INDIGENOUS CONTRIBUTIONS TO ARCTIC BIODIVERSITY CONSERVATION

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Abstract

Indigenous Contributions to Arctic Biodiversity Conservation

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A significant percentage of the earth's surface is owned, used, and managed by Indigenous peoples, securing Indigenous communities a critical role in current and future biodiversity conservation efforts. Within the Arctic, Indigenous communities are already contributing knowledge, labor, resources, and time to research, management, and conservation governance. This dissertation research examines the contributions of Indigenous knowledge and communities to biodiversity conservation in the Arctic in three areas, (1) how the evolution of conservation planning and knowledge co-production facilitates the ability of Indigenous communities to contribute to current research and conservation efforts, (2) to what extent Indigenous communities use lands, waters, and species within Arctic protected areas and to what extent they are invited to engage in management efforts, and (3) how forwarding a new framework for co-productive conservation supports partnerships with Indigenous communities, knowledge, and governance can aid in the development of ethically, conscious, culturally-relevant, and fully knowledge-based conservation efforts. Results show that Indigenous communities are critical partners in conservation, bring valuable knowledge and information to the creation of shared evidence bases, and are prepared to lead new and innovative conservation efforts when there are opportunities to support both subsistence and conservation targets and goals.

ABSTRACT

A significant percentage of the earth's surface is owned, used, and managed by Indigenous peoples, securing Indigenous communities a critical role in current and future biodiversity conservation efforts. Within the Arctic, Indigenous communities are already contributing knowledge, labor, resources, and time to research, management, and conservation governance. This dissertation research examines the contributions of Indigenous knowledge and communities to biodiversity conservation in the Arctic in three areas, (1) how the evolution of conservation planning and knowledge co-production facilitates the ability of Indigenous communities to contribute to current research and conservation efforts, (2) to what extent Indigenous communities use lands, waters, and species within Arctic protected areas and to what extent they are invited to engage in management efforts, and (3) how forwarding a new framework for co-productive conservation supports partnerships with Indigenous communities, knowledge, and governance can aid in the development of ethically, conscious, culturally-relevant, and fully knowledge-based conservation efforts. Results show that Indigenous communities are critical partners in conservation, bring valuable knowledge and information to the creation of shared evidence bases, and are prepared to lead new and innovative conservation efforts when there are opportunities to support both subsistence and conservation targets and goals.

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This work would not have been possible without the guidance of my committee members, colleagues, mentors, and fellow Indigenous scholars. Special thanks are in order for my most important mentor, Lene Kielsen Holm (1963-2021), who, among many great accomplishments, paved the way for the use of Indigenous knowledge in partnership with science, management, and policy in her home country of Greenland and whose work continues to guide and inspire me every day.

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INTRODUCTION

The Arctic is a homeland and a frontier, a unique environment in which numerous species and peoples have lived for millennia. Current trajectories in biodiversity loss and ongoing climate change impacts challenge the reciprocal relationships between wildlife and Indigenous peoples. Engagement in Arctic conservation planning is spurred by the need to mitigate and adapt to ecological and anthropogenic impacts across the landscape (Arctic Council, 1998). An environment enriched by its unique biodiversity, ecosystems, and Indigenous peoples, Arctic resiliency will be challenged throughout the 21st century. Wildlife conservation planning is particularly, and uniquely, challenging as many species are migratory, transcending ecological, jurisdictional, and administrative boundaries. They carry cultural, environmental, and economic significance that spur conflicts of interest in management decisions (AHDR, 2004). Within the Arctic context, the ways in which Indigenous knowledge and Indigenous communities contribute to the conservation planning process is not well studied.

Meaningful engagement with Indigenous communities is critical for forwarding both science and policy. As the Arctic warms six times faster than the global average, it positions Arctic Indigenous communities on the front lines of the most rapidly warming climate in the world. These rapid environmental changes challenge our very livelihoods by altering landscape morphology and species' spatiotemporal population dynamics which in turn challenge Indigenous food security and cultural continuity. Despite these challenges, now is an exciting frontier for Indigenous-led conservation as communities, researchers, land managers, Indigenous organizations, and governments increasingly work together to find innovative ways to protect biodiversity in culturally-relevant ways.

The Arctic environment and its components are highly interconnected. Despite perceptions of remoteness and isolation, the Arctic is extremely well travelled by its Indigenous peoples, where most lands and waters have been actively used and managed for time immemorial. Even the rare regions that are not in use, such as Northeast Greenland or Svalbard, support endemic biodiversity that is important for Indigenous subsistence, cultural practice, and livelihoods. Continued, sustainable use of Arctic lands, waters, and species maintains Indigenous knowledge, which is fundamental to understanding ecosystems and environmental processes across our regions.

Science has real policy implications so we as researchers have a responsibility to ensure that our science comes as close to truth as possible – Indigenous knowledge helps us get there. The Arctic remains largely data deficient, and we are learning new things about basic biology and complex processes all the time. In part, these advancements are made possible by Indigenous communities' contributions in time, labor, and knowledge, and Indigenous knowledge holders are increasingly being asked to validate findings of scientific research. Recognition of the role of Indigenous knowledge in Arctic research was more-or-less catalyzed by an erroneous study on bowhead whales in 1977 that underestimated the population and immediately imposed a conservation ban on Inuit whaling in northern Alaska. When Inuit hunters learned of the ban, they confirmed that the scientists were observing in the wrong areas and were able to correct the mistake by leading the researchers to the whales' preferred seasonal habitat. While engagement with Indigenous communities and knowledge is improving, many communities and Indigenous governments are moving forward with their own conservation efforts.

Indigenous-led protected areas are becoming an increasingly popular approach to protecting biodiversity, though each comes with it's own mechanisms and are supported through different policy structures. I will highlight just a few exciting projects here. Back in 2019, I was visiting in the community of Ikpiarjuk (Arctic Bay) when Prime Minister Justin Trudeau arrived to announce the landmark establishment of Tallurutirup Imanga National Marine Conservation Area in the Northwest Passage, an area the size of Iceland that protects critical subsistence species and waters for Inuit use. Its establishment comes with CAD $54 million in Inuit stewardship programs for research, training, and monitoring within the protected area. Some protected areas are not explicit about contributions to biodiversity management but have positive impacts nonetheless. Only weeks ago, I shadowed a hunter in the Aasivissuit-Nipisat UNESCO World Heritage Site between Sisimiut and Kangerlussuaq, Greenland, an Inuit-led project established in 2018 that protects the area from mining while supporting sustainable hunting and fishing grounds that have been in use for the past 4,000 years. Some Indigenous communities are bypassing public options in favor of private ones. In 2014, the Native Village of Eklutna in Alaska conserved the first ever Indigenous conservation easement, protecting over 1,000 acres of critical subsistence wetlands that provide high-quality salmon and migratory bird habitat. In partnership with the Great Land Trust, they have conserved over 7,400 acres of land and waterways in their region.

Global recognition for these and other contributions to biodiversity conservation are lacking, but within science and policy there is also an opportunity to change the narrative of what conservation is and how we approach it. Indigenous communities are here to stay, so finding a positive way forward for achieving our collective conservation targets and goals is positive for biodiversity. Look forward to the establishment of several new Arctic protected areas this decade.

As an Iñupiaq woman and Indigenous scholar, I am a participant observer to both past and present conservation efforts and have been personally affected, both positively and negatively, by Arctic conservation initiatives since birth. I am not impartial to the affairs occurring in my homelands, nor to the growing global movements to challenge colonial legacies and power structures that continue to surface as 'conservation as the new colonialism,' 'green colonialsm,' and 'green washing' of Arctic homelands. Indigenous communities are increasingly forced to bear the burden of climate change adaptation in the expropriation of Indigenous homelands for the development of 'green energy' like the proliferation of wind energy in Scandinavia and the development of rare earth mineral mining of copper and uranium across the Arctic for use of solar cells and nuclear energy. Issues of biodiversity conservation are deeply connected to Indigenous sovereignty, self-determination, and human and Indigenous rights.

My role in research is to challenge this legacy and instead promote partnerships with Indigenous communities, knowledge, and governance for ethical, equitable, fair, just, and meaningful participation in environmental governance and the development of ethically, conscious, culturally-relevant, and fully knowledge-based conservation efforts in the Arctic. My research interests are driven by the needs and knowledge gaps recognized by the collective Indigenous community in the Arctic and the issues that are repeatedly discussed within Indigenous organizations and international fora. Lacking networks of Arctic Indigenous scholars, these perspectives are largely absent from the published literature. Academia gives little attention to the knowledge, labor,

resources, and time that Indigenous communities contribute to research, management, and governance. The lack in foundation of how Indigenous communities engage with conservation necessitated much of this work, where simple studies and participant observation have been able to enumerate many important lessons within conservation efforts.

The purpose of this dissertation is to study the contributions of Indigenous knowledge and communities to biodiversity conservation planning in the Arctic. To this end, my research explores three important questions in the following chapters:

Where have we been?
Chapter One – Arctic Indigenous Peoples, knowledge co-production, and the trajectory of biodiversity conservation

While modern visions of conservation have been practiced the world over for more than a century, and though Indigenous communities have occupied many of the lands expropriated for these purposes, Indigenous contexts for conservation have not been explicitly acknowledged in the literature until rather recently. While Indigenous contexts shape our current trajectories for conservation practice, past trajectories incrementally enabled the discussions we are having today. While conservation has historically shaped Indigenous experiences in primarily negative ways, such as the expropriation of Indigenous lands, community resettlement, bans on hunting and fishing that adversely impacted food security and subsequently caused famine, among numerous other impacts, Indigenous peoples finally have the opportunity to shape conservation in positive ways.

Where are we at?
Chapter Two – Indigenous use and management of wetland-associated protected areas in the circumpolar Arctic

The Arctic Wetlands and Indigenous Peoples Study (AWIPS), hosted at the Conservation of Arctic Flora and Fauna, aims to capture the fundamental role Indigenous peoples play in biodiversity conservation through engagement in the management of Arctic wetland protected areas. Drawing primarily from documentation on 35 protected areas in the eight Arctic countries, AWIPS provides a synthesis of the available information on Indigenous wetland resource use and conservation, a discussion on the benefits of Indigenous participation, and a snapshot of current practices for engaging Indigenous peoples in wetlands management. This study identifies challenges and suggestions for developing and facilitating participatory processes that are inclusive of Indigenous perspectives, resource needs, and knowledge within broader conservation efforts. Findings include (1) formal Indigenous representation in management and ownership of land occur in one-fourth and one-third of surveyed sites, respectively, (2) Indigenous peoples continue to have significant ties to Arctic wetlands and 82.9% of surveyed sites support Indigenous subsistence activities, (3) most management and conservation plans, as well as other official documentation on protected areas fail to document Indigenous resource use in a functional way and as a result do not fully capture relationships between Indigenous peoples and their lands, waters, and species, (4) the lack of information on Indigenous wetland use is an important knowledge gap that may inhibit manager's abilities to support Indigenous communities and biodiversity in culturally-relevant

ways, (5) engaging Indigenous leadership and communities in participatory processes can strengthen conservation efforts to better capture and navigate information related to Indigenous knowledge, resource use, priorities, needs, and objectives while developing and implementing conservation and management plans, and (6) despite barriers to the development of meaningful engagement, Indigenous peoples have been the driving force in the establishment of four surveyed protected areas, highlighting that Indigenous communities may pursue conservation objectives when there are opportunities to align conservation and subsistence goals.

How can we continue to do this better?

Chapter Three – Framing co-productive conservation for partnership with Arctic Indigenous peoples

Indigenous communities at the front lines of climate change and biodiversity loss are increasingly shaping the conservation of lands, waters, and species. The Arctic is a hotbed for emerging local, national, and international conservation efforts, and researchers, managers, and communities alike will benefit from a framework that improves approaches to Indigenous partnerships. Co-productive conservation is a framework that encompasses both a co-production of knowledge and a co-production of public services to pursue ethically-conscious, culturally-relevant, and fully knowledge-based approaches to biodiversity concerns. Co-productive conservation recognizes that conservation can be practiced in a way that embodies Indigenous perspectives, knowledge, rights, priorities, and livelihoods. Six iterative and reflexive co-production processes, including co-planning, co-prioritizing, co-learning, co-managing, co-delivering, and co-assessing, focus on the human dimensions that allow research, management, and conservation to affect change. By opening discussions on how to structure conservation efforts in partnership with Indigenous communities, we can move away from narratives that perceive Indigenous participation as an obligation or part of an ethical narrative, and instead embrace a process that broadens the evidence base and situates conservation efforts within Indigenous contexts.

RESEARCH DESIGN OVERVIEW

MIXED METHODS APPROACH

This dissertation contains three chapters that aim to illustrate the role that Indigenous communities and knowledge have in forwarding both Arctic and global biodiversity conservation and to explore potential approaches by which this may be further facilitated. The three focal data collection strategies include (1) a review of available white and grey literature with the intention of developing a conceptual basis for the participatory inclusion of Indigenous communities in recorded conservation efforts, (2) a case study approach that details current affairs and practical applications of participatory processes in partnership with Indigenous communities within recorded and unrecorded conservation efforts, and (3) a loosely structured interview and shadowing approach that brings rare Indigenous perspective to issues of management and conservation planning including an exploration of current challenges, hardships, and best practices for partnership with Indigenous communities and Indigenous knowledge. All three of these data collection strategies required intensive international field study in the eight Arctic countries as documented information on the topic of this dissertation is often limited, only partially recorded, or captured by the living memory of those community members and professionals who contributed to the conservation efforts. I spent three years living full-time in the Arctic during the duration of this research, from 2018-2021, including one year in Akureyri, Iceland, and two years in Nuuk, Greenland.

INDIGENOUS DATA SOVEREIGNTY

Indigenous data sovereignty is the right for Indigenous peoples to govern the collection, ownership, and application of their own knowledge and data. This dissertation research upholds this sovereignty by limiting details on knowledge sources and exact methods of data collection in relation to interviews, interview content, case study analysis, and other sources of sensitive information. Facilitating Indigenous data sovereignty protects knowledge and data from misunderstanding, misinterpretation, and misuse, and aids in protecting individuals and communities holding sensitive information and the ways in which that information was chosen to be shared. No interview participant names will be shared, and no aggregation of interview content is available. These decisions are reflected in the Internal Review Board (IRB) process that was approved in early 2019. More information on the IRB can be found in Supplement 2.

FIELD LOCATIONS

To help frame and inform the direction of this dissertation research, I conducted semi-structured interviews with more than 30 Indigenous knowledge holders, researchers, and conservation professionals in 20 communities and cities across the Arctic from 2018-2021 (Figure 1). While a broader selection of field locations for semi-structured interviews was initially planned, the list was amended to accommodate additional study in the resident country of Greenland for the duration of the coronavirus pandemic. Opportunities to shadow Indigenous knowledge holders in the field as a derivate form of this interview process was later incorporated at the request of community members. These discussions contained sensitive information concerning Indigenous knowledge and affairs, so the lessons learned have been used broadly to frame this dissertation research within Indigenous contexts across all three chapters. These study sites are separate from the study sites presented in Chapter 2.

