BLM, 2013b). Aside from the non-exporting oil and gas production facilities around the village of Barrow, there are no producing developments inside NPR-A at the time of writing. Some of the major oil and gas activities that have occurred in NPR-A include formation of the first two federal Units, beginning in 2008, and completion of the most recent NPR-A management plan in 2012 and a federal Record of Decision (ROD) authorizing development that would facilitate the first oil production from NPR-A (Table 3.9).

The boundary of the Colville River Unit in the Central North Slope sub-region extends westerly across the eastern border of NPR-A and infrastructure is spreading in that direction too. In 2014, ConocoPhilips completed the construction of a gravel pad for a production facility called CD-5 within NPR-A (ADNR, 2014b) and plan to drill 15 wells from that site in 2016 (ADNR, 2015). Construction is also underway on industrial crossings of the Colville River (including three completed bridges), which constitutes NPR-A's border with the Central North Slope, and ongoing seismic surveys are taking place in the region (ADNR, 2015). BLM's 2015 ROD authorized the following infrastructure expansion to link CD-5 with the federal Greater Mooses Tooth Unit One (GMT-1) and then to begin production at GMT-1: 12 acre gravel pad, 33 wells, 7.6 mile gravel road, 8.4 mile elevated pipeline, and all accompanying industrial activity (e.g., transport of personal and materials) (BLM, 2015).

BLM's 2012 Final Integrated Activity Plan/Environmental Impact Statement (FIAP/EIS) provides an estimate of the infrastructure and operations that could be needed for exploration, development, and production of the estimated known oil and gas reserves within NPR-A (BLM, 2012). The plan states that BLM's figures "provide realistic and conservative

estimates for impact analysis that make it very unlikely that this FIAP/EIS will underestimate the impacts" (BLM, 2012, p. 71). The preferred development estimate (alternative B-2) includes proposed activities for the Greater Mooses Tooth Unit, the Bear Tooth Unit, and Umiat (Table 3.10).

Proposed offshore oil and gas developments discussed in the following two sections could affect the amount of infrastructure and operations that eventually occur within NPR-A. Offshore developments in federal waters could require the construction of connecting pipelines and roads that cut across portions of NPR-A in order to transport oil and gas from offshore production facilities to the existing infrastructure and TAPS at the Prudhoe Bay field. However, such infrastructure and operations were not estimated by BLM's 2012 FIAP/EIS. In addition, the State of Alaska's Roads to Resources Initiative, specifically the Foothills West Transportation Access project, could spur industrial development in NPR-A by providing increased terrestrial access to the sub-region, which is discussed further in the section on Wester Coastal and Interior Alaska.

3.3.3. Chukchi Sea Outer Continental Shelf

To date, there are five decommissioned and abandoned exploration wells in the Chukchi Sea Outer Continental Shelf (OCS), which were drilled between 1989 and 1991 (Bureau of Ocean Energy Management [BOEM], 2012a), and one exploration well that Shell began in 2012 at the Burger prospect (ADNR, 2012b) and completed in 2015 (Figure 3.4).[6] The existing wells

[6] An oil and gas "prospect" is a defined area that companies predict to contain commercially viable oil and gas based on the results of previous exploration efforts, such as seismic surveys.

are spread around five oil and gas prospects called Burger, Klondike, Crackerjack, Popcorn, and Diamond. Existing oil and gas infrastructure and operations in the sub-region have been relatively minimal (Table 3.11).

In recent years, oil and gas companies have submitted applications for industrial activities in this sub-region, with Shell conducting limited drilling activities in the Chukchi Sea OCS in 2012 and again in 2015. However, following its 2015 summer exploration activities, Shell has decided to cease exploration in the Chukchi Sea OCS for the foreseeable future – citing insufficient oil discoveries – and is winding down its existing operations in the region (Shell, 2015). The next potential lease sale had been scheduled for 2016 (BOEM, 2012a), but was recently canceled due to perceived lack of interest from industry (US Department of the Interior [USDOI], 2015).

The Bureau of Ocean Energy Management (BOEM) and its predecessor agency, the Minerals Management Service (MMS), have generated multiple estimates of proposed infrastructure and operations in the Chukchi Sea OCS over the years. BOEM's recent report Outer Continental Shelf Oil and Gas Leasing Program: 2012-2017 Final Programmatic Environmental Impact Statement (BOEM, 2012b), presents estimates for (1) the infrastructure that could be built over the next 40-50 years specifically as a result of the 2012-17 program and (2) infrastructure that could be built over the next 40-50 years in the cumulative case scenario, which includes all past and potential oil and gas infrastructure from all past and potential lease sales in the sub-region, within the given time frame. Regarding the estimates, BOEM states, "It should be noted that the cumulative case scenario…reflects inherent uncertainty about the future of OCS oil and gas activities…[F]uture activity is unpredictable and could span a considerable range" (BOEM, 2012b, p. 4-660). The cumulative case estimate includes the pipeline that could

be required to connect offshore production facilities to existing infrastructure by cutting across NPR-A (Table 3.12). These plans, however, may be contingent upon Shell or another large corporation restarting exploration and production activates in the OCS.

3.3.4 Beaufort Sea Outer Continental Shelf

To date, there are 30 decommissioned and abandoned exploration wells in the Beaufort Sea OCS, which were drilled between 1981 and 2002 (BOEM, 2012a), and the top hole of one well that was drilled in 2012 at the Sivulliq prospect (ADNR, 2012b) (Figure 3.5). The Northstar production island and its buried pipeline to land are located in state waters but the facility produces from oil and gas fields that are covered by both state and federal leases. Oil and gas activities in the Beaufort Sea OCS have been occurring for decades (Table 3.13).

Shell conducted limited drilling activities in the Beaufort Sea OCS in 2012, and there have been a number of proposals to drill specific wells in the recent past. At the time of writing, none of these existing proposals is active, and there are no planned oil and gas activities in the Beaufort Sea OCS. The next potential lease sale had been scheduled for 2017 (BOEM, 2012a), but was recently canceled due to perceived lack of interest by industry (USDOI, 2015).

In 2002, MMS completed an EIS for the proposed development of an oil production facility at the Liberty Unit, which is located in federal waters eight miles east of the Endicott field (MMS, 2002). The 2002 EIS assessed a proposal that centered on the development of an offshore island that would house the production facilities and connect to existing infrastructure via buried pipelines, similar to the Northstar project. This proposal, however, was later rejected in favor of a proposal that centered on ultra-extended reach drilling from the existing Endicott

facilities (in state waters) to access the oil in the Liberty field. The second proposal for developing the Liberty Unit, however, was also rejected due to feasibility issues. The most recent proposal again calls for the construction of an offshore island in federal waters with buried pipelines connecting to shore. Primary ownership of the Liberty project was acquired by Hilcorp Alaska LLC in 2014, and they released a revised development and production plan in late 2015 (Hilcorp Alaska LLC, 2015).

The EIS for BOEM's most recent five year program (BOEM, 2012b) estimates some of the infrastructure and operations that would be required for developing the known estimated oil and gas reserves in the Beaufort Sea OCS. As was the case for the Chukchi Sea OCS, the five-year program presents estimates for (1) the infrastructure that could be built over the next 40-50 years specifically as a result of the 2012-2017 program and (2) infrastructure that could be built over the next 40-50 years in the cumulative case scenario, which includes all past and potential oil and gas infrastructure from all past and potential lease sales in the sub-region, within the given time frame. Once again, BOEM cautions that "the cumulative case scenario…reflects inherent uncertainty about the future of OCS oil and gas activities…[F]uture activity is unpredictable and could span a considerable range" (BOEM, 2012b, p. 660). The data from the cumulative case includes BOEM's estimates for development of the Liberty Unit and pipeline to connect to existing infrastructure (Table 3.14).

3.3.5 Arctic National Wildlife Refuge

The US National Wildlife Refuge System goal is to promote conservation, management, and restoration of wildlife, fish, and plant species for the enjoyment of Americans. The Arctic National Wildlife Refuge (ANWR) was originally set aside for refuge purposes in 1957, prior to

Alaska statehood, and then officially established in 1960. ANWR was expanded in size and acquired many of its current features in 1980 with President Carter's signing of the Alaska National Interest Lands Conservation Act (ANILCA) (Figure 3.6).[7] ANILCA's stated purposes for the Arctic Refuge include:

> (i) to conserve fish and wildlife populations and habitats in their natural diversity…; (ii) to fulfill the international fish and wildlife treaty obligations of the United States; (iii) to provide the opportunity for continued subsistence uses by local residents; and (iv) to ensure water quality and necessary water quantity within the refuge (1980, section 303).

In addition to defining these purposes for ANWR, ANILCA designated eight million acres of the existing refuge as Wilderness, which guarantees the highest level of protection within the National Refuge System. However, a 1.5 million acre area between the refuge's northern coastline and the foothills of the Brooks Range (i.e., the Coastal Plain) was excluded from the Wilderness designation.

Section 1002 of ANILCA called for a comprehensive assessment of the Coastal Plain area, which is commonly referred to as the "1002 area." The assessment was to provide Congress with information about the area's fish and wildlife resources, the potential impacts of oil and gas activities on those resources, and an estimate of the area's oil and gas resource potential.

[7] ANILCA designated 18 million acres as part of ANWR, another one million were added in 1983, and 325,000 more acres in 1988 (US Fish and Wildlife Service [USFWS], 2008).

An oil and gas seismic exploration program for the 1002 area was conducted between 1983 and 1985 (US Fish and Wildlife Service [USFWS], 2008). One exploration well was also drilled by oil companies on Native lands within ANWR boundaries. The data from seismic exploration have received multiple interpretations over the years and have led some stakeholders, such as the State of Alaska, to conclude that the area could produce economically viable oil and gas. However, section 1003 of ANILCA states, "production of oil and gas from the Arctic National Wildlife Refuge is prohibited and no leasing or other development leading to production of oil and gas…shall be undertaken until authorized by an act of Congress" (ANILCA, 1980).

While the federal status of ANWR with regard to oil and gas activities is clear, the State of Alaska has promoted exploration in the Coastal Plain (1002 area). In 2013 the State's Division of Oil and Gas released a document called The Oil and Gas Resource Evaluation and Exploration Proposal for the Arctic National Wildlife Refuge 1002 Area (ADNR, 2013c). The state's proposal urges the US Congress to open the 1002 area to exploration and lays out a seven-year exploration plan that includes, inter alia, 3-D seismic survey of 3,305 square miles and the drilling of up to 16 exploration wells. While it is important to understand what the State of Alaska has had in mind for ANWR, this article does not include the activities described above in the proposed category of infrastructure and operation because oil and gas activities are currently prohibited within the borders of ANWR.

3.3.6 Northwest Coastal and Interior Alaska

According to the AOGCC database, a small number of abandoned oil and gas exploration wells are scattered around the Northwest Coastal and Interior Alaska sub-region (ADA, 2013) (Figure 3.7). However, neither the State of Alaska nor the federal government holds oil and gas lease sales in this region at this time. Infrastructure and operations in the sub-region related to commercial transportation, rather than oil and gas, is the focus of this section. A timeline reveals major activities related to commercial transportation in the lands and waters of Northwest Coastal and Interior Alaska (Table 3.15).

In addition to portions of TAPS and the Dalton Highway located south of the North Slope, there are three other major gravel roads in this sub-region. These roads originate near the city of Nome on the Seward Peninsula. Some of the roads around Nome were constructed in order to facilitate gold mining in the area (which began in the early 1900s and largely ended in the 1960s), while others serve primarily to connect existing communities (ADFG, 2014).

Commercial transportation in this sub-region is driven in part by the Red Dog mine, located 52 miles inland between the coastal villages of Kotzebue and Kivalina (Red Dog Mine, 2009). Red Dog mine extracts zinc and lead ore from open-pit site and mineral concentrates are trucked from the mine to a coastal port facility, and then shipped to markets (Red Dog Mine, 2009). The road from the mine to the port and the port itself are called the DeLong Mountain Transportation System (DMTS), owned by the Alaska Industrial Development and Export Authority (AIDEA). Because the waters surrounding the DTMS port are shallow, long distance ore carriers are required to anchor offshore in deeper waters and shallow-draft barges are used to transfer materials into the carriers in a process called lightering (Red Dog Mine, 2009). In

addition to the port at Red Dog mine, the other primary ports in the region are shallow draft ports (<30 feet) at Kotzebue and Nome (Protection of the Arctic Marine Environment [PAME], 2009).

Marine vessel traffic is another component of transportation in the Northwest Coastal and Interior Alaska sub-region. Maritime activity in the area includes vessels engaged in commercial transportation (e.g., cargo ships. tankers, ice breakers), scientific research vessels, pleasure vessels, and other boats. Annually there are over 400 transits of marine vessels through the Bering Strait, a number that includes both commercial vessels and non-commercial vessels, such as military, research, and law-enforcement vessels (USACE & Alaska Department of Transportation and Public Facilities [ADOT&PF], 2013). The number of large commercial vessels passing through the Bering Strait annually has been estimated at closer to 150 (excluding fishing vessels which are usually smaller) (PAME, 2009).

The Marine Exchange of Alaska monitors marine vessel traffic in Alaska's waters. A summary of Marine Exchange data for the years 2009, 2010, and 2011 suggest an increasing trend in the numbers of non-fishing vessels over 100 feet in length for the regions of the North Slope, Bering Strait, and Norton Sound combined (Table 3.16). Data on the Red Dog Mine and the gravel roads around Nome discussed above are also presented.

New commercial transportation in the Northwest Coastal and Interior Alaska sub-region is proposed by the Roads to Resources Initiative (R2R), led by the Alaska Department of Transportation and Public Facilities (ADOT&PF), which works with interested parties to "design and build projects that support development of natural resources in the oil and gas, alternative energy, mining, timber, fisheries, and agriculture industries" (ADOT&PF, 2011a). While R2R is an ongoing program, as of early 2014 construction had begun on a new road that will eventually connect the western terminus of the Elliot Highway (near Manley Hot Springs) to an area of the

Yukon River near the village of Tanana (ADOT&PF, 2011b). The Road to Tanana, as the project is named, is planned to be 36 miles long (ADNR, 2013d) and should reach completion by the end of 2015 (Bodony, 2015). According to the 2010 state-sponsored Western Alaska Access Planning Study, the road is viewed as the first segment of a more extensive road project (described below), which will eventually connect to the roads around Nome on the Seward Peninsula. The larger project is intended to provide increased access to remote villages and promote the development of natural resources in the southern part the sub-region (ADOT&PF, 2010). In addition to the Road to Tanana, three other R2R projects fall in the proposed category (Table 3.17).

Proposed infrastructure in the sub-region also includes an 11.2 mile two-lane gravel road between the village of Kotzebue and the coastal area of Cape Blossom to the south (ADOT&PF, 2011c). A 1983 feasibility study commissioned by the State of Alaska recommended Cape Blossom as the best location around Kotzebue to construct a deep-draft port in anticipation of the increased vessel traffic expected to accompany development of coal mining in the area. While coal mining around Kotzebue has not materialized to date, ADOT&PF reports that the EIS for the road to Cape Blossom has been completed and that the road project is currently in the design phase (ADOT&PF, 2011c).

Another assessment of potential locations for a deep-draft port to serve the US Arctic was recently completed, and much of the assessment's study area falls within the Northwest Coastal and Interior Alaska sub-region. In 2013, ADOT&PF and USACE released their first-year report for the assessment (USACE & ADOT&PF, 2013). Regarding the need for the assessment and the subsequent construction of a new port, the report states, "Marine Vessel traffic in the Arctic Ocean is growing dramatically with the thinning and retreat of the Arctic Ocean ice pack. This

creates the potential for conflict, accidents, and incidents" (p. 9). Accordingly, they contend that a deep-draft port is needed in the sub-region to enhance economic development, oil spill response capacity, community resupply, the US presence in the Arctic, and search and rescue capability in the region. The first-year report recommended the Nome/Port Clarence area as the best location for a deep-draft port to serve the US Arctic. A 2015 Environmental Assessment suggests that the deep-draft port in Nome would include "a 2,150-foot-long (655 meters) extension of the existing 2,700-foot-long (823 meters) causeway, removal of the existing 270-foot-long (655 meters) spur, and dredging of the associated entrance channel to a depth of -28 feet (8.5 meters)" (USACE, 2015).

Proposed commercial marine vessel traffic in the Arctic that could affect North West Coastal and Interior Alaska is qualitatively summarized by the Arctic Council's 2009 Arctic Marine Shipping Assessment:

> Arctic natural resource development (hydrocarbons, hard minerals and fisheries) and regional trade are the key drivers of future Arctic marine activity. … Future Arctic marine activity will include many non-Arctic stakeholders [and] multiple users in Arctic waterways …. Offshore hydrocarbon developments may lead to increased marine traffic in the Bering Strait region (PAME, 2009, p. 5).

It has also been proposed that trans-Arctic shipping i.e., shipping that uses the Arctic Ocean to link the Pacific Ocean with the Atlantic Ocean, will increase as sea ice decreases along the Northern Sea Route (north of the Russian Federation), the Trans-Arctic Sea Route (across the North Pole), and the Northwest Passage (north of Canada). Increased shipping and vessel activity

along the Northern Sea Route has already been observed (PAME, 2009). Recent projections suggest that substantial increases to shipping will be possible for certain types of ships by 2050 (Smith & Stephenson, 2013).

3.3.7 Regional Overview and Data Synthesis

This section provides a quick reference to "what is" and "what could be" with regard to the industrial infrastructure in the US Arctic that supports oil and gas activities and commercial transportation (Figure 3.8). The chapter synthesizes the existing, planned, and proposed infrastructure that the previous six sections present separately (Table 3.18).

Infrastructure is divided into existing, planned and proposed timeframes. Some potentially significant proposed infrastructure projects have not been quantified in a manner that allows for their inclusion in the comparison. This is the case for (1) gas pipeline and trucking projects, (2) development of shale oil and gas, (3) a potential road that may parallel a future pipeline cutting across NPR-A to support OCS development in the Chukchi Sea, and (4) construction of a deep-draft port. These projects are described in the Comments column of the table and must be considered when analyzing different infrastructure futures for the region and their impacts on community wellbeing.

Infrastructure data have been grouped into five main categories and rounded to the nearest whole number for ease of comparison. Data adhere to the following descriptions unless noted otherwise:

- Structures: indicates the number of structures and includes gravel pads, gravel islands, gravel airstrips, gravel helipads, bridges, and facilities (e.g., pump stations).

- Wells: indicates the number of oil and gas wells and includes all types (e.g., exploration, production, injection, abandoned).
- Roads: indicates miles of road, causeway, and tundra scar (i.e., semi-permanent indentations in the tundra caused by vehicular traffic).
- Pipeline: indicates miles of pipeline.
- Footprint: indicates the acreage covered by infrastructure and, where available, gravel-borrow sites (i.e., locations where gravel is mined from for construction); excludes acres that are temporarily disturbed (e.g., by exploration activities that do not disturb the environment in continuing ways).[8]

3.3.8 Summary of Findings

Industrial infrastructure in the US Arctic related to oil and gas production and commercial transportation has expanded substantially since the first commercial wells were drilled in the early 1960s. Today, the existing estimated footprint of oil and gas infrastructure totals well over 18,000 acres. At the time of this writing, expansion of oil and gas infrastructure continues as the industry develops specific projects located at the outer edges of the existing infrastructural complex. For example, infrastructure is expanding to the east in the form of the Point Thomson project and to the west through the ongoing development of the Colville River and Greater Mooses Tooth Units within NPR-A. Simultaneously, oil and gas exploration activities continue to the north (in multiple offshore environments) and to the south of existing

[8] There is an ongoing debate in the scientific community over how to categorize the impacts of some oil and gas activities. This article reproduces the terminology used by the cited references to describe impacts.

infrastructure (in the foothills of the Brooks Range). Commercial transportation infrastructure is also expanding, as construction crews finalize road from the Manley Hot Springs area to Tanana. These construction projects and others are categorized as planned infrastructure in this article. They are relatively modest in scope and size, adding to the extent of existing infrastructure by only a few percent. Nonetheless, these projects represent the latest stages of a long-term trend of incremental expansion of industrial infrastructure in the region.

If the projects captured in the proposed infrastructure category proceed, it would result in a considerably larger expansion of industrial infrastructure. As mentioned throughout this article, there is a high degree of uncertainty about the future of industrial infrastructure in the US Arctic. For that reason, it is impossible to predict which projects will go forward, what they will look like, and when they will be developed; especially considering Shell's recent shutdown of its offshore exploration program. However, if proposed infrastructure projects develop in the manner described in state and federal analyses, the extent of the US Arctic's industrial infrastructure would increase significantly. The number of structures would almost double, from 460 to 816. The number of wells would increase by around one third, from 6,215 to 8,673. Miles of road would more than double, from 1,138 to 2,503. Miles of pipeline would more than quadruple, from 901 to 4,667. Lastly, the infrastructure footprint would increase by about 50 percent, with over 27,000 acres of the US Arctic ultimately being directly covered or excavated for industrial development. The area affected by that infrastructure footprint—what the NRC refers to as "zones of influence"—would be considerably greater (NRC, 2003, p. 9).

3.4 Discussion and Conclusion

If the impacts (both positive and negative) of industrial infrastructure on the wellbeing of communities that are in the vicinity of development is proportional to the amount of infrastructure that exists on the ground and in the sea, then future impacts in the US Arctic could be considerable in a maximum development scenario. However, a minimum development scenario – which could plausibly include no additional construction of industrial infrastructure – should also be considered and would raise a different set of questions. Namely questions about decommissioning the infrastructure that has already been build and rehabilitating affected land- and seascapes (see e.g., Jorgenson & Joyce, 1994). If industrial actors were to wind down their operations, significant clean up expenses could be transferred to affected communities if the associated corporations do not fulfill their reclamation responsibilities (Marion, Massicotte, & Duhn, 2014). But what determines whether future impacts manifest as benefits or harms to communities? The key lies in governance.

Analyzing the role of governance in mitigating the relationship between industrial activity and community wellbeing in the Arctic is an emerging theme in academic research. Nuttall (2010), provides an ethnography-based analysis of how 'dreams' of oil and gas wealth have shaped relations between Indigenous people and federal governments in Canada and the US, highlighting both benefits and drawbacks of current relations but emphasizing the need for increased representation of Indigenous interests. Similarly, an edited volume out of Fennoscandia asks whether pan-arctic oil and gas development has moved beyond sustainability (Mikkelsen & Langhelle, 2008). The authors' answer is that it depends on how one defines sustainability. The resources being extracted are non-renewable, they point out, but the revenue

from development could be invested in economic diversification for economic growth that *is* sustainable. Hovelsrud, Poppel, Van Oort, and Reist (2011) focus on rural arctic communities and their adaptive capacities to a variety of changes, including increased industrial activity, concluding that governance will determine whether communities prosper or wither in the future.

With regard to the US Arctic specifically, Haley et al. (2011) argue that good governance of oil and gas production in Alaska's offshore environment includes strengthening the institutions that assure community-based involvement in decision making. Meanwhile, Sherval (2013) suggests that Alaska's oil and gas resources could contribute to the nation's energy independence, while enhancing local energy security for Alaskan communities as well. Clearly, the nexus of natural resources, Indigenous people, and governance in the Arctic is a crucial area of research and action. This article intends to contribute to the emerging body of literature that critically examines the relationship between community wellbeing and industrial activity in the Arctic by a) demonstrating a methodology that is forward looking in its emphasis on plausible future infrastructure and b) providing an in-depth case study of infrastructure development in the US Arctic, which had not existed until now

What would governance that maximizes the benefits of industrial activities for communities look like? This article suggest that two main factors play a critical role in governance: a) power (i.e., the ability to control processes of development) and b) the flow of financial capital (i.e., who profits from development). Currently, out of all stakeholders in the US Arctic, corporations are arguably the most powerful because they have the most financial capital. Under the US's free market system, in order for anyone to benefit financially from development, corporations must be willing to invest their capital in production activities. From there, other stakeholders such as native corporations and municipal, state, and federal governments can

extract revenue from the activities of the corporations and derive a share of the generated profit. Mechanisms for extracting revenue from corporations include taxing their activities on owned land, auctioning off rights to develop certain tracts of federal territory, and selling the rights to develop owned oil, gas, and minerals. Despite such mechanisms, the capital possessed by corporations give them significant leverage in governance. Also, corporations stand to secure the largest profits from the expansion of development.

The next question is whether the corporations, who are profiting the most, are also incurring the biggest risk. If such an assessment is calculated strictly in terms of dollars, the answer might be yes. Corporations invest hundreds of millions of dollars into various phases on industrial activity on well calculated gambles that may or may not pay off. However, when risks are calculated in other ways, it would appear that communities actually have the most to lose from increased industrial development. If either a major industrial accident or the crossing of an ecological tipping point caused by cumulative impacts occurs, the subsistence life-ways of Alaska Natives and other rural residents could be direly compromised. It is the stance of this paper that cultural sovereignty should be considered more valuable than the profits of transnational corporations.

However, the political-economic situation is complex because the economies of local and state governments are highly dependent on continued revenue streams from natural resource extraction, and are therefore also at risk from decreases in production. In late 2015, the economic vulnerability of local stakeholders to industrial withdrawal is playing out in the region, after Shell decided to abandon their efforts to establish production wells in the Chukchi Sea OCS. The 'domino effect' from Shell's pullout includes federal agencies canceling offshore lease sales,

decreased discussion about the need for a US Arctic deep-draft port, and a general anxiety among those who derive economic benefit from the fossil fuel industry in Alaska.

Good governance would include rules that pulled more of the control and financial benefit associated with industrial infrastructure away from the corporations and put it in the hands of communities. This could include a major restructuring of the benefit agreements between corporations and native interests, whereby the amount of profit extracted by the native interests increased substantially (perhaps in step with the amount of new infrastructure). Institutional adaptations could also include native organizations becoming the main actors in decision making about future development, rather than the current situation that sees industry calling the shots and non-native governments being the main regulators (but with minor Indigenous participation). Institutional adaptations such as these could limit the economic vulnerability of local actors allowing them to regulate the degree to which they become dependent on volatile industrial industries.

As a nation, the US could develop a new understanding of what the role of corporations should be in society; the US could implement a standard of corporate social responsibility whereby society broadly (and directly-impacted communities specifically) were the main beneficiaries of industrial activity, rather than the owners of the transnational corporations operating in the region. These are radical recommendations, but these are also radical times. The Arctic is changing at an unprecedented rate and so too must governance.

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3.5 References

Alaska Center for the Environment, Alaska Department of Natural Resources, Bureau of Land Management, & Bureau of Ocean Energy Management. (2013). *Active Leases* [Data set]. Retrieved March 14, 2014, from https://www.data.boem.gov/homepg/data_center/leasing/leasing.asp

Alaska Center for the Environment & Audubon Alaska. (2010). Arctic Roads and Pipelines [Unpublished data set].

Alaska Department of Administration. (2013). *Alaska Oil and Gas Conservation Commission's Online Public Databases.* Retrieved March 14, 2014, from http://doa.alaska.gov/ogc/publicdb.html

Alaska Department of Fish and Game. (2000). *Subsistence in Alaska: A Year 2000 Update*. Juneau, AK: ADFG Division of Subsistence.

Alaska Department of Fish and Game. (2006). *Our Wealth Maintained: A Strategy for Conserving Alaska's Diverse Wildlife and Fish Resources*. Juneau, AK: Alaska Department of Fish and Game.

