

**Expert Opinions on the Potential Role of Indigenous Peoples
in Wildlife Management in Alberta**

by

Arlana May Bennett

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Department of Resource Economics and Environmental Sociology
University of Alberta

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ABSTRACT

Management of cervids for Chronic Wasting Disease (CWD) is a challenging multi-stakeholder endeavour. This thesis focuses on the thoughts and perceptions of various experts regarding cervid management in Alberta, and the inclusion of Indigenous peoples and their knowledge. This research sought to explore diverse expert perspectives on the role of Indigenous Knowledge in wildlife monitoring and management in relation to the issue of CWD; and better understand the key challenges and opportunities regarding wildlife management in Alberta. The methods used in this thesis include a modified qualitative expert elicitation, probabilistic sampling, and thematic analysis. The major thematic results experts discussed include: the lack of Indigenous compliance in cervid monitoring with varying reasons provided; the necessity of both scientists and Indigenous communities to engage in intercultural and technical capacity development; and the need for both scientists and Indigenous communities to form a functional and mutually beneficial working relationship. This research is a preliminary investigation into the social, cultural, and economic aspects of CWD management, and is intended to provide further insights towards this end with a focus on future areas of research.

PREFACE

This thesis is an original work by Arlana Bennett. The research project, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board, Project Name “Expert Opinions on the Potential Role of Indigenous Peoples in Wildlife Management in Alberta”, PRO00074979, 2017.

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LIST OF ABBREVIATIONS

ACA	Alberta Conservation Association
AEP	Alberta Environment and Parks: Fish and Wildlife Division
AFGA	Alberta Fish and Game Association
APOS	Alberta Professional Outfitters' Society
APRI	Alberta Prion Research Institute
ATK	Aboriginal Traditional Knowledge
CFIA	Canada Food Inspection Agency
CWD	Chronic Wasting Disease
CWHC	Canadian Wildlife Health Co-operative
DAO	Designated Administrative Organization
MNA	Métis Nation of Alberta
PrP ^{CWD}	Chronic Wasting Disease Prion
RCAP	Royal Commission on Aboriginal Peoples
WAFWA	Western Association of Fish and Wildlife Agencies
WMU	Wildlife Management Unit

CHAPTER 1 - INTRODUCTION

Introduction

Natural resource management in many parts of the world are increasingly based around the recognition of Indigenous knowledge and the rights of resource users (Berkes 2018). In Alberta, there has been a historical lack of consideration of the knowledge of First Nations and Métis peoples and decisions about the development, use, management and monitoring of natural resources (Sandlos 2007; Loo 2006; Fumoleau 2004; Calliou 2000). Decisions regarding wildlife management, including allocation and access, have disregarded or undermined the social-economic and cultural lifeways of First Nations and Métis peoples (Sandlos 2007; Tough 2011). As a result of these histories, Indigenous peoples and their knowledge have little influence within provincial wildlife management regimes in contemporary Alberta (Natcher, Hickey, Nelson and Davis 2009).

Wildlife diseases such as Chronic Wasting Disease (CWD) have added further challenges for wildlife managers in Alberta. CWD is a fatal form of transmissible spongiform encephalopathy (TSE) primarily found in cervids (e.g., deer, moose, elk, and caribou). CWD in Alberta as of the 2017/2018 hunting season, has continued to spread westward along the Red Deer/South Saskatchewan/Bow watershed, the Battle watershed, and north along the Alberta/Saskatchewan border. Incidence of deer that have tested positive for CWD has increased markedly since the 2016/2017 hunting seasons, and several new Wildlife Management Units (WMU) will be added to the mandatory surveillance list for the 2018/19 hunting season (AEP 2018). First Nations and Métis communities in the Treaty 6 area—including Frog Lake First Nation, Kehewin First Nation, Fishing Lake Métis settlement, and the Elizabeth Métis settlement—are within the mandatory surveillance zone yet it remains unclear whether these communities are being actively engaged in the process of management.

Research Objectives

This thesis describes the opportunities and challenges surrounding the meaningful integration of Indigenous knowledge in wildlife management in Alberta including those associated with the monitoring and management of Chronic Wasting Disease. More specifically, the objectives of the thesis are:

1. Determine the potential for co-management of wildlife in Alberta based on a secondary literature review;
2. Discuss the role of Traditional Knowledge in monitoring and management of Chronic Wasting Disease in Alberta based on the opinions of diverse experts;
3. Better understand the key challenges and opportunities regarding wildlife management in Alberta;
4. Advance research and policy recommendations regarding the future engagement of Indigenous peoples in wildlife management in Alberta.

Methodology

The research builds on the traditions of qualitative research and participation. “Participation” (of stakeholders, citizens or the public) is thus a key element of contemporary approaches to natural resource management” (Krueger et al. 2012, 5). With the aim of contributing to wildlife management in both theory and practice, I engaged in a process of modified qualitative expert elicitation involving semi-directed interviews and thematic analysis. I attempted to identify a wide range of interviewees who represent unique socio-economic, cultural and political positions related to the problem of wildlife management in Alberta. Various iterations of this approach have been used successfully to understand and contextualize existing concerns related to complex systems and technical resource management issues (Krueger et al. 2012, 5). In addition to emphasizing diverse perspectives, this approach can also highlight opportunities for potential learning and collaboration. Given the breadth of stakeholders interested in the question of Indigenous knowledge in wildlife management, this analysis focused on understanding the opportunities for potential collaboration and co-management. A total of 10 interviews were carried out with individuals from five stakeholder groups considered experts in relation to the issue of wildlife management, CWD, and Indigenous Knowledge: Wildlife ecologist (n = 2), Resource economist (n = 2), Indigenous academic (n = 2), Biologist (n = 2), Government (n = 1), and Indigenous technician (n = 1). Thematic analysis of the interview transcripts from each revealed multiple themes around Indigenous Knowledge in wildlife management; these themes, discussed as opportunities and challenges are examined in this thesis.

Thesis Outline

This chapter introduces and contextualizes the main bodies of research and literature that provide background to the overall analysis and help address the questions posed by this work. These include: (1) Indigenous Knowledge, including a discussion of ongoing debates; and (2) Co-Management. Throughout the thesis, the terms *Indigenous Knowledge*, and *Traditional Knowledge* have been used. To clarify, the interview questions posed to respondents used the term Traditional Knowledge, and respondents mostly used this term. Owing to theoretical clarification, it is important to note that these terms are not interchangeable. Indigenous knowledge is used by the author of this thesis in writing, whereas the term Traditional Knowledge is used in the results and discussion to reflect the actual terms used by respondents.

The purpose of this chapter is to provide a broader context for the literature used throughout this thesis, and to situate the findings within the appropriate theoretical and conceptual ideas. As well, this literature review is intended to provide focus for the two main chapters within this thesis with the intent of providing insight into First Nations engagement in the monitoring and management of CWD in Alberta. The second chapter of this thesis provides an overview of the methods used in data collection and the methodological position from which the analysis is conducted. A description of the rationale for the underlying approach to research analysis is specified, and an account of the data management procedures, including instrumentation, questions, and data collection methods is described. Finally, this chapter ends with an explanation of the method of analysis used to interpret results.

Chapter 3 and 4 of this thesis comprise the results of the interviews, and an analysis and interpretation of the results according to the following six themes: (1) Active organizations; (2) Managerial and scientific concerns; (3) Indigenous non-participation; (4) Potential roles for Indigenous hunters and their knowledge; (5) Western scientific perspectives: challenges; and (6) Social scientific concerns. The concluding chapter of this thesis provides a review of each chapter including the major findings presented in the two major chapters, advances potential managerial recommendations, and suggests areas for future research that emerge from the analysis.

Theoretical Framework

This thesis is informed by literature and theory related to Indigenous Knowledge in wildlife management. This is an extensive literature with many diverse dimensions including those related to the spread of wildlife disease (Tomaselli et al. 2018; Dawe and Boutin 2016; Decker et al. 2016; Parlee et al. 2014; Brook et al. 2009; Kutz et al. 2009; Decker et al. 2006). Although this thesis pertains to Alberta, Canada, this literature is global in scale with many different questions and themes emerging depending on the social, cultural, political and ecological context.