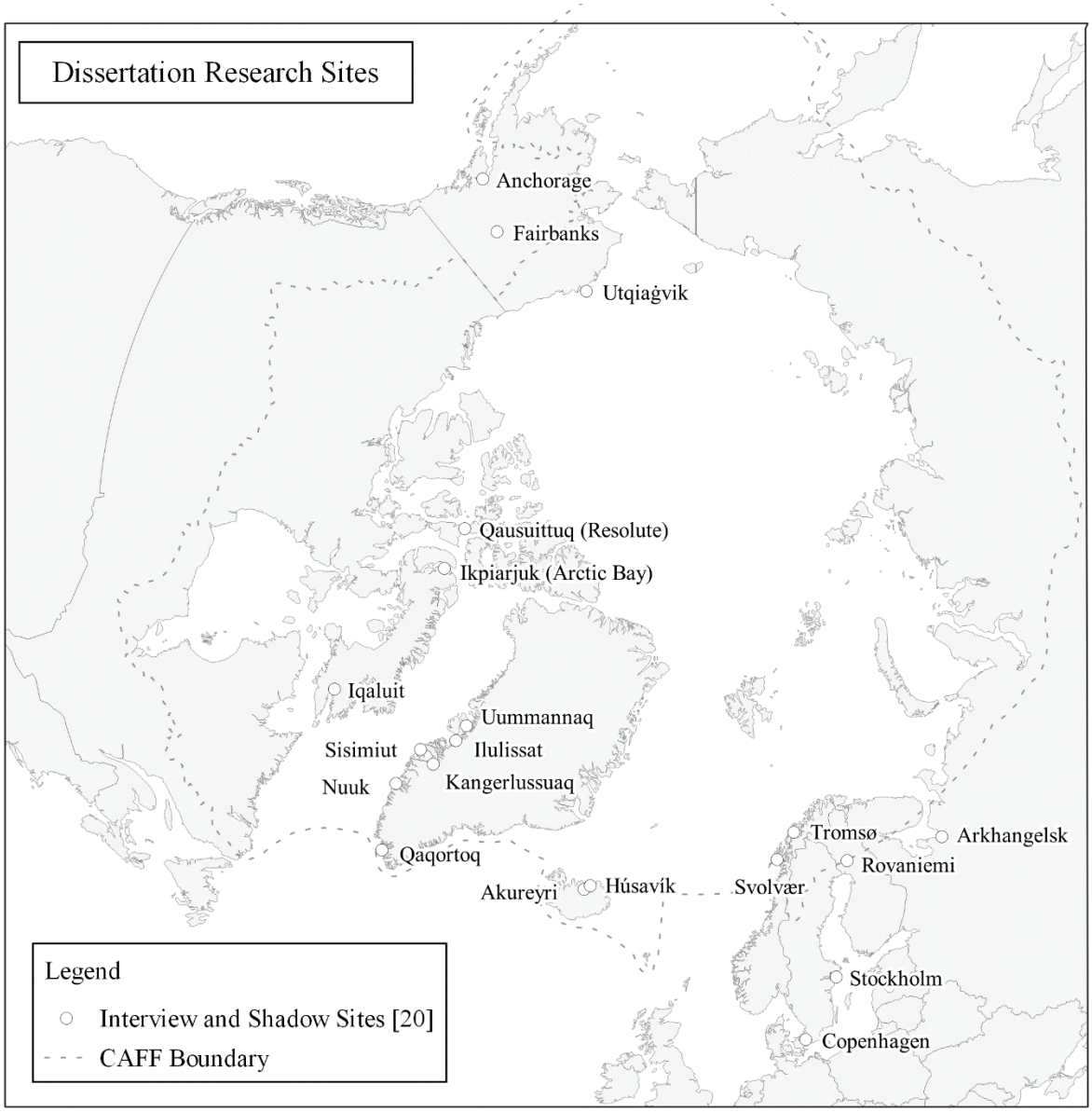

Figure 1. **Dissertation Research Sites**. These sites represent field locations where interviews were conducted with Indigenous knowledge holders, researchers, and conservation professionals from 2018-2021. Additional work was conducted by shadowing Indigenous hunters, fishers, and land managers in some of these locations. The knowledge shared and information collected at these sites help frame and inform the research directions and conclusions of this dissertation.

CHAPTER ONE

Arctic Indigenous Peoples, knowledge co-production, and the trajectory of biodiversity conservation

INDIGENOUS PEOPLES HAVE A PLACE IN CONSERVATION

Approximately one quarter of the Earth's terrestrial area is owned or actively managed by Indigenous peoples, intersecting 40% of all terrestrial protected areas globally (Garnett et al. 2018). Many contemporary conservation efforts are operating within Indigenous homelands, though explicit recognition for the Indigenous contexts and colonial histories around these efforts is lacking. Proposed conservation targets and goals such as Aichi target 11 aspire to conserve more lands and waters over the coming decades and thus the prevalence of intact biodiversity within Indigenous homelands emphasizes the critical role of Indigenous communities in future conservation efforts (Dudley et al. 2018).

The Arctic is increasingly a focal point of outside public interest and engagement, particularly in the conservation of lands, waters, and species under threat of climate change. However, the general public is largely unaware of Indigenous contexts that shape conservation, especially in the pursuit of ethical, equitable, fair, just, and meaningful conservation that supports the necessary Indigenous rights, sovereignty, and reconciliation with colonial forces and structures laid out by nationally and international recognized rights and responsibilities. Sustainability and conservation are inherently embedded within Indigenous worldviews, and globally, Indigenous communities are continuing to develop their own motivations and approaches to conservation within modern frameworks (Reed et al. 2020). This is equally apparent in the Arctic, where motivations around Indigenous food sovereignty and security have contributed uniquely to the management and conservation of lands, waters, and species and continues to be a priority area of intersection with more formally recognized conservation efforts.

Understanding how conservation theories and practices have evolved to better recognize the rights and roles of Indigenous peoples over time and how the co-production of knowledge is facilitated in this process allows us to identify how we can best move forward in the pursuit of ethically-conscious, culturally-relevant, and fully knowledge-based conservation efforts.

THE EVOLUTION OF CONSERVATION THEORIES

Conservation frameworks are evolving quickly, with new components and considerations advanced each year. Early conservation frameworks and theories rarely addressed Indigenous contexts directly, though this is also quickly changing. to understand how conservation is evolving in the context of Indigenous peoples. We must acknowledge how the trajectory of conservation ideologies and theories have shaped its practice over the last three decades. This section details conservation's journey from the prescriptive, utilitarian conservation approaches of the late 20th century to the inclusive, robust, and meaningful conservation efforts we aspire to today.

At the turn of the century, systematic conservation planning was theorized and introduced into conservation practice and it outlined six stages of the planning process, including the compilation of biodiversity data, the identification of conservation targets and goals, the review of existing conservation areas, the selection of additional areas, the implementation of conservation actions, and the maintenance of those areas into the future (Margules and Pressey 2000). While innovative

in its ability to be systematically applied at the global scale, like conservation frameworks before it, people nor communities were considered part of these environments nor focal enablers of these efforts. Further discussions emerged around regional conservation planning which spread into the social and institutional dimensions that were deemed missing for enacting change. This included cooperation with stakeholders during the implementation stage (Knight et al. 2006), and later the identification and involvement of stakeholders during the planning stage (Pressey and Bottrill 2009). What these conservation planning frameworks neglected was an approach that allowed for more than a conservation of lands and the building of reserve networks. There was room to include other forms of biodiversity conservation and improve stakeholder participation. Of note, conservation in the context of rightsholders rather than stakeholders is little discussed and uniquely important for conservation practiced within Indigenous homelands and territories as these efforts must necessarily prioritize rightsholders over stakeholders to comply with internationally mandated Indigenous rights.

Conservation planning made progress when it recognized conservation as a social process, limited not by research but by people and the decisions they make (Blamford and Cowling 2006). A more recent framework for broader landscape-scale conservation planning describes a five-staged multilayered and systematic process, moving from vision, to science, to the communication and engagement of stakeholders, to plan design, to implementation (Trombulak and Baldwin 2010). Conservation planning became an inclusive process beyond science alone and later frameworks would refer to these inclusive processes as stakeholder-driven conservation. Landscape-scale conservation also took hold at this time, referring back to old evidence supporting a large-scale approach to conservation that showed that poor planning at smaller scales accumulates and negatively impacts greater conservation visions and implementation (Theobald et al. 1997). Collaboration increasingly became paramount as conservation planning efforts focused on larger spatial scales.

While many frameworks now recognize the need to collaborate with stakeholders during the conservation planning process, the human dimensions of conservation are more frequently guiding conservation actions. The concept of ‘human dimensions’ is more in line with Indigenous worldviews that consider people and their practices to be a part of the ecosystem in which they live. While the natural sciences have historically guided conservation efforts, conservationists’ failures to engage policy and decision makers on broader conservation efforts have propelled greater inclusion of human needs in the planning process. The framework for conservation science builds on the discipline of conservation biology to address dimensions of human wellbeing through the guidance of an interdisciplinary approach incorporating public policy, economics, public health, and sociology, among others (Kareiva and Marvier 2012). This framework supports more than the inclusion of stakeholder perspectives in the planning and decision making processes and includes a consideration of human needs when identifying conservation targets and goals.

Over the last few years, the social sciences are gaining recognition for their crucial role in conservation planning as a way of addressing the human dimensions of conservation. Conservation social science as a broad understanding of the conceptual frameworks used in conservation planning argues that the social sciences add descriptive, diagnostic, disruptive, reflexive, generative, innovative, or instrumental value to the planning process and this added value can improve conservation planning, governance, and implementation processes by documenting conservation actions contextually, facilitating learning, aiding in proactive and reactive thinking, revisiting the assumptions, concepts, and models, allowing for imaginative and innovative actions, improving stakeholder engagement, fostering socially, economically, and culturally applicable

strategies, and facilitating social equity and just conservation processes (Bennett et al. 2017). However, even among current conservation efforts, the social sciences have been underutilized due to ideological, institutional, knowledge, and capacity barriers to integration in the planning process (Bennett et al. 2016).

In addition to contributing a multidisciplinary perspective to conservation efforts, the social sciences have also expanded the ways we approach evidence for use in the planning process. Qualitative methods for describing human values, perceptions, judgements, and knowledge are an important means of accumulating and disseminating information as evidence for use in conservation plans (Sutherland et al. 2018). Conservation planners strive to use systematic decision-making tools and evidence to guide decisions (Gardner et al. 2018), but as a crisis discipline, conservation efforts also rely on access to the best available information. Social scientists are pushing conservationists to question what counts as evidence as acknowledgement of the complementarity between Indigenous knowledge and scientific knowledge and the role it plays in guiding conservation efforts was suggested early amongst planners (Fazey et al. 2006). While evidence has historically come from the natural sciences and an adherence to the scientific process, some contemporary conservationists have adopted a broader definition of evidence to include qualitative information such as that coming from Indigenous knowledge (Adams and Sandbrook 2013).

Conservation planning in the Arctic especially must grapple with the effects of uncertain and unprecedented climate change at rates faster than any other landscape in the world. In considering the Arctic and the role that conservation planning has in mitigating biodiversity loss, here environmental pressures especially shape planning considerations and conservation solutions. Climate change continues to be one of the greatest drivers in how researchers and practitioners approach conservation in the region. Changes in species distributions and interspecies dynamics brought on by climate change call into question the effectiveness of conserving lands and waters alone and supports innovative conservation efforts that also focus on the management and conservation of species. The conservation of species is more than a conservation of lands, and has calls in minimizing human-wildlife conflicts, subsistence management, habitat and connectivity protection, minimization of pollution risk, and strategic monitoring and research. These pressures challenge conservation planning frameworks to adapt to emerging needs. The pressures of climate change force planners to manage species across larger spatial scales rather than through the narrow lens of individual populations or across individual ecosystems and encourages planners to consider and plan for futures in which systems have been heavily altered, calling for more agile monitoring and implementation plans (Lawler 2009).

Taking the evolution of conservation frameworks and the unique considerations needed for addressing the environmental stressors of the 21st century, conservation planning now aims to be predictive, adaptive, cooperative, multidisciplinary, and nested within a global context, and conservation plans must address both (1) multifaceted requirements such as those presented by national conservation legislation and initiatives, international treaties, agency policies, capacities, economic feasibilities, and (2) the multi-faceted objectives of stakeholder-driven processes (USFWS 2016). In this age, conservation planning cannot happen behind closed doors, nor with researchers and practitioners alone.

Returning to the human dimensions of conservation planning and the role that the social sciences have played in the evolution of the discipline, many researchers and practitioners have embraced the social-ecological systems theory to illustrate the dynamic ways in which communities,

researchers, practitioners, and decision makers engage in the environment. Within conservation efforts, the success of planning processes often depends on how well decisions account for the social systems in which they are implemented (Guerrero and Wilson 2016). For Indigenous peoples, the cultural relevance of conservation strategies aids in driving the success of the planning process as it allows stakeholder and rightsholders to negotiate the targets and goals. Some evidence of this may be found in how involving Indigenous peoples in conservation planning can provide both biodiversity and cultural benefits, even when the process is part of an internationally mandated conservation and policy directive (Ens et al. 2016). Some researchers also suggest that cultural relevance may play a role in fostering successful biodiversity conservation, particularly when recognizing Indigenous relationships with key lands and species (Garibaldi and Turner 2004).

Ecosystem management requires building knowledge of ecosystem dynamics, responding to environmental feedback, and supporting adaptive institutions (Berkes and Folke 1998). One governance strategy to conservation includes the co-management approach to data collection and implementation. Within the Arctic context, co-management approaches to wildlife conservation and management are becoming more common as a means of including Indigenous communities in participatory processes. There is evidence that adaptive co-management, the process by which knowledge systems and institutions test and revise management strategies as part of a learning process (Folke et al. 2002), benefit governance of biodiversity and ecosystem dynamics by connecting institutions and organizations across scales and improving knowledge sharing, including the use of Indigenous knowledge (Olsson et al. 2004). Co-management processes also facilitate the co-production of knowledge, which can trigger adaptive policy making that leads to positive social and ecological outcomes (Armitage et al. 2011). Co-management therefore connects Indigenous communities to researchers, practitioners, and decision makers while allowing for a cooperative approach to resource conservation and management. Additionally, a social-ecological systems approach to the planning process can aid in the integration of social and ecological data for use in the implementation of conservation plans by accounting for factors such as social values, social capital, behavior, finances, anthropogenic threats, and differences in governance systems (Guerrero and Wilson, 2016). These social, cultural, and ecological processes within conservation efforts can be effectively negotiated through intentional co-production of knowledge processes in partnership with Indigenous peoples.

THE EVOLUTION OF THE CO-PRODUCTION OF KNOWLEDGE IN CONSERVATION

In recent years and under the threat of climate change, Indigenous peoples and conservationists have attempted to reach across the divide and aid one another through collective resources and knowledge (Shackeroff and Campbell 2007). The co-production of knowledge framework is one emerging approach to partnering researchers, practitioners, rightsholders, stakeholders, and decision makers in building a body of mutual and defensible evidence for use in science assessments and decision making. While co-production has largely been practiced with Indigenous communities in extractive ways rather than of mutual benefit (Latulippe and Klenk 2020), when done through meaningful and inclusive processes, co-production can facilitate communities in adaptive decision making within colonial contexts that otherwise challenge Indigenous communities' abilities to enact change (Hill et al. 2020).

The co-production of knowledge has a particular relevance in the Arctic. Our current understanding of the co-production of knowledge in the management of wild living resources was born out of the practical and theoretical application of co-management strategies with Indigenous communities in the Arctic (Kofinas 2002). While the concept of co-production was first devised

in Elinor Ostrom's work of the 1970s (Alford 2013), it was in Kofinas' work that we find the first references to the co-production of knowledge in natural resource management. While it may seem counterintuitive for the literature on co-management of natural resources to precede the literature on the co-production of knowledge, it was a lack of attention to the generation of knowledge that challenged many early co-management strategies as there was little understanding of how to bridge the differences in knowledge, values, and priorities amongst those engaged in co-management strategies. This was followed by further exploration on how co-production of knowledge processes shape not only co-management but policy, governance, and social order (Jasanoff 2004). Furthermore, Arctic co-management and knowledge co-production processes feed into each other to facilitate mutual learning and adaptation (Armitage et al. 2011).

The ways in which science and Indigenous knowledge partner within a co-production process are still being explored by researchers, practitioners, and Indigenous scholars. There are two questions the discourse is looking to answer, first, what structures and discussions must be in place to ensure that the process is equitable and meaningful for Indigenous participants, and second, how science and Indigenous knowledge can partner in the accumulation and examination of evidence for practical use. Indigenous knowledge is a key component of both questions, as meaningful co-production can only proceed when Indigenous knowledge is respected for its validity and unique contributions, given equitable weight alongside science in decision making, and protected from erroneous and unethical uses. Arctic conservation benefits from co-production as it helps to to amass time critical information from both science and Indigenous knowledge by developing a mutual understanding of the questions that need to be addressed, collecting, monitoring, and self-validating data, and giving direction for how this information should be applied to conservation and management decisions. Specifically, Indigenous knowledge contributes to Arctic research and conservation by aiding data collection, conservation planning, conservation practice, evaluation, and reporting.