Alaska Department of Fish and Game. (2014). Nome and the Seward Peninsula. Retrieved from http://www.adfg.alaska.gov/index.cfm?adfg=viewinglocations.sewardpeninsula

Alaska Department of Natural Resources. (1995). *Trans-Alaska Pipeline* [Data set]. Retrieved March 14, 2014 from http://dnr.alaska.gov/md les/trans_alaska_pipeline.html

Alaska Department of Natural Resources. (2006). North Slope Oil and Gas Activity, 2005-2006 (July 2006). [Map]. Retrieved from http://dog.dnr.alaska.gov/GIS/ActivityMaps.htm

Alaska Department of Natural Resources. (2008a). North Slope Oil and Gas Activity 2008 (August 2008). [Map]. Retrieved from http://dog.dnr.alaska.gov/GIS/ActivityMaps.htm

Alaska Department of Natural Resources. (2008b). North Slope Oil and Gas Activity 2008 (October 2008). [Map]. Retrieved from http://dog.dnr.alaska.gov/GIS/ActivityMaps.htm

Alaska Department of Natural Resources. (2009a). North Slope Oil and Gas Activity 2008-2009 (May 2009). [Map]. Retrieved from http://dog.dnr.alaska.gov/GIS/ActivityMaps.htm

Alaska Department of Natural Resources. (2009b). North Slope Oil and Gas Activity 2009-2010 (December 2009). [Map]. Retrieved from http://dog.dnr.alaska.gov/GIS/ActivityMaps.htm

Alaska Department of Natural Resources. (2009c). *Beaufort Sea Areawide Oil and Gas Lease Sale: Final Finding of the Director.* Retrieved from http://dog.dnr.alaska.gov/Leasing/Documents%5CBIF%5CBeaufort_Sea%5CBeaufortSea_Final_BIF_20091109.zip

Alaska Department of Natural Resources. (2011a). North Slope Oil and Gas Activity 2010-2011 (January 2011). [Map]. Retrieved from http://dog.dnr.alaska.gov/GIS/ActivityMaps.htm

Alaska Department of Natural Resources. (20011b). North Slope Oil and Gas Activity 2011 (March 2011). [Map]. Retrieved from http://dog.dnr.alaska.gov/GIS/ActivityMaps.htm

Alaska Department of Natural Resources. (2011c). North Slope Oil and Gas Activity 2011 (July 2011). [Map]. Retrieved from http://dog.dnr.alaska.gov/GIS/ActivityMaps.htm

Alaska Department of Natural Resources. (2012a). North Slope Oil and Gas Activity 2012 (July 2012). [Map]. Retrieved from http://dog.dnr.alaska.gov/GIS/ActivityMaps.htm

Alaska Department of Natural Resources. (2012b). North Slope Oil and Gas Activity 2012 (December 2012). [Map]. Retrieved from http://dog.dnr.alaska.gov/GIS/ActivityMaps.htm

Alaska Department of Natural Resources. (2013a). North Slope Oil and Gas Activity (May 2013). [Map]. Retrieved from http://dog.dnr.alaska.gov/GIS/ActivityMaps.htm

Alaska Department of Natural Resources. (2013b). North Slope Oil and Gas Activity (December 2013). [Map]. Retrieved from http://dog.dnr.alaska.gov/GIS/ActivityMaps.htm

Alaska Department of Natural Resources. (2013c). *The Oil and Gas Resource Evaluation & Exploration Proposal for the Arctic National Wildlife Refuge 1002 Area.* Retrieved from http://dog.dnr.alaska.gov/Publications/Documents/OtherReports/ANWR_Resource_and_Exploration_Proposal_Web.pdf

Alaska Department of Natural Resources. (2013d). ADL 419886, DOT Public Right-of-Way for Road to Tanana (Tofty to Tanana) [Public notice]. Retrieved from http://aws.state.ak.us/OnlinePublicNotices/Notices/View.aspx?id=168193

Alaska Department of Natural Resources. (2014a). *Alaska Statewide Active Lease Boundaries* [Data set]. Retrieved January 15, 2015 from http://www.asgdc.state.ak.us/

Alaska Department of Natural Resources. (2014b). North Slope Oil and Gas Activity (September 2014). [Map]. Retrieved from http://dog.dnr.alaska.gov/GIS/ActivityMaps.htm

Alaska Department of Natural Resources. (2014c). *Unit Boundary* [Data set]. Retrieved January 15, 2015 from http://www.asgdc.state.ak.us/

Alaska Department of Natural Resources. (2015). North Slope Oil and Gas Activity (May 2015). [Map]. Retrieved from http://dog.dnr.alaska.gov/GIS/ActivityMaps.htm

Alaska Department of Transportation and Public Facilities. (2007). *Centerline Inventory – Routes Highway Data GIS/Mapping Sections* [Data set]. Retrieved March 14, 2014 from http://dnr.alaska.gov/md les/dot_centerline_route.html

Alaska Department of Transportation & Public Facilities. (2010). *Western Alaska Access Planning Study: Corridor Planning Report.* Retrieved from http://dot.alaska.gov/nreg/westernaccess/documents.shtml

Alaska Department of Transportation & Public Facilities. (2011a). *Roads to Resources.* Retrieved from http://www.dot.state.ak.us/roadstoresources/index.shtml

Alaska Department of Transportation & Public Facilities. (2011b). *Roads to Resources: Highlights.* Retrieved from http://dot.alaska.gov/roadstoresources/highlights.shtml - northern

Alaska Department of Transportation & Public Facilities. (2011c). *Kotzebue to Cape Blossom Road Environmental Documentation.* Retrieved from http://dot.alaska.gov/nreg/capeblossomroad/

Alaska National Interest Lands Conservation Act [Public Law 96-487], 16 USC 410hh-3233, 43 USC 1602-1784 (1980).

Alter, E. S., Simmonds, M. P., & Brandon, J. R. (2010). Forecasting the consequences of climate-driven shifts in human behavior on cetaceans. *Marine Policy, 34,* 943-954. doi:10.1016/j.marpol.2010.01.026

Arctic Climate Impact Assessment (2004). *Impacts of a Warming Arctic: Arctic Climate Impact Assessment. ACIA Overview report*. Cambridge: Cambridge University Press.

Associated Press. (2015, September 14). Gas Pipeline is focus of Alaska Special Session. *Fuel Fix*. Retrieved from http://fuelfix.com/blog/2015/09/24/gas-pipeline-is-focus-of-alaska-special-session/

Bailey, A. (2014, January 12). North Slope shale oil: is it an option? *Petroleum News*. Retrieved from http://www.petroleumnews.com/pntruncate/88923947.shtml

Bodony, T. (2015, September 11). New road from Tanana to Yukon River nears completion. *Alaska Public Media*. Retrieved from http://www.alaskapublic.org/2015/09/11/new-road-from-tanana-to-yukon-river-nears-completion/

BP Exploration Alaska. (2011a). Gravel Road Centerline [Unpublished data set].

BP Exploration Alaska. (2011b). Pipeline Corridor [Unpublished data set].

Brinkman, T., Maracle, K. B., Kelly, J., Vandyke, M., Firmin, A., & Springsteen, A. (2014). Impact of fuel costs on high-latitude subsistence activities. *Ecology and Society, 19*(4), 18. http://dx.doi.org/10.5751/ES-06861-190418.

Bureau of Land Management. (2012). *National Petroleum Reserve – Alaska: Final Integrated Activity Plan/Environmental Impact Statement.* Retrieved from https://eplanning.blm.gov/eplfrontoffice/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=14702

Bureau of Land Management. (2013a). Dalton Highway. Retrieved from http://www.blm.gov/ak/st/en/prog/recreation/dalton_hwy.html

Bureau of Land Management. (2013b). What is a Legacy Well? Retrieved from http://www.blm.gov/ak/st/en/prog/energy/oil_gas/npra/legacywell/about_legacywells.html

Bureau of Land Management. (2013c). *2013 NPR-A Lease Sale Tracts* [Data set]. Retrieved March 14, 2014 from http://sdms.ak.blm.gov/sdms/

Bureau of Land Management. (2014). *Draft Supplemental Environmental Impact Statement for the Alpine Satellite Development Plan for the Proposed Greater Mooses Tooth One Development Project*. Retrieved from https://www.blm.gov/epl-frontoce/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=50912

Bureau of Land Management. (2015). *Supplemental Environmental Impact Statement for the Alpine Satellite Development Plan for the Proposed Greater Mooses Tooth One Development Project: Record of Decision, February 2015.* Retrieved from http://www.blm.gov/pgdata/content/ak/en/prog/energy/oil_gas/npra/GMTU_proposed_dev_proj.html

Bureau of Ocean Energy Management. (2012a). *Proposed Final Outer Continental Shelf Oil and Gas Leasing Program 2012-2017*. Retrieved from http://www.boem.gov/uploadedFiles/BOEM/Oil_and_Gas_Energy_Program/Leasing/Five_Year_Program/2012-2017_Five_Year_Program/PFP 12-17.pdf

Bureau of Ocean Energy Management. (2012b). *Outer Continental Shelf Oil and Gas Leasing Program: 2012-2017 Final Programmatic Environmental Impact Statement.* Retrieved from http://www.boem.gov/Oil-and-Gas-Energy-Program/Leasing/Five-Year-Program/2012-2017/Download-PDF-of-Final-Programmatic-EIS.aspx

Cameron, E. S. (2012). Securing Indigenous politics: A critique of the vulnerability and adaptation approach to the human dimensions of climate change in the Canadian Arctic. *Global Environmental Change, 22*, 103-114. doi:10.1016/j.gloenvcha.2011.11.004

Clement, J. P., Bengtson, J. L., & Kelly B. P. (2013). *Managing for the Future in a Rapidly Changing Arctic: A Report to the President.* Retrieved from http://www.doi.gov/news/upload/ArcticReport-03April2013PMsm.pdf

Demarban, A. (2015, September 17). Alaska's Point Thomson on track for first oil early next year. *Alaska Dispatch News*. Retrieved from http://www.adn.com/article/20150917/alaskas-point-thomson-track-first-oil-early-next-year

Dyer, C. L. (1993). Tradition loss as secondary disaster - long-term cultural impacts of the Exxon Valdez oil-spill. *Sociological Spectrum, 13,* 65-88. doi:0.1080/02732173.1993.9982017

Dyer, S. J., O'Neill, J. P. Wasel, S. M., & Boutin, S. (2001). Avoidance of industrial development by woodland caribou. *The Journal of Wildlife Management, 65*, 531-542. doi:10.2307/3803106

Grant, A., & Briggs, A. D. (2002). Toxicity of sediments from around a North Sea oil platform: are metals or hydrocarbons responsible for ecological impacts? *Marine Environmental Research, 53,* 95-116. doi:10.1016/S0141-1136(01)00114-3

Haley, S., Chartier, L., Gray, G., Meek, C., Powell, J., Rosenberg, A. A., & Rosenberg, J. (2011). Strengthening institutions for stakeholder involvement and ecosystem-based management in the US Arctic Offshore. In A. Lovecraft & H. Eicken (Eds.), *North by 2020: Perspectives on Alaska's Changing Social-Ecological Systems* (pp. 457-476). Fairbanks, AK: University of Alaska Press.

Hilcorp Alaska LLC. (2015). *Liberty Development Project Development and Production Plan: Revision 1 (September 8, 2015).* Retrieved from http://www.boem.gov/About-BOEM/BOEM-Regions/Alaska-Region/Leasing-and-Plans/Plans/Liberty.aspx

Holton, G. (2014). *Mapping Alaska's Native Languages.* Retrieved from https://www.uaf.edu/anlc/resources/anlmap/

Hovelsrud, G. K., Poppel, B., Van Oort, B., & Reist, J. D. (2011). Arctic Societies, Cultures, and Peoples in a Changing Cryosphere. *Ambio, 40*, 100-110. doi:10.1007/s13280-011-0219-4.

Jorgenson, M. T., & Joyce, M. R. (1994). Six strategies for rehabilitating land disturbed by oil development in arctic Alaska. *Arctic, 47*, 374-390. Retrieved from http://www.jstor.org/stable/40511599?seq=1 - page_scan_tab_contents

Kruse, J. A. (1991). Alaska Iñupiat subsistence and wage employment patterns - understanding individual choice. *Human Organization*, *50*, 317-326. http://dx.doi.org/10.17730/humo.50.4.c288gt2641286g71

Larsen, J. N., Anisimov, O. A., Constable, A., Hollowed, A. B., Maynard, N., Prestrud, P., … Stone, J. M. R. (2014). Polar regions. In V. R. Barros, C. B. Field, D. J. Dokken, M. D. Mastrandrea, K. J. Mach, T. E. Bilir, …L. L. White (Eds.*), Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 1567-1612). Cambridge: Cambridge University Press.

Liebezeit, J., Kendall, S., Brown, S., Johnson, C., Martin, P., McDonald, T., … Wildman, A. (2009). Influence of human development and predators on nest survival of tundra birds, Arctic Coastal Plain, Alaska. *Ecological Applications*, *19,* 1628-1644. doi:10.1890/08-1661.1

Marion, M. A., Massicotte, M. G., & Duhn, J. L. (2014). Canada's Aging Oil and Gas Infrastructure: Who Will Pay? The Public and Private Cost Recovery Frameworks. *Alberta Law Review, 52,* 331. Retrieved from http://www.albertalawreview.com/index.php/ALR/article/download/4/4

Mikkelsen, A., & Langhelle, O. (Eds.). (2008). *Arctic Oil and Gas: Sustainability at Risk?* New York, NY: Routledge Press.

Millennium Ecosystem Assessment. (2005). *Ecosystems and Human Well-Being: Synthesis.* Retrieved from http://www.millenniumassessment.org/en/Synthesis.html=

Minerals Management Service. (2002). *Liberty Development and Production Plan: Final Environmental Impact Statement.* Retrieved from http://www.boem.gov/About-BOEM/BOEM-Regions/Alaska-Region/Environment/Environmental-Analysis/Liberty-FEIS-Executive-Summary.aspx

Moore, S. E., Reeves, R. R., Southall, B. L., Ragen, T. J., Suydam, R. S., & Clark, C. W. (2012). A new framework for assessing the effects of anthropogenic sound on marine mammals in a rapidly changing arctic. *BioScience, 62*, 289-295. doi:10.1525/bio.2012.62.3.10

Murphy, S. M., & Curatolo, J. A. (1987). Activity budgets and movement rates of caribou encountering pipelines, roads, and traffic in northern Alaska. *Canadian Journal of Zoology, 65,* 2483-2490. doi:10.1139/z87-375

National Research Council. (2003). *Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope.* Washington, DC: The National Academies Press.

Natural Resources Canada. (2002). *Canada Highway* [Data set]. Retrieved from http://www.nrcan.gc.ca/earth-sciences/geography/topographic-information/free-data-geogratis/whats-new/17213

Nellemann, C., & Cameron, R. D. (1998). Cumulative impacts of an evolving oil-field complex on the distribution of calving caribou. *Canadian Journal of Zoology, 76,* 1425-1430. doi:10.1139/z98-078

Nuttall, M. (2010). *Pipeline Dreams: People, Environment, and the Arctic Energy Frontier.* Copenhagen: IWGIA Press.

Office of the Federal Coordinator of the Alaska Natural Gas Transportation Projects. (2013). *A guide to Alaska Natural Gas Projects.* Retrieved from http://www.arlis.org/thepipefiles/Record/1481179

Palinkas, L. A., Downs, M. A., Petterson, J. S., & Russell, J. (1993). Social, cultural, and psychological impacts of the exxon valdez oil-spill. *Human Organization, 52,* 1-13. http://dx.doi.org/10.17730/humo.52.1.162688w475154m34

Protection of the Arctic Marine Environment. (2009). *Arctic Marine Shipping Assessment 2009 Report.* Retrieved from http://www.pame.is/index.php/projects/arctic-marine-shipping/amsa/amsa-2009-report

Raynolds, M. K., Walker, D. A., Ambrosius, K. J., Brown, J., Everett, K. R., Kanevskiy, M., … Webber, P. J. (2014). Cumulative Geoecological Effects of 62 years of Infrastructure and Climate Change in ice-rich Permafrost Landscapes, Prudhoe Bay Oilfield, Alaska. *Global Change Biology, 20,* 1211-1224. doi:10.1111/gcb.12500

Red Dog Mine. (2009). *Red Dog Operations.* Retrieved from http://www.teck.com/operations/united-states/operations/red-dog/

Reeves, R. R., Ljungblad, D. K., & Clarke, J. T. (1984). Bowhead Whales and acoustic seismic surveys in the Beaufort Sea. *Polar Record, 22,* 271-280. http://dx.doi.org/10.1017/S0032247400005398

Shell. (2015). *Shell updates on Alaska Exploration*. Retrieved from http://www.shell.com/global/aboutshell/media/news-and-media-releases/2015/shell-updates-on-alaska-exploration.html

Shepro, C. E., Maas, D. C., Callaway, D. G., McAnich, J., & Bergerson, J. (2010). *North Slope Borough 2010 Economic Profile and Census Report, Volume X*. Barrow, AK: North Slope Borough Department of Administration and Finance.

Sherval, M. (2013). US Arctic's role in future United States Energy Independence. *Polar Geography, 36,* 305-322. doi:10.1080/1088937X.2013.827756.

Smith, L. C., & Stephenson, S. R. (2013). New Trans-Arctic Shipping Routes Navigable by Midcentury. *Proceedings of the National Academy of Sciences, 110,* 1191-1195. doi:10.1073/pnas.1214212110.

Tiger 2000, ESRI, & Tele Atlas. (2006). *U.S. Detailed Streets* [Data set]. Retrieved March 14, 2014 from https://www.census.gov/geo/maps-data/data/tiger.html

US Army Corps of Engineers Alaska District. (2009). *Red Dog Mine Extension Aqqaluk Project: Final Supplemental Environmental Impact Statement: Volume 1.* Retrieved from http://dnr.alaska.gov/mlw/mining/largemine/reddog/pdf/rdseis2009vol1.pdf

US Army Corps of Engineers. (2012a). *Point Thomson Project EIS: Final Environmental Impact Statement*. Retrieved from http://www.pointthomsonprojecteis.com/documents.htm

US Army Corps of Engineers. (2012b). *Department of the Army Permit: Exxon Mobil Corporation and PTE Pipeline LLC.* Retrieved from http://www.poa.usace.army.mil/Portals/34/docs/regulatory/POA20011082M1Permitwithdrawings.pdf.

US Army Corps of Engineers. (2015). *Draft Integrated Feasibility Report, Draft Environmental Assessment (EA), and Draft Finding of No Significant Impact (FONSI): Alaska Deep-Draft Arctic Port System Study.* Retrieved from http://www.poa.usace.army.mil/Portals/34/docs/civilworks/arcticdeepdraft/ADDMainReportwithoutappendixes.pdf

US Army Corps of Engineers & Alaska Department of Transportation & Public Facilities. (2013). *Alaska Deep-Draft Arctic Port System Study*. Retrieved from http://www.dot.state.ak.us/stwddes/desports/arctic.shtml

US Census Bureau. (2013). *Alaska County Selection Map*. [Map]. Retrieved from http://quickfacts.census.gov/qfd/maps/alaska_map.html

US Coast Guard. (2012). *Federal Register: volume 77, number 126*. Retrieved from http://www.gpo.gov/fdsys/pkg/FR-2012-06-29/html/2012-15950.htm.

US Department of the Interior. (2015). Interior department cancels arctic offshore lease sales [Press Release]. Retrieved from https://www.doi.gov/pressreleases/interior-department-cancels-arctic-offshore-lease-sales

US Fish and Wildlife Service. (2008). *Time Line: Establishment and management of the Arctic Refuge*. Retrieved from http://www.fws.gov/refuge/arctic/timeline.html

US Fish and Wildlife Service. (2014). *FWS Special Designation Areas* [Data set]. Retrieved January 15, 2015 from https://www.fws.gov/gis/data/national/

US Geological Survey. (2010). *2010 Updated Assessment of Undiscovered Oil and Gas Resources of the National Petroleum Reserve in Alaska (NPRA).* Retrieved from http://pubs.usgs.gov/fs/2010/3102/

US Geological Survey. (2012). *Assessment of Potential Oil and Gas Resources in Source Rocks of the Alaska North Slope, 2012.* Retrieved from http://energy.usgs.gov

US National Park Service. (2014). *Gates of the Arctic National Park and Preserve, Alaska: Ambler Mining District Project Overview*. Retrieved from http://www.nps.gov/gaar/parkmgmt/ambler-mining-district-background.htm

Walker, D., Webber, P., Binnian, E., Everett, K., Lederer, N., Nordstrand, E., & Walker, M. (1987). Cumulative impacts of oil fields on northern Alaskan landscapes. *Science, 238,* 757-761. doi:10.1126/science.238.4828.757

Wernham, A. (2007). Inupiat health and proposed Alaskan oil development: results of the first integrated Health Impact Assessment/Environmental Impact Statement for proposed oil development on Alaska's North Slope. *EcoHealth, 4,* 500-513. doi:10.1007/s10393-007-0143z

Williams, R., Gero, S., Bejder, L., Calambokidis, K., Kraus, S. D., Lusseau, D., … and Robbins, J. (2011). Underestimating the damage: interpreting cetacean carcass recoveries in the context of the Deepwater Horizon/BP incident. *Conservation Letters, 4,* 228-233. doi:10.1111/j.1755-263X.2011.00168.x

Young, O. R. (2012). Arctic Stewardship: Maintaining Regional Resilience in an Era of Global Change. *Ethics and International Affairs, 26,* 407-420. doi:10.1017/S0892679412000585

Table 3.1 Stakeholders in the US Arctic.

Stakeholder	Description
Tribal Governments and Alaska Native Organizations	Alaska Native interests are represented by: (1) tribal governments that operate within individual communities and regionally, (2) tribally authorized groups, and (3) Alaska Native Corporations established under the Alaska Native Claims Settlement Act
Industrial and Commercial Stakeholders	These include representatives from the following industries: oil and gas, renewable energy, mining, shipping, commercial fisheries, and tourism
State of Alaska	The Alaska Statehood Act of 1958 granted the state approximately 104 million acres of land, ownership of the submerged lands of navigable waterways, and submerged lands up to 3 miles offshore under the Submerged Lands Act
Municipal Governments	These include cities, villages, and boroughs; they represent communities that are usually considered to be remote from large population centers
Conservation Organizations	These include non-governmental conservation and environmental organizations
Federal Government	More than 20 federal agencies play a role in management and research in the US Arctic.

Table 3.2 Predicted social impacts of NPR-A oil and gas development (columns 1-5) (BLM, 2012) and likely resultant health impacts (column 6) (Wernham, 2007).

1. Subsistence	2. Sociocultural	3. Economy	4. Air quality	5. Water quality	6. Likely resultant health impacts
Displacement of hunters away from productive areas	Loss/degradation of traditional subsistence areas	Taxation of oil facilities allows continuing services, balancing declining revenues from other oil development	Episodic localized decreased air quality events near oil development facilities	Small inadvertent discharge: spills, etc.	Increased psychological and social pathology (alcohol and drug abuse, depression, anxiety, child abuse, domestic violence, suicide)
Displacement /dispersion of animals	Fear of contaminants	Native corporations provide dividends to shareholders	Incremental degradation of air quality in/near subsistence camps	Occasional large spills	Increased injury rates
Reduced populations of subsistence species	Subsistence impacts lead to breakdown of kinship/community sharing networks	Increased income from employment			Increased risk of diabetes and related metabolic disorders
	Subsistence impacts lead to difficulty in transmitting cultural axioms to youth	Large loss of revenue sources at conclusion of project			Increased food insecurity
	Increasing economic disparities within villages				Increased pulmonary and cardiovascular disease
	Acculturation from intense exposure to large numbers of transient outside workers				Increased exposure to agents causing malignancies, neurodevelopmental delay, and endocrine disruption
	Alcohol and drug trafficking via new access routes				Increased exposure to pathogens, HIV, and syphilis

Table 3.3 Examples of the benefits and harms to community wellbeing indicated by industrial infrastructure in arctic Alaska in terms of social, environmental, and economic impacts.

	Social	**Environmental**	**Economic**
Benefits	Infrastructure can increase connectedness between communities, if public use is allowed Community ties can be strengthened through processes of informing infrastructure decisions	Development can require ecological assessments that promote conservation in the long-run Renewable energy infrastructure could reduce greenhouse gas emissions, compared to oil industry	Development can create jobs in construction, support, and science; aiding subsistence Production can generate revenue for boroughs and regional native corporations
Harms	Development can bring undesirable people and substances into communities Infrastructure can alter culturally significant landscapes and be a reminder of colonialism	Infrastructure can fragment ecosystems and generate pollution, disrupting subsistence species The production of oil and gas contributes to global greenhouse gas emissions and climate change	Revenue from production can create dependency on non-renewable resources Participation in industry can create new economic class stratifications within communities

Table 3.4 Existing oil and gas activities in the Central North Slope and State waters sub-region.

Year(s)	Event
1963-67	First drilling of exploration wells by private companies [a]
1964	First State of Alaska lease sale [a]
1968	Discovery of Prudhoe Bay field, the largest in North America [a]
1977	Trans-Alaska Pipeline System operational [a], Beginning of production from Prudhoe Bay field (Prudhoe Bay Unit) [a]
1979	Initial leasing of Beaufort Sea state waters [a]
1981	Beginning of production from Lisburne field (Prudhoe Bay Unit) and Kuparuk field (Kuparuk River Unit) [a]
1985	Beginning of production from Milne Point field (Milne Point Unit) [a]
1987	Beginning of production from Endicott field (Duck Island Unit) [a]
1989	Beginning of production from Sag Delta North field (Duck Island Unit) [a]
1991	Beginning of production from Schrader Bluff field (Milne Point Unit) [a]
1993	Beginning of production from North Prudhoe Bay field and Pt. McIntyre field (Prudhoe Bay Unit) [a]
1994	Beginning of production from Niakuk field and West Beach field (Prudhoe Bay Unit) and Sag River field (Milne Point Unit) [a]
1996	Beginning of production from Cascade field (Milne Point Unit) [a]
1998	Beginning of production from Eider field (Duck Island Unit), Tabasco field, Tarn field, and West Sak field (Kuparuk River Unit), and Badami field (Badami Unit) [a]
1999	Beginning of production from Midnight Sun field (Prudhoe Bay Unit) [a]
2000	Beginning of production from Alpine field: CD-1 and CD-2 pads (Colville River Unit) [a]
2001	Beginning of production from Northstar field (Northstar Unit), Aurora field, Borealis field, and Polaris field (Prudhoe Bay Unit), and Meltwater field (Kuparuk River Unit) [a]
2002	Beginning of production from Palm field (Kuparuk River Unit) [a]
2003	Beginning of production from Orion field (Prudhoe Bay Unit) and Ugnu field (Milne Point Unit) [a]
2005	Beginning of production from Raven field (Prudhoe Bay Unit) [a], 3-D seismic survey in Harrison Bay (Beaufort Sea) [b]
2006	Beginning of production from Fiord: CD-3 pad and Nanuq: CD-4 pad (Colville River Unit) [a]
2008	3-D seismic survey in Smith Bay (Beaufort Sea) [c], Beginning of production from Kaparuk field (Oooguruk Unit) [d]
2010	Beginning of production from Nuiqsut field (Ooogurk Unit) [e]
2011	Beginning of production from Schrader Bluff field (Nikaitchuq Unit) [f]
2012	Drilling of two exploration wells for shale oil along Dalton Highway (south of existing Units) and additional shale tests near Umiat and the southeast border of NPR-A [g]
Sources: [a](BLM, 2012); [b](ADNR, 2006); [c](ADNR, 2008a); [d](ADNR, 2008b); [e](ADNR, 2011a); [f](ADNR, 2011b); [g](ADNR, 2012a)	

Table 3.5 Existing Central North Slope and state waters oil and gas infrastructure in 2011.

Type	**Amount**
Gravel road and causeway	423 miles/3,100 acres [a]
Other travel ways (peat roads, tractor trail/tundra scar, and exploration road)	189 miles [a]
Dalton Highway (North Slope portion only)	170 miles/332 acres [b]
Facilities (production, processing, support, and exploration)	400 facility pads/5,793 acres [a]
Airstrips	13 airstrip pads/358 acres [a]
Gravel offshore islands	20 offshore island pads/202 acres [a]
Gravel mines in rivers	5,385 acres [a]
Gravel mines in tundra	1,378 acres [a]
Pipeline corridors (in-field)	491 miles [a]
Trans-Alaska Pipeline (North Slope portion only)	166 miles [b]
Culverts	2037 [a]
Bridges	27 [a]
Active Landfills	1 [a]
Power transmission lines	336 miles [a]
Total directly disturbed ground	18,357 acres [a]
Sources: [a](Raynolds et al. 2014); [b](NRC 2003)	

Table 3.6 Planned Point Thomson infrastructure as of 2012.