Indigenous Knowledge

Indigenous knowledge has many definitions; it is often used interchangeably with the concept of Traditional Knowledge. *Tradition* is defined as continuous adaptability and denotes intergenerational endurance while also indicating something that is fixed in time and unchanging (Berkes 2012a; Nadasdy 1999), however, there are sometimes assumptions made about tradition as historical, static and unchanging (Irlbacher-Fox 2014; Berkes 2012a; Nadasdy 1999). Situating Indigenous peoples and their knowledge as fixed in the past fails to recognize the flexibility and resilience of Indigenous peoples and their ways of life. *Ecological knowledge* indicates knowledge of the land, and together *Traditional Ecological Knowledge*, describes "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment" (Berkes 2012a, 7). Traditional Ecological Knowledge is not an Indigenous term. It is a contemporary term that was coined by researchers in the 1980s to describe a sub-category of Indigenous knowledge (McGregor 2004). It has been argued that by categorizing Indigenous peoples' knowledge of land and culture in this way is epistemologically inconsistent with the broader cultural and spiritual connection Indigenous peoples appreciate within their local environments (Nadasdy 1999; McGregor 2004; Battiste and Youngblood Henderson 2000a). The purpose and intent of such a term as Traditional Ecological Knowledge should be considered carefully since Indigenous populations generally tend not to fragment their knowledge in such ways. A question to be asked: who defines Traditional Ecological Knowledge, for what purpose, and why?

Traditional Ecological Knowledge is a sub-category of *Indigenous Knowledge* that focuses primarily on knowledge acquired from and about a particular environment that is local to

Indigenous peoples (Berkes 2012a; McGregor 2004). From an ecological perspective, Indigenous Knowledge is defined as “the local knowledge held by indigenous peoples or local knowledge unique to a given culture or society,” where *local knowledge* indicates knowledge that is recent (Berkes 2012a, 8). An anthropological perspective provides a slightly different description of Indigenous Knowledge that includes all activities that precede and accompany the act of harvesting an animal for subsistence, including the belief in a web of relations between humans and animals that is mutually sustaining and informs broader worldviews (Nadasdy 2003; Cruikshank 1998). Battiste and Youngblood Henderson (2000b, 42) provide a more nuanced definition of Indigenous Knowledge here:

Indigenous ways of knowing share the following structure: (1) knowledge of and belief in unseen powers in the ecosystem; (2) knowledge that all things in the ecosystem are dependent on each other; (3) knowledge that reality is structured according to most of the linguistic concepts by which Indigenous describe it; (4) knowledge that personal relationships reinforce the bond between persons, communities, and ecosystems; (5) knowledge that sacred traditions and persons who know these traditions are responsible for teaching 'morals' and 'ethics' to practitioners who are then given responsibility for this specialized knowledge and its dissemination; and (6) knowledge that an extended kinship passes on teachings and social practices from generation to generation.

The Assembly of First Nations (AFN) defines Indigenous Knowledge or what they refer to as *Aboriginal Traditional Knowledge* (ATK) as: “the summation of all knowledge, information, and traditional perspectives relating to the skills, understandings, expertise, facts, familiarities, justified beliefs, revelations, and observations that are owned, controlled, created, preserved, and disseminated by a particular Indigenous nation. Aboriginal Traditional Knowledge is comprised of a holistic body of knowledge and it remains the sole right of the community to determine what knowledge establishes their ATK” (AFN 2011, 4). Battiste (2005, 4) explains that Indigenous Knowledge is systemic and encompasses all aspects of life. Whitt (2009a, 37) describes Indigenous Knowledge as “the product of careful observations, spanning generations, of how entities in particular places are interrelated and of the complex dynamics of their relationships. It is both temporally ‘deep’ or historically replete, as well as spatially located, or endemic, knowledge – intimately bound to the land, to specific places and the entities located there.” Mistry (2009, 371-372), describes common characteristics of Indigenous Knowledge, emphasizing the cultural aspects of locality, oral or presentational transmission, adaptive capacity, collective social memory, and a holistic nature.

Commonly, non-Indigenous scholars refer to Traditional Knowledge, Traditional Ecological Knowledge, Indigenous Knowledge and various iterations of these terms (e.g., indigenous technical knowledge, ethnoecology, local knowledge, folk knowledge, and ecological knowledge), in work that involves the collection or integration of Indigenous peoples' knowledge about local ecology and change (Mistry 2009, 371). It is becoming more accepted that Indigenous hunters have a time-tested ability to endure and adapt to changing environmental conditions (Berkes, Folke and Colding 2000; Thorpe 2000 as cited in Riedlinger and Berkes 2001; Johnson, IDRC and DCI 1992). Though, how Indigenous Knowledge has been used in scientific studies is a point of contention with many communities (Baker and Westman 2018; Sandlos and Keeling 2015; Tester and Irniq 2008; Ellis 2005). Comparatively, we turn now to a brief discussion of *Western science* and its relationship with Indigenous Knowledge.

The definition of science used to guide this thesis is drawn from philosophy of science and *scientism*—that methods of scientific inquiry are considered by many institutions the only legitimate forms of intellectual analysis to the exclusion, in many cases, of non-scientific expertise (de Ridder, Peels and van Woudenberg 2018; Robinson 2015). Western scientific *ontology* (a systematic account of existence), assumes that nature is knowable, definable and supports a world view that is both *positivist* (knowledge derived from non-speculative observable reality) and *reductionist* (reducing observations to more established facts or observations), or *positivist-reductionist* indicating that science breaks a system of knowledge into smaller parts and makes predictions based on an analysis of those parts (Berkes 2012d; Blackburn 2016a; Blackburn 2016b; Blackburn 2016c). Results from Western scientific inquiry is intended to represent objective, universal and culture free knowledge that can predict, explain, and control the natural world (Aikenhead and Mitchell 2011a). This research is conducted collaboratively with the aim of reaching a consensus based on the scrutiny of methods, rigor and interpretation of empirical data (Aikenhead and Mitchell 2011b). Western scientific *epistemology* (the method of acquiring knowledge), suggests that understanding the natural world can be achieved through *empirical knowledge* (knowledge acquired through direct observation and experience), and objective facts have been and can be established and demonstrated through such inquiry (Blackburn 2016d; Blackburn 2016e).

The intellectual tradition of Western science rejects “superstition,” and instead, favours reasoned thinking, technological advancement, and economic rationalism (Herman 2016; Whitt 2009a, 32; Battiste 2005, 2). The hegemony of scientific authority distinguishes between the systematic knowledge of non-Western or non-European cultures (i.e., Indigenous), and Western or European thinking by defining the boundary between what is and what is not considered science (Herman 2016, 167; Whitt 2009a, 33). By privileging the scientific method over methods practiced by Indigenous knowledge holders, local concerns and issues are pushed aside while science-based interests are given more consideration (Marlor 2010, 514). Natural resource management is, of course, not exempt from the Western scientific tradition of marginalizing knowledges seen as “other,” and various claims of damaging or irresponsible management of resources, and lack of managerial capacity have been alleged against Indigenous peoples (Mistry 2009, 372; Natcher and Davis 2007, 273; Sandlos 2007; Loo 2006; Lynch 2006; Fumoleau 2004).