Indigenous knowledge is underappreciated and underutilized as a valid and valuable knowledge system (MEMA 2016; Thornton and Scheer 2012). In part and of particular relevance to conservation efforts, Indigenous knowledge methodologies manifest in an understanding of both place-based natural histories and an understanding of landscape-scale ecosystem dynamics. This knowledge has immense conservation value for managing harvests, conducting biodiversity assessments, and establishing community-based monitoring, among other contributions. Recognition for the role Indigenous knowledge has in biodiversity conservation is not new, and it was early recommended that conservation planners promote community-based resource management systems, such as co-management approaches, in part to conserve this knowledge (Gadgil et al. 1993).

Though inclusive and meaningful co-productive processes are widely the preference of Indigenous communities engaged in Arctic governance, many researchers lack an understanding of how co-production should proceed. There are three primary misconceptions that challenge progress and hinders discussion related to Indigenous knowledge broadly.

Indigenous Knowledge Cannot Be Transformed into Science

First, co-production processes must negotiate different streams of knowledge, such as scientific knowledge coming from academia, experiential and local knowledge coming from practitioners and communities, and Indigenous and traditional ecological knowledge coming from different approaches to understanding the world. These forms of knowledge warrant their own definitions, and Indigenous knowledge must be recognized as fundamentally different from these other forms

of knowledge. Furthermore, Indigenous knowledge cannot be integrated nor transformed into science as it cannot be understood in separation from its specific context and connections to other ecosystem components. Though some researchers continue to call for the systematic integration of Indigenous knowledge into science, others argue that there is no single approach to partnering Indigenous knowledge and science, and that the ways in which we identify, engage, evaluate, and apply different knowledges are determined by the unique needs of the planning and implementation processes (Raymond et al. 2010). This is because these different knowledge systems rely on different methodologies, include formats not easily transferable, and lack ways to validate information between systems (Tengö et al. 2017). While scholar have more frequently addressed the troubles of knowledge integration in co-production processes, few scholars have attempted to develop conceptual methodologies (Tengö et al. 2014; Tengö et al. 2017). Formal processes likely limit the natural diversity of knowledge systems by simplifying that knowledge into a single, western scientific understanding of information and evidence. Other conceptual models for partnering knowledge in ways that preserve knowledge diversity are in progress, and the success of these approaches will be contingent on the willingness of researchers to let go of the idea that Indigenous knowledge and other ways of knowing should be integrated into science.

Indigenous Knowledge is Not the Same as Citizen Science

Second, co-production of knowledge processes may encounter some of the same scepticism and criticism that hinders citizen science even though the two are in many ways dissimilar. In assessing researchers' perceptions of citizen science, barriers to the use of community members as primary tools in data collection include perceptions that citizen science is not suited to some biodiversity research, inconsistency in data quality, and bias for data sources (Burgess et al. 2017). The difference between evidence coming from Indigenous knowledge and evidence coming from citizen science is that Indigenous knowledge holders are the experts of their knowledge and have amassed lifelong experience in the assessment and validation of environmental information. Individuals partaking in citizen science are not usually experts and practice data collection as a hobby.

Co-Assessment Alone is Not the Answer for Indigenous Communities

Some authors question the economic feasibility and productivity of the co-production of knowledge for use in conservation planning, and instead promote 'co-assessment,' the process by which stakeholders come together to validate existing knowledge (Sutherland et al. 2017). While this may be an option in other contexts, it is not a valid suggestion for governance within Indigenous homelands. The Arctic is overwhelmingly data deficient, we are learning more about basic biology every year, and engagement with Indigenous communities brings valuable, time critical information to the table, provides a cross-reference by which to assess the validity of the available scientific information, fosters the much needed on-the-ground collaboration in data collection and monitoring efforts, and enables widely generalized conservation strategies to have place-based impacts to the benefit of biodiversity and local communities.

INDIGENOUS CONTRIBUTIONS TO SHAPING ARCTIC BIODIVERSITY CONSERVATION

Many researchers and practitioners operating in the Arctic continue to grapple with what it means to partner with Indigenous communities and Indigenous knowledge in the pursuit of science, management, and conservation. This direction is best given by Indigenous scholars, communities, organizations, and governments, and notably, advice and input has already been provided regarding how to work with Indigenous communities (Ikaarvik 2016), how to facilitate and respect

Indigenous sovereignty in natural resource management (ICC 2020), and insights into how an Indigenous-led conservation planning process is scoped (ICC 2017). Unfortunately, broader Indigenous guidance on how to engage in Arctic conservation is forthcoming. However, it is indisputable that Indigenous communities actively shape the ways we research and approach conservation efforts. Indigenous peoples are more frequently being called upon to supply critical information to fill research gaps, contribute labor to biodiversity research and monitoring in the field, and review information for accuracy in data deficient areas of research.

The evolution of conservation and knowledge co-production facilitates Indigenous communities in contributing to biodiversity conservation in the Arctic in emerging ways. While the theory on knowledge co-production, its best practices, and positive examples are still developing, researchers and practitioners can learn from how Indigenous communities are engaging in Arctic conservation thus far. Recognition in the literature for these contributions is limited, so this section details the specific ways in which Indigenous peoples contribute time, labor, and Indigenous knowledge in the pursuit of conservation targets and goals, whether as an explicit goal or by contributing to conservation outcomes. In exploring how Indigenous knowledge contributes to data collection, conservation planning, and conservation implementation, we can recognize and support the unique contributions it brings to the management and conservation of lands, waters, and species, and information that is otherwise unavailable, unstudied, or understudied by researchers.

Research in the Arctic is complicated by extreme weather and harsh living conditions that deter most researchers from living in Arctic communities and engaging in costly science assessments year-round. To improve data collection, Indigenous peoples often contribute time, knowledge, and labor to biodiversity research through various initiatives. Indigenous knowledge holders especially contribute important evidence for creating baseline data, data collection, and monitoring efforts.

Some projects have shown that Indigenous knowledge can provide more information on species' natural histories and population dynamics than is available through scientific research alone (Mistry and Berardi 2016; NWAB 2016). This includes the identification of critical and preferred habitat of vulnerable species at local scales that cannot be matched by satellite tagging or other remote means and is specific enough to contribute to local land use planning (NWAB 2016). Similar forms of spatial mapping and participatory GIS that physically displays the spatiotemporal value of Indigenous knowledge and resources exemplifies perhaps the most tangible method of partnering Indigenous knowledge and science. Spatial mapping of Indigenous knowledge may be an opportunity to engage researchers, practitioners, and Indigenous knowledge holders in knowledge co-production for application in conservation planning.

Indigenous knowledge has also aided in identifying important trends in Arctic abiotic change such as environmental shifts that affect subsistence practices and subsequently wildlife management efforts, including shifts in sea ice patterns (Huntington et al. 2010) and wind patterns (Gearheard et al. 2010). Indigenous knowledge is also useful in identifying trends in biotic change such as the identification of emerging wildlife diseases such as avian cholera (Henri et al. 2018) and observations of new invasive species and predation behaviors such as those noted in orcas (Higdon et al. 2014). The contribution of Indigenous knowledge to understanding these and other biophysical changes in the environment is aiding in preparing communities to adapt in regards to the flexibility of subsistence practices, hazard avoidance, and emergency preparedness (Pearce et al. 2014). These approaches to biotic and abiotic change have largely been conducted through community-based monitoring programs.

Community-based monitoring, the process by which Indigenous knowledge holders and community members contribute to the collection of observational data, aids in making information readily available to researchers, communities, and decision makers, and these efforts are often centered on community-driven research questions that center Indigenous priorities and perspectives (Johnson et al 2015). Community-based monitoring specifically aims to produce tangible products, engage researchers, stakeholders, and rightsholders and in the science-policy interface, and ensure that communities have space to contribute to the research and management of their homelands. Community-based monitoring programs that are designed in partnership with Indigenous communities and actively engage with Indigenous knowledge have positive implications for data collection in remote parts of the Arctic. These efforts have occurred in the Arctic over the past four decades and partnerships between Indigenous knowledge and science through community-based monitoring are increasingly forwarded (Moore and Hauser 2019). These efforts often improve access to time-critical information while supporting Indigenous participation in research and conservation efforts. Community-based monitoring in partnership with Indigenous communities may also lead to new and innovative advances in Arctic monitoring such as the development of new environmental monitoring technology (Gearheard et al. 2011) and new community-driven environmental monitoring platforms such as SIKU and PISUNA (Johnson et al. 2015; Kipp et al. 2019; Johnson et al. 2021). Of note, community-based monitoring is not always a co-production of knowledge as it does not necessarily engage Indigenous knowledge directly, and community members may provide their time and labor towards typical research methodologies. Challenges for community-based monitoring includes maintaining community capacity for multi-year projects and issues of data ownership, sovereignty, and protection (Johnson et al. 2021)

Indigenous youth are increasingly becoming involved as liasons for their communities and as cultural and linguistic facilitators between researchers and community members (Ikaarvik 2016). With access to basic science education, youth can also provide nuanced understandings of how Indigenous knowledge and science inform each other and find innovative ways of partnering the two in problem solving. Youth are also important for Indigenous knowledge and cultural continuity, so engaging in subsistence practices, traditional activities, and Indigenous languages directly facilitates the ability of youth to contribute to research and conservation efforts. As concrete example, in Sámi homelands, names of particular wetlands describe the ecosystem and cultural functions of those spaces and are valuable for informing land use and conservation planning (Inga et al. 2018). Other research with Arctic communities illustrates that Indigenous knowledge is foundational in understanding the effects of management decisions on long-term ecological composition, structure, and function of the landscape. (Watson et al. 2003).

Indigenous communities have also been foundational to realizing new protected areas across the Arctic. This is apparent in the rise of literature around Indigenous Protected and Conserved Areas (IPCAs) and the identification of Other Effective Conservation Measures (OECMs). OECMs recognize sites and practices that functionally contribute to biodiversity conservation though may not meet the definition of conventional protected areas, and may be opportunities to facilitate equitable and effective conservation within frameworks that are not formally recognized (Alves-Pinto et al. 2021) such as those practiced by Indigenous communities Both types of protected area initiatives benefit from partnering with Indigenous communities in identifying joint conservation targets and goals and employing culturally-relevant conservation strategies within Indigenous homelands.

Numerous new protected areas have been established or are in development across the circumpolar Arctic. A short list of these include Talluritiup Imanga National Marine Conservation Area established in Canada in 2019, National Park Beringia established in Russia in 2013, and the proposed conservation of Pikialasorsuaq, also known as the North Water Polynya, which is slated to become the first bilateral Indigenous-led protected area in the world after upcoming, joint negotiation between Canada and Greenland. Each of these protected areas, and many proposed areas actively work with Indigenous communities and within the frameworks of nationally recognized Indigenous rights. The establishment of new protected areas is not the only contribution, as Indigenous communities are also increasingly called upon to inform land use and marine spatial planning such as development of new infrastructure and shipping routes (Raymond-Yacoubian and Daniel 2018), and challenging development projects by designating lands and waters important for subsistence practices such as in the Indigenous-led Aasivissuit-Nipisat World Heritage Site established in Greenland in 2018 (Jensen et al. 2018). In Alaska, the tribally-owned Eklutna Native Conservation Easement represents one of the only conservation easements in the Arctic and protects Indigenous homelands with the dual objectives of conserving biodiversity and access to food security.

Indigenous scholars and organizations are also shaping emerging conversations around OECMs that are gaining interest in international fora such as the United Nations and the Convention on Biological Diversity. Although almost entirely undocumented, Arctic Indigenous communities have long-standing conservation practices that operate outside of conventional legal or jurisdictional framework and are largely protected and applied through Indigenous knowledge. Supporting the identification of OECMs may be an avenue to recognizing and facilitating Indigenous contributions to biodiversity conservation outside conventional protected area frameworks (Donald et al. 2019).

Once conservation initiatives have been established, Indigenous communities are also actively engaged in the protection and management of those lands, waters, and species. Communities members are employed in protected area management, within environmental guardian programs, and in Indigenous-led research to monitor and observe environmental change.

CONCLUSIONS

Indigenous communities not only actively contribute to research, planning, and implementation of conservation efforts, but are uniquely positioned to ensure that conservation efforts are relevant, actively pursued, and employ the best available information. In Arctic countries that recognize the rights of Indigenous peoples under various mandates, legislation, policies, and other mechanisms, Indigenous communities have the power to assert and demand rights that open opportunities to the management and conservation of lands, waters, and species. These rights position Indigenous communities to uniquely address three common pitfalls of conservation efforts.

Policy-Relevancy, Decision Complacency, and the Research-Implementation Gap

Co-production provides a space for researchers, practitioners, decision makers, and communities to collaborate from the beginning of the process, with opportunity to follow through from scoping, to data collection, to integration, to implementation, to monitoring, to adjusting for environmental feedback. Co-production therefore fosters a follow-through in inclusive governance, a responsibility to stakeholders in the scientific and decision making processes, and an opportunity to address the human dimensions of conservation at the science-policy interface. The meaningful participation of Indigenous communities within conservation efforts aids in overcoming the

research-implementation gap, decision complacency, and lack of policy-relevance within the conservation planning process, which contributes to the adoption of ethical conservation targets and goals and encourages a full follow-though on the use of Indigenous knowledge in decision-making processes, from data collection, to policy adoption, to implementation.

By considering the interrelated components of cultural and environmental systems, conservation plans gain policy relevance. When striving for policy-relevant biodiversity conservation, planners often speak to the science-policy interface, which encompasses the social processes by which researchers engage with others to exchange, co-produce, and evolve knowledge to improve decision making, made possible in the Arctic through Indigenous knowledge (Robards et al. 2018). The role that actors, such as stakeholders, play in the science-policy interface also shapes the way biodiversity research and policy processes are conducted (Young et al. 2014). Negotiating the science-policy interface is challenging in the context of Indigenous communities, as researchers, practitioners, and decision makers must make space for Indigenous knowledge, support the co-production of knowledge, and provide resources for the facilitation of sovereign knowledge construction and planning (Diver 2017).

Often conservationists err in assuming that evidence alone is sufficient to inform policy (Adams and Sandbrook 2013), though the success of conservation efforts is often driven by public discourse. Engaging the public and decision makers in science narratives to capture and guide the use of evidence in conservation planning and policy making is gaining recognition as a tool to make science more policy-relevant (Lawton and Rudd 2014). One scholar has suggested that conservation plans should aim for policy relevance by constructing narratives that reframe conservation actions within political contexts, use accepted evidence, and engage in boundary work (Rose 2014). Indigenous participation in conservation planning and decision making gives conservation efforts greater policy relevance by introducing cultural relevancy, recognizing the inherently political, human dimensions of the planning process, and normalizing more nuanced and diverse motivations for conservation as topics within public discourse.

There are additional challenges to conservation governance. The knowledge and evidence collected by researchers doesn't always meet the dynamic and interdisciplinary needs of practitioners and decision makers (Laurance et al. 2012). This problem is considered a research-implementation gap (Toomey et al. 2016). Likewise, practitioners and decision makers frequently fail to use accumulated evidence or systematic processes to make conservation decisions, an issue defined as decision complacency (Gardner et al. 2018). This highlights two problems, first that the current evidence is not sufficient to guide conservation efforts, and second that those making decisions fail to use this information in conservation planning nor practice. The ethical co-production of knowledge in partnership with Indigenous communities may aid in overcoming both the research-implementation gap and decision complacency, first by contributing time critical information and Indigenous knowledge to conservation planners through co-productive processes, and second, by holding decision makers accountable to the evidence they have provided within that process by continuing to assert Indigenous rights to sovereignty and decision making. Indigenous peoples are therefore the thread that follows the conservation planning process from data gathering to implementation, thus aiding in bridging the research-implementation gap (Toomey et al. 2016), and are increasingly able to assert Indigenous rights to hold decision makers accountable to this evidence within the planning process, thus aiding in overcoming decision complacency.

Future Directions

Conservation as a discipline and practice will continue to evolve. Strengthening the potential for ethically-conscious, culturally-relevant, and fully knowledge-based conservation in the Arctic is contingent on continuing to grow space for Indigenous perspectives, worldviews, knowledge, and ways of life. There are many opportunities to influence future directions, including creating opportunities for discussions around Indigenous perspectives of conservation best practices, making space for improved collaborations around research and conservation that connect local practices to global targets and goals, growing Indigenous research networks, prioritizing community-driven research, investing in science education for Indigenous youth in new and emerging programs, and encouraging youth to partake in the cultural revitalization of any locally vulnerable hunting, fishing, and other subsistence practices to maintain Indigenous knowledge and individual, community, and societal wellbeing. For Indigenous communities, the biodiversity and cultural benefits of Indigenous-led conservation efforts are salient, even if the literature currently lacks the evidence. What is certain is that Indigenous communities will continue to shape conservation efforts in ways that challenge colonial legacies and encourage the meaningful and inclusive evolution of the discipline.