Type	Amount
Gravel pads	55.3 acre Central Pad [a 1] 20.9 acre East Pad [a] 20.6 acre West Pad [a] 6.81 acres of additional pads [a 2]
Airstrip and helipad	42.3 acres [a]
Gravel roads	10.1 miles [a]
Pipelines	12-inch export pipeline: 23 miles [b] 8-inch infield gathering pipelines: 10 miles [b] Vertical support members for pipelines: .13 acres [a]
Gravel mine	48.9 acres infield gravel mine [a] yielding 2.2 million cubic yards of gravel [b]
Other infrastructure	Pier: 120 feet by 30 feet, 5 mooring dolphins, and 1,500 cubic yards of dredging [b] Dredged material deposit: 1.4 acres [a] Emergency boat launch: .05 acres [a] Wildlife corridor: .25 acres [a] Electrical trenching: .41 acres [a] Culvert scour protection: .09 acres [a] Gravel stockpile: 5.2 acres [a]
Development phase operations and seasonal infrastructure	11,000 vehicle trips, including 300 barge trips [b] 129 miles of seasonal ice road for pipeline construction, equipment transport, and supplies (up to 3 years) [b] 23 miles of seasonal infield ice roads throughout production phase [b]
Sources: [a](USACE, 2012b); [b](USACE, 2012a)	
[1]This number includes 12.9 acres of existing pad (PTU-3) [2]This number includes 4.1 acres of existing pad (Alaska C-1 pad)	

Table 3.7 Planned infrastructure and operations in the Central North Slope and State waters as of 2013.

Infrastructure	Location	Activity phase
22 wells	Mustang field (South Miluveach Unit)	Development, expect to begin production in late 2014
24 wells and pad, access road, gravel mine, pipelines, power lines	Shark Tooth field (Kupaurk River Unit)	Development, expect to begin production in late 2015
2 wells	Qugruk field (east of Colville River Unit)	Exploration
1 well	Southeast of Kuparuk River Unit	Exploration
3-D seismic survey of shale formations (mileage unknown)	Along Dalton highway, south of existing Units	Exploration
293 square miles of 3-D seismic survey	Schrader Bluff, south of Kupaurk River Unit	Exploration
280 square miles of 3-D seismic survey	Southeast of Badami Unit and south of Point Thomson Unit	Exploration
Up to 8 wells in 2014-2015 and surveys (mileage unknown)	Smith Bay in state waters offshore of NPR-A	Exploration

Table 3.8 Recent proposed projects for commercializing North Slope natural gas.

Main concept	**Infrastructure and operations**	**Project status**
Pipe gas to Nikiski, Alaska where it would be processed for sale to Asian markets via shipping	800 mile long pipeline, mostly buried, paralleling TAPS from Prudhoe Bay to Fairbanks, then cutting south to Nikiski on the Kenai Peninsula, a processing plant	Being assessed for feasibility
Pipe gas to Alberta, Canada where it would enter an existing pipeline system for sale to US markets	1,700 mile long pipeline, buried, paralleling TAPS from Prudhoe Bay to Delta Junction (southeast of Fairbanks) and then cutting southeast to Alberta	On hold
Pipe gas to southcentral Alaska where it would be processed and sold to the Alaskan market	737 mile long pipeline, buried, paralleling TAPS from Prudhoe Bay to the Big Lakes area (north of Anchorage), a processing plant	Being actively pursued
Truck gas to Fairbanks, Alaska where it would be sold to markets in the state's interior	A processing plant on the North Slope, storage tanks in Fairbanks, and a fleet of trucks operating continuously along the Dalton Highway	Being actively pursued

Table 3.9 Existing oil and gas activities in NPR-A.

Year	Event
1950	Beginning of production from South Barrow field (non-export) [a]
1976	Naval Petroleum Reserve No. 4 becomes NPR-A managed by BLM, USGS launches major exploration efforts in NPR-A [a]
1981	Beginning of production from East Barrow field (non-export) [a]
1982	Beginning of leasing in NPR-A [a]
1985	First industry exploration well drilled in NPR-A [a]
1993	Beginning of production from Walakpa field (non-export) [a]
2008	Formation of first federal oil and gas Unit (Greater Mooses Tooth) in NPR-A [b], first discoveries and wells drilled in Greater Mooses Tooth Unit [c], continued seismic survey activities around Umiat on southeast border of NPR-A [b]
2009	Formation of Bear Tooth Unit in NPR-A (adjacent to Greater Mooses Tooth Unit) [d]
2010	USGS finishes an updated assessment of oil and gas reserves in NPR-A [e]
2012	Completion of most recent NPR-A comprehensive management plan and EIS
2013	First discoveries and wells drilled in Bear Tooth Unit [f]
2015	Record of Decision authorizing development of Greater Mooses Tooth One project (first potential production of oil from federal land in NPR-A)[g]
Sources:[a](BLM, 2012); [b](ADNR, 2008a); [c](ADNR, 2009a); [d](ADNR, 2009b); [e](USGS, 2010); [f](ADNR, 2013a); [g](BLM, 2015)	

Table 3.10 Proposed infrastructure and operations supporting oil and gas production in NPR-A.

Type	**Amount**[1]
Wells (oil and gas exploration)	152 wells/912 acres (short term)[2]
Central processing facilities	8 /320 acres (long term)
Gravel production pads (oil and gas)	82/580 acres (long term)
Wells (oil and gas production)	705 wells (no additional acreage)
In-field gravel roads	566 miles/4,245 acres (long term)
Gravel runways	27/297 acres (long term)
Pipelines	1,520 miles/8002 acres (short term), 1,653 acres (long term)
Pump stations and staging bases	5 /160 acres (long term)
Gravel pits	≤ 31/1,125 acres (long term)
Ice roads/snow packed trails	59,342 miles/249,246 acres (short term)
Ice air strips	65/715 acres (short term)
Surveying (2-D and 3-D) and camp train	61,093 miles/581,397 acres (short term)
Total short term disturbed land area	846,661 acres[3]
Total long term disturbed land area	8,402 acres

[1]Data from (BLM 2012)
[2]BLM (2012), explains, "Short-term activities are commonly associated with the footprint during winter exploration or construction, while the long-term acreage figures reflect the gravel footprint of the development" (p. 71).
[3]Combined total of seismic surveying and exploration from (BLM, 2012)

Table 3.11 Existing oil and gas activities in the Chukchi Sea OCS.

Year(s)	Event
1989-1991	First five exploration wells drilled [a]
2008	Lease sale 193 (most recent lease sale)
2012	BOEM completes most recent five year plan covering 2012-2017 [a], Drilling of top hole at Burger-A prospect [b]
2016	Next potential lease sale [c]
Sources: [a](BOEM, 2012a);[b](ADNR, 2012b); [c](ADNR, 2013b)	

Table 3.12 Proposed infrastructure and operations supporting oil and gas production in the Chukchi Sea OCS.

Type	**Amount**[1]
Production platforms	3-16 structures
Exploration wells	12-54
Production wells	234-1,115
New offshore pipeline	150-1,000 miles
New onshore pipeline	250-500 miles
New waste facilities	2-4
New gas processing facilities	2-4
Dock/causeways	2-4
Vessel trips per week (service and helicopter)	6-96
Total offshore bottom area disturbed	10-60 acres (platform footprint), 518-3,459 (pipeline construction)
Total terrestrial area disturbed	4,510-9,019 acres (pipeline construction)
[1]All data from BOEM (2012b)	

Table 3.13 Existing oil and gas activities in the Beaufort Sea OCS.

Year	Event
1979	Initial leasing of Beaufort Sea OCS federal waters [a]
1981	First exploration well drilled [a]
2007	Lease sale 202 (most recent lease sale)
2008	Seismic survey in Beaufort Sea OCS, including around Liberty Unit [b]
2012	BOEM completes most recent five year plan, covering 2012-2017, drilling of top hole for well at Sivulliq prospect (north of Point Thomson Unit) [c]
2017	Next potential lease sale [d]
Sources: [a](BOEM, 2012a); [b](ADNR, 2008b); [c](ADNR, 2012b); [d](ADNR, 2013b)	

Table 3.14 Proposed infrastructure and operations supporting oil and gas production in the Beaufort Sea OCS.

Type	**Amount**[1]
Production platforms	2-10 structures
Exploration wells	12-40
Production wells	110-335
New offshore pipeline	50-423 miles
New onshore pipeline	40-290 miles
New waste facilities	2-4
New gas processing facilities	2-4
Dock/causeways	2-4
Vessel trips per week (service and helicopter)	4-60
Total offshore bottom area disturbed	7.4-37 acres (platform footprint), 173-1,470 (pipeline construction)
Total terrestrial area disturbed	717-4,510 acres (pipeline construction)
[1]All data from (BOEM, 2012b)	

Table 3.15 Existing commercial transportation activities in Northwest Coastal and Interior Alaska.

Year	Event
1974	Completion of Dalton Highway [a]
1989	Beginning of operations at Red Dog mine main pit [b]
2011	Beginning of EIS for Roads to Resources Initiative [c] (suspended in 2013 because of changes made to project proposals) [d]
2012	Red Dog mine ends main pit production and begins production at Aqqaluk pit [b]
2013	Release of first year report for current assessment of deep draft port locations [e]
Sources: [a](BLM, 2013a); [b](Red Dog Mine, 2009); [c](ADNR, 2011c); [d](ADNR, 2013b); [e](USACE & ADOT&PF, 2013)	

Table 3.16 Existing commercial transportation infrastructure and operations in Northwest Coastal and Interior Alaska.

Type	Amount
Dalton Highway (south of North Slope)	244 miles[1]
TAPS (south of North Slope to end of Dalton Highway)	244 miles[2]
Roads around Nome [a]	72 miles: Teller Highway 86 miles: Kougarok Road 72 miles: Nome-Council Road
Red Dog mine [b 3]	1,531 acres disturbed (open-pits, waste areas, support facilities) 52 miles/616 acres disturbed: DMTS road and port 406.5 additional acres disturbed by Aqqaluk extension preferred alternative 48.9 vehicle trips per day on DMTS 27 ore carriers per year anchor in deep water offshore of the port 327 round trips for barges and tugs per year to load ore carriers 12 barges per year to supply mine Up to 11 fixed wing flights per week (between mine and other Alaska locations)
Marine vessel trips of non-fishing vessels over 100 feet [c]	602 in 2009 986 in 2010 678 in 2011
Bering Strait transits of all vessel types [c]	>400 per year
[1]This number was calculated by subtracting the number of miles on the North Slope presented by NRC (2003) from the total length of the Dalton Highway as reported by BLM (2013a). [2]This is a very rough estimate made by this report based on the fact that TAPS runs roughly parallel to the Dalton Highway in this sub-region. [3]Estimates by USACE (2009) use data from 2006 (acres), 2003 (DMTS road trips), 2005 (marine vessel trips) and 2008 (fixed wing trips).	
Sources: [a](ADFG, 2014); [b](USACE, 2009); [c](USACE & ADOT&PF, 2013)	

Table 3.17 Proposed projects of the Roads to Resources Initiative.

Name	**Description**	**Estimated road length**
Road to Nome (proposed expansion of the planned Road to Tanana)	"Overland access from Interior Alaska to the Seward Peninsula has long been a key element of Alaska's transportation planning … to address national security, for economic development, and to improve community access to goods and services." [a]	500 miles [a]
Foothills West Transportation Access[1]	"This project will provide access to known gas and oil reserves on the north side of the Brooks Range, about 100 miles west of the Dalton Highway, [around Umiat]." [b]	100 miles [b]
Ambler Mining District Access	"This project is to provide an all-season transportation access road to promote exploration, development, and production of known mineral resources in the Ambler mineral belt." [b]	200 miles [c]
[1] This project would likely fall in the Central North Slope and State waters sub-region, however, it is presented here in order to keep all the R2R projects in the same section.		
Sources: [a](ADOT&PF, 2010); [b](ADOT&PF, 2011b); [c](US National Park Service [USNPS], 2014)		

Table 3.18 Synthesis of existing, planned, and proposed infrastructure for the US Arctic and each sub-region.

Entire Region							
	Existing Infrastructure		Planned Infrastructure		Proposed Infrastructure		Comments
The US Arctic	Structures	460	Structures	7	Structures	349	Acres of temporarily disturbed land and sea (from industrial activities such as oil and gas exploration) are not represented in this table.
	Wells	6,215	Wells	57	Wells	2,401	
	Roads	1,138 miles	Roads	21 miles	Roads	1,365 miles	
	Pipeline	901 miles	Pipeline	33 miles	Pipeline	3,733 miles	
	Footprint	18,454 acres	Footprint	202 acres	Footprint	8,499 acres	
Sub-regions							
Central North Slope and State waters	Structures	460 [a]	Structures	7 [b c]	Structures	-	These numbers do not include the proposed gas pipeline (ranging from 737 miles to 1,700 miles, but not all in this sub-region) or the proposed shale developments. The State of Alaska does not provide comprehensive projection of additional infrastructure for incremental expansion within existing Units or new development from current leases.
	Wells	6,046 [e]	Wells	57 [c]	Wells	-	
	Road	612 miles [a]	Road	10 miles [b]	Road	-	
	Pipeline	657 miles [a] (pipeline corridor)	Pipeline	33 miles [b]	Pipeline	-	
	Footprint	15,900 acres (this is a projection for 2012 from [d])	Footprint	202 acres [b]	Footprint	-	
NPR-A	Structures	-	Structures	-	Structures	122 [d]	These numbers only include production from within NPR-A and do not include estimates for infrastructure supporting proposed OCS production from federal offshore waters.
	Wells	122 [e]	Wells	-	Wells	857 [d]	
	Road	-	Road	-	Road	566 miles [d]	
	Pipeline	-	Pipeline	-	Pipeline	1,520 miles [d]	
	Footprint	-	Footprint	-	Footprint	8,402 acres [d]	
Chukchi Sea OCS	Structures	-	Structures	-	Structures	28 [f]	These numbers do not include a road that could run parallel to the proposed onshore pipeline that would cross NPR-A to connect proposed offshore infrastructure to existing onshore infrastructure (BLM, 2012).
	Wells	5 [g] (does not include top hole drilled in 2012 [h])	Wells	-	Wells	1,169 [f]	
	Road	-	Road	-	Road	-	
	Pipeline	-	Pipeline	-	Pipeline	1,500 miles [f]	
	Footprint	-	Footprint	-	Footprint	60 acres [f]	
Beaufort Sea OCS	Structures	-	Structures	-	Structures	22 [f]	These numbers assume that any infrastructure from the proposed Liberty project is included in the estimates from BOEM (2012b).
	Wells	30 [g] (does not include top hole drilled in 2012 [h])	Wells	-	Wells	375 [f]	
	Road	-	Road	-	Road	-	
	Pipeline	-	Pipeline	-	Pipeline	713 miles [f]	
	Footprint	-	Footprint	-	Footprint	37 acres [f]	
ANWR	Structures	-	Structures	-	Structures	-	Oil and gas activities and commercial transportation are not permitted in ANWR.
	Wells	1 [i]	Wells	-	Wells	-	
	Road	-	Road	-	Road	-	
	Pipeline	-	Pipeline	-	Pipeline	-	
	Footprint	-	Footprint	-	Footprint	-	
Northwest Coastal and Interior Alaska	Structures	-	Structures	-	Structures	-	These numbers do not include the acres impacted by the proposed deep-draft port.
	Wells	11 [e]	Wells	-	Wells	-	
	Road	526 miles (see table 9.2 for references)	Road	11 miles [j]	Road	800 miles (see table 9.3 for references)	
	Pipeline	244 miles (see table 9.2 for references)	Pipeline	-	Pipeline	-	
	Footprint	2,554 acres (includes Red Dog mine open pits [k])	Footprint	-	Footprint	-	

Sources: [a](Raynolds et al., 2014); [b](USACE, 2012b); [c](ADNR, 2013b); [d](BLM, 2012); [e](ADA, 2013); [f](BOEM, 2012b); [g](BOEM, 2012a); [h](ADNR, 2012b); [i](ADNR, 2009c); [j](ADNR, 2013d); [k](USACE, 2009)

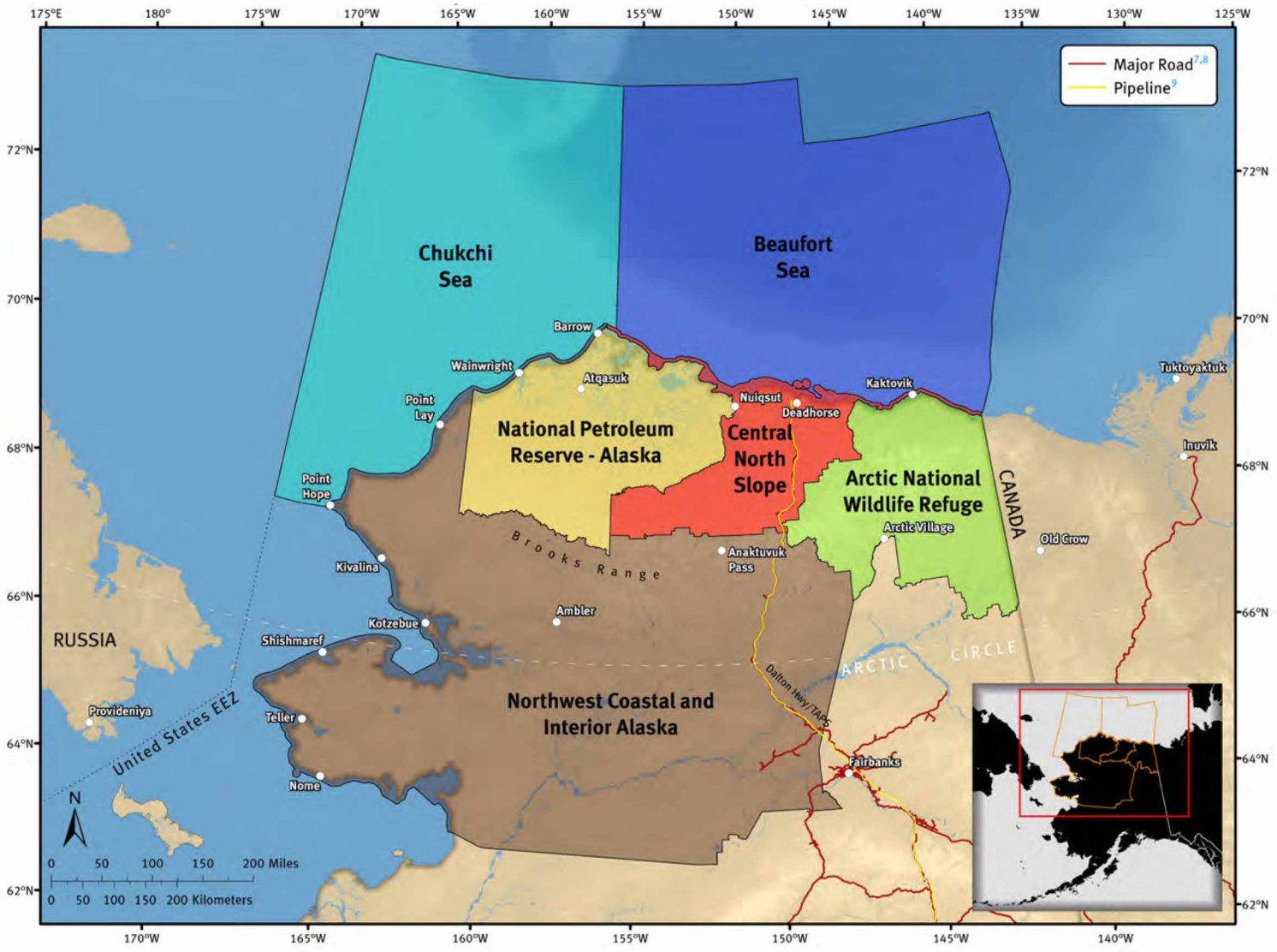

Figure 3.1 Sub-Regions of the US Arctic. Sources: ADNR, 1995; ADOT&PF, 2007; Natural Resources Canada [NRC], 2002.

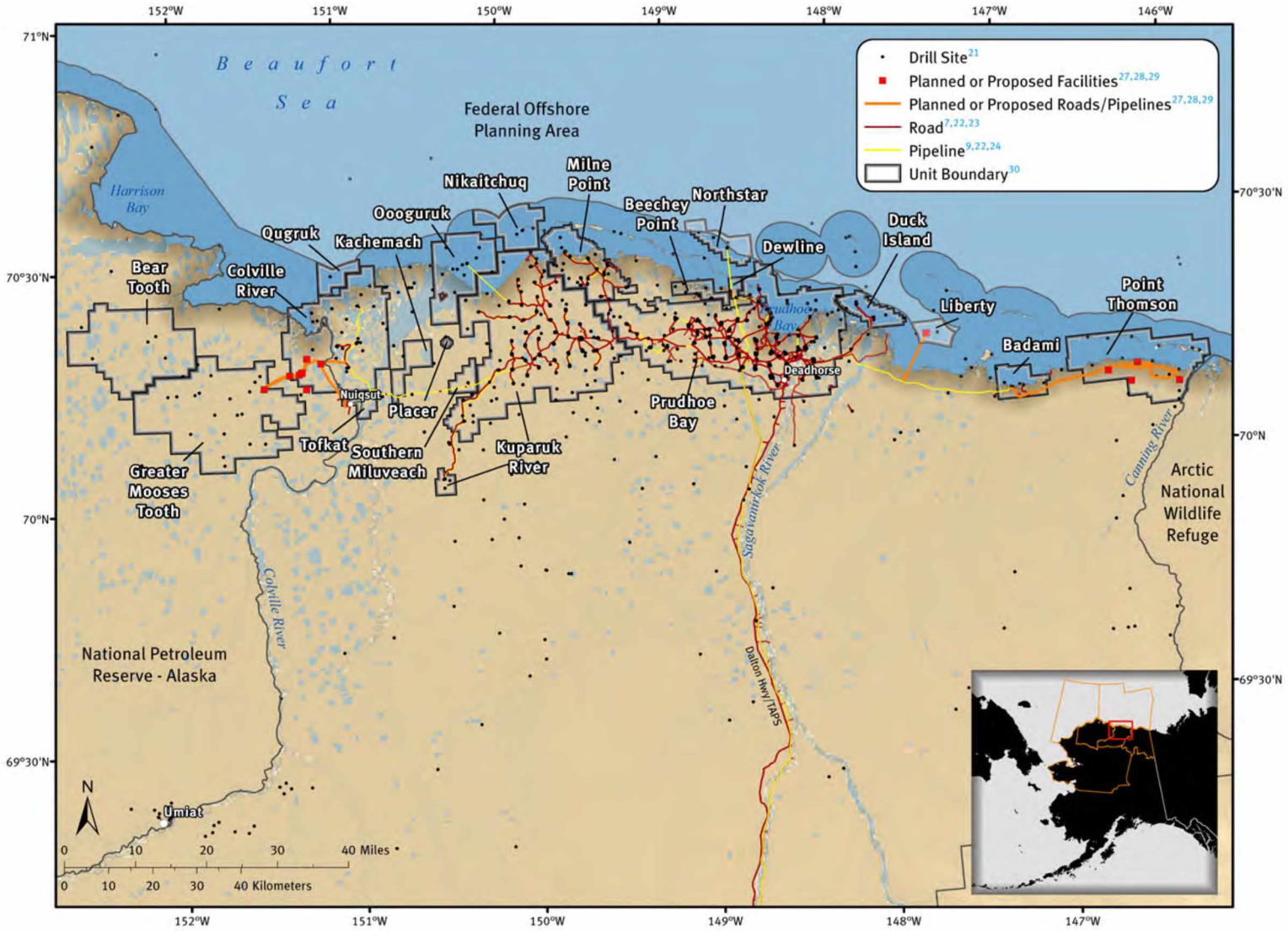

Figure 3.2 North Slope oil and gas units and infrastructure. Sources: Alaska Center for the Environment & Audubon Alaska [ACE & AA], 2010; Alaska Department of Administration [ADA], 2013; ADNR, 2014c; ADOT&PF, 2007; BP Exploration Alaska [BPXA], 2011a, 2011b; BLM, 2014; MMS, 2002; USACE, 2012a.

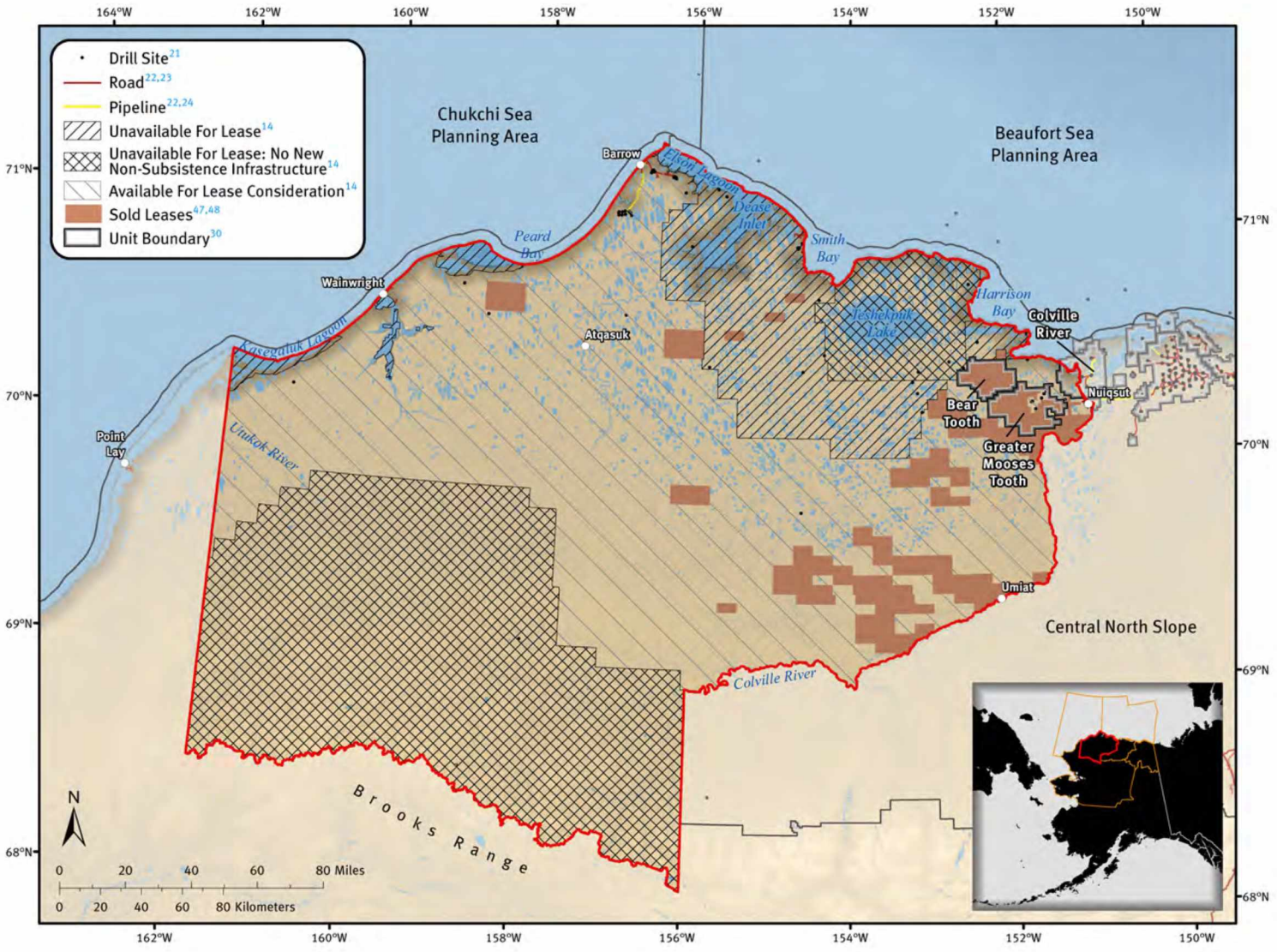

Figure 3.3 National Petroleum Reserve – Alaska Sources: ACE & AA, 2010; ACE, ADNR, BLM, & BOEM, 2013; ADA, 2013; ADNR, 2014c, BPXA, 2011a, 2011b; BLM, 2012, 2013c.