A broad definition of Indigenous ontology suggests that the natural world and humans mutually co-exist in a reciprocal balance, co-producing reality. Indigenous peoples are in many cases reluctant to provide information specific to Indigenous Knowledge since much of this knowledge is sacred, individualistic, and context specific (McGregor 2004). Most importantly, Indigenous worldviews are holistic and uphold the idea that the world is cyclical and paradoxical (Little Bear 2000; Battiste and Youngblood Henderson 2000b). These worldviews accept that the world is animate, contains knowledge that is process-oriented and grounded in a particular location, and place emphasis on customs and reciprocal relationships with all living and non-living beings (Little Bear 2000). The purpose of Indigenous customs and values is to reinforce and maintain relationships that exist between humans and non-humans, while acknowledging and respecting the keepers of such knowledge (Little Bear 2000; Battiste and Youngblood Henderson 2000a). Ecological perspectives identify Indigenous Knowledge as *socially constructed*, a standpoint which rejects the positivist assertion that there is a single, objective and value-free reality (Berkes 2012d; Blackburn 2016f; Dudgeon and Berkes 2003). Social constructivist perspectives have largely been criticized within Indigenous and Native American Studies for ignoring the material and relational ontologies that underlie Indigenous ways of knowing (Bhattacharyya and Slocombe 2017; Sepie 2017; Castro, Hossain and Tytleman 2016; Oetelaar 2014; Panelli 2010; Hacking 1999). As well, feminist and Indigenous feminist perspectives have critiqued scientific

objectivity for its disregard of an individual's socio-cultural and political embeddedness (Crasnow 2013; Crasnow 2008; Janack 2002).

Controversies surrounding the meaningful use of Indigenous Knowledge have plagued many co-management and wildlife monitoring projects that seek to engage Indigenous resource users as collaborators and/or data collectors. Criticisms citing “knowledge extraction” and “decontextualization” where Indigenous Knowledge is reduced to usable figures to supplement or fill gaps for western scientific research are interpreted as assimilative (Stevenson 2004, 2), or a form of cognitive imperialism (Battiste 2005, 7; Battiste and Youngblood Henderson 2000; Whitt 2009b, 220). By decontextualizing Indigenous Knowledge and removing the cultural and social contexts from which it is situated (as a means of making it “fit” into Western scientific frameworks), Western scientific researchers are effectively ignoring the conditions that underlie the creation and resilience of this knowledge and reducing the role Indigenous peoples can play in the management and monitoring of resources critical, in some cases, to their survival (Mistry 2009; Stevenson 2004, 5; Simpson 2001, 133-34; Stevenson 1998, 5). Focusing on integration, where Indigenous Knowledge is manipulated into Western scientific categories has the unintended consequence of subjugating and reinforcing already existent hierarchies of authority and subordination (Wyndham 2017, 78; Ludwig 2016, 41). Rarely is the Western scientific epistemological viewpoint challenged when faced with opposing viewpoints inherent to Indigenous Knowledge (Herman 2016, 170; Simpson 2004, 373-374).

The process of knowledge integration has been widely criticized in terms of the absence of clarity about how to combine Indigenous Knowledge and Western science (Evering 2012, 360; Bohensky and Maru 2011, 2). Specific barriers (e.g., broad claims of “differences in knowledge systems,” and representation) have been cited as impediments to the use of Indigenous Knowledge in resource management which serve to further reinforce the dichotomy between an empirically based Western science versus the more holistic nature of Indigenous Knowledge (Bayha 2010, 29; Peters 2003, 50). Other issues, such as a lack of familiarity with social science research methods (Brook and McLachlan 2008, 3508; Huntington et al. 2011; Huntington 2000, 1273) difficulty integrating social scientific data (Bell and Hardwood 2012, 422) are perceived barriers researchers experience when attempting to work with Indigenous Knowledge. Some researchers have even gone so far as to suggest that Indigenous Knowledge is more akin to non-

science, is inconsistent, and should be confirmed by Western scientific methods before acceptance in natural resource management (Brook and McLachlan 2008, 3502-03; Gilchrist, Mallory and Merkel 2005; Usher 2000). As Whitt (2009a, 29) argues, the policies and practices that emerge from Western science “arise within a cultural milieu notable for its marginalization and dismissal of Indigenous knowledge systems.” Simpson (2004 375) goes further and calls attention to, “the forces of cultural genocide, colonization, and colonial policy perpetuated over the last several centuries by successive occupying settler governments is responsible for the current state of Indigenous Knowledge, yet this assertion remains conspicuously absent from the literature—literature written primarily by non-Indigenous scholars and academics.” This depoliticization of Indigenous Knowledge and Indigenous social/cultural/political conditions makes knowledge extraction easier for natural resource managers and scientists who claim objectivity, and who have little intention of acknowledging the historical wrong doings they themselves, by association with specific governments or disciplines they are implicated in (Simpson 2004, 375-376).

According to Peterson, Riley, Busch and Liu. (2009, 2499), being respectful of the resource, and serving the community requires an acceptance that objectivity is impossible, and that Western science is not the sole purveyor of knowledge. Gratani et al. (2014, 180), go further and argue for the full consideration and accommodation of Indigenous Knowledge in its entirety, as a means of reconceptualizing its value as a knowledge system and seeing it instead as a philosophical guide to natural resource management. Riedlinger and Berkes (2001, 326), acknowledge that strictly focusing on Western scientific methods and knowledge limits the understanding of complicated environmental issues (i.e., climate change and impacts to local ecosystems), and advocate instead for a viewpoint that allows for full participation of all stakeholders. Lynch, Fell and McIntyre-Tamowy (2010, 252) further echo this point and acknowledge that both science and Indigenous Knowledge have a role to play in building a more complete understanding of environmental systems, and that a turn away from the polarizing science versus Indigenous Knowledge debate towards an accommodation of both perspectives would be in the best interest of conservation needs. This shift in thinking towards acceptance of differing worldviews, and even moving towards the co-creation of more integrated research and management paradigms is certainly gaining prominence. How the two systems can come together, some researchers suggest, requires the creation of a shared and mutually respectful space (Turnbull 2009, 4). Lynch, fell and

McIntyre-Tamwoy (2010, 251), argue for a more inclusive role for Indigenous people as part of a move towards self-governance which requires not only an understanding and acceptance of Indigenous worldviews but requires an ongoing process of “trust building, faith keeping and benefit sharing between Indigenous groups, scientists and managers.” A first step towards establishing what Tester and Irniq (2008, 58-59) refer to as *kappiananngittuq* or “a place about which there is no reason to be scared,” or “communities of learning” (Robson et al. 2009 as cited in Lynch, Fell and McIntyre-Tamwoy 2010) where Indigenous peoples and scientists can speak openly, learn, and reach a mutual understanding of each other’s social/cultural/political contexts is becoming accepted (Herman 2016, 170). Rather than falling back on tried methods of knowledge integration which further entrench power imbalances and invoke feelings of assimilation, a harmonization of both knowledges to create a unified whole, absent of assimilative tendencies and cultural fragmentation would be ideal (Gratani et al. 2014, 169).

In response to challenges experienced by researchers and Indigenous communities with regard to wildlife management, methods of participatory research and monitoring have been established in an effort to ameliorate differences and support better, more effective working relationships. Methods such as Community-based monitoring, and Harvest-based monitoring enable a more democratic process of wildlife monitoring that utilizes data collected cooperatively by government, industry, academics, community groups, and citizens to monitor and respond to issues of concern to a local population (Brook et al. 2009, 267; EMAN and CNF 2003). Community-based monitoring is commonly typified by more a more equitable distribution of power, use of various cross-disciplinary methods of inquiry and data collection (quantitative and qualitative), and collaboration among all participants (Brook et al. 2009, 267). Specifically, Community-based monitoring is a long-term process of data collection with the intent of improving the management of, for example, wildlife (McKay and Johnson 2017). The multi-faceted effort devised by Brook et al. (2009, 269-272), was particularly effective at providing a meaningful way of communicating with community members about issues of concern, engaging local students in practical and educational workshops, collaborating with local harvesters who were trained as wildlife health monitors to collect samples, record wildlife conditions, and provide local knowledge that complimented scientific research. Most importantly, the authors found that youth engagement was a particularly effective way of supporting positive relationships which then helped establish a good working relationship with other communities

interested in participating (Brook et al. 2009, 276). McKay and Johnson (2017, 21) found that community participants looked favorably on the relationship building aspect of Community-based monitoring, indicating that it would be a necessary component of effective management. As well, Jack et al. (2010) find that relationship building activities, initiated early in the research project between researchers and community members, were integral to fostering good working relations. Although Community-based monitoring programs can be time consuming, costly and potentially difficult to initiate, the monitoring of disease pathogenesis requires decades of data collection, capacity building, and the need to develop good working relationships with local communities impacted or potentially impacted by wildlife diseases (Brook et al. 2009). For example, Friendship and Furgal (2012), find that the success of a research project requires sufficient time to build relationships, researchers being physically in the community, and open communication between partners. Community-based monitoring projects then, can offer a means of developing a baseline of ecological change over an extended period of time by incorporating local observations to help distinguish natural cycles from non-natural variation (Sandlos and Keeling 2015, 280; Riedlinger and Berkes 2001, 321). As well, many Indigenous communities tend to look less favourably on research programs that enter the community for a short period of time, extract information, and do not return (Bell and Hardwood 2012, 428; Dowsley 2009, 54).