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CHAPTER TWO

Indigenous use and management of wetland-associated protected areas in the circumpolar Arctic

ABSTRACT

The Arctic Wetlands and Indigenous Peoples Study (AWIPS), hosted at the Conservation of Arctic Flora and Fauna, aims to capture the fundamental role Indigenous peoples play in biodiversity conservation through engagement in the management of Arctic wetland protected areas. Drawing primarily from documentation on 35 protected areas in the eight Arctic countries, AWIPS provides a synthesis of the available information on Indigenous wetland resource use and conservation, a discussion on the benefits of Indigenous participation, and a snapshot of current practices for engaging Indigenous peoples in wetlands management. This study identifies challenges and suggestions for developing and facilitating participatory processes that are inclusive of Indigenous perspectives, resource needs, and knowledge within broader conservation efforts. Findings include (1) formal Indigenous representation in management and ownership of land occur in one-fourth and one-third of surveyed sites, respectively, (2) Indigenous peoples continue to have significant ties to Arctic wetlands and 82.9% of surveyed sites support Indigenous subsistence activities, (3) most management and conservation plans, as well as other official documentation on protected areas fail to document Indigenous resource use in a functional way and as a result do not fully capture relationships between Indigenous peoples and their lands, waters, and species, (4) the lack of information on Indigenous wetland use is an important knowledge gap that may inhibit manager's abilities to support Indigenous communities and biodiversity in culturally-relevant ways, (5) engaging Indigenous leadership and communities in participatory processes can strengthen conservation efforts to better capture and navigate information related to Indigenous knowledge, resource use, priorities, needs, and objectives while developing and implementing conservation and management plans, and (6) despite barriers to the development of meaningful engagement, Indigenous peoples have been the driving force in the establishment of four surveyed protected areas, highlighting that Indigenous communities may pursue conservation objectives when there are opportunities to align conservation and subsistence goals.

ARTICLE IMPACT STATEMENT

This study examines Indigenous use and management of Arctic protected areas, supplying new insights on Indigenous engagement in conservation efforts.

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KEYWORDS

Biodiversity, conservation planning, subsistence, co-management, co-production of knowledge, Indigenous knowledge

INTRODUCTION

Global Perspectives on Wetland Biodiversity and Indigenous Peoples

Wetlands are vitally important for maintaining Arctic ecosystems, species, and peoples and comprise approximately 60% of the surface in the Arctic (Ramsar 2014). Between 1700 and 2000, wetlands have been reduced 85% globally, a rate three times faster than forests, and these losses are compacted at a time in which nearly one million species face the threat of extinction (IPBES 2019), many of which occur in the Arctic.

The relationship between Indigenous peoples and protected areas is critical for biodiversity conservation (RRI 2015). Approximately 28% of all land on earth is held or managed by Indigenous peoples, of which 40% is formally held in protected areas (IPBES 2019). Lands held and managed by Indigenous Peoples also account for 37% of all remaining terrestrial areas experiencing very low anthropogenic impact (IPBES 2019). There is growing recognition for the role Indigenous peoples play in conservation due in part to an attention to Indigenous sovereignty, an examination of the ethics of climate change impacts, and the recognition of increasing stress on the ecosystems on which Indigenous communities depend for their livelihoods (UNDRIP 2007). Additionally, increasing recognition for the role that Indigenous and local systems of knowledge have in capturing important environmental information has made community engagement in conservation efforts a compelling means for improving information and capacity to address rapid environmental change (Fazey et al. 2006; Adams & Sandbrook 2013).

Ecosystems are dynamic and benefit from diverse cultural foundations of management and governance (Folke 2004). Efforts to address the relationships between Indigenous peoples and protected areas are increasingly evidenced by international reports and other publications that address legal and moral imperatives related to the expropriation of Indigenous lands and the engagement of Indigenous peoples in protected area management, including in regards to best practices (UN 2000), international legal perspectives (RRI 2015), national legal perspectives (CSIPN 2017), and contributions to global conservation efforts (IPBES 2019). Given its increasing significance, the lack of research on Indigenous contexts within Arctic conservation efforts merits much greater attention. This assessment is one product of a wetlands initiative hosted by the Conservation of Arctic Flora and Fauna working group of the Arctic Council.

Arctic Perspectives on Conservation and Indigenous Peoples

Indigenous involvement in conservation planning has a long history in the Arctic. In 1986, the Inuit Circumpolar Conference General Assembly became the first forum in the world to adopt a bi-lateral conservation strategy, and the first Indigenous forum to adopt a formal conservation strategy of any kind (ICC 1986). This initiative was self-organized and driven by Inuit from across Alaska and Canada in recognition that they "… depend completely on maintenance of the harvested resources, ecological processes and biological diversity of the Arctic for subsistence, cultural and economic survival, and sustainable development… conservation and sustainable development of these natural resources are seriously threatened…" (ICC, 1986). Since the adoption of this conservation strategy, Indigenous participation in biodiversity conservation and protected area management has been the subject of increasing interest across the Arctic.

Many organizations, agencies, and governments operating in the Arctic have formal policies and laws that require consultation or other forms of engagement with Indigenous communities when working on issues that could impact Indigenous livelihoods. While some of these entities recognize the need for inclusive management strategies, many conservation strategies continue to negatively impact Indigenous communities (Shakeroff & Campbell 2007; ICC 2015), who experience inadequate consideration of their knowledge, perspectives, needs, and concerns within the decision making process (ICC 2015; MEMA 2016). Engagement of Indigenous peoples in wetland protected area management supports Indigenous visions of responsible conservation and sustainability. However, support for the inclusion of Indigenous peoples varies cross-nationally with regards to their legal status, claims to their traditional lands and resources, and their rights to be included in governance decisions. Additionally, Arctic protected areas continue to represent spaces of nature-use conflict between Indigenous peoples, industry, and government (Pristupa et al. 2016). From a global perspective, it is recognized that involvement of Indigenous peoples in management efforts contribute to positive conservation and socioeconomic outcomes, while protected areas that exclude local communities and anthropogenic considerations are less likely to achieve these goals (Oldekop et al. 2015). Among research conducted on Arctic wetlands, the examination of management and conservation plans as change drivers have not been studied as much as human drivers of wetland change (Seifollahi-Aghmiuni et al. 2019), and while some research has been compiled on Indigenous governance of Arctic lands and protected areas (Hermann and Martin 2016), prior circumpolar assessment of how Indigenous peoples contribute to the development and management of protected areas has not been conducted.

Wetland Biodiversity and Indigenous Subsistence

Documentation of subsistence practices in the Arctic is inconsistent, though wetlands are known to be productive ecosystems with both inland and coastal wetlands supporting spawning grounds for marine, freshwater, and anadromous fishes, critical habitats for migratory waterfowl, seabirds, and shorebirds, and feeding grounds for aquatic and semi-aquatic mammals that Indigenous peoples rely on for food security and cultural continuity (Huntington et al. 2013). Wetlands also supply Indigenous peoples with a variety of plant and fungal species. Additionally, inland wetlands such as mires critically support reindeer herding across the Nordic countries and Russia (Inga et al. 2018).

Wetland ecosystems are critical spaces that support diverse Indigenous subsistence practices. Indigenous practices such as the farming of food crops, the haying of wetlands, and the herding of reindeer and sheep are primarily practiced in the Eurasian Arctic. Of an approximate 2.2 million reindeer in the circumpolar north, most are found in Russia (1.5 million), some are found in the Nordic countries (<650,000) and few are found in Alaska, Canada, and Greenland (<20,000) (Huntington et al. 2013). Reindeer herding can also be broken down into four cultural groups that determine how herds are pastured, transported, and housed (Huntington et al. 2013) which influences the ways in which wetlands are used, altered, and managed (Inga et al. 2018). Sámi use wetlands for pasturing, migrating, resting, gathering, corralling, milking, calving, and sheltering their herds (Inga et al. 2018). Additionally, there is evidence that reindeer herding promotes biodiversity by trampling and grazing, thus maintaining species diversity (Linkowski 2017). Research from two decades ago suggests that approximately half of all reindeer foraging species in Scandinavian are found in wetlands (Warenberg 1997; Inga et al. 2018). Loss of pasture is the

main threat to reindeer herding in the Nordic countries, including issues of new infrastructure and forestry development (Huntington et al. 2013). These issues are tied to the loss of critical wetland ecosystems that reindeer rely on for grazing while they free-pasture.

Arctic Indigenous peoples also rely on gathering activities in wetlands to support the collection of food and materials. Those consumed include numerous species of berries and mushrooms, and though non-consumptive species are not well documented, they are known to include wetland species from the genus *Carex* and *Eriophorum*. In Scandinavia, Sámi collect various species of the genus *Carex* for insulation (Inga et al. 2018) while Alaskan Inuit also collect species from the genus *Eriophorum*, the tundra cottons, for insulation and children's clothing. Additionally muskox hair is collected in Alaska, Canada, and Greenland for a variety of clothing and crafts.

Subsistence fishing and hunting are of special interest within the context of biodiversity conservation. A key area of conflict in Arctic wildlife management lies in species of both conservation and subsistence interest. These charismatic species include salmonids, migratory birds such as eiders, puffins, and murres, and various species of seal and whale. Subsistence hunting occurs in every Arctic country, through the degree of reliance is most notable in more rural Arctic communities where alternative foods are less available or too costly. Migratory birds are hunted in every Arctic country, including waterfowl from inland wetlands and seabirds from coastal wetlands. Many Arctic species of birds and mammals are migratory, exposing many species to subsistence and recreational hunting in multiple countries including those beyond the North.

In North America and Greenland, subsistence activities are actively managed separately from sport hunting and fishing. Subsistence activities in Greenland are managed differently than in Alaska and Canada as hunters hold professional positions are able to sell their products in local markets (Huntington et al. 2013). In Alaska and Canada, subsistence hunting and fishing is often licensed but operates on a relatively open access basis with the exception of certain national or regional limitations placed on vulnerable species or managed by international commissions established through international law. These include limitations on the hunting of certain species of migratory birds and marine mammals. Despite the important relationship between biodiversity and food security, the burden of conservation can be a driver of Indigenous food insecurity and sanction against the subsistence of key wildlife species challenges Indigenous sovereignty and self-determination and can create hardships for health, economy, and culture in Indigenous communities (ICC 2015; ICC 2020).

METHODS

This study investigates the current status of use, management, and conservation of Arctic wetland protected areas in relation to Indigenous peoples. Through a comparative case study approach, it explores common themes among Indigenous use and participatory processes in management efforts across the circumpolar Arctic. A similar approach has been used by various organizations conducting research on Indigenous relationships with protected areas across the globe (UN 2000; MacArthur 2010).

Protected Area Selection

AWIPS selected a diverse group of 35 protected areas in the Arctic and sub-Arctic that encompass inland or coastal wetlands within Indigenous homelands to assess trends in conservation across national designations and contexts (Fig. 1). These protected areas vary in size from 58(h) to 7,805,000(h), with a median over 100,000(h). The IUCN protected area categories provide useful reference for international standards of biodiversity protections though neither national nor international designations are fully descriptive of the degree of biodiversity protections, typical management activities, or degree of use by resource users. This study only includes protected areas containing wetland ecosystems which are either actively managed or support species that are actively managed. Among the many Arctic protected areas that met these criteria, sites were further selected to maintain diversity across ownership, management structure, stages of establishment, intensity of management, degree of known Indigenous engagement, and spatial geographies and scales across the eight Arctic countries. The intent of accounting for a diversity of conservation aims, approaches, and planning processes, and political, legal, and cultural contexts is to ensure than no two cases exhibit the same combination of attributes.

Data Collection and Analysis

This study pursued a mixed methods approach to collect data from various sources including protected area management plans, conservation plans, participation plans, supplemental documentation such as annual reports and publications, and direct communication with management authorities and Indigenous organizations. Using focused comparison, AWIPS then identified trends through descriptive statistics within seven foci of interest including (1) management authorities, (2) management actions, (3) conservation actions, (4) species protections, (5) Indigenous resource use, (6) Indigenous participation, and (7) environmental concerns. This study also pursued a combination of process-oriented and structure-oriented analysis to explore how researchers and practitioners develop and implement participatory processes in collaboration with Indigenous peoples.

RESULTS

Status of Indigenous Use

Arctic Indigenous peoples rely on subsistence activities for nutritional and cultural sustenance. The five types of subsistence practiced in the Arctic include (1) farming, (2) herding, (3) gathering, (4) fishing, and (5) hunting, dependent upon the cultural contexts of the Indigenous communities. Coastal and inland wetlands support all five types of subsistence.

AWIPS examined documentation of the surveyed protected areas' management and conservation plans for references to Indigenous resource use within the areas. Indigenous use of wetlands was documented at 82.9% of sites, a number that is likely underreported. Surveyed protected areas may be used for all five types of subsistence, though most are used for only several of these categories, including site uses for farming (5.7%), herding (45.7%), gathering (42.9%), fishing (65.7%), and hunting (74.2%) (n=35). The exact species herded, gathered, fished, and hunted in each protected area are dependent on the cultural practices of the local Indigenous people, the local species composition, and the laws in place governing subsistence activities. While it is unclear which species are subsisted, the level of reliance, and the exact terms of access, it is clear that Indigenous

peoples currently use and consume a wide array of species that include marine, freshwater, and anadromous fishes, migratory birds, and terrestrial and marine mammals. For those protected areas reporting on reindeer herding, between an average of 150 to 8000 reindeer are grazed within areas from 1910(ha) to 1,400,000(ha). Exact numbers were not available in any of the management or conservation plans. Rising or declining trends in the number of reindeer herded within surveyed protected areas were only occasionally documented.

Status of Management and Conservation Efforts

Indigenous peoples hold at least partial ownership over 25.7% of the surveyed sites (n=35). The context for ownership varies cross-nationally with many sites sharing ownership and management authority. The majority of sites are owned by national governments and management authority is primarily shared between and regional authorities. For greater context, in Russia, Indigenous peoples have limited rights to resource use and are not often invited to share management authority in protected areas, while in Sweden, shared management authority is partial and primarily present in legal rights to manage reindeer herding in protected areas. In Canada, management authority is intended to be shared equally between the national and regional governments and Indigenous authorities while in Greenland, approximately 90% of the population is Indigenous and distinguishing an authority as Indigenous or non-Indigenous makes little sense as management authorities are staffed by, and work directly with, Indigenous people. The conservation easement in Alaska is the only example of a protected area entirely owned and managed by an Indigenous community.

Many of the surveyed wetlands have complex institutional arrangements that include more then one management authority responsible for the development and implementation of management and conservation strategies. Indigenous communities have the right to involvement in management processes at just 34.2% of these sites (n=35). Additionally, with the exception of Alaska, many surveyed sites share management authority between national and regional agencies. In these instances, the national management authority often oversees the general management while the regional management authorities make more localized decisions regarding wildlife and execute implementation processes. Many of the sites also have more than one nationally or internationally recognized conservation designation which may produce separate planning and reporting processes.

Regarding the conservation of priority species, few regional and long-term monitoring efforts exist on the biodiversity of Artic flora and fauna (Wrona and Reist 2013) and identification of priority species within Arctic protected areas is lacking. At the surveyed sites, many management authorities keep track of vulnerable species of fauna that are recognized by the IUCN and their individual country's Red Lists, but often information on local abundances, population dynamics, and trends are limited. It is unclear exactly how many of these nationally or globally threatened species are important to subsistence activities and the health and wellbeing of local Indigenous communities. Additional information on whether local management authorities have the legal right or capacity to restrict subsistence hunting of vulnerable species within the protected area is often not addressed in management plans.

Non-Indigenous management authorities may have different understandings of the drivers of negative impacts to wetland protected areas. Indigenous activities were cited as negative contributors to management and conservation efforts at 17.1% of the surveyed protected areas, with 45% of sites not reporting on environmental concerns or change drivers at all. Management and conservation plans produced in the Eurasian Arctic were the only to cite Indigenous activities as negative impacts to wetlands and referenced or affirmed the rights of Indigenous peoples less often than documents produced in the North American Arctic. Concerns about Indigenous activities in wetlands are not found in reports that were co-produced with Indigenous leadership and communities.