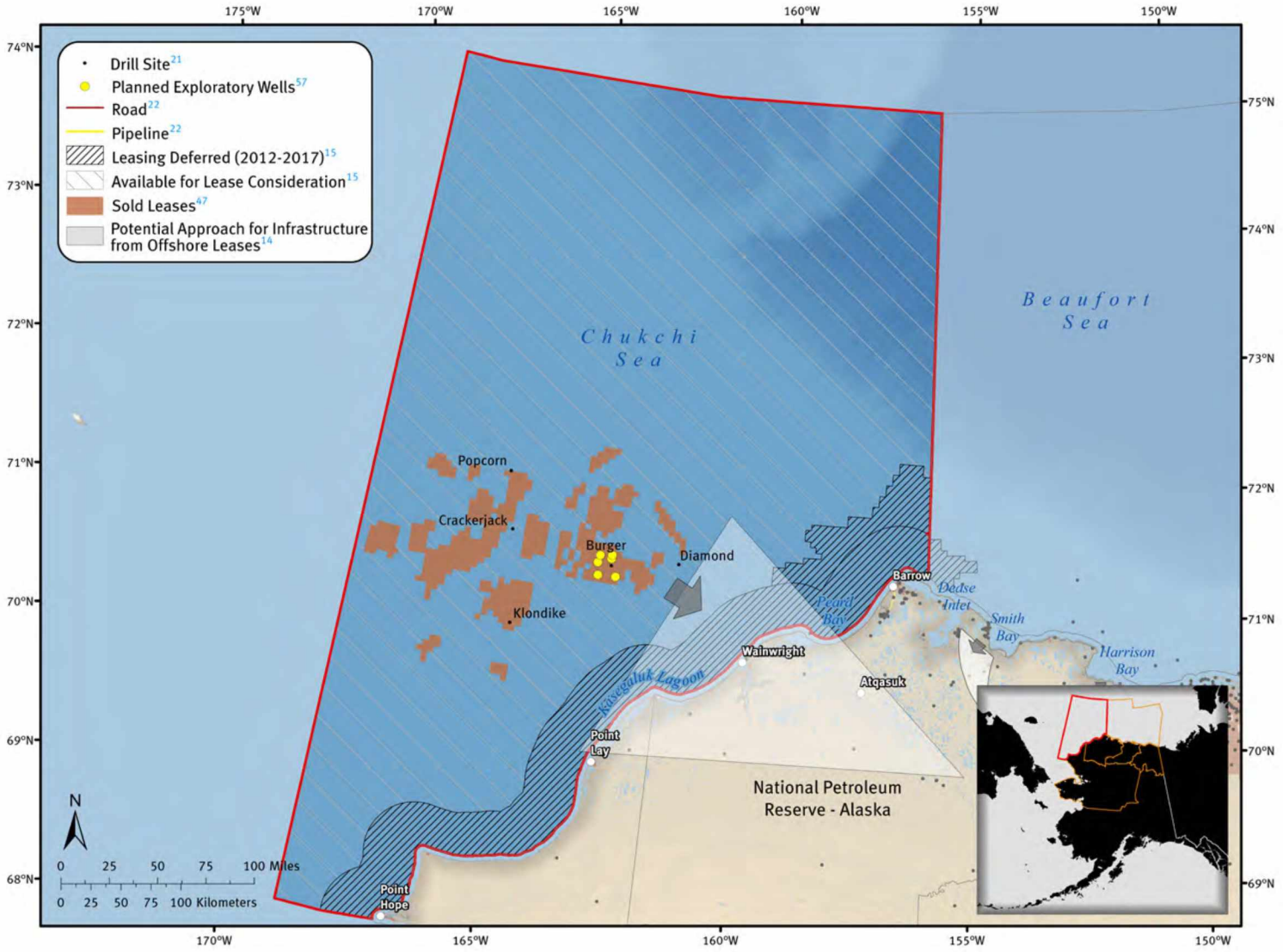

Figure 3.4 Chukchi Sea Outer Continental Shelf oil and gas planning area. Sources: ACE & AA, 2010; ACE, ADNR, BLM, & BOEM, 2013; ADA, 2013; BOEM, 2012a; BLM, 2012; US Coast Guard [USCG], 2012.

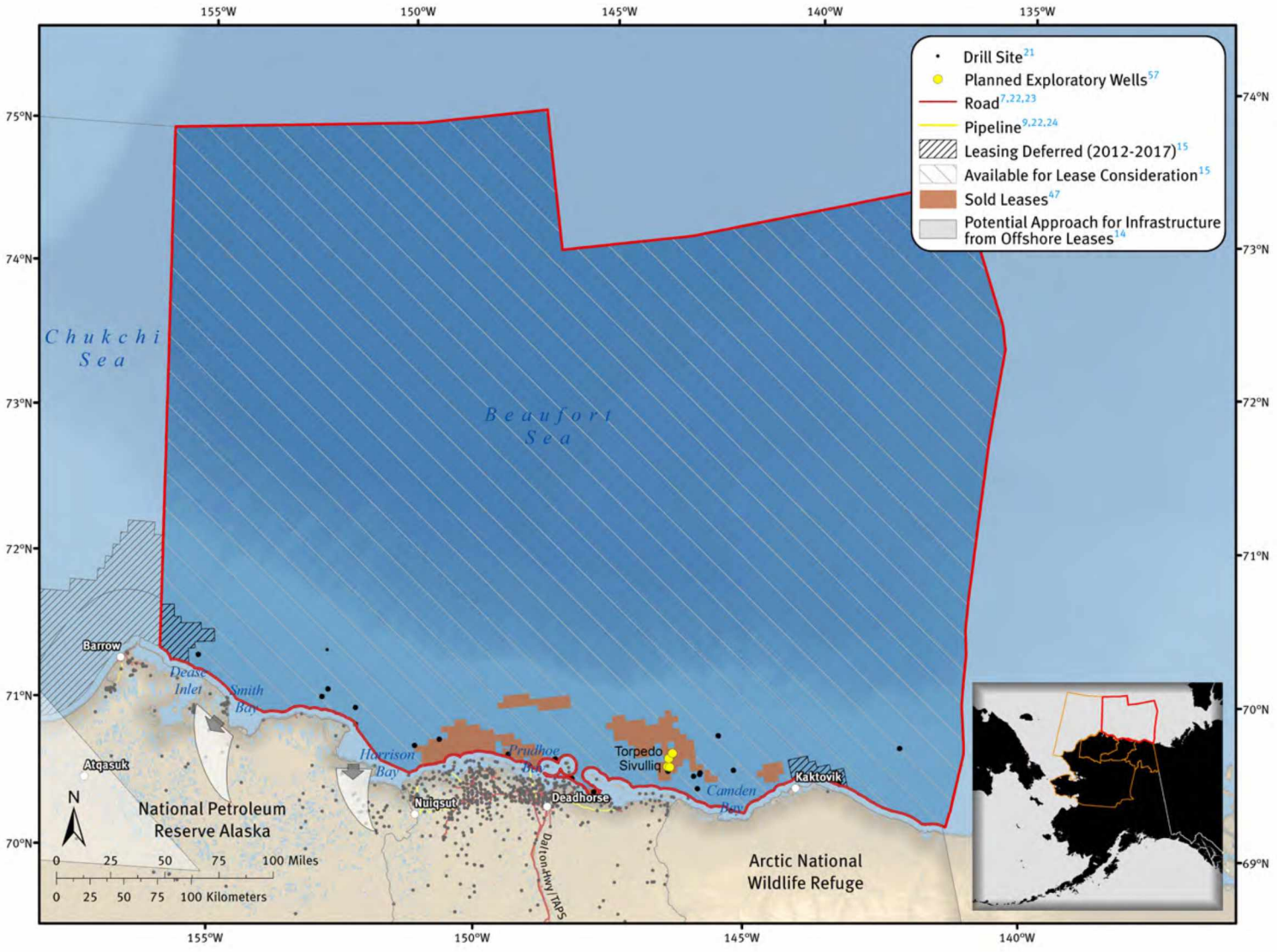

Figure 3.5 Beaufort Sea Outer Continental Shelf oil and gas planning area. Sources: ACE & AA, 2010; ACE, ADNR, BLM, & BOEM, 2013; ADA, 2013; ADNR, 1995; ADOT&PF, 2007; BLM, 2012; BOEM, 2012a; BPXA, 2011a, 2011b; USCG, 2012.

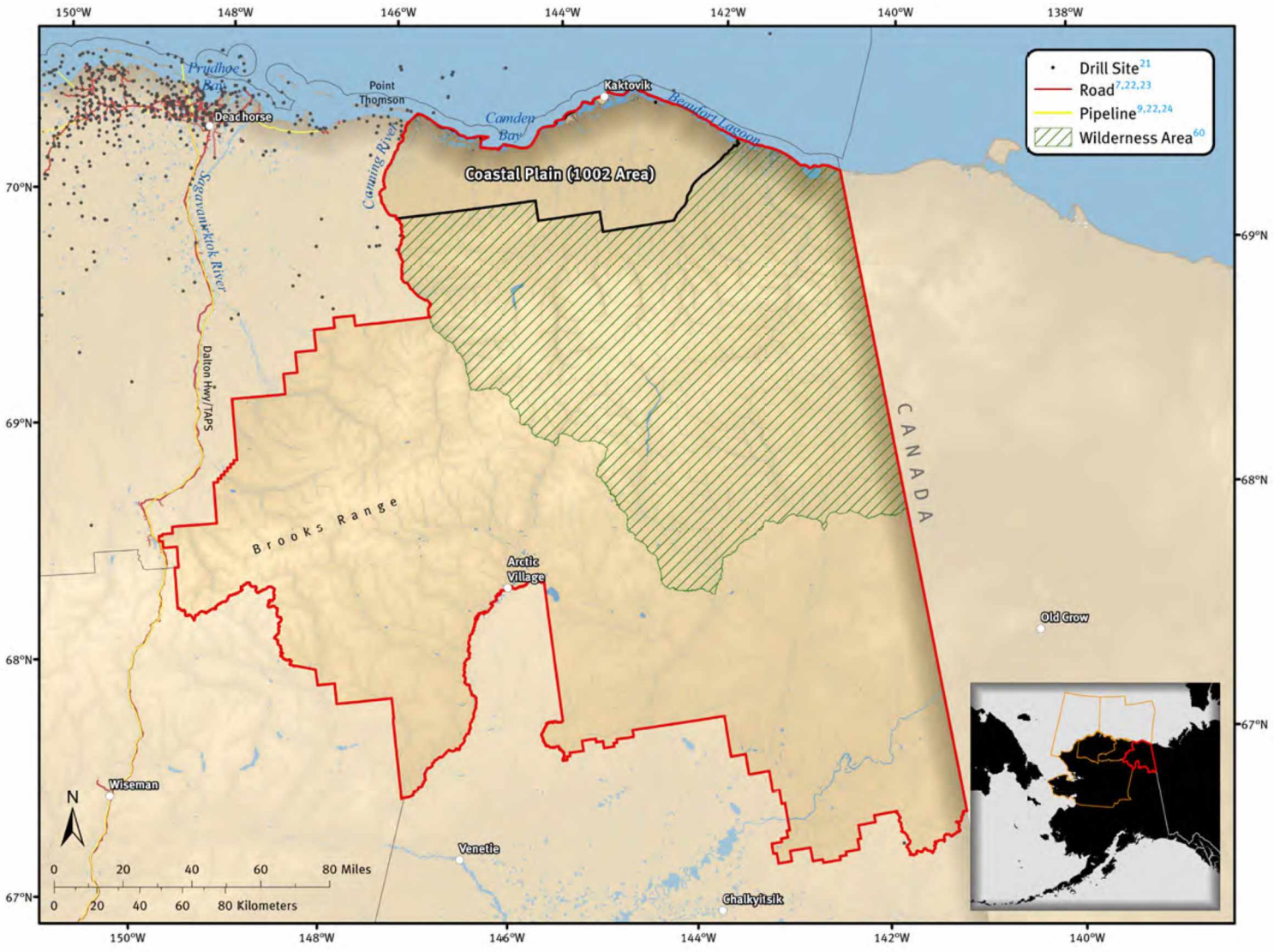

Figure 3.6 Arctic National Wildlife Refuge. Sources: ACE & AA, 2010; ADA, 2013; ADNR, 1995; ADOT&PF, 2007; BPXA, 2011a, 2011b; USFWS, 2014.

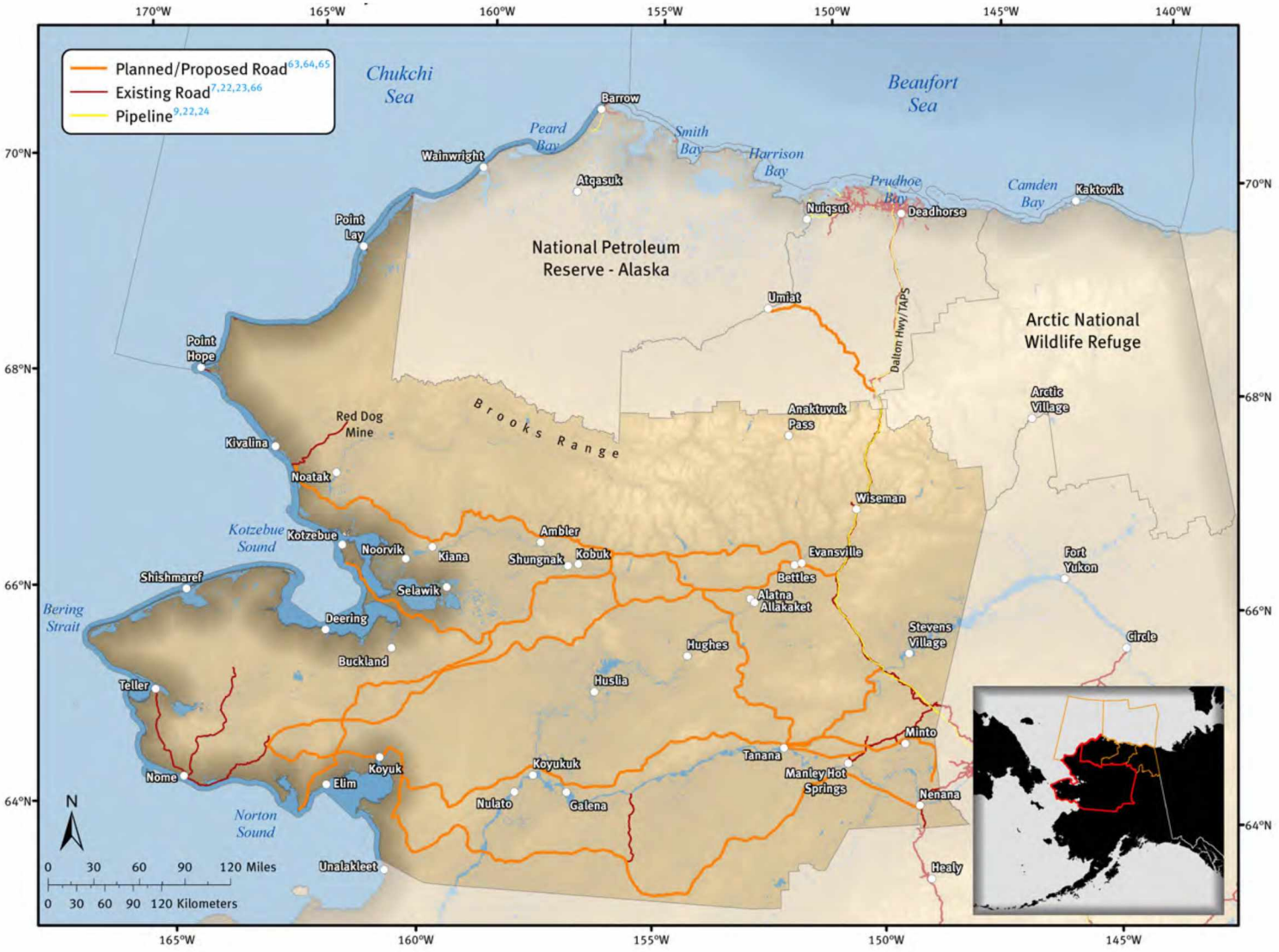

Figure 3.7 Northwest Coastal and Interior Alaska. Sources: ACE & AA, 2010; ADNR, 1995; ADOT&PF, 2007, 2010, 2011a; BPXA, 2011a, 2011b; Tiger 2000, ESRI, & Tele Atla, 2006.

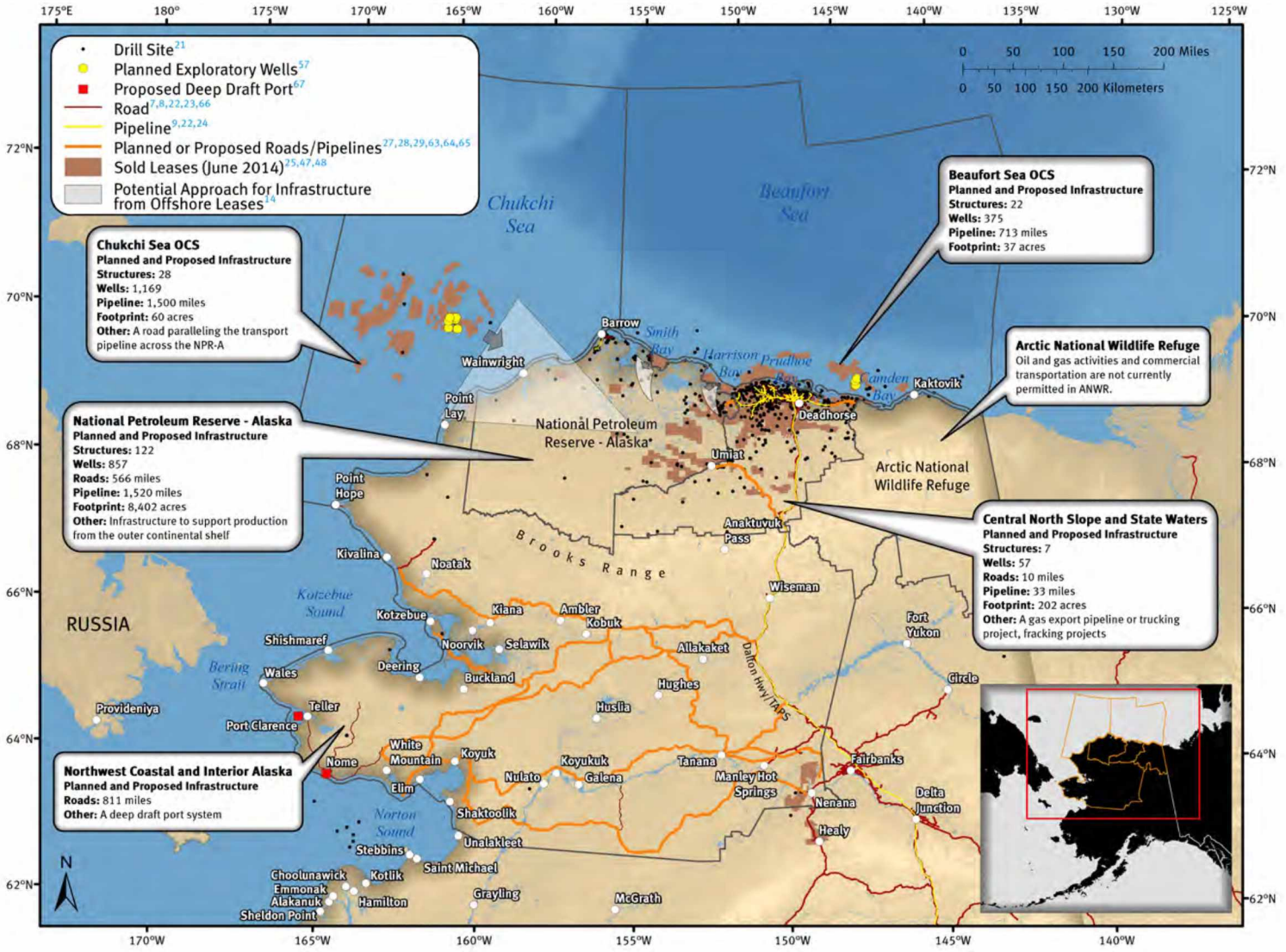

Figure 3.8 Sources: Existing, planned, and proposed infrastructure supporting oil and gas activities and commercial transportation in the US Arctic. Sources: ACE & AA, 2010; ACE, ADNR, BLM, & BOEM, 2013; ADA, 2013; ADNR, 1995, 2014a; ADOT&PF, 2007, 2010, 2011a; BPXA, 2011a, 2011b; BLM, 2012, 2013c, 2014; NRC, 2002; MMS, 2002; Tiger 2000, ESRI, & Tele Atlas, 2006; USACE, 2012a; USACE & ADOT&PF, 2013; USCG, 2012.

CHAPTER 4: RELEVANCE OF A PARTICULARLY SENSITIVE SEA AREA TO THE BERING STRAIT REGION: A POLICY ANALYSIS USING RESILIENCE-BASED GOVERNANCE PRINCIPLES[1]

Abstract: The Bering Strait, separating the North American and Asian continents, is a productive social-ecological marine system that is vulnerable to increasing maritime traffic. In other parts of the world, the International Maritime Organization, an agency of the United Nations, has designated similar marine systems as a Particularly Sensitive Sea Area (PSSA) in efforts to protect vulnerable resources from international shipping. We present information about the 14 existing PSSAs around the world and the political process by which designation is achieved. We examine specific characteristics of the Bering Strait system that are relevant to a PSSA application; including vulnerable resources – marine mammals and their contribution to the food and cultural security of Indigenous communities – threats to these resources from shipping activities, and the viable mitigation options to reduce these threats. We then use five criteria derived from empirical research on resilience-based governance to analyze if a PSSA designation would promote resilience of marine mammal populations and Indigenous communities to increased maritime activities. Despite the elusiveness of a definitive answer, we conclude that while the designation is not a perfect fit from a theoretical standpoint, it still holds the potential to benefit the resilience of marine mammals and Indigenous communities. We finish by identifying critical challenges and tradeoffs that practitioners would need to negotiate when attempting to apply theoretical governance-principles via real-world policy tools.

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[1] Hillmer-Pegram, K., & Robards, M. D. (2015). Relevance of a Particularly Sensitive Sea Area to the Bering Strait Region: a Policy Analysis Using Resilience-Based Governance Principles. *Ecology and Society, 20*(1), 26-36. doi:10.5751/ES-07081-200126

Keyword: *Arctic, ecosystem services, Indigenous, international shipping, law, marine protected area, praxis, transboundary, whale*

4.1 Introduction

Experts from multiple fields of the social and natural sciences have proposed frameworks and principles for steering human-environment interactions in directions that promote their long term health and sustainability; through management approaches that account for both the environmental and social dimensions of a given system. Prominent examples include: principles of ecosystem stewardship (Chapin et al. 2009); ecosystem-based management (McLeod and Leslie 2009); integrated management (Sorensen 1997); adaptive management (Lee 1999); adaptive co-management (Armitage et al. 2007); design principles for sustainable management of common-pool resources (Ostrom 1990); and resilience-based governance (Garmestani and Benson 2013).

However, there is a practical need to move beyond academic explorations of what good governance may theoretically look like, and better understand the process of implementing broad-scale practices that support resilient human-environment interactions. Scholars have begun unraveling this component of the policy process by offering critiques of resilience-based governance research and the resultant frameworks it calls for. Legal scholars, for example, have brought to light multiple ways social-ecological resilience may not be compatible with the processes inherent in dominant legal systems of western societies (Holt et al. 2011; Ruhl 2010; Ruhl and Fischman 2010; Ruhl 2012; Doremus 1991; Doremus 2003a; 2003b).

Taking these critiques seriously, we engage a core group of five resilience-based governance principles, including two derived from legal studies and the policy sciences, to explore a case study of protecting transboundary marine environmental and cultural resources in the Arctic through an international policy tool called a Particularly Sensitive Sea Area (PSSA).

By doing so, we are able to assess whether the designation would foster resilience within this social-ecological system. Our discussion underscores important lessons for practitioners and scholars interested in taking the core group of principles from social-ecological governance frameworks and implementing them through specific real-world policy tools. Our analysis exposes tensions between theory and practice and prompts further questions concerning whether the protective status offered by a PSSA is a) viable, and b) likely an effective governance tool for promoting resilience.

While comparing a policy option to a set of theoretical principles (even when the principles are derived from empirical studies) may not provide conclusive evidence of the policy's eventual effectiveness, such analysis is useful in at least two main measures. First, it can provide guidance in decision-making contexts where uncertainty is high. In our case study, given the potentially non-linear rate of Arctic industrialization, environmental change, and the high number of other variables influencing the social-ecological system, accurately predicting future system states quantitatively is difficult, if not impossible. Thus, there is value in demonstrating that a given policy option meets a set of principles that have been shown in other cases to promote resilience. Second, an analysis based on theoretical criteria opens the door for a discourse on praxis (i.e., the practical application of theory). In addition to exploring whether a PSSA will foster system resilience, we wish to offer inights for resilience practitioners. How can they incorporate the tradeoffs and challenges of the policy process into developing framworks promoting social-ecological health and sustainability?

4.1.2 Background

While environmental scholars use terms like resilience-based governance (Anderies et al. 2006; Plummer and Armitage 2007; Chapin et al. 2009), they have generally focused on desired institutional outcomes, while failing to adequately define the procedural mechanisms underlying the concept, which are an inherently social set of political and deliberative processes. Garmestani and Benson (2013) were two of the first scholars to use the specific term resilience-based governance. They use the concept in relation to US law, exploring a legal framework that would incorporate the insights of resilience science by accounting for complexity and unpredictability in social-ecological systems. However, such a framework, which they call reflexive law, is largely absent in the United States. Reflexive law would allow "for iterative processes in the law and policy processes," "seek[s] to determine the organizational and procedural aspects of regulated action," and "incorporate[s] top-down, as well as bottom-up aspects of data collection and integration into the management paradigm." Reflexive law would be better synchronized with inherent patterns and processes of social-ecological systems than current United States' laws, which are predominately top-down, non-iterative, and outcome-focused. Reflexive law would facilitate adaptive management and adaptive governance, both of which are "vehicles for putting resilience theory into practice."

Garmestani and Benson (2013) usefully distinguishing between adaptive management and adaptive governance. Both share the basic tenet of being able to change the rules (i.e., the institutions) that steer human interactions with the environment in response to new knowledge about environmental and social conditions. The most important difference, however, is that adaptive management occurs through conventional institutions of rulemaking and enforcement

(e.g., the US Departments of the Interior and Commerce), while adaptive governance includes the influence of not only the government but also a range of other actors (e.g., Non-Governmental Organizations, corporations, community groups), and can include informal norms of behavior, as well as more formalized rules. Governance is more concerned with power sharing between actor groups at different scales than is management, which usually occurs at a single scale (Garmestani and Benson 2013).

We return to the concept of resilience-based governance later in the article, identifying five main principles and using the principles as an assessment rubric for our case study. Importantly, identifying the core principles of resilience-based governance is not simply a semantic exercise but has real-world ramifications, as stakeholders increasingly use resilience as a normative policy goal (Cote and Nightingale 2012; Robards et al. 2011). We now turn to the case study; the proposition of establishing a Particularly Sensitive Sea Area in the Bering Strait.