Methods of collaborative research such as Harvest-based monitoring also provide successful examples of community engagement, and new and interesting ways of applying a mixed methods approach using both qualitative and quantitative data to inform changes in wildlife populations. Harvest-based monitoring typically occurs during seasonal harvesting activities, is dependent on time and place, and uses environmental and animal health indicators which provide an in-depth assessment of a specific area and the species in it (Tomaselli et al. 2018; Parlee et al. 2014; Riedlinger and Berkes 2001, 321; Lyver and LKDFN 2005; Moller et al. 2004). As a method of data collection, Harvest-based monitoring can provide additional data (quantitative and/or qualitative) towards the condition and status of a species that wildlife managers and scientists may lack (Manseau, Parlee and Ayles 2005; Moller et al. 2004). Bell and Hardwood (2012, 421) define Harvest-based monitoring as “the long-term collection of data or samples from a subsistence harvest in order to reveal, document, and track changes in biophysical resources...[such] studies have usually been designed to detect (but not necessarily explain) change, to involve local harvesters, and to *incorporate Indigenous and science-based knowledge*

[emphasis added].” They outline five steps for the initiation and execution of Harvest-based monitoring projects, including: (1) development of the research framework and question(s) with long-term harvest samples or information as the primary source of data; (2) using Indigenous protocols as the basis for program development; (3) establishing roles and responsibilities of participants; (4) conducting data collection and research activities; and (5) analyzing data and disseminating results (Bell and Hardwood 2012, 421).

Observing change over a large area is challenging, therefore, engaging with local resource users to inquire into the situations of change and crisis is particularly advantageous (Parlee et al. 2014; Kendrick and Manseau 2008, 416). The engagement of local harvesters (i.e., Indigenous hunters) as part of a long-term monitoring program is particularly advantageous due to the extensive oral histories which detail change in species range and condition (for example), over time, thus establishing a baseline of information that researchers can collaboratively draw from (Parlee et al. 2014). As well, many of the indicators of health used by Indigenous harvesters correspond to symptoms associated with CWD, thus providing contextual information for further analysis of host condition (Parlee et al. 2014). In their collaborative research with Indigenous harvesters in Nunavut, Canada, Tomaselli et al. (2018) found that harvesters alerted them to critical deficiencies in the passive methods used to collect data on disease and wildlife mortalities and found strong evidence to support the fact that local knowledge was particularly ideal for detecting changes in wildlife (i.e., population numbers, indicators of health, distribution and demography). Most examples of Harvest-based monitoring conducted with Indigenous communities come from co-management agreements signed by Indigenous communities as part of land-claims settlements. Agreements negotiated in the NWT, YK, and NT designate wildlife co-management boards to monitor change in species. Boards and committees such as the Nunavut Wildlife Management Board, the Yukon Fish and Wildlife Management Board, the Inuvialuit Game Council, or the Fisheries Joint Management Committee, oversee the management of wildlife as negotiated under comprehensive land claims agreements. The most successful Harvest-based monitoring programs generally allow for equal participation of Indigenous representatives and meaningful incorporation of Indigenous Knowledge. In the case of the Fisheries Joint Management Committee (FJMC) in the Inuvialuit Settlement Region (ISR), Bell and Hardwood (2012, 429) find that the success of a monitoring program is largely determined by the level of participation (in this case equal or more), and the skills and

knowledge Indigenous harvesters bring to the team out in the field. Nearly all land-claims or settlement agreements, such as the Gwich'in Renewable Resources Board, make reference to the use of Indigenous Knowledge in the delivery of wildlife co-management monitoring programs (INAC 1993), which may indicate why these programs see greater and more meaningful levels of participation across all stakeholders and participants.

Co-management

The Royal Commission on Aboriginal Peoples (RCAP 1996) broadly defines Co-management as a power sharing relationship between two or more stakeholders over the management of a resource. Subsequent definitions note four main components of a Co-management agreement, these include: (1) involvement of the State, including federal and provincial/territorial counterparts; (2) participation of a community that is directly impacted by the resource in question; (3) the promotion of collaboration between community and government; and (4) the recognition of co-management as an evolving process (Carlsson and Berkes 2003; Carlsson and Berkes 2005; Plummer and FitzGibbon 2004). Specifically, Co-management is recognized as a move away from centralized government control to a decentralized form of natural resource governance that seeks to relinquish financial responsibility from the federal government by moving the decision-making process to the local level, thus effectively bestowing the process of deliberation to more cost-efficient agencies on the ground (Plummer and FitzGibbon 2004). These partnerships, it is noted, do not always delineate responsibility equitably and in most cases, power can be distributed unequally across stakeholders, participants, and government representatives (Plummer and FitzGibbon 2004). It should be noted that the distribution of power varies among agreements, and that decentralization (either deconcentrating, delegation, devolution and or privatization) is the primary goal of the state within a co-management agreement (Plummer and FitzGibbon 2004). Co-management arrangements then, inform, consult, communicate and act as conduits for the exchange of information, in addition to advising, supporting joint action, partnerships, and community and area co-ordination (Armitage, Berkes and Doubleday 2007; Plummer and FitzGibbon 2004). Involvement of Indigenous communities in the process of co-managing natural resources provides examples of consultation processes, roles of community members, and various successes resulting from increased Indigenous engagement which provide the basis for comparison across provinces in natural resource management (i.e., wildlife), situations.

There are three major turning points in recent history that have contributed to the emergence of Co-management as a process of managing natural resources in remote areas. First, an acknowledgement of the need to re-evaluate governance approaches led to what is now a bottom-up approach, or decentralization of government especially in regard to natural resources in Canada's north (Nadasdy 2005). Second, Indigenous, Inuit, and Métis self-advocacy contributed to the development of policies that reflected a more equitable representation of Indigenous communities, while enabling regular opportunities to provide input into development projects that may directly impact Indigenous ways of life (Nadasdy 2005). Finally, scholars, policy makers, and the general public have consistently acknowledged the need for a shift in established approaches to development and resource management, and instead, move towards what has been called a "new ecological ethic," that seeks to turn away from traditional western scientific epistemological approaches to resource management and instead focus on understanding more sustainable modes of existence (Berkes 2012a). The failure of centralized and externally produced development programs initiated by organizations such as the International Monetary Fund (IMF), and World Bank shifted the focus toward decentralized and participatory development programs that sought to empower marginalized (Indigenous) groups (Agrawal 1995). Sustainable Indigenous practices were brought to the attention of the global community following the publication of the Report of the World Commission on Environment and Development (the Brundtland Commission), and five years after its publication, the Convention on Biodiversity was signed which echoed the role of Indigenous peoples' sustainable practices for development and resource management, and later the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) which solidified recognition of Indigenous rights and knowledge (WCED 1987; United Nations 1992; McGregor 2004; UNDRIP 2008). Development projects in rural settings were reassessed and it was determined that more participatory approaches, those that included Indigenous peoples, would be the solution to failed projects (Agrawal 1995). The Traditional Ecological Knowledge industry emerged in the 1980s, and included a sharp rise in the interest, acquisition, decontextualization, and assimilation of Indigenous Knowledge to meet legal obligations set out by governments who required consultations with Indigenous communities to maintain legitimacy (Cruikshank 1998; McGregor 2004).