Status of Indigenous Engagement

While some Indigenous communities participate in wetland protected area management, the depth of this participation varies cross-nationally. For example, Indigenous peoples in Russia have limited rights to resource use in protected areas and are not often invited to share management authority. In Sweden, shared management authority is partial and primarily present in legal rights to manage reindeer herding in protected areas. In Canada, management authority is intended to be shared equally between the national and regional governments and Indigenous leadership and organizations. In Greenland, approximately 90% of the population is Indigenous and distinguishing an authority as Indigenous or non-Indigenous makes little sense in their management contexts as management authorities are staffed by, and work directly with, Indigenous people.

In assessing these sites, this study identifies six categories of participation that may occur in management and conservation efforts:

(1) 'token' consultation: (authority to Indigenous leadership, one-way). Often, management authorities make only a symbolic effort to include Indigenous peoples within participatory processes. This mechanism is not a true participatory approach as it is a one-way effort to inform Indigenous leadership of actions pre-determined and being taken without consideration for Indigenous needs or perspectives. Example activities include informing Indigenous leadership of new national or regional management and conservation efforts that may impact or restrict access, availability, stability, or use of plant and wildlife resources. This includes predetermined research or management actions that may change or reduce quotas, bag-takes, occurrence or duration of hunting and fishing seasons, or delineation of hunting and fishing areas.

(2) information sharing: (authority to Indigenous community, one-way). When engaging Indigenous communities near, or within, protected areas, information sharing is intended to ensure that Indigenous communities are informed of interesting and relevant happenings, though this does not provide a space in which the community can contribute to the body of information, project, or management action. Example activities include informing Indigenous communities of research through local communications, establishing community-information sessions in which community members can learn and ask questions about research or management efforts, or establishing lecture series so that community members are informed of scientific developments and findings.

(3) community-based monitoring: (Indigenous community to authority, one-way). An emerging method for engaging rural communities in citizen-science-based data collection, community-based monitoring may take the form of biological inventories, local point observations, capture-recapture efforts during subsistence activities, or the collection of oral histories for the construction of baseline data.

(4) knowledge exchange: (authority to Indigenous community, two-way). This information sharing approach provides a forum where Indigenous communities can actively shape and direct management and research efforts within a protected area. The flow of information is bidirectional and provides a space in which Indigenous knowledge and science can begin to interact by facilitating activities such as the collective discussing of biodiversity issues and potential change drivers in community meetings and facilitating discussions between scientists and Indigenous knowledge holders to address management and conservation strategies.

(5) co-management: (authority sharing with Indigenous leadership, two-way). Co-management is a concept in management and biodiversity conservation that emerged several decades ago through legal cases in Canada and the U.S. that specified Indigenous rights to inclusion in the management lands and species. Co-management is a common participatory approach in Alaska and Canada, although the laws supporting the sharing of management authority and the degree of efforts towards co-management caries. Some co-management efforts also exist in the Nordic countries where Sámi have some legal rights to co-manage activities involving reindeer husbandry in protected areas. Overall, the sharing of management authority in the Eurasian Arctic is uncommon. For instance, management of protected areas in Russia is almost entirely dependent on the leadership of each individual protected area, and while some may be receptive to Indigenous involvement in management efforts, others are more restrictive. Co-management can be characterized by collaboration between national, regional, and Indigenous management authorities to specify management actions appropriate to ensure the conservation of lands and species and sharing management authority in the establishment, development, and implementation of joint management committees.

(6) co-production: (authority sharing with Indigenous leadership, two-way). Co-production in natural resources management originated in the Canadian Arctic (Kofinas 2002) and can be described as encompassing co-management activities while also supporting the co-creation of ideas, objectives, and shared responsibility in achieving conservation goals. Within the realm of protected area management, co-production encompasses both a co-production of knowledge and a co-production of services. While the co-production of knowledge broadens the base of information from which management authorities can base decisions, the co-production of services supports the development of shared management responsibility and the implementation of chosen conservation strategies. Co-production activities include co-planning to identify important areas for scoping and funding of potential research and management projects, co-prioritizing between management authorities to develop shared vision, purpose, common goals, ownership, and mutual responsibility, co-learning to develop a shared evidence base, co-management of lands and species through adaptive and reflexive processes, co-delivering of management plans and other products and programs and ensuring their execution in an adaptive and flexible way, and co-assessment of conservation targets and goals.

Many of the management authorities at surveyed protected areas pursued more than one approach at different stages of the establishment, development, and implementation of management strategies. Each of these approaches can be summarized by how management authorities interact with Indigenous communities and whether knowledge is exchanged unidirectionally or bidirectionally.

DISCUSSION

Links Between Conservation and Indigenous Use

Overall, the prevalence of Indigenous use of wetlands and their species within these protected areas is most likely underreported. Reasons for this include perceptions that Indigenous use may be minimal enough to be negligible, that Indigenous use may be illegal and thus not appropriate to report on, and that Indigenous use is not mainstream enough to warrant consideration in an official plan or report. The lack of information on Indigenous wetland resource use therefore represents an important knowledge gap that may inhibit management authorities' abilities to support Indigenous communities and biodiversity simultaneously. Understanding Indigenous needs, perspectives, and relationships with the lands require meaningful engagement with the Indigenous communities using those lands, waters, and species.

Furthermore, the finding that Indigenous communities can be the primary force behind establishing new protected areas negates the idea that Indigenous and conservation priorities are necessarily in conflict or that Indigenous peoples are passive participants in local, national, and international conservation efforts. Documentation from several of the surveyed areas illustrates that Indigenous peoples can be major drivers in establishing and maintaining protected areas and achieving the dual goals of biodiversity conservation and supporting Indigenous use of lands, waters, and species. By identifying lands important to Indigenous livelihoods and making explicit the goals of provisioning for subsistence activities, management authorities and Indigenous communities can achieve conservation objectives in partnership. It is important to recognize that biodiversity conservation can both support and inhibit Indigenous food security. Addressing Indigenous resource use could further the dual goals of biodiversity conservation and Arctic food security and provide for more diverse and inclusive conservation efforts. These findings also suggest room for additional partnerships that recognize the role of subsistence and Indigenous livelihoods as a foundation for the establishment of additional protected areas, as directed by Indigenous communities.

Limitations of Management and Conservation Plans

Findings illustrate that most management and conservation plans, as well as other official documentation on protected areas, fail to document Indigenous resource use in a systematic or functional way. As a result, documentation does not provide a complete picture of resource use and management within the protected areas. Regarding knowledge gaps, limitations in the use of written documentation include that some surveyed protected areas do not have published management or conservation plans, and those that do may be somewhat outdated. This study used documentation of conservation and management efforts within protected areas as its primary source of information. However, some surveyed protected areas do not have published

management or conservation plans, and those that do may be somewhat outdated. Under these conditions, it is unclear what management actions are currently being taken in several of the surveyed protected areas.

While much can be learned from what is documented within management and conservation plans, much can also be learned from what is absent. It is clear through review of management and conservation plans that there are inconsistencies in quality and quantity of information provided cross-nationally, and plans are often structured to address national priorities rather than international conservation objectives. Information that may be absent includes past management legacies, information about current Indigenous use of wetlands resources, and information about specific management and conservation targets and goals. Additionally, written documentation can only accurately capture the perspectives of the management authorities and additional authors involved. The quantity, quality, and robustness of the information that management authorities choose to include in protected area plans, reports, and publications may not fully capture the work and cooperation required of planning and implementing conservation efforts, especially where Indigenous leadership and communities are not invited to engage in management and conservation efforts.

Conservation Lessons Learned

This study informs several future suggestions for planning, research, and management. First, improving documentation of Indigenous resource use may allow management authorities to make decisions that respect and accommodate Indigenous resource use by ensuring that subsistence activities are not unnecessarily impeded by management actions. The recommendation to improve documentation on Indigenous uses is not intended to facilitate increased oversight, but to aid in more accurately managing non-subsistence resource uses that may impact subsistence activities. While documentation of certain species and the total abundances consumed is surveyed in some locations, these data are often collected inconsistently, may be underreported, and may not capture the extent to which Indigenous peoples rely on these species. It may be beneficial for protected area management and conservation plans to support clear documentation of both past and current Indigenous resource use in the areas, including detailed information on Indigenous uses of lands, waters, and species, degree of reliance, and terms of access. Access is especially important in the context of Indigenous peoples because laws governing Indigenous resource use vary across Arctic States. Management and conservation plans often fail to affirm Indigenous rights or point towards these laws and policies, which undermines the ability of management authorities, governments, and organizations to support Indigenous communities nor help assess sustainability.

Second, developing participation plans alongside management and conservation plans may aid in navigating long-term Indigenous engagement in management efforts. Participation plans specify cooperative objectives, participating entities, and terms of evaluation so that management authorities can continue to engage Indigenous peoples even when authorities and other interested parties experience turn-over. Participation plans can help management authorities further understand Indigenous resource use, understand the needs and perspectives of communities, understand how these needs and perspectives shape management, allow for others to learn from participatory methods, and provide transparency of information where often invisible.

Third, pursuing critical knowledge gaps may bridge both Indigenous and conservation priorities. Three priorities could aid in furthering the dual goals of biodiversity conservation and Indigenous use: (1) focusing on Indigenous knowledge of wetland ecosystems, including community ecology, environmental changes, shifts in species' distributions, and impacts on migratory species could be beneficial to both Indigenous communities and researchers, including Indigenous communities in developing the research priorities and questions ensures the research is relevant and applicable both for conservation and Indigenous activities; (2) Examining the intersection of wetland biodiversity and Arctic food security through six dimensions of food security including access, availability, stability, health and wellness, culture, and decision-making power (ICC 2015) will illuminate how wetlands species and dynamics support Arctic food and inform management practices and related change drivers; (3) prioritizing species of conservation and subsistence interest could improve understandings of conflict and provide resolutions. Many species of conservation and subsistence interest are present in coastal and inland wetlands. Examples of how some management authorities engage Indigenous peoples over the most controversial species may help other management authorities learn from their experiences and develop best practices for partnership.

Fourth, supporting the engagement of Indigenous peoples in monitoring efforts may benefit the following areas: help researchers and managers partner with Indigenous knowledge (ie. for data collection), help identify ecosystem services (ie. for medicinal plants), help monitor for rapid changes (ie. for disease emergence), support year-round sampling in remote locations (ie. for annual inventories), support collection of current and historic observational information (ie. for baseline construction), and help review results from scientific studies (ie. for improving ground-truthing and predictive capacity of population modelling.

Fifth, examining the opportunities between international research and policy-shaping organizations may further facilitate research on Indigenous relationships with Arctic biodiversity, particularly as they relate to subsistence activities. Inventories of key species critical to Indigenous subsistence activities could foster future partnerships for the development of additional conservation plans and protected areas. Answering simple questions such as 'which species are Arctic peoples eating' could inform management and conservation efforts at the global scale.

Indigenous Engagement Lessons Learned

Much can be learned from the approaches of each Arctic State, their protected areas, their management authorities, and their Indigenous communities. Important lessons learned from documentation on all surveyed protected areas include: (1) approach Indigenous participation as an opportunity. Leaving aside all legal and moral imperatives, Indigenous engagement in conservation efforts enables management authorities to address collective conservation targets and goals. Approaching Indigenous participation as an opportunity rather than as an obligation may foster stronger partnerships and build trust, which may in turn ensure the collection of more robust biodiversity data, facilitate culturally-relevant conservation efforts, and provide for innovative conservation strategies; (2) seek to build partnerships with Indigenous governments, organizations, and communities. Improving relationships between management authorities and local Indigenous communities could reduce conflict in protected areas by ensuring that Indigenous peoples have a voice in the development and implementation of conservation efforts that affect their lands, waters,

and resources; (3) engaging Indigenous leadership and communities at the beginning of the process. Engaging Indigenous peoples in conservation and management efforts from the beginning ensures communities can help create a vision for the protected area and meaningfully contribute to its development. In circumstances where management authorities have yet to include Indigenous peoples in the process, developing an inclusive and meaningful forum for the engagement of local Indigenous communities is likely beneficial; (4) welcome elders, recruit youth. While elders are often valued for their Indigenous knowledge, Indigenous youth should also be engaging in conservation efforts to support the voices and concerns of those that must live with management and conservation decisions in the foreseeable future. Recruiting young community members and Indigenous scholars also aids in ensuring the Indigenous culture and practices are carried on as the world changes.

FIGURES

Figure 1. **AWIPS Study Sites.** This study relies on a case study approach to assessing 35 protected areas across the circumpolar Arctic and sub-Arctic that are found within Indigenous homelands. These sites comprise of six relative designations of protected areas with the aim of providing a diverse set of conservation aims, approaches, and planning processes for study comparison.

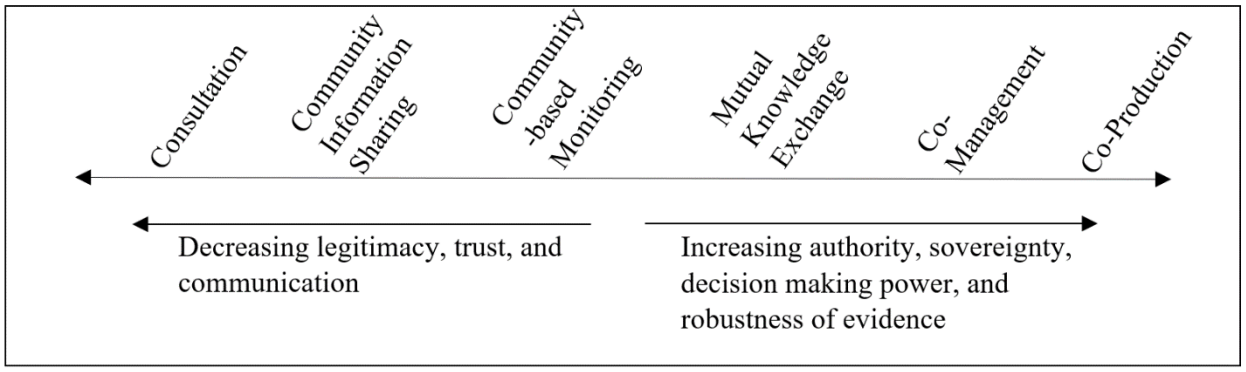

Figure 2. Conceptual Model of Indigenous Participation Spectrum. Within co-management efforts of Arctic protected areas, Indigenous communities participate through various processes, including the six shown here, running from consultation to co-production. Indigenous communities prefer participatory processes that lean towards co-production but are often left engaging solely in lesser participatory processes such as consultation. Indigenous communities prefer processes like co-production and those approaching co-production as they give communities greater authority, sovereignty, and decision making power, and leads to more robust evidence for use in conservation efforts.

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CHAPTER THREE

Framing co-production conservation for partnership with Arctic Indigenous peoples

ABSTRACT

Indigenous communities at the front lines of climate change and biodiversity loss are increasingly shaping the conservation of lands, waters, and species. The Arctic is a hotbed for emerging local, national, and international conservation efforts, and researchers, managers, and communities alike will benefit from a framework that improves approaches to Indigenous partnerships. Co-productive conservation is a framework that encompasses both a co-production of knowledge and a co-production of public services to pursue ethically-conscious, culturally-relevant, and fully knowledge-based approaches to biodiversity concerns. Co-productive conservation recognizes that conservation can be practiced in a way that embodies Indigenous perspectives, knowledge, rights, priorities, and livelihoods. Six iterative and reflexive co-production processes, including co-planning, co-prioritizing, co-learning, co-managing, co-delivering, and co-assessing, focus on the human dimensions that allow research, management, and conservation to affect change. By opening discussions on how to structure conservation efforts in partnership with Indigenous communities, we can move away from narratives that perceive Indigenous participation as an obligation or part of an ethical narrative, and instead embrace a process that broadens the evidence base and situates conservation efforts within Indigenous contexts.

ARTICLE IMPACT STATEMENT

This framework improves upon Arctic conservation by detailing co-production with Indigenous peoples, communities, knowledge, and governance.