4.3 A Bering Strait Particularly Sensitive Sea Area (PSSA)

Our case study focuses on the Bering Strait—the transboundary marine area separating Alaska in the US from Chukotka in the Russian Federation. We limit the geographic scope of our assessment to the area from St. Lawrence Island north through the Bering Strait to Point Hope in the northeast, and Wrangel Island in the northwest. We focus on the specific policy tool of a PSSA designation to protect this area, because it represents an international social-ecological policy tool that has been designed to mitigate threats to local resources from international activities. It is the only tool at the International Maritime Organization that allows for local cultural and ecological resources to justify environmental protections through the regulation of

international vessel traffic (as opposed to vessel or mariner safety justifying regulations). Consequently, the international deliberations about the legal application of this tool to protect local ecosystem services at the expense to "freedom of navigation" offers valuable insights into the implementability of multi-scale institutions that can facilitate resilience.

4.3.1 Key Bering Strait Ecological and Cultural Resources

The Bering Strait region encompasses the Bering Strait, an 85 kilometer-wide passage that connects the North Pacific Ocean and Bering Sea to the Chukchi Sea and Arctic Ocean; and the Anadyr Strait, a 70 kilometer-wide passage separating St. Lawrence Island in Alaska from Chukotka. This transboundary region is globally significant for marine, avian and coastal biological diversity, and home to a wide array of Indigenous subsistence communities dependent on marine life for their food and cultural security. The International Union for the Conservation of Nature (IUCN) has designated 13 ecological and biological sensitive areas in the Arctic as a whole and three of these are in the Bering Strait region alone. Some species such as the Western Arctic bowhead whale and Pacific walrus have almost their entire population (~17,000 and >150,000 animals, respectively) pass through the area twice each year (Robards 2013).

Profound reductions and changing patterns of sea-ice cover in recent years as a result of climate change are affecting wildlife distributions and subsistence hunters' ability to secure food (Robards et al. 2013). The changing sea ice combined with strong currents, globally iconic aggregations of Arctic wildlife, and over 20,000 Indigenous people living in coastal villages and reliant on local marine ecosystem services, make this region a challenging area for mitigating the cumulative risks of climate change, new industrial developments, and international shipping.

4.3.2 Particularly Sensitive Sea Areas (PSSAs)

The International Maritime Organization (IMO) is the United Nations' agency responsible for the safety and security of international shipping and the prevention of marine pollution. IMO pursues its objectives through creating and implementing an authoritative and universally applicable regulatory framework for international shipping. One component of IMO's purview is the designation of various marine protected areas around the world, including PSSAs, which are one specific type of protected area. IMO states:

> A Particularly Sensitive Sea Area is an area that needs special protection through action by IMO because of its significance for recognized ecological or socio-economic or scientific reasons and which may be vulnerable to damage by international maritime activities (IMO 2013).

In practice, a PSSA is an international legal status that allows countries to promulgate regulations, called Associated Protective Measures (APMs), for all vessels in their waters, not just their own flagged vessels or those visiting their own ports. This includes vessels in innocent passage or in "international waters" such as narrow straits separating different countries (like the Bering Strait).

APMs serve as the 'teeth' of the PSSA policy tool. Each APM is linked to specific marine ecosystem services, with the goal of sustaining those services in the face of threats from vessel traffic. The following suite of mandatory APMs have been authorized in existing PSSAs around the world (Table 4.1): (1) ship routing schemes; (2) ship reporting programs; (3) ship

pilotage programs; (4) no anchoring areas; (5) areas to be avoided; and (6) Special Area status (another IMO tool focused on preventing marine pollution from international vessel traffic). IMO is granted the power from United Nation member countries to authorize enforcement of APMs through international legal precedent, including the Convention on the Law of the Sea (Ünlü 2004). However, it is the individual countries that carry the legal authority to monitor and enforce the rules in their own waters. Because of the high-level authoritative status of IMO, PSSA designation grants marine areas unparalleled international recognition compared to many other marine protective statuses (Roberts 2007).

The application assessment process within IMO has changed since the first PSSA was designated in 1990 and a revised set of guidelines from 2005 is in affect today. To start, a PSSA designation for an international strait requires the different coastal states with authority over that area to submit a mutually-agreed to application to the IMO. This application must pass a three-part stepwise test. First, the area must possess significant resources in at least one of three categories: (1) ecological; (2) social, economic, and cultural; or (3) scientific and educational. Second, those resources must be shown to be vulnerable to the impacts of international maritime traffic. Third, the demonstrated vulnerabilities must be realistically reducible through the implementation of APMs.

To gain insight into whether a PSSA status is appropriate for the Bering Strait, we reviewed the successful applications for the 14 existing PSSAs (application are available at: http://docs.imo.org). Key features of each area that made it viable for PSSA designation and the associated APMs are presented in Table 4.1. We also show the diverse character and magnitude of vessel traffic at the time of designation for each of the existing PSSAs (Table 4.2), which range from iconic marine environments like the Great Barrier Reef, to highly industrialized

transportation zones like the Baltic Sea (with over 65,000 vessel transits per year), to relatively pristine ecosystems like the waters of Papahānaumokuākea Marine National Monument in Hawai'i. What all PSSAs share, however, is possession of significant resources that are vulnerable to international shipping but can be protected.

4.3.3 Risk Factors in the Bering Strait Resulting from Maritime Traffic

According to Rear Admiral Thomas Ostebo, Commander of the 17th District of the US Coast Guard, about 500 vessels transited the Bering Strait in 2012 (Personal Communication). Vessel traffic through the Bering and Anadyr straits is expected to significantly increase over the next decade and beyond as the Arctic warms, industrial activities such as mineral and oil and gas extraction expand, and as the Northern Sea Route and Northwest Passage become more active trans-global shipping routes (Smith and Stephenson 2013). Already cargo on the Northern Sea Route has increased by an order of magnitude since 2007, with over 1.3 million tons of cargo transported in 2013 by 71 vessels (information from Center for High North Logistics, accessed 7/20/2104), up from only two vessels in 2007 (Figure 4.1). Arctic shipping has transitioned from what had previously been called "experimental" shipping activities (Brigham 2010) to at least a more routine use of the Northern Sea Route. Increases in vessel traffic supporting the massive mining efforts that dot the Arctic landscape (termed destination traffic) are also evidenced by a suite of new vessel lines linking United States, Canadian, and Russian ports (AMSA 2009).

We focus on the known impacts that vessel traffic could have on (1) iconic populations of large cetaceans (bowhead *Balaena mysticetus* and gray whale *Eschrichtius robustus*) that congregate in vast numbers in this region; and (2) Indigenous food and cultural security along

the coasts of the Bering Strait region. Other ecosystem services (such as seals or commercial fish) are present in the region, but are beyond the scope of a single manuscript. Aggregations of whales in shipping lanes elsewhere (including Alaska) have resulted in persistent ship strikes and the death of whales (e.g., Neilson et al. 2012; Silber et al. 2012). In the Bering Strait region, whale strikes by ships could impact conservation, food security, and trigger other political processes (i.e., actions at the International Whaling Commission through subsistence quotas or nationally via the Marine Mammal Protection Act). Without policies that proactively address the risks associated with when large vessels are transiting hotspot areas for marine mammals, or areas that support Indigenous subsistence practices, negative impacts on marine mammal populations and Indigenous food security are expected.

4.3.4 Implementing a PSSA in the Bering Strait

The Bering Strait meets the basic criteria necessary for a PSSA designation from the IMO. The area (1) possesses resources from the necessary resource categories (marine mammals and Indigenous cultural practices), (2) those resources are vulnerable to international maritime traffic (i.e., via ship strikes or disturbance of subsistence), and (3) the resources could realistically be protected by measures used in other PSSAs (Table 4.3). Mandatory reporting, ship routing schemes, areas to be avoided, and IMO Special Areas are potential candidates for mitigating our identified risks, and each have precedent elsewhere. However, speed restrictions for vessels have no PSSA precedent to date, but are likely one of the most valuable tools for reducing fatal vessel strikes on large cetaceans (Laist et al. 2014). Collectively, these types of measures also offer opportunities for officials to monitor and enforce marine vessel activity from

afar (via vessel tracking systems), which is an especially important consideration in such a sparsely populated remote region.

Given that a PSSA designation is a reasonable scenario for the Bering Strait (i.e., it is theoretically consistent with the language and role of a PSSA, as well as existing precedents), we now ask if a PSSA designation would promote social-ecological resilience in the system. To do so, we draw on five theoretical principles.

4.4 Resilience-Based Governance Principles

We identify three principles of resilience-based governance that integrate the central governance themes within current resilience and social-ecological system literatures (e.g., Young 2002; Folke et al. 2005; Berkes et al. 2007; Olsson et al. 2007; Carpenter and Brock 2008; Brondizio et al. 2009). These principals include the core ideas that institutions that guide human-environment interactions must a) be ecosystem-based, b) consider cross-scale impacts, and c) be adaptive in order to foster resilience. However, recent critiques from scholars of legal and policy studies emphasize that rules of environmental governance must also be legitimate, which is largely a function of social perception, and implementable through law, which is a function of the process of extant legal systems. We therefore add the two principles of legitimacy and implementability, thus grounding the established theoretical ideals of system function with the political and legal realities of operationalization.

4.4.1 Principle 1: Institutions must be Ecosystem-Based

The rules that steer human-environment interactions must fit the complexity of the ecosystems they are intended to govern (Young 2002). Context-specific ecosystem-based rules accounting for all ecosystem services are needed because ecosystems and their human users are heterogeneous over space and time, generally making one-size-fits-all approaches ineffective (Daily and Matson 2008; Crowder and Norse 2008). The operationalization of in-depth local observations and knowledge of natural processes, which is often derived from bottom-up through local research and (sometimes Indigenous) stakeholders is also widely regarded as a critical component of ecosystem-based approaches (Berkes et al. 2007). Ecosystem-based governance can be challenged by outdated institutional structures that fail to address complex environmental interactions across space, time, and system components, resulting in the erosion of resilience. However, case studies suggest that bottom-up pilot programs supported by top-down structures can help overcome this barrier (Osterblom et al. 2010).

4.4.2 Principle 2: Institutions must be Cross-Scale

Rules of environmental governance must function effectively across scales or levels in order to promote resilience, since the connections between ecosystems and people who use them transcend any single scale or level (Olsson et al. 2007). Rules that exhibit congruence between the international, national, and sub-national scales (i.e., multi-level governance) are often difficult to achieve since stakeholders can possess different and conflicting priorities (Adger et al. 2005; Brondizio et al. 2009) and even fundamentally different types of environmental

knowledge (Ahlborg and Nightingale 2012). Conflicts across scales can be managed through strong social networks and leaders that bridge organizations, policy levels, and system scales, or enhance knowledge flow (Olsson et al. 2006; Bodin and Crona 2009). Polycentric governance, emphasizing the functional overlap in multi-level governance systems, has also been shown to be responsive to novel conditions (Fabricius et al. 2007; Biggs et al. 2012).

4.4.3 Principle 3: Institutions must be Adaptive

Rules steering human-environment interactions must be flexible enough to change (incrementally or entirely) should new environmental and social conditions render them ineffective (Nelson et al. 2007; Rijke et al., 2013). The ability of social systems to incorporate knowledge from past ecological experiences (in the existing or analogue systems) into future decisions (i.e., to reflect and learn) is central to effective adaptive governance (Folke et al. 2005). Social systems are increasingly expected to adapt proactively to anticipated ecological changes in order to maintain resilience, due to the increasingly rapidity and unpredictability of change (Ash et al. 2012). The capacity to adapt the rules of human-environment interaction, both reactively and proactively, is a keystone of resilience-based governance.

4.4.4 Principle 4: Institutions must be Legitimate

Multi-sector stakeholders at various scales must collaborate in some manner during policy formation, implementation, and amendment in order for rules to be legitimate (Cosens 2013). From a normative stance, environmental governance must represent the wills of affected

groups, as resilience itself could prove undesirable if the social system is undemocratic (Lebel et al. 2006). The preferences of local stakeholders can be trumped by the priorities of larger-scale groups under the banner of accomplishing 'the greater good' (e.g., Robards and Greenberg 2007). Conversely, powerful small-scale special interests can overpower the democratic process of larger groups in some circumstances to accomplish their own security (Robards and Lovecraft 2010). The presence of power dynamics emphasizes the need to consider normative aspects of environmental institutions (Lovecraft 2008; Robards et al. 2011). Legitimate environmental policies can also help assure compliance through what Agrawal (2005) describes as environmentalities, where the subjects of governance view the rules as part of their own identities, sometimes because they have a meaningful voice in creating and implementing them (Plummer and Armitage 2007).

4.4.5 Principle 5: Institutions must be Implementable

Rules for ecosystem governance must be implementable through existing legal frameworks in order to promote resilience (Ruhl 2010). It makes little difference if a policy tool is ecosystem-based, adaptive, cross-scale, and legitimate if the laws that would implement the tool are not viable or do not support proper functioning. The legal sciences challenge resilience thinking on this front by showing that courts of law generally favor stability over adaptability and can thereby be at odds with the other requirements of resilience-based governance (Ruhl and Fischman 2010). For resilient social-ecological systems, there must be congruence between not only the ecosystems and the rules that govern them but also between the rules and the legal frameworks that bring the rules into being and control their adaptation. Non-implementable rules

(either formal or informal), like those offered up by many well-intentioned, but unrealistic academic theoreticians, do little to stem unsustainable human-environment interactions (Garmestani and Benson 2013).

4.5 Analysis and Discussion

We break this section into two parts: (1) the political issues around the question of whether a PSSA could be adopted for the Bering Strait, and (2) the likely results should a PSSA be adopted and implemented. Two of the resilience-based governance principles fall broadly under the first category (cross-scale and implementable) and three fall under the second (ecosystem-based, adaptable, and legitimate). We identify how key characteristics of the Bering Strait system lend themselves to (or constrain) the implementation of each principle of resilience-based governance (Table 4.4).

4.5.1 Political Issues

4.5.1.1 Does a PSSA Function Effectively Across Scales?

Many hurdles would have to be overcome for a Bering Strait PSSA to function effectively as an institution of cross-scale governance. Because of the overarching international importance of the freedom of the seas, the national priorities of the US and the Russian Federation might align more closely with the priorities of transnational shipping corporations than with the priorities of local subsistence hunters or marine mammal conservation. Such cross-

scale tensions could inhibit the initial PSSA application process if more economically or international maritime freedom-motivated stakeholders protest the designation.

In addition, based on the top-down structure of the PSSA application process, there is no evidence that a Bering Strait PSSA would help alleviate the historic cross-scale hostility on the part of the State of Alaska toward attempts by the US federal government to create policies that might adversely affect Alaska's economic interests, as regulating maritime traffic in the Bering Strait might be perceived to do. There is a long-standing tension, for example, between the state and federal governments with respect to who can profit from commercial activity in the Arctic offshore environment, including the Bering Strait (e.g., Paulin 2013).

4.5.1.2 Is a PSSA Implementable?

While implementablity through existing legal and political systems is a key component of successful environmental policy (Cumming 2013), and PSSAs have been successfully implemented around the world, questions remain about whether the US and Russian Federation possess the political will to create a Bering Strait PSSA at this time. The application process requires committed resources and prolonged collaboration, both scientifically and politically. While the US and Russian Federation possess such resources, current tensions between the countries might make a partnership unlikely. If such tensions can be overcome, both countries possess the technological capacity to monitor and enforce the APMs. Moreover, both countries are member states of the International Maritime Organization; a requirement for PSSA designation.

The existence of stable legal systems in both nations is critical for implementability as well, since it would ultimately be the onus of the US and Russian Federation to confront shipping companies if the companies failed to abide by the protective measures. The relative simplicity of the APMs that the International Maritime Organization could apply in the Bering Strait (e.g., clearly defined shipping lanes, vessel notifications, and automated electronic tracking) is favorable for effective monitoring and enforcement. However, the potential exists for those negatively impacted by increased regulation (i.e., the shipping companies) to attempt to hinder the progress of the application process.

4.5.2 Likely Results

4.5.2.1 Is the Institution Ecosystem-Based?

The environmental science contained in the PSSA application would have to address the complexity and interconnectedness of this transboundary ecosystem. The application would also need to address the ecological changes occurring in Bering Strait. However, it is unclear whether the PSSA application would include local-scale and traditional ecological knowledge, as this is not a current requirement of the International Maritime Organization.

Roberts (2007) argues that the increased level of regional environmental knowledge generated through a successful PSSA application is one of the main benefits of achieving the designation; consistent with the strong emphasis on learning within the resilience literature (Tschakert and Dietrich 2010). By highlighting the connections between animals and their habitats, PSSAs avoid the pitfall of protecting specific species rather than overall systems, which

other environmental laws (e.g., the Endangered Species Act) have fallen into (Benson 2012). Overall, PSSAs achieve a good institutional fit with the environment by invoking protective measures that target the particular ecosystem services of each area, rather than attempting to protect the environment through blanket policies.

4.5.2.2 Are the Institutions Adaptive?

A Bering Strait PSSA might not be adequately adaptive to handle the rapidly changing Arctic environment. While it is hypothetically possible for the coastal states (US and Russian Federation) to apply to the International Maritime Organization to amend an APM following its implementation (Ünlü 2004), there is no precedent of this occurring. Nor does the International Maritime Organization offer a clearly defined process for the adaptation of APMs if needed (e.g., guidelines for monitoring change, thresholds of change to qualify for an amendment, amendment timeline). An entirely new institutional mechanism would need to be developed to give countries the power to change APMs in order to achieve this principle. From within the resilience literature, Walker (2012) poses the question, "What are the rules for changing the rules?" In the case of the PSSA policy tool, there are no rules for changing the rules. There is no clear process, for example, to change areas to be avoided if whales alter their migratory patterns, or for scaling back mandatory reporting measures if marine traffic flows subside. Institutional rigidity, or the inability to adapt, can lead to dysfunctional governance practices in a changing environment (e.g., Carpenter and Brock 2008).

4.5.2.3 Are the Institutions Perceived as Legitimate?

Because the PSSA application and designation processes do not contain a formalized mechanism to ensure the participation of the State of Alaska and Chukotka regional governments, or Indigenous groups, it is possible that a PSSA would be perceived as illegitimate by key stakeholders. Some applications for existing PSSAs do emphasize Indigenous use of marine areas for nutritional and cultural purposes, but there is no required inclusion of Indigenous issues at the International Maritime Organization (there is a Permanent Forum on Indigenous Issues at the United Nations, but the link between this forum and the International Martime Organization is beyond the scope of this discussion). Cosens (2013) writes, "[C]hanges to governance needed to foster ecosystem resilience will not be adopted by democratic societies without careful attention to their effect on the social system itself." PSSAs are arguably undemocratic institutions, initiated, pursued, and regulated by government agencies at the national and international scale. Inadequate participation in policy processes can leave stakeholders feeling resentful, thereby delegitimizing the policy (Cosens and Williams 2012). Greater emphasis on stakeholder inclusion in the PSSA application process would be required to fulfill this principle.

A second component of legitimacy is the perception of contemporary need for a PSSA – is there a current problem or is this about a perceived potential problem in the future (after some threshold in vessel traffic is reached). While PSSAs have generally, but not always reacted to a recognized problem, proactive examples do exist with low transit numbers such as in the northwest Hawaiian Islands. For Bering Strait, the relatively few transiting vessels, perhaps warrants closer attention to the value of proactive voluntary measures within the APMs

(Huntington et al., in press). Governments and international shipping companies, who are likely to view mandatory regulations as an imposition on maritime freedoms, or an impediment to their efficient operation, are likely to be more amenable to such voluntary measures. Voluntary measures foster social learning, facilitate adaptive change, and could foster learning and new environmentalities (central tenets of resilience approaches). Furthermore, additional protective measures known to reduce impacts to whales such as limited speeds, which have no precedent in PSSAs elsewhere could be explored. However, for the protective measures we identify, international compliance with voluntary measures may not always be adequate (McKenna et al. 2012), supporting the value of a policy 'testing period' in which compliance and effectiveness can be assessed prior to finalizing APMs for a PSSA.

4.6 Conclusion

We addressed the concept of a PSSA designation in the Bering Strait region, and if it would increase the resilience of the social-ecological system. We did so by objectively comparing what we know about PSSAs as a policy tool and what we know about the Bering Strait social-ecological system in the context of five principles of resilience-based governance. Our principles included three that were derived from the current resilience and social-ecological system literatures, and two from the legal and policy science literatures concerning the political and legal realities of operationalization.

Holling (2012), in responding to an article demonstrating the difficulties of actualizing resilience-based governance, acknowledged the imperative to create environmental policies even in the absence of perfect options. He states:

> All that can be done now is to focus on some fundamental developments that slow the worst problems and also dramatically explore several real options that are promising gambles (p. 1).

A PSSA designation is a real and promising option for the Bering Strait, providing opportunities to support social-ecological resilience in the presence of uncertainty. Of the five principles, our analysis suggests that the potential exclusion of key stakeholders (notably Indigenous communities and the regional governments) is perhaps the greatest weakness of the PSSA policy tool.

With regard to the question of praxis, we reiterate some frequently identified challenges and tradeoffs that resilience practitioners should be prepared to address - the real work of 'doing resilience' lies here (Table 4.5). We contend that, while the identification of best-practice principles for social-ecological governance is important, they are by-and-large already known. Consequently, we recommend resilience practitioners step away from the burgeoning array of theoretical frameworks and focus on the implementation of these frameworks by managers, policy makers, lawyers, and stakeholders. These are the people who are making the day-to-day decisions and difficult trade-offs concerning natural resource management. A greater focus is needed from academics exploring new modes of governance on the types of factors that support or detract from praxis as we have begun to unravel here. Further integration of resilience ideals with the Policy Sciences, Political Philosophy, and with concept of Power offer fruitful further directions.

4.7 References

Adger, W. N., K. Brown, and E. L. Tompkins. 2005. The political economy of cross-scale networks in resource co-management. *Ecology and Society* **10**(2): 9. [online] URL: http://www.ecologyandsociety.org/vol10/iss2/art9/.

Agrawal, A. 2005. *Environmentality: technologies of government and the making of subjects.* Duke University Press Durham, North Carolina, USA.

Ahlborg, H. and A. J. Nightingale. 2012. Mismatch between scales of knowledge in Nepalese forestry: Epistemology, power, and policy implications. *Ecology and Society* **17**(4): 16. [online] URL: http://www.ecologyandsociety.org/vol17/iss4/art16/.

Anderies, J. M., B. H. Walker, and A. P. Kinzig. 2006. Fifteen weddings and a funeral: Case studies and resilience-based management. *Ecology and Society* **11**(1): 21. [online] URL: http://www.ecologyandsociety.org/vol11/iss1/art21/.

Arctic Marine Shipping Assessment. 2009. *Arctic Marine Shipping Assessment 2009 Report.* Arctic Council. [online] URL: http://www.pame.is/amsa-2009-report.

Armitage, D., F. Berkes, and N. Doubleday, editors. 2007. *Adaptive Co-Managment.* UBC Press, Vancouver, Canada.

Ash, A., P. Thornton, C. Stokes, and C. Togtohyn. 2012. Is proactive adaptation to climate change necessary in grazed rangelands? *Rangeland Ecology and Management* **65**(6): 563-568.

Benson, M. H. 2012. Intelligent tinkering: The Endangered Species Act and resilience. *Ecology and Society* **17**(4): 28. [online] URL: http://www.ecologyandsociety.org/vol17/iss4/art28/.

Berkes, F., M. K. Berkes, and H. Fast. 2007. Collaborative integrated management in Canada's north: The role of local and traditional knowledge and community-based monitoring. *Coastal Management* **35**(1): 143-162.

Bodin, O. and B. I. Crona. 2009. The role of social networks in natural resource governance: What relational patterns make a difference? *Global Environmental Change-Human and Policy Dimensions* **19**(3): 366-374.

Biggs, R., M. Schlüter, D. Biggs, E.L. Bohensky, S. Burn Silver, G. Cundill, V. Dakos, T.M. Daw, L.S. Evans, K. Kotschy, A.M. Leitch, C. Meek, A. Quinlan, C. Raudsepp-Hearne, M.D. Robards, M.L. Schoon, L. Schultz, and P.C. West. 2012. Toward principles for enhancing the resilience of ecosystem services. *Annual Review of Environment and Resources* **37**: 421-448.

Brigham, L.W. 2010. The Fast-Changing Maritime Arctic. *Proceedings of the US Naval Institute*, **136**(5), 54–59. [online] URL: http://www.usni.org/magazines/.

Brondizio, E. S., E. Ostrom, and O. R. Young. 2009. Connectivity and the governance of multilevel social-ecological systems: The role of social capital. *Annual Review of Environment and Resources* **34**:253-278.

Carpenter, S. R. and W. A. Brock. 2008. Adaptive capacity and traps. *Ecology and Society* **13**(2): 40. [online] URL: http://www.ecologyandsociety.org/vol13/iss2/art40/.

Chapin, F., G. P. Kofinas, and C. Folke, editors. 2009. *Principles of Ecosystem Stewardship: Resilience-Based Natural Resource Management in a Changing World*. Springer Science, New York, New York, USA.

Cosens, B. A. and M. K. Williams. 2012. Resilience and water governance: Adaptive governance in the Columbia River basin. *Ecology and Society* **17**(4): 3. [online] URL: http://www.ecologyandsociety.org/vol17/iss4/art3/.

Cosens, B. A. 2013. Legitimacy, adaptation, and resilience in ecosystem management. *Ecology and Society* **18**(1): 3. [online] URL: http://www.ecologyandsociety.org/vol18/iss1/art3/.

Cote, M., & Nightingale, A. J. (2012). Resilience thinking meets social theory: Situating social change in socio-ecological systems (SES) research. *Progress in Human Geography, 36*(4), 475-489. doi:10.1177/0309132511425708

Crowder, L. and E. Norse. 2008. Essential ecological insights for marine ecosystem-based management and marine spatial planning. *Marine Policy* **32**(5): 772-778.

Cumming, G. S. 2013. Scale mismatches and reflexive law. *Ecology and Society* **18**(1): 15. [online] URL: http://www.ecologyandsociety.org/vol18/iss1/art15/.

Daily, G. C., and P.A. Matson. 2008. Ecosystem services: from theory to implementation. *Proceedings of the National Academy of Sciences* **105**(28): 9455-9456.

Doremus, H. 1991. Patching the ark: Improving legal protection of biological diversity. *Ecology Law Quarterly* **18**(2): 265-333.

Doremus, H. 2003a. Shaping the future: The dialectic of law and environmental values. *Environs: Environmental Law and Policy Journal* **27**: 233.

Doremus, H. 2003b. Constitutive law and environmental policy. *Stanford Environmental Law Journal* **22**: 295.

Fabricius, C., C. Folke, G. Cundill, and L. Schultz. 2007. Powerless spectators, coping actors, and adaptive co-managers: A synthesis of the role of communities in ecosystem management. *Ecology and Society* **12**(1): 29. [online] URL: http://www.ecologyandsociety.org/vol12/iss1/art29/.

Folke, C., T. Hahn, P. Olsson, and J. Norberg. 2005. Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources* **30**: 441-473.

Franklin, E.C. 2008. An assessment of vessel traffic patterns in the Northwestern Hawaiian Islands between 1994 and 2004. *Marine Pollution Bulletin* **56**(1): 136-162.

Garmestani, A. S. and M. H. Benson. 2013. A framework for resilience-based governance of social-ecological systems. *Ecology and Society* **18**(1): 9. [online] URL: http://www.ecologyandsociety.org/vol18/iss1/art9/.

Green, O. O., A. S. Garmestani, H. F. M. W. van Rijswick, and A. M. Keessen. 2013. EU water governance: Striking the right balance between regulatory flexibility and enforcement? *Ecology and Society* **18**(2): 10. [online] URL: http://www.ecologyandsociety.org/vol18/iss2/art10/.

Holling, C. S. 2012. Response to "Panarchy and the Law". *Ecology and Society* **17**(4): 37. [online] URL: http://www.ecologyandsociety.org/vol17/iss4/art37/.