Two key issues emerged as a result of the necessity to consult Indigenous peoples regarding development and natural resource management; increased Indigenous representation and assertion of rights, and exposure of entrenched and unequal power relations between Indigenous peoples and the state (McGregor 2004; Cruikshank 1998; Agrawal 2002). Though Indigenous peoples were able to assert control over resources and lands through self-government and comprehensive land claims agreements, especially in northern Canada, there have been considerable challenges with regards to inclusion and equal parity of Indigenous Knowledge to Western science and resource management policies (McGregor 2004; Berkes 2012d). In many cases, Indigenous peoples have voiced their dissatisfaction with the process of engagement claiming that they are peripheral participants, not adequately consulted, and knowledge that is taken is decontextualized and reconstituted to suit the needs of researchers and managers (Nadasdy 1999; Brook and McLachlan 2008; Cruikshank 1998). In consideration of these challenges, it becomes clear that co-management and similar collaborative arrangements that seek Indigenous participation continue to evolve in ways that may not fully represent the interests of Indigenous communities.

The Royal Commission on Aboriginal Peoples (RCAP 1996), recommends that the federal government work in co-ordination with territorial, provincial and Indigenous governments to create co-management agreements with the purpose of (1) serving as a stopgap measure until treaty negotiations are finalized; (2) provide equitable representation of government and Indigenous representatives; (3) respect and incorporate Knowledge of the indigenous community involved; and (4) funding be made available from the provincial, territorial, and federal government to ensure continuous stability and the development of necessary capacity. Co-management is seen as a suitable arrangement for allocating tasks across stakeholders to allow for specialization and efficiency; to exchange skills and experience across a network in an effort to support capacity development; to create links within and across a network with the intent of supporting further collaboration between participants; to reduce the cost associated with centralized resource management; to spread risk evenly across a network thereby avoiding individual responsibility; to address single issue problems; and to reduce conflicts and distribute power equitably among all members of a network (Carlsson and Berkes 2003). Co-management is intended to give various representatives and knowledge holders a forum to collaborate effectively and manage to the best of their ability, single-issue problems with the understanding

that ecosystem management is complex, challenging, and requires the participation of more than one institution (Berkes 2009). Management boards, municipal organizations, and various forums are spaces where individuals can meet on a regular to semi-regular basis to facilitate the effective working relationships between scientists and local knowledge holders (Berkes 2009). These working relationships are intended to provide access to information, resources, support trust-building, provide networking opportunities, enable conflict resolution, and establish a clear vision of intended outcomes and goals (Berkes 2009; RCAP 1996).

A criticism of this approach to decentralized, participatory governance of natural resources, or “devolution,” draws our attention toward the entrenchment of established state bureaucracy into communities which, it has been noted, has the effect of further regulating Indigenous activities (Cruikshank 1998). Specific attention needs to be paid to the integration of Indigenous Knowledge into co-management agreements, and the resolution of conflicts. A key component of the RCAP recommendations on co-management agreements concerns the respect and integration of First Nations, Inuit, and Métis knowledge into co-management strategies (Nadasdy 2003; RCAP 1996). Though it has been noted elsewhere that co-management agreements tend to be overly romanticized as a distinctly Canadian way of approaching conflict-laden issues, in actuality, some Indigenous groups perceive these agreements as a means of bureaucratically assimilating Indigenous peoples into western epistemological approaches to resource management (Spak 2005). Research involving Indigenous Knowledge emerged out of a need to redefine the relationship between science and the natural world, instead of a hard division between mind and nature, scholars (and eventually policy makers, and the public) reacted to this materialist tradition within the environmental sciences specifically, by searching for alternative methods of resource stewardship and ways of engaging with the natural environment (Berkes 2012b). Indigenous ecological practices helped inform this new ecological ethic that attempted to understand and extract ideas and lessons from Indigenous ecological knowledge or Traditional Ecological Knowledge (Berkes 2012a). Though well intended, research that has consulted Traditional Ecological Knowledge has invariably decontextualized this knowledge from the broader worldviews which it emerges (Cruikshank 1998). There is much debate ongoing regarding the fragmentation of Indigenous Knowledge, what implications it has for Indigenous peoples, and the responsibility now placed on Indigenous Knowledge holders to hand over their knowledge and provide solutions to problems created by the colonial state (Cruikshank 1998).

Further issues arise when Indigenous Knowledge is decontextualized with the intent of integrating segments of knowledge into Western scientific frameworks. Scholars such as Houde (2007) for example, seek to make Indigenous Knowledge and its components more accessible to non-Indigenous researchers by dissecting it into workable parts. The “six faces of TEK,” Houde (2007), describes include (1) factual observations; (2) management systems; (3) past and current uses; (4) ethics and values; (5) culture and identity; and (6) cosmology. The result is intended to be an empirically workable and dissectible body of knowledge that can be used to integrate Traditional Ecological Knowledge into co-management agreements (Houde 2007). A critical assessment of this approach to understanding Indigenous Knowledge recognizes that it reduces Indigenous Knowledge into “useful” and “non-useful” parts for the purpose of integration into Western scientific paradigms which have been criticized for resembling assimilative policies enacted by the Canadian government (Evering 2012; McGregor 2004).

Conclusion

This chapter sought to bring together the primary theoretical bodies of literature that support the major findings in this thesis. The major bodies of literature that this thesis draws from offer political, social, and cultural context and examples that provide a better understanding of the major issues involving wildlife management, Indigenous engagement, and the use of Indigenous knowledge in management projects nationally, and even internationally. The lack of consideration of Indigenous communities and their knowledge in wildlife management in Alberta is not uncommon and is certainly not unique to this province. Management of wildlife is a complex endeavor, one that often finds success in the incorporation of all knowledges and viewpoints. What the recent developments in CWD spread point to is a need for both Indigenous communities and the provincial government to come together to address the potential impacts to these communities, and to develop a comprehensive and holistic plan that seeks to control, and limit spread of the disease.

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CHAPTER 2 – METHODS

Introduction

Research was carried out to learn more about the possibilities and limitations regarding the monitoring and management of cervids in the province (Parlee et al. 2014). This research engaged in a qualitative inquiry into the opinions and perceptions of experts, from a range of backgrounds, regarding key opportunities and challenges towards (1) the management of cervids in the province; and (2) the engagement of Indigenous communities—including Indigenous Knowledge—in the management of cervids. Semi-structured interviews were conducted with 10 participants in 2017, regarding these two broad issues. Thematic analysis was the chosen method used to interpret the results of this research. These methods of inquiry and analysis were chosen to allow respondents the opportunity to freely discuss their thoughts, and to investigate repeated themes that emerged from the data.

Research Methodology

The intent of this research was to investigate the key issues surrounding the monitoring and management of cervids in Alberta, and the potential engagement of Indigenous peoples in either monitoring or management of cervids in the province by eliciting the perspectives of experts. This method of research can be typified as a modified qualitative expert elicitation (Hagerman et al. 2010). This diverse group of experts (table 1) were identified based on their extensive work in three key areas: wildlife management and monitoring; prion epidemiology and pathogenesis; and Indigenous cultural politics and engagement. The rationale for selecting those from different socio-economic, cultural and political circles was to understand the range of perspectives on the issue of Indigenous knowledge and wildlife management, identify areas of divergence or conflict as well as to ascertain opportunities for learning and collaboration. Given the limited time constraints, the study is best described as preliminary or exploratory. Therefore, drawing from experts who have a substantial knowledge of these three key research areas was a pragmatic approach intended to elicit the richest data within a short period of time.