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KEY WORDS

Indigenous-led Conservation, Indigenous partnerships, Indigenous Knowledge, Co-Production of Knowledge, Co-Management, Arctic Conservation

The Arctic is the most rapidly warming environment in the world (Post et al. 2019), and its Indigenous peoples are on the front lines in a time of unprecedented change. Many Indigenous communities are apt to address issues of climate change such as coastal erosion, ocean acidification, pollution, fluctuating and unpredictable wildlife populations, and biodiversity loss. The conservation of lands, waters, and species is quickly gaining traction in the Arctic as a tool for addressing these issues, but current efforts require a new framework as we advance more intentional Indigenous partnerships for the benefit of achieving both local and global conservation targets and goals.

INDIGENOUS PEOPLES SHAPE CONSERVATION

Indigenous peoples are increasingly recognized for leading conservation efforts around the world. Globally, one-quarter of all land on earth is owned, managed, used, or occupied by Indigenous peoples, and these lands represent 35% of all formal protected areas and 35% of all remaining terrestrial areas experiencing low human intervention (Garnett et al. 2018; IPBES 2019). Within these lands, Indigenous communities' cultural practices are complementary to conservation as they emphasize the long-term sustainable use of biodiversity and natural resources to support traditional and modern livelihoods, continuity of culture, and environmental monitoring efforts. Recognition for the role of Indigenous-led conservation efforts in achieving global conservation targets and goals is increasingly evident by the growing body of literature on Indigenous protected and conserved areas which move beyond colonial conservation models and are linked to political, socio-cultural, and ecological benefits (Moola & Roth 2019; Tran et al. 2020).

Within the Arctic, Indigenous communities are increasingly leading the conservation of wildlife (Gadamus et al. 2015) and the establishment of protected areas (ICC 2018; Artelle et al. 2019). The 2019 designation of Tallurutiup Imanga National Marine Conservation Area in Canada and other Indigenous-led protected areas such as Pikialasorsuaq are setting a new precedent for conservation planning, where Indigenous communities are the direct beneficiaries of the establishment and development of protected areas and related conservation efforts. Furthermore, many species of conservation interest are also critical species for Indigenous subsistence and cultural practices. Many wildlife species are migratory, transcending ecological, jurisdictional, and political boundaries, while carrying cultural, environmental, and economic significance that spur conflicts of interest in conservation decisions (AHDR 2004).

The colonial legacy of conservation in Indigenous homelands in the Arctic both historically and currently strains relationships between researchers, practitioners, and Indigenous communities. Many researchers and organizations are calling for the end of colonial approaches in favor of those that support Indigenous communities (ICC 2015; Moola & Roth 2018; Witter & Satterfield 2019). This comes with recognition that conservation may mitigate biodiversity loss but some strategies burden Indigenous communities (Shackeroff & Campbell 2007) and may additionally undermine Indigenous knowledge and sovereignty (ICC 2015; ICC 2020). Despite a growing body of evidence that Indigenous communities support global conservation efforts through traditional management practices (Nakashima et al. 2012; IPBES 2019), Indigenous peoples continue to be criminalized in their own lands through externally-imposed, top-down policies that lack the flexibility and adaptability required for supporting Indigenous livelihoods and cultural practices (ICC 2015; ICC 2020).

However, over decades of gains for Indigenous communities in sovereignty, research, policy, and law, and an ongoing social shift in perspectives, approaches, and solutions for addressing Arctic issues, we are pushing the envelope of what is collectively possible. Conservation can be practiced in a way that embodies Indigenous peoples, knowledge, rights, priorities, and livelihoods. Indigenous approaches to natural resource management, planning, and policy are unique as they emphasize values, representation, and Indigenous governance (Raymond-Yacoubian & Daniel 2018). Furthermore, Indigenous knowledge is increasingly becoming a central focus of management and conservation efforts and has a formal role in national management institutions in the Arctic (Raymond-Yacoubian et al. 2015). Indigenous communities and practitioners are calling for collaborative and co-productive approaches to engagement and research focused on conservation (Jasanoff 2004; ICC 2015; Wyborn 2015; ITK 2018; Miller & Wyborn 2018; Wheeler et al. 2019) and a recognition that Indigenous ways of life fundamentally facilitate conservation objectives (CAFF 2019).

THE CASE FOR CO-PRODUCTIVE CONSERVATION

Since its inception, conservation has vastly evolved from its roots in natural resource management. Conservation tools, targets, and goals have progressed to incorporate of a diverse array of natural and social needs (Kareiva & Marvier 2012; Bennett et al. 2017), support for adaptive approaches that account for global environmental change (Wyborn et al. 2016; Colloff et al. 2017; van Kerkhoff et al. 2019), cooperation across communities, governments, and organizations (Armitage et al. 2012; Kareiva & Marvier 2012), and the inclusion of Indigenous knowledge in planning processes (Fazey et al. 2006; Adams & Sandbrook 2013).

Conservation often strives to be both evidence-based and stakeholder-driven. In the Arctic, these goals require the recognition of Indigenous peoples as rightsholders beyond stakeholders, and the meaningful participation of Indigenous peoples within conservation efforts so they are met with respect and understanding from step one. As Indigenous communities often serve vital roles in protecting natural resources and spaces, conservation efforts are increasingly recognizing risks to biodiversity associated with the failure to support Indigenous sovereignty and self-determination (Schmidt & Peterson 2009). To improve support and efficacy of conservation efforts in Indigenous homelands, conservation must challenge its own colonial legacy and support efforts that pursue co-production, promote partnerships with Indigenous communities, methodologies, knowledge, and governance, and offer ethically-conscious, culturally-relevant, and fully knowledge-based practices.

The co-productive conservation framework recognizes that conservation can be practiced in a way that embodies Indigenous values, perspectives, knowledge, rights, priorities, and livelihoods. While conservation efforts typically focus on research and the co-management of species and natural spaces, limited effort is spent on the human dimensions and social processes necessary for conservation to affect change. By opening discussions on how to structure conservation efforts in partnership with Indigenous communities, we can move beyond narratives that perceive Indigenous participation as an obligation or moral imperative, and instead embrace a process that broadens the evidence base and situates conservation efforts within Indigenous contexts.

Leading Principles for Co-Productive Conservation

Conservation within an Indigenous context must embrace diverse motivations and approaches to achieving conservation targets and goals. The three leading principles that guide co-productive conservation are that conservation must be ethically-conscious, culturally-relevant, and fully knowledge-based, meaning approaches must be (a) ethical, equitable fair, just, and meaningful, and in line with Indigenous sovereignty and self-determination, (b) must be open to traditional methods of management and conservation as guided by Indigenous knowledge and ways of life, and must not unnecessarily impede traditional practices, and (c) must trust and respect Indigenous knowledge, its methodologies, and its validation and evaluation processes as legitimate, and must take Indigenous direction on how Indigenous knowledge and science should be partnered in the creation of a shared evidence base.

SIX PROCESSES OF CO-PRODUCTIVE CONSERVATION

Both knowledge and action are required to achieve conservation targets and goals (Lauber et al. 2011; Cook et al. 2013; Wyborn 2015). To this end, co-productive conservation bridges the co-production of knowledge and the co-production of public services in six iterative and reflexive processes – co-planning, co-prioritizing, co-learning, co-managing, co-delivering, and co-assessing (Fig. 1). Prior literature on co-production identified co-planning, co-prioritizing, co-managing, co-delivering, and co-assessing (Bovaird & Loffler 2012). The necessity of adding co-learning is apparent when working with Indigenous communities where researchers, managers, and policy makers must navigate differing world views, cultural practices, and knowledge systems in developing a shared evidence base. By breaking down the co-production process into these six activities, we can better parse out how people direct how, where, and why their collective knowledge supports action.

Figure 1 outlines the six co-production processes, their related co-production activities, and offers concrete examples of these activities for conservation in a real-world context. These processes are not intended as a linear process, though they are described in the following order.

Co-planning:
Co-planning encompasses an attention to the identification, conceptualization, scoping, and funding of potential conservation projects. In the pursuit of ethical, equitable, fair, just, and meaningful conservation initiatives within Indigenous homelands, establishing strong foundations for partnership and engagement is critical. Researchers widely recognize that the engagement of managers, practitioners, and communities in scoping is a promising first step in achieving conservation goals (Klenk & Hickey 2012). Careful consideration must be given to ensure that Indigenous engagement is more than a long list of procedural checkboxes as Indigenous peoples should hold more than an advisory role. Consultation processes are often insufficient forms of engagement as consultation at its best places Indigenous communities in merely an advisory role, while consultation at its worst informs an Indigenous community about a predetermined decision. Projects are afforded credibility, legitimacy, and accountability when they are meaningful, inclusive, and reflective of diverse participation and governance structures (Miller & Wyborn 2018). Special attention should be given to working within Indigenous governance structures, even when there is no legal requirement to do so.

Within the Arctic, Emerging opportunities for conservation initiatives may surface in community meetings and workshops, governance discussions between Indigenous and non-Indigenous entities, or within environmental organizations. As examples, these discussions may lead to the identification of potential protected areas that would benefit both conservation and Indigenous subsistence and cultural interests, new approaches wildlife and land management efforts, or the identification of new funding opportunities. Funding agencies are critical enablers in stimulating and supporting new co-production projects because support is often lacking in places of conventional knowledge production, such as academic (Klenk & Hickey 2012). Long-term conservation funding opportunities from governments may afford the co-planning process more flexibility than academic grants where funders may require a more concrete understanding of the planned activities before awarding the initiative. Funding is therefor a primary barrier to conservation efforts as it may be contingent on meeting the funder's priorities, which may not reflect Indigenous needs (ICC 2020). Additional barriers to co-planning may include navigating a diversity of preferred approaches, needs, and expectations in conceptualizing conservation initiatives.

Co-prioritizing:

Co-prioritizing is characterized by a collective agenda setting amongst all involved, including the development of shared vision, purpose, common goals, ownership, and mutual responsibility prior to knowledge creation. What proceeds implementation is a critically important step in the management of wild living resources, may reduce conflict, and gives the process an appropriate direction (Chuenpagdee & Jentoft 2007). Co-production processes in Indigenous homelands must necessarily grapple with a diversity of priorities, knowledge, and practical needs, which if not addressed early may present barriers to later stages of co-production. Co-prioritizing conservation agendas may include activities such as developing a shared vision and purpose for a particular resource or protected area, identifying shared conservation targets and goals and engagement methodologies, and defining norms, roles, and responsibilities, all which contribute to a growing sense of project ownership and accountability between Indigenous communities and others.

This development of priorities and interpersonal relationships can be framed as the development of 'co-production communities,' (Godemann 2008). This mindset mirrors Indigenous approaches to problem solving, which revolve around community structures to address and solve collective problems. Within this process, it is important to consider institutional and power structures that may limit the ability of participants to engage equitably (Wamslet 2017). This includes identifying ways in which institutional and power structures afford non-Indigenous participants more influence than others and mitigating these power imbalances, which can present a formidable barrier to capturing priorities if unaccounted.

Co-learning:

Co-learning is the process by which participants approach the partnership of Indigenous knowledge and science through a true co-production of knowledge. Co-learning includes the activities by which participants come together to demonstrate knowledge, build a shared evidence base, identify specific concerns, challenges, and opportunities, and begin to proceed towards ethically-conscious, culturally-relevant, and knowledge-based objectives. Indigenous knowledge and science are partnered towards mutually-developed goals in a process that emphasizes

Indigenous values, equity, trust, respect, and self-determination. It is through this process that partners learn how the other participants work, reason, establish methodologies, execute methodologies, interpret evidence, and apply information. Co-learning is also the space in which the politics and agendas of the participants shape knowledge with potential consequences for conservation efforts and outcomes. During the co-learning process, participants must recognize that public engagement, deliberation, and debate on the creation of knowledge will affect the ability of outputs to empower others towards change (Miller & Wyborn 2018).

Partnering knowledge systems is perhaps the pinnacle activity of co-production activities, yet the literature largely lacks practical advice for doing so. The co-learning process must grapple with different ways of knowing, such as scientific knowledge coming from academia, experiential knowledge coming from practitioners and communities, and Indigenous and traditional ecological knowledge coming from entirely different world views and cultural references. Co-learning can only be productive when Indigenous knowledge is trusted, valued, and respected, and when knowledge holders are given the opportunity to demonstrate the depth and applications of their knowledge to others.

Partnering information and evidence from these different knowledge systems is complicated because they each approach the collection and validation of information and evidence in different ways. These ways of knowing additionally manifest in formats that are not easily transferable and lack practical ways to validate information between systems (Tengö et al. 2017). Participants in co-learning processes must include an exploration of what is evidence, how is evidence gathered, how is evidence communicated, and how is evidence validated within its own system of knowing. Within a conservation planning process, any conflicting information should be widely discussed and concluded upon, with special attention to power imbalances in asserting information.

Co-learning towards conservation may take the forms of literature reviews, participatory mapping of resources, place names, or spatiotemporal population dynamics, community meetings on climate impacts, collections of case studies identifying factors and variable of importance, storytelling, and identifying appropriate scientific and Indigenous methodologies. As example, participatory mapping is a co-learning activity that can highlight the powerfully descriptive nature of Indigenous knowledge. Some mapping projects exemplify that Indigenous knowledge is often more spatially descriptive of species' spatiotemporal population dynamics than is currently available and possible through scientific methodologies such as remote sensing and satellite tagging (Gadamus & Raymond-Yacoubian 2015; NWAB 2016). These kinds of projects produce evidence that is of vital importance to all participants involved, as well as broader management, conservation, and research communities. However, these kinds of project also illustrate risks to Indigenous knowledge, as special attention must be given to ensure that the evidence is guided by Indigenous values and that the Indigenous knowledge is not taken out of context, misunderstood, or used to support initiatives that Indigenous communities oppose.

Co-learning may make researchers and practitioners wary because there is no standard processes for partnering Indigenous and scientific knowledges. Despite researchers' and practitioners' calls for the systematic integration of evidence in the co-production process, some scholars argue that there is no single approach to the partnering of knowledge systems, and that the ways in which we identify, engage, evaluate, and apply different knowledges are determined by the unique needs of

the particular co-production process (Raymond et al. 2010). The success of this activity relies on its ability to create relevant, effective, and accessible materials (Polk 2015) in ways that respect Indigenous knowledge and related decision-making processes.

Co-managing:
Co-management occupies the space of engaging management, policy, and law through delineation, allocation, and regulation of resources and spaces. This co-production activity is the most widely practiced in relation to Indigenous communities and has the largest body of published literature of the six co-production processes. Typically, within the Arctic context, management refers to wildlife or protected area management and encompasses the environmental, social, fiscal, and political challenges of navigating such a process. Co-managing in the context of conservation may encompass marine and terrestrial spatial planning, including the delineation of management zones, protected areas, and shipping routes, and wildlife management such as the regulation of hunting and fishing activities.

Like the other co-productive processes, co-managing should focus on developing true partnerships between communities, practitioners, and decision makers as it is critical for addressing nationally and internationally recognized Indigenous rights, sovereignty, and self-determination in management and conservation efforts (ICC 2020). These partnerships must be ethical and equitable and hold Indigenous communities as the primary beneficiaries of conservation efforts occurring on their homelands. Effective partnerships with Indigenous communities may lead to solutions and goals that differ from conventional conservation efforts and may reach beyond ecosystem-based approaches and towards more flexible management strategies (Gadamus et al. 2015).

While co-management often dominates discussions around conservation, co-learning is equally important and the two are often intertwined in practice, as the co-production of knowledge is a key mechanism for learning and adapting within co-management activities. Developing adaptive capacity though co-learning and co-managing is important because the ability to experiment with evidence throughout change allows participants to use evidence effectively and towards the stated goals (Armitage et al. 2011). Best practices for successful co-management include supporting social learning in a process by which information and decisions are constantly evolving to meet the needs presented in the environmental and political contexts (Berkes 2009). These processes may include building cooperation and maintaining relationships between participants, collaborative observing and monitoring in partnership with communities, and downwards accountability to those communities (Berkes 2009). Some barriers to co-managing may include a lack of institutional capacity, differences in assumptions when interpreting and applying evidence, and other areas of social conflict often present in co-management processes, to which end external partners may help to ensure that management efforts are treated as more than formalities (Robards et al. 2018). Co-managing may be more successful when the processes are innovative and adaptive, allowing for continual reassessment of environmental factors, and continually open opportunities for additional co-learning activities.