Holt, A.R., J.A. Godbold, P.C. White, A.M. Slater, E.G. Pereira, and M. Solan. 2011. Mismatches between legislative frameworks and benefits restrict the implementation of the Ecosystem Approach in coastal environments. *Marine Ecology Progress Series* **434**: 213-228.

Huntington, H.P., R. Daniel, A. Hartsig, K. Harun, M. Heiman, R. Meehan, G. Noongwook, L. Pearson, M. Prior-Parks, M. Robards, and G. Stetson. In Press. Vessels, risks, and rules: Planning for safe shipping in Bering Strait. *Marine Policy*.

International Maritime Organization. 2013. *Particularly Sensitive Sea Areas*. [online] URL: http://www.imo.org/OurWork/Environment/PollutionPrevention/PSSAs/Pages/Default.aspx.

Laist, D.W., A.R. Knowlton, and D. Pendleton. 2014. Effectiveness of mandatory vessel speed limits for protecting North Atlantic Right Whales. Endangered Species Research **23**: 133-147.

Lebel, L., J. M. Anderies, B. Campbell, C. Folke, S. Hatfield-Dodds, T. P. Hughes, and J. Wilson. 2006. Governance and the capacity to manage resilience in regional social-ecological systems. *Ecology and Society* **11**(1): 19. [online] URL: http://www.ecologyandsociety.org/vol11/iss1/art19/.

Lee, K. N. 1999. Appraising adaptive management. *Conservation Ecology*, **3**(2): 3. [online] URL: http://www.ecologyandsociety.org/vol3/iss2/art3/.

Lefevre, J. 2013. A pioneering effort in the design of process and law supporting integrated Arctic Ocean management. *The Environmental Law Reporter* **43**(10): 10893-10908.

Lovecraft, A.L. 2008. Climate change and Arctic cases: A normative exploration of social-ecological system analysis. In *Political theory and global climate change*, ed. S. Vanderheiden, 91-120. MIT Press, Cambridge, MA, USA.

McKenna, M. F., S. L. Katz, C. Condit, and S. Walbridge. 2012. Response of commercial ships to a voluntary speed reduction measure: are voluntary strategies adequate for mitigating ship-strike risk? *Coastal Management* **40**(6): 634-650.

McLeod, K., and H. Leslie, H. (Eds.). 2009. *Ecosystem-based management for the oceans*. Island Press, Washington, DC, USA.

Neilson, J. L., C. M. Gabriele, A. S. Jensen, K. Jackson, and J. M. Straley. 2012. Summary of reported whale-vessel collisions in Alaskan waters. *Journal of Marine Biology* **2012**: 1-19.

Nelson, D. R., W. N. Adger, and K. Brown. 2007. Adaptation to environmental change: Contributions of a resilience framework. *Annual Review of Environment and Resources* **32**: 395-419.

Olsson, P., L. H. Gunderson, S. R. Carpenter, P. Ryan, L. Lebel, C. Folke, and C. S. Holling. 2006. Shooting the rapids: Navigating transitions to adaptive governance of social-ecological systems. *Ecology and Society* **11**(1): 18. [online] URL: http://www.ecologyandsociety.org/vol11/iss1/art18/.

Olsson, P., C. Folke, V. Galaz, T. Hahn, and L. Schultz. 2007. Enhancing the fit through adaptive co-management: Creating and maintaining bridging functions for matching scales in the Kristianstads Vattenrike Biosphere Reserve, Sweden. *Ecology and Society* **12**(1): 28. [online] URL: http://www.ecologyandsociety.org/vol12/iss1/art28/.

Osterblom, H., A. Gardmark, L. Bergstrom, B. Muller-Karulis, C. Folke, M. Lindegren, M. Casini, P. Olsson, R. Diekmann, T. Blenckner, C. Humborg, and C. Mollmann. 2010. Making the ecosystem approach operational: can regime shifts in ecological and governance systems facilitate the transition? *Marine Policy* **34**(6): 1290-1299.

Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press, Cambridge, UK.

Paulin, J. 2013. A conflict between Alaska and the Feds over Arctic Policy? *Alaska Dispatch*, September 8, 2013. [online] URL: http://www.alaskadispatch.com/article/20130908/conflict-between-alaska-and-feds-over-arctic-policy.

Plummer, R. and D. Armitage. 2007. A resilience-based framework for evaluating adaptive co-management: Linking ecology, economics and society in a complex world. *Ecological Economics* **61**(1): 62-74.

Rijke, J., M. Farrelly, R. Brown, and C. Zevenbergen. 2013. Configuring transformative governance to enhance resilient urban water systems. *Environmental Science and Policy* **25**: 62-72.

Robards, M. D. and J. A. Greenberg. 2007. Global constraints on rural fishing communities: Whose resilience is it anyway? *Fish and Fisheries* **8**(1): 14-30.

Robards, M. D. and A. L. Lovecraft. 2010. Evaluating comanagement for social-ecological fit: Indigenous priorities and agency mandates for pacific walrus. *Policy Studies Journal* **38**(2): 257-279.

Robards, M. D., M. L. Schoon, C. L. Meek, and N. L. Engle. 2011. The importance of social drivers in the resilient provision of ecosystem services. *Global Environmental Change* **21**(2): 522-529.

Robards, M. D. 2013. *Resilience of International Policies to Changing Social-ecological systems: Arctic Shipping in the Bering Strait Arctic Resilience Report*. Arctic Council, in press.

Robards, M. D., A. S. Kitaysky, and J. J. Burns. 2013. Physical and sociocultural factors affecting walrus subsistence at three villages in the northern Bering Sea: 1952-2004. *Polar Geography* **36**(1-2): 65-85.

Roberts, J. P. 2007. *Marine Environment Protection and Biodiversity Conservation: The Application and Future Development of IMO's Particularly Sensitive Sea Area Concept*. Springer Science, New York, New York, USA.

Ruhl, J. 2010. General design principles for resilience and adaptive capacity in legal systems-with applications to climate change adaptation. *North Carolina Law Review* **89**:1373-1401.

Ruhl, J. and R. L. Fischman. 2010. Adaptive management in the courts. *Minnesota Law Review* **95**:424-484.

Ruhl, J. B. 2012. Panarchy and the law. *Ecology and Society* **17**(3): 31. [online] URL: http://www.ecologyandsociety.org/vol17/iss3/art31/.

Silber, G. K., A. S. Vanderlaan, A. Tejedor Arceredillo, L. Johnson, C. T. Taggart, M. W. Brown, S. Bettridge, and R. Sagarminaga. 2012. The role of the International Maritime Organization in reducing vessel threat to whales: Process, options, action and effectiveness. *Marine Policy* **36**:1221-1233.

Smith, L.C., and S.R. Stephenson. 2013. New trans-Arctic shipping routes navigable by midcentury. *Proceedings of the National Academy of Sciences*, **110**: 1191-1195.

Sorensen, J. 1997. National and international efforts at integrated coastal management: Definitions, achievements, and lessons. *Coastal management* **25**(1): 3-41.

Tschakert, P., and K. A. Dietrich. 2010. Anticipatory learning for climate change adaptation and resilience. *Ecology and Society* **15**(2): 11. [online] URL: http://www.ecologyandsociety.org/vol15/iss2/art11/.

Ünlü, N. 2004. Particularly Sensitive Sea Areas: Past, Present and Future. *World Maritime University Journal of Maritime Affairs* **3**(2): 159-169.

Walker, B. H. 2012. A Commentary on "Resilience and water governance: Adaptive Governance in the Columbia River basin". *Ecology and Society* **17**(4): 29. [online] URL: http://www.ecologyandsociety.org/vol17/iss4/art29/.

Young, O. R. 2002. *The Institutional Dimensions of Environmental Change: Fit, Interplay, and Scale*. MIT press, Cambridge, Massachusetts, USA.

Table 4.1 Existing PSSAs (all data from IMO application documents) and whether Associated Protective Measures were proactively or reactively responding to threats.

PSSA	Countries	Examples of ecological resources	Examples of social, economic, and cultural resources	Examples of scientific and educational resources	Associated protective measure(s)	Was designation proactive or reactive to ecological degradation?
Great Barrier Reef	Australia	Coral reefs and related species	Traditional fishing and tourism	Broad range of natural phenomenon	Pilotage, reporting	Largely proactive
The Sabana-Camagüey Archipelago	Cuba	Marine species and landscapes	Fishing and tourism	Cayo Coco research center	Areas to avoid	Largely proactive
Malpelo Island	Columbia	Mangroves, coral, beaches, fish,	Fishing	Established research collaborations	Areas to avoid	Largely reactive to illegal fishing and increased pleasure cruising
Sea around the Florida Keys	United States	Coral reefs and marine mammals	Fishing and tourism	Draws international scientists	Areas to avoid, and no anchoring areas	Largely reactive, but phrased in terms of "preventing damage"
Wadden Sea	Denmark, Germany, Netherlands	Tidal flats and seals	Fishing and tourism	Established scientific institutions	Routing	Largely proactive, area is already protected by numerous measures
Paracas National Reserve	Peru	Marine mammals, birds, and flora	Tourism	Educational programs carried out	Areas to avoid	Largely proactive, no serious previous impacts mentioned
Western European Waters	Belgium, France, Ireland, Portugal, Spain, United Kingdom	Marine mammals, shellfish, and unique landscapes	Seafood industry and tourism	Established biodiversity research	Reporting	Largely proactive but phrased in terms of reacting to threat of marine pollution from ship wrecks
Torres Strait Extension of Great Barrier Reef PSSA	Australia, Papua New Guinea	Coral, marine mammals, fish	Indigenous hunting	Collaborative Indigenous and scientific research	Pilotage, routing	Largely proactive with some mention of vessel pollution
Canary Islands	Spain	Marine mammals, high biodiversity	Tourism	Established international research	Areas to avoid, routing, reporting	Largely proactive
Galapagos Archipelago	Ecuador	Marine mammals, sea birds, mangroves	Small-scale fishing	Collaborative local and scientific programs	Area to avoid, reporting, routing	Largely proactive with some reference to ship groundings
Baltic Sea Area	Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Sweden	Wetlands, sea birds, fish	Fishing and tourism	History of data collection	Routing, areas to avoid, Special Area	Largely reactive to pollution and substantial number of recent vessel accidents
Papahānaumokuākea Marine National Monument	United States	Marine mammals, coral reefs, fish	Numerous sacred cites	Baseline for undisturbed ecosystem	Areas to avoid, reporting	Largely proactive
Strait of Bonifacio	France, Italy	Fish, flora	n/a	Potential for sustainable resource management research	Routing, areas to avoid, reporting, pilotage	Largely reactive to series of recent vessel groundings
Saba Bank in the Caribbean Sea	Netherlands	Coral reefs and related species	Small-scale fishing	Baseline for undisturbed ecosystem	No anchoring area, area to avoid	Largely proactive with minor mention of previous anchor damage to reef

Table 4.2 Vessel usage in the Particularly Sensitive Sea Area prior to designation by the International Maritime Organization.

PSSA	Designation Year	Estimated number of vessels annually reported in PSSA and immediate vicinity at the time of designation	Primary Vessel Types
Great Barrier Reef	1990	2,000 ships passing through PSSA area each year[1]	Tanker, cargo, recreational/tourism vessels
Sabana- Camagüey Archipelago	1997	No specific data	Fishing vessels and vessels over 150 gross tonnage[2]
Malpelo Island	2002	1,139 vessels in vicinity of PSSA area[3]	Tanker, cargo, local fishing vessels
Sea around Florida Keys	2002	8,000 large cargo ships transit PSSA area[4]	Tanker, cargo, cruise ships
Wadden Sea	2002	No specific data, but very heavily trafficked[5]	Tanker, cargo, passenger, fishing, special purpose, recreational
Paracas National Reserve	2003	4,740–6,420 vessels in vicinity of PSSA area[6]	Tanker, cargo
Western European Waters	2004	43,209 vessels in PSSA area[7]	All types
Torres Strait	2005	1,008 vessels making 3,136 voyages in PSSA area[8]	Tanker, cargo, fishing vessels
Canary Islands	2005	1,500 vessels pass through PSSA area[9]	Tanker, cargo, fishing
Galapagos Archipelago	2005	156 vessels made port call in PSSA area[10]	Tourism, fishing, Cargo/Container
Baltic Sea Area	2005	65,000 vessels entered PSSA area[11]	Tankers, cargo, container
Papahānaumokuākea Marine National Monument	2007	75 vessels voluntarily reported within PSSA area[12] 34 vessels in PSSA area on average: 1994-2004[13]	Freighters, tankers, fishing, research
Strait of Bonifacio	2011	2,984 mandatory vessel reports in PSSA area[14]	Tanker, cargo, passenger, fishing, recreational
Saba Bank in the Caribbean Sea	2012	200 vessels pass through PSSA area[15]	Tanker, cargo

[1] IMO document MEPC 46/23, Annex 6, p. 17; [2]IMO document MEPC 46/23, Annex 6, p. 21; [3]IMO document MEPC 46/6/3, p. 3; [4]IMO document MEPC 46/6/2, p. 7; [5]IMO document MEPC 48/7/2, p. 8; [6]IMO document MEPC 48/7, Annex, p. 15, adapted figure; [7]IMO document MEPC 49/8/1, Annex 1, p. 36; [8]IMO document MEPC 49/8, p. 13; [9]IMO document MEPC 51/8, Annex, p. 11; [10]IMO document MEPC 51/8/2, p. 12, adapted figure; [11]IMO document MEPC 51/8/1, p. 11; [12]IMO document MEPC 56/8, p. 12, adapted figure; [13]Franklin, 2008; [14]IMO document MEPC 61/9, Annex, p. 10; [15]IMO document NAV 58/3, p. 3.

Table 4.3 Selected examples of Bering Strait resources, vulnerabilities and mitigation tools.

Bering Strait Resource	**Vulnerability to shipping**	**Mitigation tools**
Ecological		
Large cetaceans	Fatal Ship strikes	Vessel speed Areas to be avoided, Routing, Reporting
Critical wildlife habitats	Disturbance that displaces animals away from critical habitats	Areas to be avoided
Social, cultural, and economic		
Ability of hunters to be successful and safe	Disturbance that displaces animals away from villages or where wakes jeopardize the safety of hunters, particularly in broken ice	Areas to be avoided, Routing Reporting,
Health of subsistence resources	Pollution	Special Areas

Table 4.4 Bering Strait: System properties and decision processes associated with operationalization of resilience-based governance principles through a PSSA.

Resilience-Based Governance Principle	Bering Strait System Properties	Decision Processes
Political Issues around Designation		
Cross-scale	Stakeholder groups at the local, sub-national, national, and international scales have substantial interest in how the Bering Strait is governed – economically as well as environmentally; both economic and environmental drivers across scales affect the system.	The process of selecting protective measures needs to accommodate the sometimes conflicting environmental, economic, and political considerations that occur across scales, and effectively address cross-scale interactions. Understanding cross-scale trade-offs will be a critical consideration in analyses of the viability and effectiveness of a PSSA designation. The US and Russian Federation would have to come together, along with other stakeholders, to create a successful application.
Implementable	The national governments that would be tasked with enforcing protective measures are stable and both legal systems possess the capacity to enforce rules. However tensions between the US and Russian Federation may continue to exacerbate agreements.	National governments would have to choose to work together and commit financial resources for effective monitoring tools (e.g., through vessel monitoring and reporting of seasonal risks to cetaceans), and enforcement to proactively prevent negative impacts on cetaceans, ecosystems, and cultures. The maritime insurance industry may also monitor actions that jeopardize the health and safety of Indigenous groups or iconic coastal aggregations of wildlife as part of mitigating their own risks.
Likely Results if Implemented		
Ecosystem-based	The Bering Strait ecosystem is reasonably bounded and studied, providing much of the necessary information to inform protective measures. However, the area is rapidly changing due to global climate change and social or economic factors. Combined with the remoteness, this can be a harsh and challenging environment to conduct environmental research or to assess long-term chronic or actute impacts of vessel traffic on the marine environment and the people who rely on it.	The PSSA application would need to address the protection of ecosystem functions and key processes. The specific justification for a PSSA (as required) in this case study is the health and safety of large cetaceans and Indigenous communities in a migration bottleneck. The inclusion of human interests within the ecosystem, including the safety of hunters and the health of subsistence resources (through minimizing discharges) reflects important ecosystem-based considerations.
Adaptive	There is reasonable ecological, economic, social, and vessel baseline data about the Bering Strait, but data on the local rates and processes of change are often lacking. Directional change in system properties is predicted to continue in the foreseeable future but there is uncertainty about rates of change making management decision rules difficult to develop.	While IMO has been reticent to apply adaptive or seasonal protective measures under a PSSA designation, seasonal application of protective measures and monitoring of key system variables would be essential if seeking to ensure an optimal link between economic, social, and ecosystem needs in Bering Strait. However, political trade-offs with an adaptive approach may support more static, or alternatively voluntary protective measures. Furthermore, in the case of cetacean strikes, the importance of an effective monitoring system to assess the prevalence of strikes is vital for an adaptive approach to reducing impacts.
Legitimate	While there is historical precedent for a strong focus on the freedom of navigation across the world's oceans, there has been minimal attention to the voice of Indigenous coastal food security in IMO policy decisions. In contrast, in the United States, there is relatively strong recognition of Indigenous rights and increasing numbers of formal processes for tribal consultation or co-management. Nevertheless state-federal relations may exacerbate existing cross-scale political tensions both in the US and Russian Federation.	The US and Russian Federation governments, along with sub-national and international stakeholder groups would need to support protective measures. These would reflect the needs and interests of Indigenous subsistence hunters as well as the conservation and economic needs of regional and national governments. Conversely, international shipping and national security interests would need to support actions that impact policy positions concerning the established legitimacy of freedom of navigation elsewhere.

Table 4.5 Key challenges and tradeoffs for operationalizing resilience-based governance.

• Reconciling different priorities across scales and in areas of multiple jurisdictional oversight • Institutionalizing effective processes for adaptive environmental policies • Achieving adequate stakeholder participation to ensure legitimacy at local, regional, national, and international scales • Generating political will to act proactively (especially in transboundary areas) • Balancing environmental protection with economic or maritime freedom

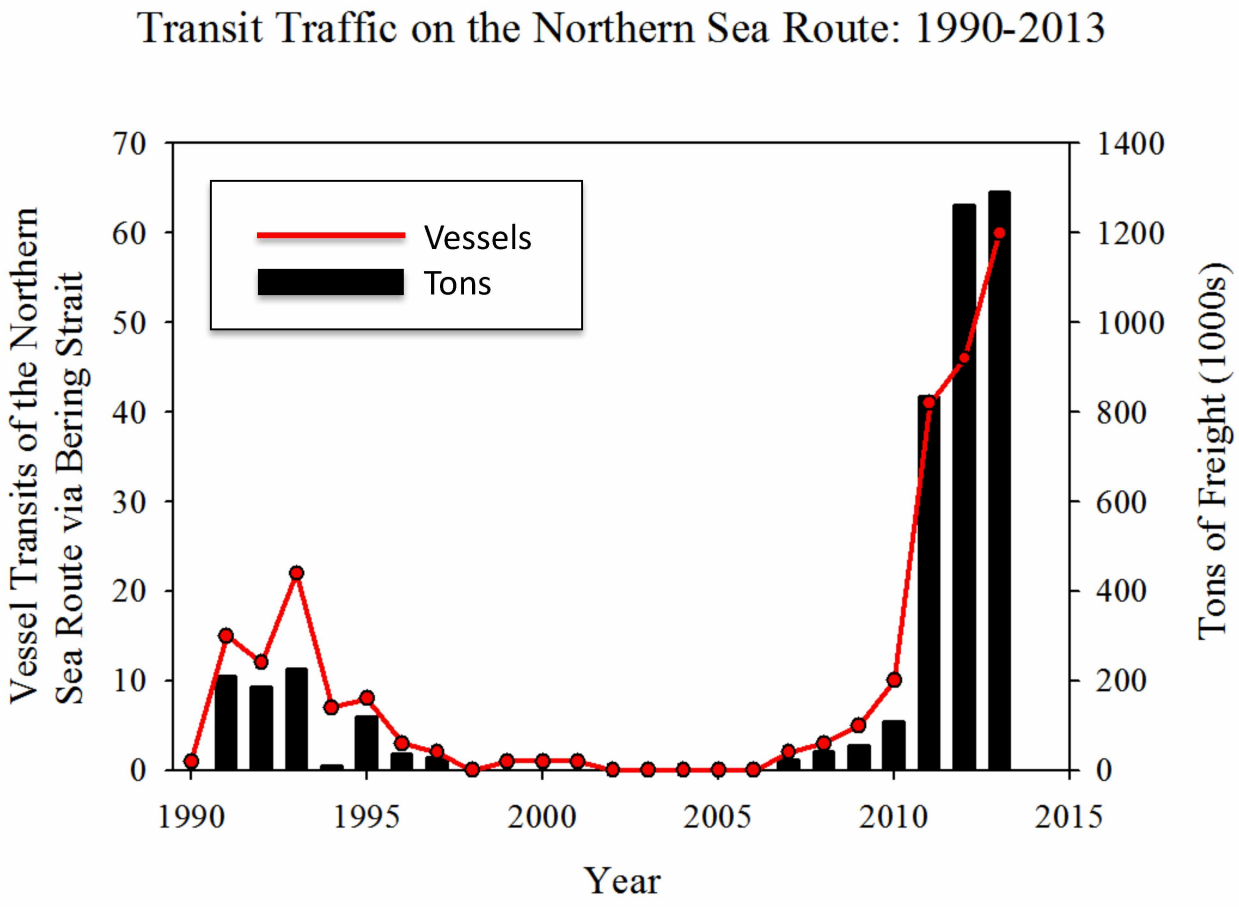

Figure 4.1 Reported vessel traffic on the Northern Sea Route, 1990 – 2013. While transits are regarded as those vessels passing between the Barents and Bering Seas via the set of waterways between Kara Gate at the southern tip of Novaya Zemlya) and the Bering Strait, this is only a small proportion of the vessel traffic entering the Northern Sea Route which includes cabotage and import/export (Data from High North Logistics).

CHAPTER 5: CONCLUSION

5.1 Introduction

In this chapter I apply the radical resilience framework developed in the general introduction to the three case studies presented in the body of the dissertation. This is achieved by rereading each case study in light of the five questions that were generated by integrating vocabulary from radical political economy with key concepts from conventional resilience thinking. The questions are:

- What are the key social-ecological dynamics of the given system?
- Who benefits from the arrangement, at what scale, and how much?
- Who suffers from the arrangement, and at what scale, and how much?
- Is power equitably distributed in this arrangement?
- In this context, what should be made resilient to what and for whom?

After addressing the above questions for each case study, I turn to a discussion of the dissertation's overarching research question: How is the global capitalist system affecting the social-ecological resilience of Indigenous communities in northern Alaska as the Arctic continues to industrialize? Finally, I offer recommendations for improving Arctic stewardship, which advances the dissertation's goal of improving resilience thinking and its application. First, however, I further examine what a reconstructed resilience thinking looks like in terms theory, research, and action.

Resilience thinking has produced myriad theoretical heuristics that represent the key ontologies and epistemologies of the field (see Walker et al., 2006). I am focusing my

reconstruction on the adaptive cycle, which is arguably the most important heuristic, as it lies at the center of much resilience-based analysis. The adaptive cycle is intended to provide a general model for the process by which systems change over time. In this model, systems move through four unique and sequential stages and then start over again: growth, conservation, release, and renewal. The act of passing through these phases (which is represented graphically by a figure-eight shape lying on its side) gives systems the capacity to respond to changes imposed upon them from outside or inside their own boundaries. When a system reorganizes following a release phase, it can do so either around the same fundamental structures and functions, which is considered an adaptation, or around fundamentally different structures and functions, which is termed a transformation. Adaptive cycles exist at multiple spatial and temporal scales and are linked across scales to other adaptive cycles, forming a panarchy of mutually influential driving forces. Clearly this heuristic is highly abstract, but that is what grants it generalizability.

The connection between the adaptive cycle and radical political economy is that resilience thinkers speak of the capacity of systems to adapt and transform in terms of their capital – a concept central to political economy. Walker and Cooper (2011), in comparing natural systems to economic systems, explain that in the view of Holling (who is considered the originator of resilience thinking), "What unites these diverse systems… is the proposition that each can be defined by a concept of 'capital' – this capital be it financial… or biophysical, is the inherent potential of a system that is available for change" (8). If we take seriously Marx's definition of capitalism, as described in the Introduction, it becomes apparent that in capitalist systems, the systems potentiality is exploited and appropriated by an elite minority class that uses it to maximize its own profits. When a system's social and natural capital is controlled in a capitalistic manner, it is easy to see how systems can be directed to operate in ways that benefit

the capitalists. The seizing of control over systems by capitalists can take the form of either transforming a non-capitalist system into a capitalist mode of production and consumption (which is what sustainable development via neoliberalization is often criticized for), or, alternatively, by maintaining a system in a capitalist mode in the face of movement towards system transformation.

Remembering the critiques of resilience thinking and insights of Gibson-Graham (1996) about alternatives to capitalism, we can see that while it may be the presence of capital within a system that signifies its capacity for adaptation and transformation, it is by whom the exploitation of that capital is appropriated and how the value is disturbed and reinvested that actually matter for the structure and function of the system (e.g., the production of social well-being vs. negative externalities). Radical resilience conceptualizes the adaptive cycles of social-ecological systems as being largely steered by human decisions and power (this is the Anthropocene after all), and would explicitly acknowledge the social and ecological undesirability of capitalist systems. The reconstruction does not fundamentally change the adaptive capacity heuristic, but it does alter our understanding of the nature of capital in the cycle. Other foundational theoretical concepts in resilience thinking (e.g., panarchy, traps, feedbacks, cross-scale interactions, fast and slow variables) should be similarly recast in light of a critical understanding of capital and its multiple potential uses.

In terms of research, a reconstructed resilience thinking would include a new method for bounding systems. Speaking from personal experience, resilience thinkers are trained to limit the scope of their analysis by drawing strict boundaries around a system of interest. The problem with this, however, which MacKinnon and Derickson (2013) point out, is that resilience-based research often focuses on local to regional scale systems while ignoring the embeddedness of

such systems in larger scale circuits of capitalist production and consumption. In resilience language, the perturbation of neoliberalism's international policies to the resilience of non-capitalist systems must become a central topic of study for a reconstructed resilience thinking. How can non-market, sharing economies be made resilient to the global sustainable development agenda, for example? Complementarily, the study of transforming capitalist systems into non-capitalist systems within the theoretical framework of resilience thinking would be an area of research. This second line of research would complement the efforts of political ecology to be a "seed" of positive action, instead of just a "hatchet" with which to critique.

The dominant methodology of conventional resilience thinking (i.e., modeling) gets to the heart of the ontological and epistemological divide between positivists and critical theorists (Cote & Nightingale, 2012). Can we really ever know a system? Nevertheless, there is a growing body of resilience-based research that engages alternative qualitative methodologies, such as ethnography. A mixed-methods approach to researching the resilience of alternatives to capitalism is the most promising option for moving forward, as this would create a better understanding of the role of identities in non-capitalist resilience, while also offering new modeling challenges, such as calculating the statistical influence of international free trade policies on the self-perceived well-being of ecosystem dependent local populations. Importantly, the indicators that researchers measure as proxies of resilience would change from absolute economic output, for example, and instead examine the social distribution of economic capital.

Lastly, a reconstructed resilience thinking could empower action that leads to genuine movement away from capitalistic social-ecological relations, and some research suggests that is already the case (e.g., MacKinnon & Derickson, 2013). This might include communities separating themselves from global flows of capitalism in a return to local production and

consumption. It might see communities accessing global flows of capital, but then using them for communal purposes, thus subverting the logics of capital accumulation and creating heterogeneous systems where multiple modes of economy exist side-by-side, like those suggested by Gibson-Graham. The key in terms of action, is to prevent capitalists from using resilience thinking as a discursive tool to make people believe that it is their responsibility, as individuals or communities, to absorb the harms of capitalism.