Table 1: Participant Information

Background	Research Focus	CWD
I1 Wildlife Ecologist	Cervid harvest policy in Alberta.	Yes
I2 Resource Economist	Wildlife harvest and wildlife management in Alberta.	Yes

I3 Wildlife Ecologist	Foraging and nutritional ecology of ungulates.	Yes
I4 Indigenous Academic	Engagement, politics, science and technology.	No
I5 Resource Economist	Wildlife harvest and wildlife management in Alberta.	Yes
I6 Government	Ecological monitoring with Indigenous communities.	No
I7 Biologist	Biological/biochemical properties of Prions.	Yes
I8 Indigenous Academic	Engagement, politics, and wildlife management.	No
I9 Biologist	Prion infectivity in environmental samples.	Yes
I10 Indigenous Technician	Land user and environmental consultant (Treaty 8).	No

Identifying Experts

Experts are defined as “A person regarded or consulted as an authority on account of special skill, training, or knowledge; a specialist” (Oxford English Dictionary *s.v.* “experts”). Definitions of expert generally come down to the level of experience an individual possesses related to a specific subject matter, and can include scientists, technical managers, and knowledgeable members of the public (Kreuger et al. 2012). Criteria used for identifying experts in this research included: (1) involvement or experience with monitoring and/or management of cervids specific to Alberta; (2) being engaged in some aspect of CWD research, monitoring, and/or management; and (3) having knowledge, or experience in working with Indigenous populations, especially related to issues of governance. The experts identified for this research have extensive experience in the above-mentioned areas. The method of identifying experts can be best described as purposive since individuals were selected based on specific criteria related to the primary research objective—eliciting various expert opinions on cervid management, and the engagement of Indigenous peoples in management and monitoring of CWD (Guest 2006). It was important for this research that the experts who were identified and interviewed came from academic, governmental, and non-governmental viewpoints, thus, being experienced experts.

Expert elicitation, such as the modified qualitative method employed here, typically features disagreement or consensus within a group with the intent of allowing such claims to encapsulate the most salient issues surrounding an issue (Hagerman et al. 2010). That is, group consensus or disagreement around a particular issue is not meant to be resolved, but instead, represent current challenges. Due to the wealth of knowledge these individuals have, it is believed that their opinions regarding cervid management, monitoring, CWD, and Indigenous engagement and governance are not only formative, they are established and foundational. Therefore, I am

comfortable asserting that the data presented in this research is reflective of a higher standard of expertise compared to non-specialist populations.

Referrals were provided by three participants and of these referrals, one individual agreed to participate in the study. Three of the referrals declined to participate, and one referral was unable to participate due to scheduling constraints. The purpose of selecting participants through non-random sampling methods like criterion and snowball sampling is to produce data that provides the precise information needed to investigate specific research questions (Lunenburg and Irby 2008, 177). In this case, employing a criterion/snowball sampling strategy was time efficient, financially prudent, and yielded data specific to the research questions.

Ethics

The University of Alberta Human Ethics Board procedures were used to ensure that consent of interviewees was attained for the project. An initial set of interviews intended only as “scoping” interviews were carried out in 2017; they were included in the thesis project according to ethics approval Pro00074979. Audio recordings and notes from each of these 2017 interviews were transcribed and shared with interviewees in 2018 to verify consent for their use in the thesis (Appendix A).

Semi-Directed Interviews

Semi-structured interviews were undertaken with 10 experts during the spring and summer of 2017. A set of guiding questions was used to ensure participants focused on the key themes of the project. 10 individuals were selected based on their expertise and experience. In situations where the opinions of experts formed a consensus on a particular subject, they were grouped according to their disciplines (i.e., *Western scientific* and *Social scientific*) to reflect broader commonalities within these epistemological fields. Categorizing participants into these two main groups was a response to the distinct vantage points each individual offered (some were trained in social sciences, while others were trained in more STEM-oriented disciplines), and a means of simplifying the writing process. Two participants in this study declined to have their identities shared, so identifying information for all participants was withheld in accordance with the Tri-council Policy Statement (TCPS2 2014, 52), Chapter 5, section B, article 5.1 that states, “Where an individual participant waives anonymity but other members of the participant group object

because identification may cause harm to the group, researchers shall maintain anonymity for all members of the participant group.” As shown in table 2, the following five questions were provided to participants upon initiating contact via email, and then again during the actual interview. Each question was delivered and discussed in sequential order.

Table 2: Interview questions

Questions
1. What is your current research area?
2. What are the key issues that you think need to be considered in the management and monitoring of deer, moose and other cervids in the province?
3. Who is currently involved in the management and monitoring of moose, deer and other cervids in the province, and what are their roles and contributions?
4. What are the key opportunities and challenges with respect to greater involvement of aboriginal peoples in management and monitoring in the province?
5. What role do you think Traditional Knowledge could play in the monitoring and management of moose, deer and other cervids in the province?

Respondents were mostly interviewed at locations most convenient to them (i.e., personal offices). Prior to meeting with individuals, consent forms were emailed in advance and detailed summaries were provided. All interviews were conducted in English, and the average length of time for each interview ranged from 48:09 minutes to 16:28 minutes in length. Data was collected using a digital voice recording device. Participants were provided with a brief summary of the project including research questions and a consent form (Appendix A). Consent was acquired prior to conducting the interview, and care was taken to ensure all participants were fully aware of the project scope and their rights to withdraw their responses at any time up until completion of the project. After each interview, mp3 files were created from the digital recording and transcribed using *Audacity*, an open source, cross-platform audio software program used to slow audio recordings. Files were converted, transcribed, and initially coded as interviews were completed (an average turnaround of 1-2 days). Again, owing to new data involving confirmed positive cases of CWD in Alberta, the international focus on potential human health risks associated with CWD transmission, and the resulting change in focus this project assumed, an additional consent form and project outline was provided to interviewees to maintain and uphold ethical standards.

Research Methods: Thematic Analysis

Data analysis was conducted using thematic analysis. Thematic analysis is associated with more exploratory methods of research. As a method of qualitative inquiry associated with grounded theory, thematic analysis is a method that allows themes to emerge organically from data (Guest, MacQueen and Namey 2012, 10). Researchers employing thematic analysis typically spend significant amounts of time reviewing and familiarizing themselves with rich data in an effort to make connections between ideas to generate broader themes (Guest, MacQueen and Namey 2012; Braun and Clarke 2006). Comparatively, hypothesis driven methods typically utilize predetermined ideas, themes to assess established theories, which was not the intent of this research. Instead, the intent of this research was to examine the themes presented by research participants, and further assess those themes as they relate to the respective field in which the interviewee is engaged, and to narrow responses according to these respective fields to further the analytical process. To clarify, this research methodology is not engaging in a formal expert elicitation method (Cooke 1991) but is instead attempting to inform future CWD management directions that seek to engage Indigenous communities.

The flexibility of thematic analysis allows for theoretical freedom and detailed accounts of qualitative data while remaining approachable as a method of analysis (Braun and Clarke, 2006:12). Themes identified in this research were derived inductively—emerging directly from data—and not pre-determined by existing coding frames or specific theoretical/epistemological grounding. Once transcribed into a word document, the researcher conducted an initial note taking session wherein initial ideas were collected. This involved generating initial codes and highlighting phrases of interest. This was done in a systematic fashion across all questions as summarized in table 3.

Table 3: Six Step Thematic Analysis

Process	Result
Transcription and familiarization	<ul style="list-style-type: none"> • Interviews transcribed into word documents and initial ideas noted in margins. • Transcripts re-read to familiarize.
Initial codes	<ul style="list-style-type: none"> • First codes generated and collated into analogous groups.
Initial themes	<ul style="list-style-type: none"> • Potential themes emerge from code groups.
Assessing themes and analysis	<ul style="list-style-type: none"> • Cross referencing themes with codes and generating thematic map.
Establishing themes	<ul style="list-style-type: none"> • Refining themes through ongoing analysis and map assessment.

Writing

- Final analysis.
- Selection of relevant quotes
- Assessment in relation to literature and research questions.

Source: Braun and Clarke 2006, 35.