Co-delivering:
The co-delivering process entails the implementation of additional, non-management activities and the production of materials, typically thought of as "outputs." These activities primarily encompass enforcement, research, education, and reporting. The intended beneficiaries of these activities

might be communities, co-managing bodies and boards, governing bodies, conservation organizations and cooperatives, Indigenous knowledge networks, research councils, international fora, and academic institutions. As the purpose of co-production is often to connect knowledge to decision making, providing the right people with the right information to enact change is paramount to the process. The power of co-productive products or materials to enact change has been called external transformative capacity and represents the intention of co-production to be more than just the creation of knowledge (Polk 2015).

Enforcement of conservation measures should be decided collectively to ensure they are fair, just, and culturally-relevant. Both legal and social enforcement of these defined rules and regulations should be considered, and Indigenous communities must be included in identifying proper and traditional uses of lands, waters, and species and related infractions. The enforcement of such uses and the development of criminal punishment should be directed by Indigenous communities so that measures are healing rather than counterproductive to community wellbeing. For example, an infraction that removes a hunter from their family could be detrimental to family and community food security.

Research and education are continual outputs that allow researchers, practitioners, and communities to incorporate new information that may lead to the necessary changes in management regulations and conservation strategies. When done well, research and education serve as long-term investments in Indigenous communities and may take the form of ongoing projects, community-based monitoring efforts, species assessments, the development of spatial products and data packages, community outreach, community liaison and technician training programs, and stable partnerships that support community members to stay engaged in initiatives. Within both conservation research and education, Indigenous knowledge should be a central component of the design, methodologies, and curriculums of those efforts, thereby producing tangible products, engaging rightsholders and scientists in the science-policy interface, and ensuring that Indigenous knowledge holders have space to contribute to the management of their own lands, waters, and species.

Reporting on management and conservation efforts typically involves the development of community briefers, technical reports, academic publications, policy briefs, and data portals. When working with Indigenous communities, special attention must be given to data sovereignty, ownership, and protection, as Indigenous knowledge is often collectively owned by communities and is not always acceptable for public dissemination, though direction should always be taken from the Indigenous communities involved. Materials should also be produced in the appropriate Indigenous languages and their particular dialects to ensure that community members can remain informed and engaged around the initiatives occurring in their homelands. Of note, materials may need to be packaged separately for communities, researchers, practitioners, decision makers, and funders and should be tailored to both scale and jurisdiction (Lövbrand 2011; Briley et al. 2015).

Co-assessing:
Co-assessing is the co-production activity of evaluating and adapting the process to be inclusive of new evidence, perspectives, ideas, solutions, circumstances, and other emerging changes. While this activity is presented last, best practices suggest that co-assessment should occur throughout

the process iteratively and reflexively (Polk 2015). New knowledge generated during the co-production process should be incorporated into the evidence base, and how the information performs its function should be continually reassessed to ensure that the evidence body is serving its intended purpose. Co-assessment may best be facilitated by building in the time to revise and revisit the priorities, products, and materials throughout the co-production process to ensure that the process is supporting its intended purpose while also opening opportunities for the process to accommodate new information and areas of interest. In relevance to conservation, formal assessments may take the form of community surveys, project assessments, performance assessments, and conservation target assessments.

CONCLUSIONS

Co-productive conservation provides a space for communities, researchers, practitioners, and decision makers to collaborate from the beginning of the process and follow through scoping, data collection, development of a shared evidence base, implementation, monitoring, and adjustments for environmental feedback. Co-productive conservation therefore fosters a follow-through in governance, a responsibility to rightsholders and stakeholders in the scientific and decision making processes, and an opportunity to address the human dimensions of conservation at the science-policy interface. Over the next decade, we look forward to improved partnerships in conservation efforts, new Arctic protected areas, and a greater recognition for Indigenous contributions to effective governance as we address the rapid changes occurring in the North. Through partnerships with Indigenous communities, researchers, and decision makers, Indigenous communities will continue to shape the future of our Arctic.

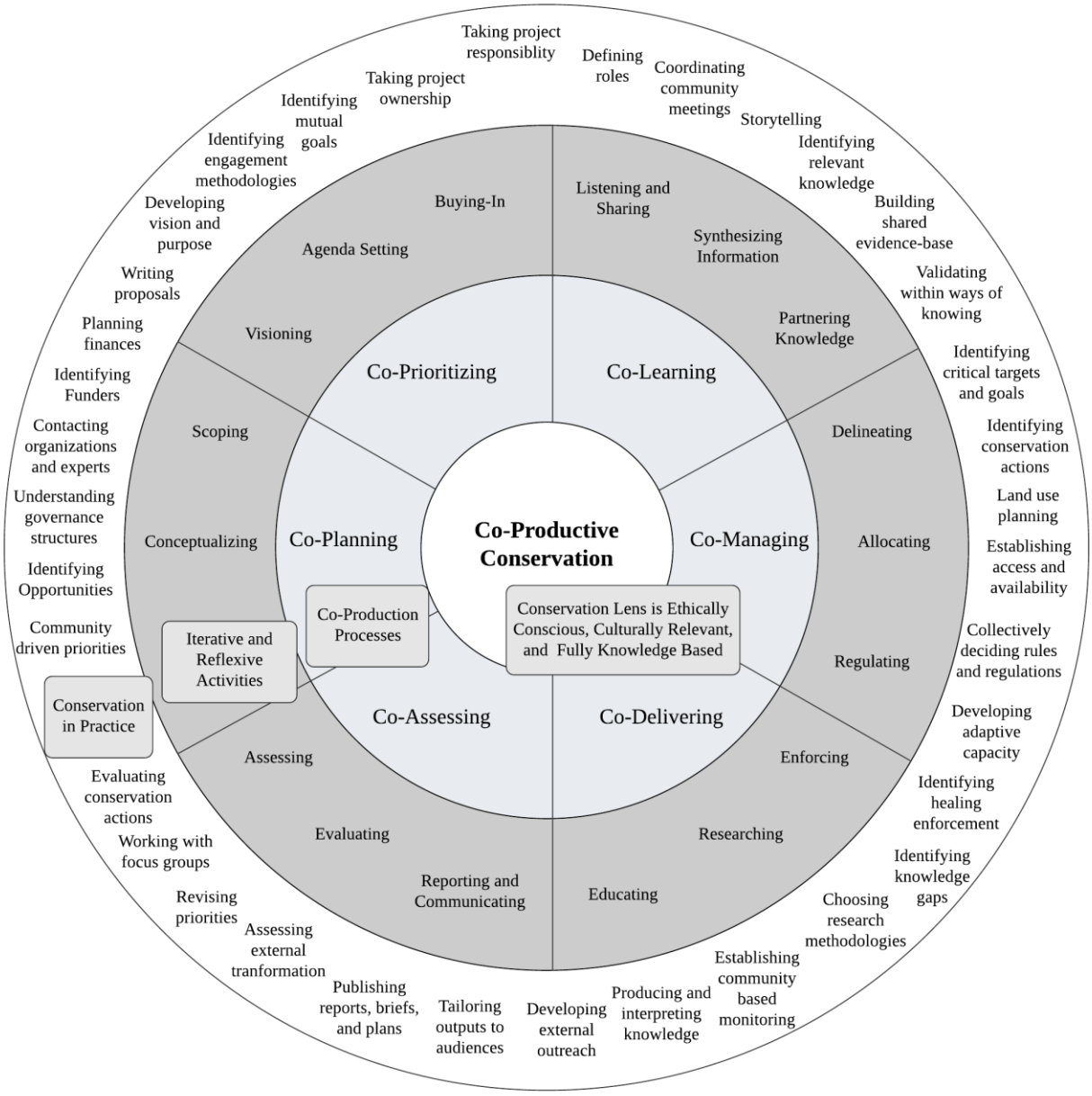

Figure 1. **Co-Productive Conservation Framework**. Co-productive conservation focuses on six iterative and reflexive processes centered around the co-production of knowledge and the co-production of public services for conservation action: co-planning, co-prioritizing, co-learning, co-managing, co-delivering, and co-assessing. The conservation lens highlights three guiding principles, namely that conservation efforts must be ethically-conscious, culturally-relevant, and fully knowledge-based. The inner ring highlights the six co-productive processes while the middle ring elaborated on related conservation activities. The outer ring includes non-exhaustive examples of conservation practices that put these processes into action.

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SUPPLEMENTS

[1] CHAPTER 2 – ADDITIONAL CITATIONS, TABLES, AND FIGURES

The materials presented here can be found in full in this chapter's technical report. These materials will not appear in the manuscript version for publication in a scientific journal.

Technical Report

Buschman, V. 2019. Arctic Wetlands and Indigenous Peoples study (AWIPS) an assessment of indigenous engagement in wetland protected areas. Conservation of Arctic Flora and Fauna. Akureyri, Iceland. ISBN 978-9935-431-84-4.

Figures

Figure 1. Types of Arctic Indigenous Subsistence Practices.

Tables

Protected Area	National Designation	Country	Year Est.	Area (ha)	Formal Designations	Num Man. Authorities
Lataseno-Hietajoki	Wilderness	FIN	2004	43367	6	4
Lemmenjoki	National Park	FIN	2004	285990	4	4
Sammuttijanka	Wilderness	FIN	2004	51749	4	4
Myvatn-Laxa	Nature Res.	ISL	1977	20000	2	1
Snaefell & Eyjabakkar	National Park	ISL	2013	26450	2	1
Tanamunningen	Nature Res.	NOR	2002	3409	2	1
Pasvik	Nature Res.	NOR	1996	1910	3	1
Brekhovsky Islands	Proposed Area	RUS	1994	1400000	1	2
Ob Estuary	Nature Res.	RUS	1994	128000	2	2
Parapolsky Dol	Wildlife Refuge	RUS	1994	1200000	2	6
Karaginski	Nature Res	RUS	1994	193597	2	6
Utkholok	Nature Res.	RUS	1994	220000	2	3
Moroshechnaya	Nature Res.	RUS	1994	219000	2	3
Numto NR	National Park	RUS	1997	721797	1	3
Pirttimysvuoma	Nature Res.	SWE	2013	2586	5	3
Sjaunja	World Her.	SWE	1974	181333	10	4
Tarnasjon	Nature Res.	SWE	1974	23236	3	1
Paivasvuoma	Nature Res.	SWE	2013	2759	3	2
Blaikfjallet	Nature Res.	SWE	2013	43487	8	1
Kilen	National Park	GRE	1988	51280	2	1
Hochstetter Forland	National Park	GRE	1988	184820	2	1
Heden	Wildlife Refuge	GRE	1988	252390	1	1
Kuannersuit	Wildlife Refuge	GRE	1988	5190	1	1
Kitsissunnguit	Wildlife Refuge	GRE	1988	6910	3	1
Mykines	Proposed Area	FAR	2012	2300	1	0
Yukon NWR	Wildlife Refuge	USA	1980	7750000	1	1
Arctic NWR	Wildlife Refuge	USA	1960	7805000	1	1
Eklutna Easement	Easement	USA	2014	58	1	0
East Bay Sanctuary	Wilderness	CAN	1959	113800	1	4
Auyuittuq NP	National Park	CAN	1972	2147000	1	4
Sirmilik NP	National Park	CAN	2001	2200000	1	4
Tallurutiup Imanga	Proposed Area	CAN	2019	4430000	1	3
Ahiak	Wilderness	CAN	1982	6292818	2	4
Edehzhie	Proposed Area	CAN	.	1420000	1	2
Old Crow	National Park	CAN	1982	617000	2	3
Median				181333	2	2

Table 1. Additional Site Information and Metrics.

Country	National Park	Nature Reserve	Wilderness Area	Wildlife Refuge	World Heritage	Conservation Easement	Proposed Areas	IUCN Protected Area Categories				
								Ia	Ib	II	IV	Unreported
Iceland	1	1	-	-	-	-	-	-	-	1	-	1
Norway	-	2	-	-	-	-	-	1	-	-	1	0
Sweden	-	4	-	-	1	-	-	1	1	-	-	3
Finland	1	-	2	-	-	-	-	-	1	-	-	2
Russia	1	4	-	1	-	-	1	1	4	1	-	1
USA	-	-	-	2	-	1	-	-	-	-	2	1
Canada	3	-	2	-	-	-	2	-	2	2	1	2
Greenland	2	-	-	3	-	-	-	-	-	2	1	2
Faroes	-	-	-	-	-	-	1	-	-	-	-	1
Subtotal	8	11	4	6	1	1	4	3	8	6	5	13
Total	35							35				

Table 2. Distribution of Relative Protected Area Designations By State.

National Designations
National Park (8)
Nature Reserve (11)
Wilderness Area (4)
Wildlife Refuge (6)
World Heritage Site (1)
Conservation Easement (1)
Proposed Protected Area (4)

Table 3. National Designations Represented by Sites.

International Designations
Ramsar Wetland (25)
World Heritage Site (1)
EU Natura 2000 (5)
EU Natura 2000 SPA (5)
EU Natura 2000 SCI (3)
EU Natura 2000 SAC (2)
Transboundary Designation (2)

Table 4. International Designations Represented by Sites.

Data Collection Sources
- Management plans
- Conservation plans
- Official reports
- Official publications
- Correspondence with management authorities
- Correspondence with Indigenous organizations

Table 5. Data Collection Sources.

Topics of Data Analysis
- Management authorities - Management actions - Conservation actions - Species protections - Indigenous use - Indigenous participation - Environmental concerns

Table 6. Topics of Data Analysis.

Land Ownership	National	National & Indigenous	Regional	National & Private	Regional & Private	Indigenous & Private	Private
% Distribution	51.4%	22.9%	14.3%	2.8%	2.8%	2.8%	2.8%

Table 7. Distribution of Ownership Across Sites.

Management Authority Shares	Federal	Regional	Indigenous	Uncertain & Not Reporting
% Reporting	57.1%	60.0%	34.2%	22.8%

Table 8. Distribution of Management Authority Across Sites.

	Indigenous Use	Farming	Haying	Herding	Gathering	Fishing	Hunting
% Occurring	82.9%	5.7%	14.2%	45.7%	42.9%	65.7%	74.2%
% Not occurring	5.7%	57.2%	42.9%	25.7%	5.7%	5.7%	8.6%
% Not reporting	11.4%	37.1%	42.9%	28.6%	51.4%	28.6%	17.1%

Table 9. Prevalence of Indigenous Wetland Use Across Sites.

	Indigenous Activities	Extractives	Forestry	Infrastructure Development	Hydro-Engineering	Not Reporting
% Reporting Concern	17.1%	28.6%	5.7%	17.1%	8.6%	45%

Table 10. Prevalence of References to Different Negative Environmental Impacts.

Engagement Activity	Route of Information	Direction of Engagement	Example
Consultation	Authority to Indigenous leadership	One-way	Government informing Indigenous leadership of pre-approved project
Information sharing	Authority to Indigenous community	One-way	Researchers providing information sessions at community meetings
Community-based monitoring	Indigenous community to authority	One-way	Community members contributing to year-round biodiversity sampling
Knowledge exchange	Between authority and Indigenous community	Two-way	Managers and community members discussing potential change drivers
Co-Management	Authority sharing with Indigenous leadership	Two-way	Joint committees collaborating on wildlife management plans
Co-Production	Authority sharing with Indigenous community	Two-way	Indigenous communities shaping new conservation efforts in collaboration with managing authorities (both co-production of knowledge and co-production of service)

Table 11. Commonly Employed Mechanisms for Engaging Indigenous Communities in Conservation.

[2] IRB OVERVIEW

[1] Study Overview: This study has a dual purpose, (1) to identify potential case studies for use in other chapters of this dissertation, and (2) to explore perspectives on participatory processes that facilitate Indigenous engagement in biodiversity conservation and planning. This study will recruit participants from all eight Arctic countries that work professionally at academic institutions, conservation and environmental organizations and agencies, and Indigenous organizations and governing bodies. This study is designed to expand the knowledge base of conservation planning and produce results that are expected to be useful in wider applications of conservation efforts, focus directly on the institutional and practical expertise of individuals in their fields, and improve activities of the accepted practice of conservation planning.