Perhaps the most important alteration for the research, theory, and action aspects of a rebuilt resilience thinking is the conceptual move of framing capitalism as an undesirable system trait rather than a natural social-ecological condition. Remember, getting rid of capitalism here does not mean getting rid of markets or the exploitation of labor to produce surplus value, which are acceptable, but rather getting rid of the appropriation of that surplus value by an elite class, which leads to harmful social-ecological relations (i.e., externalities). Resilience thinking is a powerful conceptual framework that can be used to steer transformations in a desirable direction. It is up to critical scholars to wrestle the definition of 'desirable' away from the capitalist agenda and to save resilience thinking from its unfortunate ingestion of the contradictions of capitalism.

Radical resilience is exciting because it provides a well-reasoned and specific idea for harnessing existing resources to increase social well-being and environmental sustainability. It takes the resilience thinking bundle of theory, research, and action that we already have and points in a new direction. It builds on the essential work of critiquing resilience and tries to take the next step of reconstruction. It is hopeful and optimistic because it emphasizes 'the good' in alternative ways of doing economy—we can still produce and consume and invest, we just have to do it in ways that subvert capital accumulation by the elite. Perhaps this is a step towards creating systems of social, environmental, and economic relations that are every bit as efficient

and energized as capitalist systems, but based on an entrepreneurship of communal well-being, rather than of selfish greed. The interpretation of resilience described above allows a radical rereading of the three case studies the dissertations presented previously.

5.2 Case 1: Tourism

5.2.1 What are the Key Social-Ecological Dynamics of the Given System?

This case study examined the tourism situation in Barrow, Alaska. A key driver of tourism in the community was shown to be the community's natural capital, especially the desire of tourists to view certain animals such as polar bears and specific avian species. The case also revealed that tourists are attracted to the community due to its extreme northern-ness, which brings with it natural phenomenon such as the presence of sea ice, tree-free landscapes, and the aurora borealis. While the Northern Lights will remain unaffected by global warming, the same cannot be said for Barrow's other natural attractions. Climate change is predicted to degrade the suitability of critical habitat for polar bears and other species that are highly adapted to the Arctic's unique climate (Intergovernmental Panel on Climate Change [IPCC], 2014). Reduced sea ice, increased landscape shrubification, and a northerly advancing tree line have also been projected by ecological and geophysical models under climate change scenarios (IPCC, 2014). For tourism, these changes could constitute a reduction in the desirability of the community as a destination, although this could be many years off and further research is needed to understand the motivation of Barrow's tourists quantitatively.

In the interim, knowledge about climate change and its impacts in the Arctic might create a temporary increase in tourism, as visitors seize what they view as their last chance to experience threatened phenomenon. In Barrow, climate change may actually increase polar bear viewing opportunities in the near term, as reduced sea ice has been linked to increased use of land among polar bears in the Chukchi Sea area (Rode et al., 2015). A significant tension within Arctic tourism is that tourists' activities tend to exacerbate the impacts on the natural phenomenon they seek to experience though, for example, the emission of greenhouse gases associated with travel and more direct harassment of species during viewing activities. Tourism in Barrow also has a strong cultural component. The Indigenous Iñupiat culture is both a tourism attraction and a potential site for tourism impacts. Impacts can occur through external cultural commodification and through increased competition for subsistence resources including access to specific species and relevant landscapes.

5.2.2 Who Benefits from the Arrangement, at What Scale, and How Much?

The benefits of tourism in Barrow are split between local and non-local stakeholders. Local beneficiaries include tour guides, hotels, restaurants, and handicraft artisans who extract profit from visitors to the community. Local beneficiaries are split between Alaska Native and non-native individuals and business owners. Beneficiaries outside of the community primarily consist of tourism companies that utilize Barrow as a destination, such as those based in other parts of Alaska and in more distant locations such as Europe and Asia (e.g., foreign cruise ship lines). Tourists themselves also ostensibly benefit from tourism in Barrow, although in a non-financial manner. Comparing the prices of the tourism services offered by local Indigenous

beneficiaries to those offered by non-local beneficiaries reveals a significant contrast. Iñupiaq artisans sell their handicrafts for between a few tens of dollars to a few hundred dollars usually, with occasional custom pieces reaching into the thousands of dollars. Similarly, a two to three hour tour with an Iñupiaq guide in Barrow costs a few hundred dollars per person.

In contrast to the small tour operators and independent artisans located within Barrow, the Asia-based cruise line Crystal Cruises is planning a 2016 transit of the Northwest Passage that illustrates the scale of non-local tourism activities occurring in the region (Crystal Cruises, n.d.). Crystal Serenity is the name of the ship making the transit, and tickets for one of its 1,080 passenger spaces range between $21,000 and $46,000, depending on the level of luxury desired. Of course tourists would spend significantly more money in Barrow if they stayed there for a length of time comparable to the duration of a cruise, and of course the cruise goes to more location than Barrow. The point of this comparison is simply to illustrate that the portion of the total arctic tourism dollar being spent in Indigenous communities is very small.

5.2.3 Who Suffers from the Arrangement, at What Scale, and How Much?

The tragic irony of Arctic tourists contributing to the destruction of the very ecosystems they visit through the emission of greenhouse gases has not been lost on tourism scholars. Dawson, Stewart, Lemelin, and Scott (2010), for example, quantify emissions and gauge tourists' perceptions of their own carbon choices related to polar bear viewing in Churchill, Canada. There is also concern that Arctic tourism has already and will increasingly disturb Indigenous cultures by introducing large numbers of visitors to small, largely-Indigenous coastal communities that may not be well equipped to handle such human influx, neither in terms of

physical infrastructure nor culturally (Luck, Maher, & Stewart, 2010). Moreover, communities run the risk of potentially overinvesting in tourism infrastructure, which may be profitable in the short term, but later prove costly to maintain if tourism number decrease. Larger tourism business operating in the region possess the ability to simply stop running Arctic tours if it becomes unprofitable. As the case study of Barrow shows, many of the concerns about who suffers from Arctic tourism are based on projections about what might happen in the future, rather than current conditions. However, as the Crystal Cruise transit of the Northwest Passage described above indicates, the future appears to be approaching rapidly.

5.2.4 Is Power Equitably Distributed in this Arrangement?

Within the tourism system of Barrow, Alaska, power is divided between stakeholders across various scales. The local governments (city and borough) and native corporations (village and regional) hold jurisdiction over different segments of the land and own some of the tourism infrastructure in and around the community, and thus control tourism activities to some extent. The City of Barrow, I was told during an interview, possess jurisdiction over the portion of the coastline where cruise passengers make landfall, which would give the city the right to extract a head tax on cruise tourists. At larger scales, the activities of tourists in Alaska are affected by state, federal, and transnational rules and regulations pertaining to the movement of people through space and their allowable impacts on natural environments. The production and sale of Indigenous handicrafts, for example, is limited by marine mammal protection laws imposed by the US federal government (Robards & Lovecraft, 2010). Similarly, cruise tourism is governed in part by the UN International Maritime Organization, but also by the standards of industry

organizations, which have emerged from decades of complex political debates and legal decisions about passenger safety, inter alia. Due to the long distances and high costs associated with Arctic tourism, large tourism businesses hold substantial power in the system because they possess the financial capital needed to generate the economies of scale that make Arctic tourism profitable. Lastly, the tourists themselves possess consumer power.

5.2.5 In this Context, what should be made Resilient to What and for Whom?

Approaching resilience thinking from the perspective of radical political economy reveals that in the case of tourism in Barrow, the distribution of risk and benefits are more evenly distributed between stakeholders (along axes of local vs. non-local, Indigenous vs. non-Indigenous, and financially powerful vs. financially disempowered) than in the cases of natural resource extraction and shipping that follow. This is because the risks and benefits are currently less, in an absolute sense, in this case than in the others; that is to say that tourism does not currently produce the same levels of profits nor social-ecological harms as natural resource extraction and shipping.

However, tourism is similar to the other cases to the extent that non-local, financially powerful actors (e.g., cruise ship firms, tour companies based in southern Alaska) still extract the most financial benefit and carry the least risk, since they can simply leave the region if changing conditions challenge their bottom line. Local communities, on the other hand, are intrinsically tied to a particular territory and thereby find themselves subjected to the changes being brought about largely by outside influences, such as globalization. Globalization affects demand for, supply of, and access to tourism destination in the Arctic broadly, and in northern Alaska more

specifically. Take China, for example, which after opening its borders to the rest of the world through its increasing embrace of capitalism, has generated a large middle-class society of consumers and investors. Evidence suggests that China's new capitalists are increasing demand for tourism destinations – including those in the Arctic – as they gain consumptive power (Li, Lai, Harrill, Kline, & Wang, 2011), while also increasing the supply of Arctic destinations through foreign direct investment and the establishment of Chinese tourism enterprises in locations such as Iceland (Huijbens & Alessio, 2015). Globalization is partially defined by an increased rate in the flow of people and capital around the world, and increasing demand for and supply of Arctic tourism destinations is part of this phenomenon. When considering resilience in this context, we ought to ask, how can local goals for tourism development be made resilient to (1) agendas and priorities of outside actors and (2) environmental change, and how can this be done for the benefit of local stakeholders, especially Indigenous populations?

5.3 Case 2: Natural Resource Extraction

5.3.1 What are the Key Social-Ecological Dynamics of the Given System?

Within the region that this case study defines as US Arctic, there are over 30,000 residents – a high percentage of whom are Alaska Natives engaged, to varying degrees, in subsistence lifestyles. Natural resource extraction in this region, in the form of oil and gas production, mining, and all accompanying development, has caused direct alterations of particular places on landscapes and seascapes, while also contributing to cumulative impacts on regional ecosystems more broadly. Oil leaks and mine tailings pose the threat of environmental

pollution, while industrial phenomenon like seismic prospecting and the construction of roads, pipelines, and offshore drill platforms may disrupt the normal patterns of keystone species, such as caribou and bowhead whales (Glenn, Itta, & Napageak, 2011; Huntington, 2009). Climate change is also contributing to the cumulative impacts to regional ecosystems through, for example, altering the abundance and spatial distribution of caribou food sources and arctic sea ice (IPCC, 2014). In contrast, the production of oil and gas resources in the region contributes to climate change through the release of greenhouse gases during the combustion of these fossil fuels for energy.

5.3.2 Who Benefits from the Arrangement, at What Scale, and How Much?

The corporations responsible for industrial development are the largest beneficiaries of existing and plausible future development in US Arctic, despite being based outside of the region. Local communities, however, also receive substantial benefits from natural resource extraction through a variety of financial arrangements that channel revenue to regional boroughs, native corporations, and individuals (e.g., taxes, royalties, partnerships, employment). The native regional corporation in Northwest Arctic Borough reports that in 2015 Red Dog Mine paid $11.6 million to the borough in lieu of taxes, $187 million in royalties to native shareholders, and $39.3 million in wages to native employees (NANA Regional Corporation, 2015). This financial inflow aids local communities in securing basic social services and helps subsistence users pay for the modern technology needed for subsistence hunting and gathering, such as snow machines, boats, and fuel. The corporate partner in Red Dog Mine is a Canadian firm called Teck – who reported gross corporate profits of nearly $3 billion in 2014 from 12 mining

operations spread throughout North and South America (Teck Resources Limited, 2015). A similar dynamic is present between the oil and gas corporations operating in the region (e.g., Shell, Exxon-Mobile, BP) and local communities; wherein significant financial revenues flow to boroughs and native corporations while extra-local corporations running the activates secure huge profits.

5.3.3 Who Suffers from the Arrangement, at What Scale, and How Much?

The ecosystems that have been directly impacted by the building of industrial infrastructure are some of the largest losers in this arrangement. As the case study points out, the footprint of existing infrastructure is over 18,000 acres, and that could increase by nearly 50% under a maximum development scenario. Moreover, the area affected by industrial activities is much greater than the actual footprint (National Research Council [NRC], 2003). This affected space, both terrestrial and maritime, is no longer engaged in producing the same level of ecosystem services that unaltered environments would supply (although permitting processes aim to minimize impacts on ecosystem services, such as habitat provision for subsistence species). Through the degradation of ecosystems and also the reduction in physical space available for subsistence use, local communities are negatively affected by industrial activity in the region.

Industrial activity has also made local communities vulnerable to volatility in global natural resource markets. Due to their dependence on the revenue associated with the single sector of either mining or oil and gas, a crash in these markets could spell financial disaster for communities that have little economic diversification. However, this is also largely the case for

the State of Alaska. The financial future of many communities is linked to the production of non-renewable resources, which is not conducive to long term sustainability. The multi-national corporations that run natural resource extraction, on the other hand, are less vulnerable to a halt in production from within the region. As we saw with Red Dog mine and as is the case for the big oil and gas companies, natural resource corporations in northern Alaska have operations throughout the world. If the resources dry up in Alaska, or if market forces make continued operation unprofitable, they can refocus their efforts elsewhere. Obviously the same cannot be said for regional communities, for whom location is unalterable.

5.3.4 Is Power Equitably Distributed in this Arrangement?

A degree of equity and power sharing was established by the Alaska Native Claims Settlement Act (ANCSA) of the US Congress, which granted native populations ownership over limited portions of the surface and subsurface lands in US Arctic. It is the act of owning the land that allows Alaska Natives to secure revenue flows from some of the natural resources extraction taking place in the region. However, in many ways it is still the multi-national corporations that hold the power since they decide whether or not to operate in the region – decisions that Marxism shows are based strictly on profitability analyses. Other stakeholders, such as the State of Alaska and the federal government, can encourage or discourage natural resource extraction by making the processes relatively easier (e.g., streamlining permitting) or harder (e.g., increasing environmental regulations), but it is ultimately the corporations whom everyone else seems to be waiting on. This situation played out in the study region following the summer of 2015, when Shell decided to end its explorations activities in the Chukchi Sea. Shell's

withdrawal caused other companies who were depending on them as a partner for field development to end operations in the region as well, and other stakeholders to worry about where the next oil will come from.

There is also a question of equity and power sharing within local communities. In other contexts, integration into global capitalism has generated class divisions within communities that did not exist beforehand through, for example, the creation of local elites, i.e., those who control financial capital within a community (e.g., Ovadia, 2012). While limited research argues this is the case in Alaska (Mason, 2002), and future research should explore this, it is worth noting that the tendency towards local elitism may be mitigated by two factors. First, native persons became shareholders in their respective native corporations as part of ANCSA, assuring everyone alive at the time (not just local elites who possess privileged relationships with corporate leaders) received a piece of corporate profits. Second, the native cultures in the region strongly value sharing and community wellbeing over individualism, which may curtail rampant greed and excessive accumulation on the part of individuals. That being said, the relationship between Indigenous values and Western values is under continual negotiation.

5.3.5 In this Context, what should be made Resilient to What and for Whom?

This case study brings into relief the complexity and conflicting nature of the relationship in the US Arctic between local communities, multi-national natural resource corporations, and global markets. On the one hand, communities secure important revenue from these corporations because they own land that is valuable to processes of extraction. On the other hand, communities have become highly dependent on nonrenewable resources, and global markets

over which they have little influence, as it is the corporations that engage the market, not the communities. The corporations with which communities have established financial relationship possess greater flexibility in terms of being able to leave the region should production prove unprofitable. Ecosystems have already absorbed significant impacts; directly from infrastructure development and indirectly from the climate warming caused by the release of greenhouse gasses that the infrastructure development facilitates.

A resilience approach that is informed by radical political economy directs us to examine the plight of those who have been historically marginalized through processes of capital production and consumption. In this case it may be difficult to say that local communities in Northern Alaska are in this marginalized position, since they have profited from the extraction of natural resources. However, when the revenue garnered by communities is compared to that of the multi-national corporations, and the relative degrees of vulnerability that each has incurred as a result of their ties to global markets, it is clear that local communities are indeed in a disadvantaged position. Moreover, when examined historically, we see that the current state of affairs, with some equity and power sharing, resulted from processes of colonial dispossession whereby Alaska Natives waged an intense political battle for ownership over their historic homeland, and were able to secure only a small portion of their original claims. For the sake of equity, the focus of resilience should be on local communities to the economic and ecological vulnerability brought about by decades of nonrenewable natural resource extraction, and this should be pursued for the Indigenous inhabitants of the region.

5.4 Case 3: Shipping

5.4.1 What are the Key Social-Ecological Dynamics of the Given System?

This case study focuses the transboundary area of the Bering Strait, between the Russian Federation and the US state of Alaska. Within this space, comprised of maritime and coastal environments, over 20,000 Indigenous people draw at least part of their livelihood directly from the ecosystem. Key subsistence activities include fishing, hunting of marine mammals, and gathering of edible plant and animal species. Changes to the Bering Strait ecosystem are being driven by both climate change and globalization. Rising air and water temperatures are altering the sea ice regime, which in turn affects keystone species such as walrus, for whom sea ice constitutes critical habitat. Reduced sea ice, the desire of international shipping companies to minimize their transportation costs, and increased hydrocarbon production in the Russian maritime Arctic is leading to increased shipping through the Bering Strait. Such large ships, however, are known to disrupt marine mammals (sometimes by striking them directly) and discharge pollution into marine ecosystem (Neilson, Gabriele, Jensen, Jackson, & Straley, 2012; Protection of the Arctic Marine Environment [PAME], 2009). This case study is largely forward looking, as it focuses on predicted increases in shipping and policy strategies for mitigating the accordant social-ecological impacts.

5.4.2 Who Benefits from the Arrangement, at What Scale, and How Much?

International, non-local shipping firms benefit financially from the current and projected future social-ecological arrangements in the Bering Strait, whereby free passage is assured under the international convention of the Law of the Sea. Studies indicate that cargo ships using transarctic routes can reduce the distance between Europe and Asia by as much as 40% compared to using the Suez Canal (Liu & Kronback, 2009). Translating this reduced distance into profit, however, is complicated by factors such of the time per year that the route is passible and cost of hiring ice breakers to aid in transit. Liu and Kronback (2009) estimate that if the conditions are right, shipping companies transitioning to a transarctic route can expect an annual profit growth of up to 83%. Subsistence users in the Bering Strait also benefit from the natural capital in the region. Subsistence is closely linked to cultural and spiritual wellbeing for Alaska Natives (Clement, Bengtson, & Kelly, 2013) and prevents the need to import costly foods from non-local sources, which are also less healthy. A recent survey of four Bering Strait villages revealed that the harvest of wild foods provides the daily caloric needs for residents at the rates of 27%, 30%, 40%, and 86% respectively (Fall et al., 2013).

5.4.3 Who Suffers from the Arrangement, at What Scale, and How Much?

Looking towards the future, migratory whale species stand to be negatively impacted by increased shipping, as the rate of ship strikes will likely increase. Local subsistence hunters also stand to lose out, as climate change and more ships are expected to decrease their capacities to access healthy wild foods. Moreover, local communities have little to gain from increased

shipping, because they are not owners within those circuits of capital, and thus cannot profit. International shipping companies, on the other hand, have little to lose from operating in the region, as they are usually well insured against various types of maritime accidents that may be associated with transiting icy waters. Overinvesting in transarctic shipping (e.g., building ice reinforced vessels) is one area of risk for international corporations, as is a negative impact on their reputation in the case of a major accident.

5.4.4 Is Power Equitably Distributed in this Arrangement?

International shipping corporations stand to gain substantial profits from increasing operations in the Bering Strait and, outside of some manageable financial risk, have little to lose. In contrast, climate change and shipping in the region threaten to end the life of specific marine mammals – through both direct ship strikes and the degradation of critical habitat. Subsistence users stand to lose the cornerstone of their culture if they can no longer hunt and gather successfully, and to incur significant financial burdens if it becomes necessary to import more food. The parties who stand to be negatively impacted have little power over determining the rules that control shipping and climate change in the region.

This is largely a case where international shipping is empowered to act environmentally irresponsible by an absence of strict regulations. Since the region is an international strait, ships are unrestricted by national standards and subject only to the international laws (e.g., Law of Sea, endangered species agreements, Polar Code) that favor the free passage of vessels. The Polar Code, for example, which is scheduled to enter into effect on January 1st, 2017 does not include any regulations equivalent to those that could be provided by Particularly Sensitive Sea Area

designation. Areas to be avoided, mandatory pilotage, ship reporting, no anchorage areas, ship routing schemes, and even voluntary speed limits are all absent from the Polar Code (International Maritime Organization, n.d.). This freedom is granted by the rules of the United Nations and is a product of the same neoliberal ideology that endorses free markets and other policy strategies that mobilize capitalist economics.

Subsistence users can use their status in state, federal, and international politics – which is not insubstantial – to lobby for regulations in the region, but they have little direct control of the situation. Local communities may also be able to invoking national-scale laws, such as the Marine Mammal Protection Act and the Endangered Species Act, to limit the activities of shipping in the region. NGOs play a significant role in promoting a discourse of environmental conservation, but their power is also small compared to that of industry to transit freely in the international strait.

5.4.5 In this Context, what should be made Resilient to What and for Whom?

In the case study presented in the dissertation, my coauthor and I discuss the resilience of the Bering Strait social-ecological system. We define the system as the set of relationships between the regions ecosystems, its subsistence users, and shipping. As is common in mainstream resilience thinking, we are uncritical of capitalist modes of production and consumption (represented by international shipping in this case) and seek a way to balance this with the needs of other users through improved governance. We never seriously consider the highly inequitable distribution of risks and benefits incurred by industry on the one hand, and

local users and marine mammals on the other hand, nor do we acknowledge the highly inequitable power relations between these actors.

By using a radical political economy approach to consider resilience in the Bering Strait it becomes clear that in order to promote equity, local users and local ecosystems should be given priority over international shipping. In this case, the extra-local capitalist economic activity provides little to no benefit to local users and stands to directly impair non-capitalist social-ecological relations (i.e., subsistence) and destroy the life of marine mammals. When we consider Bering Strait resilience, then, it should be in terms of the resilience of ecosystems and subsistence systems to international shipping and climate change, for the local users and local ecosystems.

5.5 Global Capitalism's Effects on Indigenous Communities: Northern Alaska and Beyond

5.5.1 Overview

Economic activity can be viewed as impacting the environment through two basic mechanisms. First, economic production is fundamentally a consumptive phenomenon, meaning that elements of the non-human world (what is commonly called raw materials) must be enter the process at the beginning to create a product for exchange. Humans are also drawn into the process of production in the form of labor and sometimes as commodities. Secondly, processes of production by which raw materials are transformed into their exchangeable forms (including transportation to markets) and processes of consumption often entail the generation of environmentally harmful byproducts. Pollution must then be absorbed by the environment. This

model of the environment as source for economic products and sink for economic byproducts, while highly simplified, is an accurate and inescapable representation of reality.

Economies in and of themselves are not necessarily ecologically unsustainable or socially unjust. Economic modes of exchange—whereby goods and services are distributed to humans—are fundamental aspects of social existence and can likely operate within environmental boundaries whereby the continuation of the economy can last indefinitely. This does not mean that the economy will remain in a single state for all time, consuming the same raw materials at the same levels, producing the same products, and seeing the same dynamics of exchange. Ecosystems, or the environment, or nature, changes on its own in addition to coevolving with society, so economies must adapt to natural variability over time to remain viable. Along these lines, political ecologists have cautioned against the "rejection of forms of economic activity that may be less environmentally damaging than assumed" (Forsyth, 2004, p. 118), including industrialization processes that are genuinely controlled by local interests. While economic activity should never be thought of as inherently objectionable, it is still possible to reflect on the impacts of global capitalism on Indigenous communities in northern Alaska and the wider Arctic.

5.5.2 Northern Alaska and the wider Arctic

Looking at the three case studies together through the lens of radical resilience demonstrates that global capitalism has a mixed impact on the resilience of local communities in northern Alaska. The effect is likely worse than conventional resilience thinking would acknowledge, but better than hardcore radical political economy would admit. As discussed in

the introduction, resilience is fundamentally a process whereby systems change, or adapt, in order to remain the same. For many of the communities in northern Alaska, remaining the same specifically includes maintaining the ability to engage in subsistence livelihoods, as subsistence has been identified by communities as a cornerstone of their identity (Thornton, 1998). As the case studies reveal, the forces of global capitalism manifest in northern Alaska as specific industrial activities (e.g., tourism, natural resource extraction, shipping) that negatively impact the habitats of subsistence species and compete with subsistence users for access to landscapes and seascapes. Moreover, the greenhouse gas emissions that are part and parcel to industrial capitalism are contributing to the rapid change of the Arctic environment. The supply of subsistence resources in northern Alaska and the ability to access them would likely be more reliable overall if capitalism did not affect the region via industrialization and climate change.

However, the same forces of global capitalism that negatively impact the supply of subsistence species and access to them also support community resilience in other ways. As the case studies show, industrial corporations serve as an important source of financial capital for many communities in the region—contributing to the community's adaptive capacity, which allows them to change in order to remain the same. This is seen, for example, in the adoption of modern technology for subsistence purposes, including four-wheelers, outboard engines, snowmobiles, and high-tech rifles. Technology allows subsistence users to overcome some of the challenges of a changing resource base by traveling longer distances in shorter periods of time to access preferred species. Technology has also enhanced subsistence planning within communities through the provision of satellite images, GPS, and mapping (Chapin, Lamb, & Threlkeld, 2005). In a broader sense, integration into global markets allows communities to fund many important western-style social and consumer services that are also elements of community

identity, and therefore constitute a component of resilience. Schools, retirement homes, banks, and retail stores are examples of the social and consumer services that integrations with global capitalism helps finance and support.

In what ways are the findings from this comparative case study applicable to arctic Indigenous communities outside of northern Alaska in regards to their plights to remain resilient? Considering first Indigenous communities in the rest of Alaska, it can be observed that some of the key social-ecological conditions are similar to those in northern Alaska, while others are different. Indigenous populations in the rest of Alaska are culturally and linguistically distinct from the groups in northern Alaska (Holton, 2014), but all Alaska Natives groups were subject to the 1971 ANCSA legislation that enrolled them into Native corporations. Some Native corporations flourished while others went bankrupt, but the takeaway is that all of Alaska's diverse Indigenous communities went through the same capitalist enculturation process at the same time, and thus share a specific legal capacity to engage in capitalist pursuits for the benefit of their people. The regional economies of Alaska vary, with service industries and fisheries being highly developed in southcentral Alaska and tourism being a large source of local revenue in southeast Alaska. It is also worth noting that certain impacts from shipping (e.g., marine mammal strikes) will not directly affect the preferred subsistence species of Indigenous communities in interior Alaska, since they are non-coastal.

However, other shipping impacts (e.g., marine pollution) may affect subsistence salmon in the interior, since salmon spend a portion of their life in the open sea. Similarly, while interior Indigenous communities and coastal communities in the southern Alaska will not experience direct negative impacts from disappearing sea ice (since they have never relied on it), they have climate change threats to contend with too, including invasive species, flooding, and forest fires

(IPCC, 2014). To summarize, while the specifics of each Indigenous community's social-ecological system throughout Alaska differ, the general process of change that each is going through – in terms of environmental-capitalist relations – is quite similar. Capitalism is both a cause and a solution to contemporary problems, but its influence on resilience depends on how it is done, who controls it, and who the main beneficiaries are.