After initial transcription and familiarization, responses were assembled by question into four separate documents. Second, initial codes were generated by determining commonalities across all responses. These codes were comprehensive in nature and focused on how the data provided an answer to the corresponding research question. Following this, codes were plotted into spreadsheets according to respondents, colour coded in accordance with their respective fields to further the analytical process. As such, individuals are grouped in the following categories: *biologists, resource economists, Indigenous academics, government, and Indigenous technician*. Third, these codes were then reduced into larger themes. The intent of breaking codes into themes by respondent categories was to contextualize codes by discipline or affiliation, and to enable parallels to be drawn between responses and respective fields. Fourth, themes were mapped into a program called *SimpleMind* (a cross platform mind mapping program) that was used to visualize themes, organize them within larger categories and determine connections among the larger categories. Finally, themes were established through further analysis and reduction of the initial thematic map. The larger categories that emerged were then assessed in comparison with literature on the ecology and management of prion diseases (specifically CWD), and, very broadly, Indigenous consultation and engagement in natural resource management (wildlife).

Conclusion

The intent of this chapter was to provide an account of the methods used to conduct this research, and the underlying methodological insights used in data analysis. Currently, CWD is advancing both in the number of positive cases, and range. Because of this, it is critically important to engage all stakeholders on the ground who are available to assist in establishing some understanding of disease spread both in the environment and within key species (i.e., cervids). For these reasons, it would be especially prudent to engage meaningfully with Indigenous communities in knowledge sharing regarding CWD since communities within the mandatory surveillance zone are likely encountering positive cervids.

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CHAPTER 3: RESULTS

Introduction

Ten experts were interviewed from a range of socio-economic and political backgrounds as well as experience and expertise relative to the themes of Indigenous Knowledge, wildlife management and chronic wasting disease. There are important differences in the kinds of knowledge that was shared by each of the interviewees (figure 1). In terms of shared opinions across participants with differing backgrounds, this research finds that *biologists*, *ecologists*, and *economists* all emphasized that Indigenous harvesters and their knowledge would be more attuned to small scale changes in herds and the environment, and therefore, they would be first to alert wildlife managers and scientists to early changes in cervids in areas of the province where CWD has yet to be detected. As well, *ecologists*, *biologists*, *economists*, *Indigenous academics*, and the *government* respondent all made reference to the ability of Indigenous harvesters and their knowledge to provide a baseline condition of herds. Although, the temporal time periods varied by respondent with some (i.e., *government*, and *Indigenous academic*), indicating that Indigenous knowledge could provide historical examples, whereas, *ecologists*, *biologists*, and *economists* tended to focus on a contemporary assessment based on observable data collected from a distance. Across respondents, there were more diverging opinions than commonalities. For example, where *economists* and *ecologists* tended to focus on knowledge integration and making Indigenous knowledge more amendable to scientific (i.e., quantitative) methods, *Indigenous academics* and the *government* respondent focused on the need for scientists and managers to undertake intercultural capacity training as a means of engaging with Indigenous communities in a more culturally sensitive way. As well, both *Indigenous academics* placed a strong emphasis on Indigenous knowledge as comparable to scientific/quantitative methods of data collection, and as such, equally valid in the process of wildlife management.



Figure 1: Thematic groupings by expert and background.

The results of this chapter are broken into the following discussion points: (1) Groups affiliated with cervid management; (2) Managerial and scientific concerns; (3) Indigenous non-participation; (4) Perceived roles for Indigenous hunters and their knowledge; (5) Knowledge integration; and (6) Social scientific concerns.

Active Groups Affiliated with Cervid Management in Alberta

Respondents were asked to summarize, to the best of their knowledge, what organizations are currently associated with the management and monitoring of cervids in Alberta, and to include what their roles and contributions are (table 4). The results compiled in this table are reflective of the responses provided by participants. While not all participants were aware of active groups responsible for wildlife management, testing, and involvement of key groups (including all

relevant stakeholders), the majority of respondents were. The remaining gaps in data were collected through a secondary review intended to provide additional context beyond what was known by participants.

Table 4: Cervid Management in Alberta

Affiliation	Group	Role
Federal Government	• Canada Food Inspection Agency (CFIA)	• Testing of captive cervids and policy
	• Parks Canada	• Monitoring
Provincial Government	• Alberta Environment and Parks: Fish and Wildlife	• Management and monitoring (surveillance) of cervids
	• Alberta Prion Research Institute	• Research, testing, surveillance and advisory
	• Environmental Monitoring and Science Division	• Monitoring
	• Western Association of Fish and Wildlife Agencies (WAFWA)	• Advisory
	• Canadian Wildlife Health Cooperative (CWHC)	• Research, data collection and advisory
	• University of Alberta	• Research and advisory
	• Alberta Conservation Association	• Monitoring and data collection
	• Longman Laboratory	• Testing
	• Alberta Professional Outfitters' Society	• Passive surveillance and advisory
	• Alberta Fish and Game Association	• Advisory, project sponsorship
Public	• Hunters	• Harvested samples and monitoring
	• Citizen scientists	• Passive surveillance (monitoring)
	• General public	• Passive surveillance (monitoring)
	• Land owners	• Passive surveillance (monitoring)
	• Indigenous hunters	• Undetermined

There are three major categories that appear in this summary: (1) federal government organizations; (2) the government of Alberta and organizations that are directly affiliated with the provincial government; and (3) public (non-specialist) participants. Each of these organizations, associations, institutions, or groups is in some way responsible for some aspect of

cervid monitoring and management either in Alberta, Canada, or internationally—as in the case of the Western Association of Fish and Wildlife Agencies (WAFWA). Further clarification on the roles and contributions of these organizations will be discussed further.

Federal Government Organizations

The Canadian Food Inspection Agency (CFIA) tests captive cervid samples for CWD, while also confirming positive cases from hunter harvested samples that have tested positive for the disease by ARD (ARD 2011, 14). Although not mentioned by participants, the CFIA is the federal body responsible for the detection and confirmation of CWD in captive cervid samples (CFIA 2018). In 2008, the Parks Canada Agency, met with other organizations, researchers, and governmental groups affiliated with CWD monitoring, management, and research to set about establishing a formal CWD management program to guide the Parks Canada Agency. According to I3, the Parks Canada Agency is responsible for cervid management within parks boundaries, and any CWD monitoring or control efforts within national parks fall under their jurisdiction, “The federal government in general has more to do with these terrestrial species in national parks, vs outside on crown lands.” According to I1, within Alberta, excluding national park lands, the government of Alberta Environment and Parks: Fish and Wildlife Division (AEP), is primarily responsible for the monitoring and management of cervids in the province. The federal government is not involved in the administration or organization of CWD management at the provincial level, and in lieu of a national control strategy for CWD, provinces and territories are responsible for directing, executing and funding their own programs.

Organizations Under Direction of the Provincial Government

AEP is the primary branch of the provincial government that is in control of cervid management in the province. Under AEP, organizations and groups operating at the provincial level fall into two categories: *government organizations* and *delegated administrative organizations* (DAO). First, under the auspices of the provincial government: the Alberta Prion Research Institute (APRI), the Canadian Wildlife Health Cooperative (CWHC), Western Association of Fish and Wildlife Agencies (WAFWA), the University of Alberta, and the Longman laboratory (located at the University of Alberta) collectively research, monitor and test samples for CWD. All of the above-mentioned organizations, groups, and associations all contribute to the formal data generation, management, and surveillance of cervids for CWD in Alberta.

APRI, is the primary Prion research facility in Alberta, and was established in 2005, following the Bovine spongiform encephalopathy (BSE) crisis in 2003 (APRI n.d.). According to I3, APRI has engaged Indigenous communities in the research process through the facilitation of meetings, “I do know that, for example, [APRI does] include First Nations. I think it was a year ago, maybe it was two years ago now, we had a meeting and we had a very good group that came in and spoke about how they were monitoring for CWD in their own populations, and so there are linkages out there that are not just government oriented.” The CWHC operates on a national scale at the provincial level. In Alberta, CWHC works in partnership with AEP through the Faculty of Veterinary Medicine at the University of Calgary, to provide data for the administration of the national wildlife health surveillance program. CWHC’s CWD surveillance program is focused mainly in Saskatchewan with no data or information on efforts in Alberta. WAFWA is a fish and wildlife agency comprised mostly of government representatives from western provinces, territories and states in north America. Recent efforts concerning CWD put forth by WAFWA include recommendations for adaptive management of CWD which advises provinces, territories and states to reduce host concentration, increase buck harvests, and continue targeted reductions (WAFWA 2018).