[2] Participants Overview: This study is interested in interviewing two groups of people, of which some overlap is expected, (1) Indigenous professionals belonging to several ethnic groups across all eight Arctic countries, above 18 years of age, of any gender, and of any professional connection to subsistence practices, Indigenous knowledge, wildlife management, conservation planning, or natural resource governance, and (2) conservation professionals working across any of the eight Arctic countries, above 18 years of age, of any gender, and of any professional connection to wildlife management, conservation planning, or natural resource governance. Individuals will be recruited based on a network approach to the interview process beginning with my personal contacts and mentors working in the field.

[2.1] Inclusion Criteria: At the end of every interview, I will ask for the contact information of anyone else the subject believes would be an important addition to my research, either for their unique expertise or enriching perspectives. This study is particularly interested in interviewing individuals that are sceptical of Indigenous contributions to conservation planning.

[2.2] Exclusion Criteria: Individuals will be excluded if they are geographically isolated and unavailable, particularly constrained by the policies of their workplace, are unable to conduct an interview in English and a translator cannot be found or funded, are living in a country in conflict with the U.S. and cannot be reached by other technological means or are unwilling to answer either the professional or personal set of interview questions.

[2.3] Indigenous Participation: I find it necessary to include here the information that I am myself Indigenous and have much experience with the cultural and ethical considerations of research involving Indigenous peoples. I will be interviewing individuals from many different professions and organizational and governing bodies.

[2.4] Third Party Subjects: This study will collect additional information on other individuals that the subject believes would be valuable to the interview process. Collected information will include work affiliation, professional contact information, and email. Not all of the additional individuals may be included in the study.

[3] Site Selection Overview: This dissertation research is circumpolar in nature as wildlife populations transcend ecological, political, and jurisdictional boundaries. To consider wildlife populations and the way they are managed and conserved across the region, this

study requires a comprehensive look at how research is conducted and decisions are made across the landscape, regardless of geopolitical boundaries. This study also values a diversity of Indigenous perspectives and experiences, so an equal spread of representation by different Indigenous peoples in the region is paramount.

[3.1] Local Context: I have experience working with other Indigenous peoples and communities, both personally and professionally. I am certain that I have enough cultural competency to respectfully engage Indigenous and non-Indigenous professionals in the region on Indigenous engagement in conservation.

[3.2] Site Specific Administration: Individuals from some organizations may have policies that limit the extent to which they can respond to interview questions. I will confirm with subjects that they have expressed approval to share any internal or controversial information to include in my research.

[4] Recruitment Overview: This study will recruit and screen subjects personally using a network approach to the interview process. If an individual's professional position and expertise aligns with my interests, I will reach out to the individual either in person or over email. If the individual is interested and willing to accommodate an interview, they will be considered eligible.

[4.1] Recruitment Materials: Recruitment will occur loosely through a network approach to the interview process. I will be forthcoming with my position as a Ph.D. student, as an affiliate of the Conservation of Arctic Flora and Fauna, and as an Indigenous Fulbright scholar when reaching out to potential subjects. During the recruitment process, potential subjects will receive notification via email of the format for the interview, including the use of audio recorders, and the several condition of the consent form. Only a small section of this email will be standardized, a copy of which can be found in Supplement 3, (p. 50). A pdf version of the consent form will also be delivered to their email prior to their formal acceptance of the interview. The signing of the consent form will occur, under normal circumstances, in person prior to the commencement of the interview. The University of Washington Institutional Review Board has accepted to waive this study's requirement to obtain signed consent forms for individuals interviewed remotely. A copy of the consent form can be found in Supplement 3.

[4.2] Relationship with Participant Population: I have personal and professional relationships with the participant population and consider myself a participant observer to my research. As an Indigenous scholar, I have relationships with communities and organizations in Alaska and Scandinavia. I am also associated with professionals connected to the Conservation of Arctic Flora and Fauna, including various Indigenous organizations and governing bodies that I intend to include in this study. Additionally, I will most likely include interviews with individuals that I consider mentors in the fields of biodiversity conservation and planning.

[4.3] Non-monetary Compensation: Under special circumstances, gifts of food or trinkets are expected as acts of good will prior to requesting something, such as an interview, from another person. This non-monetary compensation will be of little value and will not be contingent on beginning or finishing an interview.

[5] Procedures Overview: Under normal expected circumstances, interviews will take place in the professional workplace of interviewees for the duration of one hour. Any culturally appropriate gifts will be given before starting the process. The subject will receive a consent form prior to beginning the interview that allows them to consent (or not) to the use of a voice recorder during the interview process for transcription purposes. There will be time for questions regarding the consent form so that the conditions are well understood. Two sets of questions will be asked in the following order, (1) questions aimed at the professional functions of the subject's job and the workings of their organizations, and (2) questions regarding their personal perspectives given their expertise in their discipline. No records, either professional or personal will be drawn upon during the interview. However, publications the interviewee is cited on may be discussed. In the event that a subject is unavailable for an in-person interview, the interview will be conducted remotely either by video platform or by phone.

[5.1] Data Variables: The majority of the interview questions will be qualitative in nature and will not incur answers that fit well into categorical or numerical datasets. Of (1) the professional questions, and (2) the personal questions, the professional questions are the only questions that may be used to collect tabular data (Supplement 5, p.52). Data derived from questions aimed at their personal perspectives on relevant issues may be considered the most sensitive because of possible inclusion of Indigenous knowledge or the inclusion of opinions that run counter to the official stance of the organizations for which they work professionally. The questions asked during this section are difficult to summarize, as they will be largely dependent on the person, their expertise, their professional role, and the work of their organization. These responses will be primarily qualitative, but may be generalized through transcription software into tabular data at a later time.

[5.2] Data Sources: Some data may be collected prior to the interview process as it relates to the subject's organization. Other variables, including those that require confirmation from a professional working in the organization will be collected during the interview process. In scenarios where several individuals from the same organization supply conflicting information, their responses will be recorded regardless of conflict. All answers to the section on personal questions will be obtained exclusively from the subject's responses during the interview process.

[5.3] Data Identifiers: I will have access to all identifiers of subjects and data throughout the duration of the study. I will obtain identifiers for all subjects during the recruitment process, including name, professional affiliation, and professional contact information. Thus, these identifiers will already exist at the time of the interview process. Each subject will receive a coded identifier and all data with the exception of the tabular data described below will be stored separately. For the collected tabular data on the subject's organization, identifiers will not be linked to the study data.

[5.4] Communication with Subjects: This study will use professional email accounts and phone numbers unless offered more convenient or personal methods of communication by the subject.

[5.4] Future Contact with Subjects: I will retain the professional contact information of individuals for professional matters extraneous to my dissertation research. Use of the contact information will be limited to myself or other professionals at the Conservation of

Arctic Flora and Fauna. The contact information will not be made available to anyone as it concerns my own dissertation research but may be made available to someone in the discipline for a professional matter. This will not appear on the consent form as the professional contact information of my subjects is mostly available online through their organizations.

[5.5] Supporting Documents: This research requires that data be gathered in an evolving way. As stated in section [5.1], the questions asked during this sections are difficult to summarize, as they will be largely dependent on the person, their expertise, their professional role, and the work of their organization. Interview questions will be tailored to the circumstances and work of the individual and their connection to wildlife conservation, management, food security, and Indigenous participation in the policy and management processes. Questions will also be tailed based on the country of operation, as I will also ask about the particular policies and laws that shape the conservation work.

[6] Consent Overview: This study will obtain consent prior to interviewing subjects, but in special circumstances will not collect documentation of this consent. Prior to the interview, the subject will receive a copy of the consent form by email what allows them to consent (or not) to the use of a voice recorder during the interview process for transcription purposes. Providing the consent form prior to the interview is to ensure that the subject has time to ask questions about the consent form before signing and beginning the interview. The consent form will be signed in person prior to the interview if the interview is conducted in person. If the interview is conducted remotely, no consent form will be signed in accordance with the waiver given by the University of Washington Institutional Review Board. The subject interviewed remotely will still receive a copy of the consent form via email and will have time to ask questions prior to beginning the interview.

[6.1] Consent Comprehension: The consent form will be signed prior to starting the interview process. During this time I will assess whether or not the conditions of the consent form are understood.

[6.2] Written Documentation of Consent: This study will obtain written documentation of consent for some of the research procedures. The procedures for which there will be no documentation of consent includes that which has already been stated, in accordance with a waiver given by the University of Washington Institutional Review Board, for remote subjects in rural and inaccessible parts of the Arctic. These subjects do not require an ink signature of consent but will receive the consent form for their review prior to beginning the interview process, with time to ask clarifying questions about the conditions of consent.

[6.3] Consent Related Materials: A copy of the consent form can be found in Supplement 3.

[7] Privacy and Confidentiality Overview: Privacy protections for subjects include confidentiality for all interview responses. This study may choose to use potentially identifiable information about subjects in publications and presentations. This may not be intentional, but the discipline is small enough that individual identities may be inferred. For any intentional use of identifiable information in publications or presentations, consent will be obtained from the subject prior to including the information in these formats.

[7.1] Data and Specimen Security Protections: This study meets the sensitivity requirements for level 3 protection in the University of Washington Institutional Review Board guide for Human Subjects Research. This research may contain sensitive information related to Indigenous knowledge, which in the hands of certain individuals could be considered a breach of trust among Indigenous communities, and may have genuine impact on conservation plans, wildlife management, food sovereignty, or other impacts that could affect the livelihoods of Indigenous community members. This information will most likely be present in audio recordings and transcriptions, and most likely will not be present in any tabular data associated with organizational structure. Information regarding the expected data security protections can be found in Supplement 4.

[8] Risk and Benefit Assessment Overview: There may be some professional risks associated with this study, namely that subjects may become identifiable given their professional affiliations within the discipline and the known work of certain organizations, potentially bringing these subjects under attack of certain environmental organizations. A few examples of how references to Indigenous knowledge may harm the subject or the work of these individual include, (1) information about culturally sensitive locations, including those related to spirituality, subsistence hunting/fishing/gathering, upcoming conservation projects, etc. that should not be included in broader publications to protect privacy, resources, etc. at the wish of the community at large, as exposure of such information could hurt the person's reputation within their own community, and the duration or reversibility of this harm is unspecifiable, (2) information gathered an recognized through Indigenous knowledge that comes in direct conflict with currently accepted scientific information, where the belief of that information could jeopardize a person's reputation or employment in the scientific community, government, or organization for which they work, and (3) information about the private workings and projects of Indigenous governments and organizations, where exposure of the information could jeopardize that work of project or place individuals under verbal or physical attack by certain environmental organizations or under the scrutiny of certain humanitarian organizations. In order to manage these risks, I will refrain from publishing anything that could foreseeable hurt an Indigenous community, organization, or government. I will not include the names of individuals in publications.

[3] IRB CONSENT FORM

APPROACHING BIODIVERSITY CONSERVATION AND PLANNING THROUGH A CO-PRODUCTION OF KNOWLEDGE WITH INDIGENOUS COMMUNITIES IN THE ARCTIC

Victoria Buschman
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Fulbright-NSF Arctic Research Fellow | CAFF, Iceland
PhD Student | University of Washington, USA

Kristiina Vogt
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Professor | University of Washington, USA

I volunteer to participate in a dissertation research project conducted by Victoria Buschman from the University of Washington, USA. I understand the project is designed to gather information about how organizations and agencies engage with Indigenous knowledge and science in wildlife management and conservation planning. I will be one of approximately 30 people being interviewed.

1. My participation in this interview is voluntary. I understand that I will not be paid for my participation. Even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequence.
2. Participation in this study involves being interviewed by a researcher from the University of Washington. The interview will last approximately one hour. During the interview, an audio tape will be recorded, or written notes will be taken.
3. I understand that I will be asked to participate in two sections of the interview: Section 1 in a professional capacity regarding my position and the workings of my organization. Section 2 in a personal capacity regarding my opinions on the topic given my expertise. The data collected during this interview will be stored confidentially with my name removed from the data.
4. Government or University staff sometimes review studies such as this one to make sure they are being done safely and legally. If a review of this study takes place, your records may be examined. The reviewers will protect your privacy. The study records will not be used to put you at legal risk of harm.
5. The researcher may choose to redact sensitive information in transcriptions from this interview. This includes sensitive information about Indigenous knowledge. If I feel my response to a question has exposed some sensitive information, I may request that my response to that question be off the record . Examples of the most sensitive topics include Indigenous knowledge, its use alongside science, and its use within organizations.
6. Risks may include discussion of culturally sensitive information that may harm professional reputations or ongoing activities, projects, and programs. I will be contacted for permission in the future if the study would like to use my name in any presentations or publications.
7. I understand that I may specify whether the use of an audio recorded is allowed during this interview:
   - □ The researcher may use an audio recorder for the use of transcription
   - □ The researcher may NOT use an audio recorder during this interview
8. This study has been explained to me. I volunteer to take part in this research. I will not benefit as a participant of this study. I have had a chance to ask questions. If I have questions later about the research, or if I have been harmed by participating in this study, I can contact one of the researchers listed above. If I have questions about my rights as a research subject, I can call the Human Subjects Division at +206 543 0098 or call collect at +206 221 5940. I will receive a copy of this consent form.

_____	_____
My Signature	Date
_____	_____
My Printed Name	Signature of the Investigator

[4] IRB DATA SECURITY PROTECTIONS

Data Classification: Level 3 Protection
This research may contain sensitive information related to Indigenous knowledge, which in the hands of certain individuals could be considered a breach of trust among Indigenous communities, and may have genuine impact on conservation planning, wildlife management, food sovereignty, or other impacts that could affect the livelihoods of Indigenous community members. This information will most likely be present in audio recordings and transcriptions, and most likely will not be present in any tabular data associated with the structure of the conservation and Indigenous entities.

Expected Data Security Protection:

> *Users:* myself, viewing access may be granted to employees of the Conservation of Arctic Flora and Fauna. (U1) limit access, (U2) no shared passwords, (U3) protection of passwords, (U4) strong passwords, (U5) different passwords, (U6) changing passwords, (U7) comprised passwords, (U8) report loss of data, NOT (U9), (U10) documentation of access, (U11) data disposal, NOT (U12), NOT (U13), NOT (U14), NOT (U15), NOT (U16).
>
> *Devices:* audio recorders, desktop computer, laptop computer, flash drives. (D1) configure the device, (D2) configure the applications, (D3) update the operating system and applications, (D4) protection against loss, NOT (D5), (D6) portable devices, (D7) permanent storage, NOT (D8), NOT (D9).
>
> *Servers:* SEFS Department IT server named GIBSON, U-drive, email. (S1) complex passwords, (S2) server communication, (S3) server-application communication, (S4) password change method, (S5) server operators, NOT (S6), (S7) current patches, (S8) malware detection, (S9) no shared accounts, (S10) administrative functions, (S11) idle sessions, (S12) improper access, (S13) logging access, (S14) reporting breaches, (S15) reviewing logs, (S16) secure disposal, NOT (S17)-S(22).
>
> *Paper:* consent forms. (P1) limiting access, (P2) protecting records, (P3) destruction of records, NOT (P4), NOT (P5).
>
> *Data Transmission:* email and fax. (T1) email and ax security, (T2) email risk, (T3) fax security, NOT (T4), NOT (T5)-(T8).
>
> *Vendors:* There will be NO venders to consider.

Protections That Will NOT Be Taken:

> NOT (U9) data storage policy: Unless specifically requested in the interviewee's consent form, audio recordings and transcriptions will include direct identifiers. This is in order to attribute responses to the professional opinions of experts in their disciplines. Direct identifiers will in most cases NOT be used in result reporting except in cases where direct quotes are taken from audio recordings or transcripts.

NOT (U12) authorization process: this research does not fall under this level of protection.
NOT (U13) confidentiality and security training: this research does not fall under this level of protection.
NOT (U14) authorized users: this research does not fall under this level of protection.
NOT (U15) certificate of confidentiality: not required.
NOT (U16) monitoring of these user requirements: this research does not fall under this level of protection.

NOT (D5) device disposal: no devices are expected to be disposed of.
NOT (D8) encryption: this research does not fall under this level of protection.
NOT (D9) device management and monitoring: this research does not fall under this level of protection.

NOT (S6) commercial services: no commercial services will be used.
NOT (S17)-S(22): this research does not fall under this level of protection.

NOT (P4) documentation of access: this research does not fall under this level of protection.
NOT (P5) logging access: this research does not fall under this level of protection.

NOT (T4) emailing or faxing PHI: no protected health information will be collected.
NOT (T5)-(T8): this research does not fall under this level of protection.