In Canada and Greenland, the situation is similar in many ways to northern Alaska. The Indigenous populations, while culturally distinct from Alaska's Iñupiat Inuit, are ethnically and linguistically Inuit as well (Arctic Centre – University of Lapland, n.d.). Canada's and Greenland's Inuit have similar colonial histories to Alaska's Indigenous groups – having withstood forced settlement, religious missionaries, forced schooling, and attempts to eradicate their languages. The regions also share the trait of a relatively recent – last three decades or so – movement toward Indigenous self-empowerment, in terms of land rights and political representation at the national and international scales (Larsen, Nilsson, & Young, 2014). This empowerment trend has meant increased Indigenous interaction with corporations operating in each groups' respective territory. Indigenous peoples in Canada and Greenland have emerged on the political-economic scene as players that must now be consulted with, at the least, or partnered with, at the most. Moreover, the industries operating in Canada and Greenland are quite similar to northern Alaska, with oil and gas being prominent, and increases in tourism and shipping predicted (Larsen et al., 2014). However, Alaska is the only of these three regions to be subjected to the increases in shipping caused by the Bering Strait bottle neck. Also, Canada's and Greenland's Inuit do not operate in the same corporate structure as Alaska's Native corporations, which has ramifications for the structure of Indigenous-industry relations. Indigenous subsistence practices in Canada and Greenland are similar to northern Alaska, with whales and

caribou being key (Arctic Council, 2013). Being careful to avoid erroneous extrapolation, it still appears safe to conclude that the impacts of industrial activity on Indigenous communities in Canada and Greenland are also mixed, but slightly worse than in northern Alaska. This is thought to be because Canada's and Greenland's Inuit do have an Indigenous corporate culture that is as well-developed (nor as lucrative) as that of Alaska's Indigenous populations. Thus, the former groups are subject to the same threats from capitalism – environmental degradation and social exploitation – but are not able to extract the same degree of benefit. Whether Alaska's Indigenous capitalists have lessons to teach Inuit in the rest of North America is an interesting question for future research.

In arctic Europe (Norway, Finland, and Sweden) and arctic Russia, the primary nature-based livelihoods of Indigenous people are reindeer herding and fishing (Arctic Council, 2013). The Sami, whose recognized homeland extends throughout the artic European countries and into western Russia, and the Nenets of northern Russia are the largest Indigenous groups in arctic Eurasia. The colonial histories of Indigenous people on these continents is fundamentally similar to that in North America, being marked by forced schooling, religious missionization, attempts at linguistic eradication, and other forms of cultural assimilation and marginalization (Larsen et al., 2014). One notable difference between the arctic Indigenous groups of Eurasia and those of North America is the former – especially the Nenets – have retained elements of their pre-colonial nomadic lifestyle, which revolves finding pasture for their reindeer by moving their communities across the tundra. Similar to North American arctic Indigenous groups, however, traditional livelihoods in arctic Eurasia are threatened by increasing levels of industrialization – including oil and gas pipelines that inhibit reindeer grazing – and climate change, which is altering the distribution of the lichen that reindeer eat (Arctic Council, 2013). The international

tourism industry has already commodified Sami culture to a significant degree, with only minimal benefits flowing to the Sami. The presence of a developed tourism industry in arctic Europe contrasts to arctic Russia, where tourism is currently small, but growing, as Russia only opened to the forces of global capitalism a few decades ago. Across arctic Eurasia, coastal Indigenous communities that depend on fishing are vulnerable to increases in shipping along the Northern Sea Route, with Russian offshore oil production being a major cause. The benefits of capitalism for these groups varies. While a large portion of Sami and some Nenets are now urbanized and depend on social services provided by taxes on capitalist activities, many continue traditional lifestyles (Larsen et al., 2014). Unlike Indigenous communities in Alaska, Sami and Nenets have not been organized into for-profit corporations, and so their capacity to benefit from increasing levels of arctic industrialization is likely less than Indigenous communities in US Arctic, although additional research is needed to confirm this.

Comparing the social-ecological relationship between Indigenous communities and industrialization in northern Alaska to those in Canada, Greenland, Norway, Finland, Sweden, and Russia reveals broad similarities, with one major contrast being the corporate structure of Alaska's Indigenous communities. Currently communities in northern Alaska are remaining resilient, as they adapt to increased industrialization and climate change. However, as the case studies demonstrate, social-ecological changes are projected to continue, and to increase in many cases, over the next decades. In the Introduction I showed that arctic stewardship is a promising governance framework for steering arctic change is a desirable direction, but that it remained somewhat problematic from a theoretical perspective because it did not adequately integrate insights from critical social theory writ large and radical political economy specifically. In the following section, I offer recommendations for arctic stewardship that address these shortcoming

and are intended to create a future that has a more equitable distribution of the social-ecological benefits and risks that are associated with arctic change.

5.6 Recommendation for Arctic Governance

The panarchy model from resilience theory conceptualizes how systems change at given scales and how coupled systems at different scales affect one another (see Figure 1.3 in General Introduction). Panarchy holds that the relationship between systems at multiple scales is often dominated by the function, structure, and identity of the large scale systems but that this relationship can, at times, be controlled by smaller scale systems. The tendency of large-scale systems to control smaller-scale systems occurs through a process called system memory, while the rarer occurrence of small scale systems dominating a system of coupled cross-scale systems is called revolt (Figure 5.1). The understanding that revolts can occur across spatial scales from the bottom up influenced early resilience thinkers to name their model panarchy, which distinguished it from other conceptualizations of cross-scale system interactions that posited a strictly hierarchical (top-down) relationship between systems (Gunderson & Holling, 2002).

The recommendations I offer for arctic governance are meant to enhance the possibilities for revolt within the matrix of coupled social-ecological systems that affect biological diversity and human wellbeing in the Arctic. These systems include the community-scale subsistence systems that are a cornerstone of Indigenous identity in the Arctic and the global scale capitalist economic systems at the root of many arctic changes. By promoting the capacity of small-scale systems to influence control over large scale systems in the Arctic, I am attempting to correct for the problem that MacKinnon and Derickson (2013) identify as being present in recent attempts to

apply resilience thinking through the creation of public policy. The authors show that when resilience thinking is applied to communities without consideration of the larger-scale structural processes that create the need to be resilient in the first place, a condition of responsibility without power can occur. In other words, the onus to adapt to global changes is being put onto communities but communities do not necessarily possess the capacities (i.e., economic, political, environmental) to make the changes that would be required in order to maintain the desired structure, function and identity of the system from the community perspective. Promoting the ability of small-scale systems to revolt is a strategy for empowering communities with the capacities they need to influence larger-scale systems, so that they have both the responsibility and the power to remain resilient. Three recommendations for promoting revolt are provided and discussed in turn: 1) communities need sovereignty over the territory they use for subsistence; 2) communities need effective representation in regional scale deliberations that will affect them; and 3) communities need effective representation in global scale deliberations that will affect them.

5.6.1 Territorial Sovereignty

Currently the power to control the territory on which Indigenous groups in the Arctic conduct subsistence is divided between federal, sub-federal and local stakeholders, with the allocation of power-sharing varying by country. In Alaska for example, the management of land and sea resources is split between the federal and state governments based on land ownership, with Indigenous interests being represented through co-management arrangements in some cases. However, in order for communities to increase their power over social-ecological systems

at larger scales, it is necessary for them to acquire sovereignty over the spaces where subsistence occurs. This would strengthen Indigenous communities at the community and regional scale, giving them a firm base of resource control on which they could build the capacity to affect change at larger scales. It is necessary for Indigenous communities to control subsistence at the local-scale before they attempt to influence the larger scale processes that also affect subsistence. The main challenge to this recommendation is that state and federal agencies are unlikely to relinquish power over managing subsistence resources without being forced to do so through legal battles.

While sovereignty is never complete nor total, current management regimes could transition to allow Indigenous groups more power – and government agencies less – over decisions about when, where, and how to hunt, fish, and gather. One such effort in this direction is from Alaska where tribal governments have been waging a ten-year legal battle in the nation's court system to achieve land-rights comparable to those of tribal governments in the United States' lower 48 states. Currently the laws are different in Alaska because they were created at a different period of time under alternate circumstances. In brief, Alaska tribes are arguing that the federal government should be able to take land into trust on behalf of the tribes to create the equivalent of Indian reservations, which are units of territory over which tribal governments possess primary jurisdiction. The action is opposed by the State of Alaska, which intends to maintain its authority over much of the territory in question. A recent legal ruling (Akiachak Native Community v. Department of the Interior) has gone in the direction of the tribes, as a US federal appeals court decided that Alaska Natives cannot be treated differently than other Native Americans in terms of lands-in-trust ("Tribes in Alaska Celebrate", 2016). Currently in Alaska, the only Indigenous entities allowed to own land are the Native corporations, which has caused

resentment amongst those who believe that Indigenous interests are better represented by tribal governments. Moreover, Native corporations do not possess primary jurisdiction over subsistence on the lands that they own. Thus, while there is a degree of Indigenous sovereignty currently, is perceived as inadequate by many Alaska Natives.

5.6.2 Effective Representation at the Regional Scale

In the Arctic, community stakeholders need to have representation in deliberative processes at the regional scale, which is meant to mean all scales between communities and the Arctic as a whole. As discussed in the tourism chapter of this dissertation, native groups in the northern portion of Alaska have come together to form a non-profit organization with the explicit goal of representing Indigenous interests at larger scale political and economic forums. Time will tell whether this effort and others that are underway in the Arctic are truly effective in influencing the functioning of systems at larger scales. The presence of Indigenous groups within the Arctic Council through their Permanent Participant status is another example of community representation at a larger scale. The Arctic Council itself, however, does not possess direct regulatory power in the Arctic and operates instead by attempting to steer discourses about arctic change through the production of knowledge. Thus, the Arctic Council remains questionable in terms of serving as an avenue to affect change directly. A radical political economy perspective suggests that much of the real power in the Arctic is held by the multinational corporations that possess the massive financial capital to operate in the region. Gaining effective community representation in the decision making processes of such corporations will require increases in

both community power (via territorial sovereignty for example) and increased corporate social responsibility on the part of the corporations.

This is not meant to imply that there is currently a complete absence of representation by Indigenous groups at the regional scale, even within the corporate world. In Alaska the recently created Arctic Inupiat Offshore LLC – a partnership between the Arctic Slope Regional Corporation and six North Slope village corporations – is testament to the capacity of the region's Indigenous groups to represent themselves in the capitalist arena. Arctic Inupiat Offshore has a binding agreement with the oil-giant Shell that gives them the option to acquire an interest in Shell's offshore leases in the Chukchi Sea, off of the northwest coast of Alaska (Arctic Slope Regional Corporation, 2014). While Shell has since halted their activities in this region, following the 2014 crash in global oil prices, the agreement nonetheless marks a major achievement in Indigenous-corporate cooperation and profit sharing in the natural resource sector. This type of political economic representation could be pursued by Indigenous groups in other parts of the Arctic.

5.6.3 Effective Representation at the Global Scale

Aspects of global scale systems that affect the resilience of arctic communities include global agreements on issues such as international trade and environmental pollution (including greenhouse gas emissions). Such agreements, while global in scope and effect, are commonly negotiated at specific places over a specified period of time. Indigenous communities need effective representation at such negotiations to prevent what have been called "new forms of global colonization" (Langton, 2003) and to increase the capacity for systemic revolt. In 2015,

for example, delegations of Inuit leaders from the Arctic traveled to Paris, France to participate in the United Nations Conference on Climate Change. Again, however, questions remain about the adequacy of the Indigenous participation in terms of actual influence, as there is no mandate for decision makers to address community concerns to the extents demanded by different communities. Radical political economy demonstrates how decisions made at the global scale over the last few decades have largely followed neoliberal logics in their prioritization of capitalism through free trade, the spread of markets, and the rolling back of government social programs. While global capitalism supports community resilience in the Arctic in some regards, it also challenges it by contributing to climate change and increasing competition for the use of land and sea. An effective voice for Arctic communities at global deliberations could decrease the negative impacts of globalization at the local scale.

Indigenous representation at the global scale is being pursued currently by the Inuit Circumpolar Council (ICC). Founded in 1977 to help unify Indigenous political activity, ICC now represent over 160,000 Inuit from four Arctic nations (Canada, Greenland, Russia, and US) and serves as a major international non-government organization (Inuit Circumpolar Council Canada, n.d.). ICC concerns itself with a wide range of Indigenous issues, including equitable trade, environmental protection, self-governance, resource management, and community health. ICC focuses its effort on interacting with the United Nations and the Arctic Council, and the various sub-organizations of each. ICC is an important voice for arctic Indigenous groups at the global level and future efforts can build on its success. However, the ultimate assessment of the effectiveness of such organization will be demonstrated by whether Indigenous arctic communities continue to exist in the manner they desire as the Arctic changes.

5.7 Conclusion

The Arctic is a rapidly changing region. Climate change and socio-economic globalization are challenging the sustainability of Indigenous communities by altering the landscapes and seascapes from which they draw their subsistence. However, global changes are also affording communities new opportunities to engage in the benefits of the global economy and many communities have integrated such opportunities into their own identities. In order to guide future changes in a manner that promotes biological conservation and human wellbeing, scholars and policy makers are increasing turning to resilience thinking and the closely related concept of arctic stewardship. However, critics of resilience thinking have been quick to point out its inadequacies in terms of failing to understand critical social theory and, therefore, in inadvertently supporting environmentally and socially destructive modes of economic production and consumption.

In the Introduction I laid out the contributions that the field of radical political economy can make to resilience thinking, and proposed the framework of radical resilience that asks a specific set of questions aimed at integrating systems thinking with Marxism and post-Marxism. In this Conclusion, I examined three case studies about arctic change and industrialization in northern Alaska through the lens of radical resilience. This examination demonstrates that resilience of local communities in the Arctic is both negatively and positively impacted by global scale capitalism – the effects are complex and mixed, in other words. Further quantifying these impacts is one important area for future research. I then fed this finding back into the arctic stewardship framework for governance of arctic change by making three recommendations to support the capacity for revolt within the panarchy of arctic social-ecological systems. In the section that follows, I consider what such a revolt might look like.

First, however, it is important to inquire as to why Indigenous communities in northern Alaska have embraced capitalism at all. Italian Marxist Antonio Gramsci's concept of hegemony (1971) helps shed light on this phenomenon. Gramsci, writing from prison in the first half of the 20th century, used his formulation of hegemony to explain why capitalism had not been overthrown by communist revolutions – as Marx predicted it would be – in most of the western world. He described a process by which the bourgeoisie perpetuate capitalist culture through not only violence and coercion, but also through ideology and the manufacturing of consent (Gramsci, 1971). Political leaders in capitalist nations, he reckoned, use their material and discursive authority to engender within the exploited working class an association and affinity with the goals and values of the bourgeoisie – to trick the working class, in other words, into convoluting their own wellbeing with that of their masters. Within a hegemonic ideology, capitalist values *appear* as common sense (or natural) and the exploited, operating under a false consciousness, voluntarily participate in social (and ecological) relations that go against their actual own best interests.

In northern Alaska, the passing of ANCSA – which created for-profit Native corporations for the first time – can be viewed as an act of hegemonic power. After centuries of colonial domination (including attempted cultural genocide and territorial dispossession), the US federal government presented Alaska's Indigenous groups with an opportunity to participate in the capitalist system – to buy-in to what appeared as the only game in town by exchanging their land claims for 44 million acres of land and close to a billion dollars. With no perceived viable alternatives for the survival of their people, Alaska Natives consented to join the global capitalist system and, in so doing, perpetuate capitalist hegemony. There were, and are, however, radical Native activists the resist integration into global capitalism. Moreover, as this dissertation shows,

the hegemony is not complete within Indigenous communities, as anti-capitalist communal values persist. This is a key reason why livelihood such as subsistence hunting and gathering are so important for the future of humanity – they provide a concrete alternative to the socially and ecologically destructive relations of capitalist ideology (see Hunn, 1999).

In contrast to traditional subsistence activities, when viewed through a Gramscian theoretical lens, multilateral environmental agreement – such as the Particularly Sensitive Sea Areas discussed in Chapter 4 – are not concrete alternatives to capitalist ideology. Instead, they are understood as regulatory instruments that attempt to minimize the social-ecological harms of capitalism, but only within the constraints of global hegemonic system that has already positioned capitalism an unquestionable (see the column "Conventional Resilience Thinking" in the Introduction's Table 1.1).

Communities in northern Alaska neither completely embrace nor completely reject capitalism and its associated benefits and harms. As demonstrated in the tourism case study, capitalism is embraced only to the degree that it supports the values of the Indigenous culture. In Barrow and presumably other primarily Indigenous communities in the US Arctic, capitalism is largely embedded in Indigenous values and must confirm to certain principles, such as sharing, compassion, and respect for nature. If the Arctic social-ecological panarchy experienced a revolt – whereby the structure, function, and identity of large scale systems was determined by smaller scale systems – values such as those practiced by the Iñupiat would assume a more central role at the regional and global scales. Principles such as sharing, compassion, and respect for nature stand in stark contrast to the values of capitalism, which include individualized pursuit of profit, a survival of the fittest mentality, and viewing nature only in terms of its value within capital circuits of production and consumption. The neoliberal ideology that has guided current global

trade agreements and environmental protocols (emphasizing privatization, competitive markets, and the shrinking of environmental regulations) could be severely challenged by the upscaling of community-oriented Indigenous values.

Conventional arctic stewardship informed by mainstream resilience thinking calls for a balanced approach to negotiating the benefits and risks of change between stakeholder groups at different scales. However, it does little to challenge the dominance of the capitalism-supporting neoliberal global system that is the root of many community scale problems in the Arctic. More promising for creating positive change is a form of arctic stewardship that embraces radical resilience, which has been informed by radical political economy. Such an approach acknowledges that capitalism brings certain inescapable harms to social-ecological systems and, rather than attempting to promote capitalism at all costs, embraces capitalism only to the extent that it serves to enhance community wellbeing as defined from within. To prioritize community wellbeing, a recast arctic stewardship would need to call for revolt, or the increased effective representation of community interests at all scales. The potential results of a global system structured around, for example, sharing, compassion, and respect for nature, (and ways that these values potentially already operate at the global scale) is another promising area for future research.

5.8 References

Arctic Centre – University of Lapland. (n.d.). Arctic Indigenous peoples. Retrieved from http://www.arcticcentre.org/EN/communications/arcticregion/Arctic-Indigenous-Peoples

Arctic Council. (2013). *Arctic resilience interim report 2013*. Stockholm: Stockholm Environment Institute and Stockholm Resilience.

Arctic Slope Regional Corporation. (2014, July 31). *ASRC, North Slope Village Corporations and Shell announce historic venture* [Press Release]. Retrieved from https://www.asrc.com/PressReleases/Pages/Arctic-Inupiat-Offshore.aspx

Chapin, M., Lamb, Z., & Threlkeld, B. (2005). Mapping Indigenous lands. *Annual Review of Anthropology, 34*(1), 619-638. doi:10.1146/annurev.anthro.34.081804.120429

Clement, J.P., Bengtson, J.L., & Kelly B.P. (2013). *Managing for the future in a rapidly changing Arctic: A report to the President*. Retrieved from http://www.doi.gov/news/upload/ArcticReport-03April2013PMsm.pdf

Cote, M., & Nightingale, A. J. (2012). Resilience thinking meets social theory: Situating social change in socio-ecological systems (SES) research. *Progress in Human Geography, 36*(4), 475-489. doi:10.1177/0309132511425708

Crystal Cruises. (n.d.). The Northwest Passage. Retrieved from http://www.crystalcruises.com/alaska-cruises/northwest-passage--6319

Dawson, J., Stewart, E. J., Lemelin, H., & Scott, D. (2010). The carbon cost of polar bear viewing tourism in Churchill, Canada. *Journal of Sustainable Tourism, 18*(3), 319-336. doi:10.1080/09669580903215147

Fall, J. A., Braem, N. S., Brown, C. L., Hutchinson-Scarbrough, L. B., Koster, D. S., & Krieg, T. M. (2013). Continuity and change in subsistence harvests in five Bering Sea communities: Akutan, Emmonak, Savoonga, St. Paul, and Togiak. *Deep Sea Research Part II: Topical Studies in Oceanography, 94*, 274-29 doi:10.1016/j.dsr2.2013.03.010

Forsyth, T. (2004). *Critical political ecology: The politics of environmental science*. New York, NY: Routledge.

Gibson-Graham, J. K. (1996). *The end of capitalism (as we knew it): A feminist critique of political economy*. Oxford, UK: Blackwell

Glenn, R., Itta, E., & Napageak, T. (2011). Local perspectives on the future of offshore oil and gas in northern Alaska. In A. Lovecraft & H. Eicken (Eds.), *North by 2020: Perspectives on Alaska's changing social-ecological systems* (pp. 605-616). Fairbanks, AK: University of Alaska Press

Gramsci, A. (1971). *Selections from the prison notebooks of Antonio Gramsci*. New York, NY: International Publishers.

Gunderson, L. H., & Holling, C. S. (2002). *Panarchy: Understanding transformations in systems of humans and nature.* Washington DC: Island Press.

Holton, G. (2014). *Mapping Alaska's Native Languages.* Retrieved from https://www.uaf.edu/anlc/resources/anlmap/

Huijbens, E. H., & Alessio, D. (2015). Arctic 'concessions' and icebreaker diplomacy? Chinese tourism development in Iceland. *Current Issues in Tourism, 18*(5), 433-449. doi:10.1080/13683500.2013.837867

Hunn, E. S. (1999). The value of subsistence for the future of the world. In V. D. Nazarea (Ed.), *Ethnoecology: Situated knowledge/located lives* (pp. 23-36). Tucson, AZ: University of Arizona Press.

Huntington, H. P. (2009). A preliminary assessment of threats to arctic marine mammals and their conservation in the coming decades. *Marine Policy, 33*(1), 77-82. doi:10.1016/j.marpol.2008.04.003

Intergovernmental Panel on Climate Change, Stocker, T., and Working Group I (2014). *Climate change 2013: The physical science basis: Working Group I contribution to the fifth assessment report of the Intergovernmental Panel on Climate Change.* Retrieved from http://www.ipcc.ch/report/ar5/wg1/

International Maritime Organization. (n.d.). Shipping in Polar Waters. Retrieved from http://www.imo.org/en/MediaCentre/HotTopics/polar

Inuit Circumpolar Council Canada. (n.d.). About ICC. Retrieved from http://www.inuitcircumpolar.com/icc-international.html

Langton, M. (2003). The 'wild', the market and the native: Indigenous people face new forms of global colonization. In W. M. Adams & M. Mulligan (Eds.), *Decolonizing nature: Strategies for conservation in a post-colonial era* (pp. 79-107). London: Earthscan.

Larsen, J. N., Nilsson, A., & Young, O. (Eds.). (2014). *Arctic Human Development Report II.* Denmark: Nordic Council of Ministers.

Li, X. R., Lai, C., Harrill, R., Kline, S., & Wang, L. (2011). When east meets west: An exploratory study on Chinese outbound tourists' travel expectations. *Tourism Management, 32*(4), 741-749. doi:10.1016/j.tourman.2010.06.009

Liu, M., & Kronback, J. (2010). The potential economic viability of using the Northern Sea Route (NSR) as an alternative route between Asia and Europe. *Journal of Transport Geography, 18*(3), 434-444. doi:10.1016/j.jtrangeo.2009.08.004

Luck, M., Maher, P. T., & Stewart, E. J. (Eds.). (2010). *Cruise tourism in Polar Regions: Promoting environmental and social sustainability?* London: Earthscan.

MacKinnon, D., & Derickson, K. D. (2013). From resilience to resourcefulness: A critique of resilience policy and activism. *Progress in Human Geography, 37*(2), 253-270. doi:10.1177/0309132512454775

Mason, A. (2002). The rise of an Alaskan Native bourgeoisie. *Études/Inuit/Studies, 26*(2), 5-22. doi:10.7202/007643ar

NANA Regional Corportation. (2015). Red Dog by the Numbers. Retrieved at http://nana.com/regional/resources/red-dog-mine/red-dog-faq/

National Research Council. (2003). *Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope.* Washington, DC: The National Academies Press.

Neilson, J. L., Gabriele, C. M., Jensen, A. S., Jackson, K., & Straley, J. M. (2012). Summary of reported whale-vessel collisions in Alaskan Waters. *Journal of Marine Biology, 2012*, 1-19. doi:10.1155/2012/106282

Ovadia, J. S. (2012). The dual nature of local content in Angola's oil and gas industry: development vs. elite accumulation. *Journal of Contemporary African Studies, 30*(3), 395-417. doi:10.1080/02589001.2012.701846

Protection of the Arctic Marine Environment (2009) *Arctic marine shipping assessment 2009 report*. Retrieved from http://www.pame.is/index.php/projects/arctic-marine-shipping/amsa/amsa-2009-report.

Robards, M. D., & Lovecraft, A. L. (2010). Evaluating comanagement for social-ecological fit: Indigenous priorities and agency mandates for Pacific Walrus. *Policy Studies Journal, 38*(2), 257-279. doi:10.1111/j.1541-0072.2010.00361.x

Rode, K. D., Wilson, R. R., Regeher, E. V., St. Martin, M., Douglas, D. C., & Olson, J. (2015). Increased land use by Chukchi Sea Polar Bears in relation to changing sea ice conditions. *PLoS ONE*, 10(11): e0142213. doi:10.1371/journal.pone.0142213.

Teck Resources Limited. (2015). *Adaptability. Teck 2014 Annual Report.* Vancouver, BC: Teck Resources Limited. Retrieved from http://www.teck.com/media/Investors-teck_2014annualreport_T5.1.1.pdf

Thornton, T. J. 1998. Alaska Native subsistence: A matter of cultural survival. *Cultural Survival Quarterly 22.* Retrieved from https://www.culturalsurvival.org/ourpublications/csq/article/alaska-native-subsistence-a-matter-cultural-survival

Tribes in Alaska celebrate long-awaited victory in trust land case. (2016, July 4.) Retrieved from http://www.indianz.com/News/2016/07/04/tribes-in-alaska-celebrate-longawaited-v.asp

Walker, J., & Cooper, M. (2011). Genealogies of resilience: From systems ecology to the political economy of crisis adaptation. *Security Dialogue, 42*(2), 143-160. doi:10.1177/0967010611399616

Walker, B., Gunderson, L., Kinzig, A., Folke, C., Carpenter, S., & Schultz, L. (2006). A handful of heuristics and some propositions for understanding resilience in social-ecological systems. *Ecology and Society, 11*(1), 13. Retrieved from http://www.ecologyandsociety.org/vol11/iss1/art13/

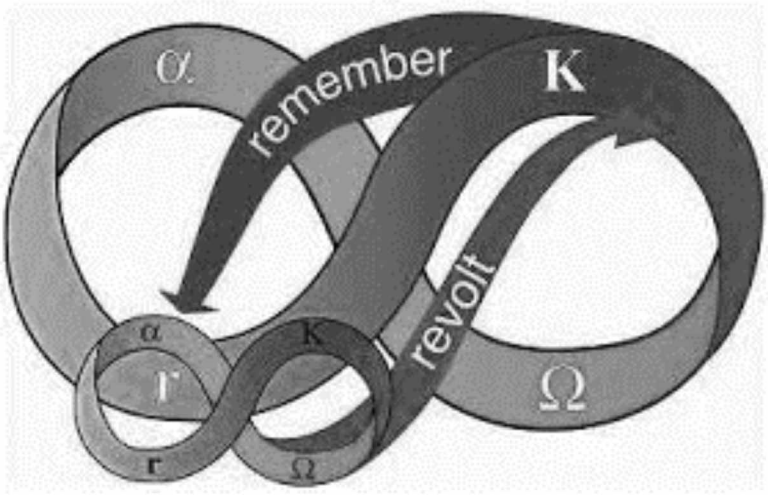

Figure 5.1 Revolt in the panarchy model of system change across scales, Source: Gunderson & Holling, 2002.

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August 26, 2014

To:	Amy Lovecraft, PhD Principal Investigator
From:	University of Alaska Fairbanks IRB
Re:	[641858-1] Building a Resilient Visitor Industry in Barrow, Alaska: Opportunities and Challenges

Thank you for submitting the New Project referenced below. The submission was handled by Exempt Review. The Office of Research Integrity has determined that the proposed research qualifies for exemption from the requirements of 45 CFR 46. This exemption does not waive the researchers' responsibility to adhere to basic ethical principles for the responsible conduct of research and discipline specific professional standards.

Title:	Building a Resilient Visitor Industry in Barrow, Alaska: Opportunities and Challenges
Received:	August 21, 2014
Exemption Category:	2
Effective Date:	August 26, 2014

This action is included on the September 3, 2014 IRB Agenda.

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