The following organizations consist of informal or stakeholder level participants and they include: the Alberta Conservation Association (ACA), the Alberta Professional Outfitters’ Society (APOS), and the Alberta Fish and Game Association (AFGA). The ACA identifies as a delegated administrative organization (DAO), that conducts operations in accordance with the *Wildlife Act* (ACA 2018a). The government of Alberta recognizes DAOs as part of the services it offers to residents of Alberta (AEP 2015). Though not officially part of the government body, DAOs like the ACA, APOS, and AFGA deliver services to stakeholders in accordance with legislation yet operate independently of the government by self-funding operations (AEP 2015). The level of government intervention is clear; the provincial government provides the mandate for a DAO, appoints officials to the board, sets performance and outcomes in consultation with directors, reviews outcomes on a yearly basis, and has the ability to refocus activities (AEP 2015). Essentially, a DAO operates as an extension of the government but is funded entirely with public dollars. As part of the *Wildlife Program Agreement* and the Memorandum of Understanding between the department of Environment and Sustainable Resources Development

(ESRD now AEP) and the ACA, the ACA primarily conducts research that informs regulation changes, management plans and strategies administered by AEP (*Wildlife Program Agreement* 2014). The majority of its funding is obtained from the sale of hunting and fishing licenses, land purchases, and donations in Alberta (ACA 2018b). According to I1, the ACA “is sort of a support group and they don’t do any management. They do assist sometimes with data collection...[and] part of their function is to provide support for government...to provide conservation support.” Similarly, I2 points out that the ACA works in coordination with the provincial government to conduct monitoring or surveillance of herds “So those two groups together [AEP and ACA] are quite active in trying to monitor especially what I’ll call ‘big game’ species such as moose, deer, and other cervids in the province.”

APOS describes itself as a not-for-profit DAO. According to their website, APOS “administers the outfitted-hunting industry in Alberta...and is an active participant in the province’s conservation community and contributes considerable funding to aerial surveying, conservation projects and research initiatives through [the] Wildlife Management Fund.” (APOS n.d.). The delivery of such projects is intended for the benefit of the outfitting industry, and “to support AEP’s wildlife management priorities” (APOS n.d.). The AFGA is also a DAO and operates for the benefit of hunters, anglers, and outdoor enthusiasts with the intent of supporting responsible stewardship and conservation of natural resources in Alberta (AFGA 2017b, 5). According to I2, the AFGA is “the official voice of recreational hunters in the province.” Some of the more relevant objectives that the AFGA include on their organizational profile include the promotion of non-commercial harvesting as part of wildlife management programs, the promotion and delivery of provincial wildlife management programs, and emphasizing the importance of “proper resource management” (AFGA 2017a).

Public, Indigenous and Special Interest Groups

Hunters are informed of head submission requests through My Wild Alberta—an aggregated information hub for wildlife recreationalists in Alberta that is affiliated with AEP—in addition to various outdoor magazines, license vendors, hunting organizations, public broadcasters, print and online media outlets, and through license draws (MWA n.d.). Hunters in general play an important role in management of cervids in Alberta by providing samples, being engaged with organized conservation, or hunting and recreation groups, or by providing information on

abnormal sightings (AEP 2017). The reliance on hunters to test and monitor CWD in wild cervid populations is certainly apparent. Organizations not mentioned by participants include: the Alberta Game Warden Association which, as indicated on their website, consists of wildlife officers, management personnel, and various public members; and the Alberta Bowhunters Association, a user group dedicated to bowhunters in Alberta. Other groups not referenced and who do fall within the CWD mandatory surveillance zone—in reference to Indigenous groups—include the Métis Nation of Alberta, and Treaty 6 Nations (specifically, Frog Lake First Nation, and Kehewin First Nation) which also fall under the purview of Tribal Chiefs Ventures Inc. In 2017, the Métis Nation of Alberta (MNA) published a notice to members regarding the potential transmission of CWD to humans, and further information regarding protocols and policy on CWD in Alberta (MNA 2017). To date, the MNA is the only Indigenous group to publicly provide information on CWD to their members.

I10 states that “First Nations in the Treaty 8 territory are not providing samples to test for CWD.” Currently Treaty 8 communities do not fall within the mandatory surveillance zone. I8 speculates that one reason why indigenous communities may be absent from cervid management could largely be due to a protectionist approach to hunting areas, “There’s such a hesitancy from communities to share information [in Alberta] and I think about ... the competition with non-First Nations hunters, to talk about where you’ve been harvesting moose for example. I can understand why people wouldn’t want to share locations.” I3 does note that Indigenous groups are active in some cases (i.e., attending APRI meetings), as well “First Nations, I know as well monitor in their areas to various degrees, and I’m not as familiar with [First Nations monitoring efforts], but I do know they’re very active in some areas and have a lot of interest in these particular species....In the panels that I’ve been involved in, there’s also First Nations involved as well, both from the standpoint of giving their expertise about what they know about the area, their expertise on the animal itself, as well as their concerns about what’s going on in terms of the management and monitoring.” Likewise, I5 suggests that Indigenous groups implicitly participate in cervid management by harvesting deer, moose, or elk and there by removing them from herds “I think people are, whether implicitly or explicitly, involved because the hunters are there—whether they’re Indigenous hunters or non-aboriginal people—they are playing a role in management. They are indirectly playing a role in monitoring because they’re reporting heads, harvests, population numbers, all those kinds of things.” There appears to be some Indigenous

engagement in CWD research to a certain degree, however, the level of engagement, participation, and consultation regarding CWD research and management with Indigenous communities remains somewhat vague and not as clearly defined as involvement from groups such as APOS, AFGA, or ACA.

Management Considerations: Environmental, Data, and Social Challenges

Several participants suggested that issues such as persistent infectivity of soils, environmental remediation, and environmental disturbance are key challenges that impacts the ability of management to contain and potentially eliminate CWD from cervid populations and the environment. Environmental infectivity of CWD prions (PrP^{CWD}) through uptake of contaminated soils was identified as an important challenge to be considered by management in the monitoring of deer, moose and other cervids in Alberta. Contamination of clay rich soils through the shedding of prions has been established as a potential vector of disease spread since uptake of prions that bind to soil can persist beyond the removal of infected animals resulting in future transmission of infective prions to unsuspecting hosts. As I7 explains, “the other thing that is really critical with CWD...is environmental contamination...so think about that part of the Saskatchewan River valley that has now had CWD for 15 years. There are areas in there where prevalence is pretty high. Even if you go in and remove all of those animals, there is a fairly good chance that there is enough environmental contamination that new deer coming into that area are going to get infected.” Continued infectivity and environmental remediation of infected sites is an ongoing challenge that could complicate the rehabilitation of areas with a high prevalence of PrP^{CWD}. Prions are difficult to eliminate, and methods of eliminating prions from soil are insufficient for adequate rehabilitation in areas where infectivity is pronounced over a large area. As I7 points out, full remediation of infected soils is a complicated endeavor, “50% bleach works. If you have a huge area of the environment that’s been contaminated, we can’t bleach it. There was a contaminated farm in Wisconsin a [number] of years ago, they ended up having to dig up the top six inches of top soil and bury it in a clay lined pit to try to reduce the potential for subsequent transfer of infectivities. I think that’s going to be a huge issue.”

Environmental disturbance was recognized by several interviewees as a factor that could contribute to increased prevalence of CWD into novel areas of the province. Interviewees discussed issues such as linear features from oil and gas development and exploration, mining,

and forestry including roads, pipeline right of ways, seismic lines, and trails as features that could provide optimal conditions for the migration of cervids into different areas. As I3 explains, “The first [hypothesis] is that industrial development is opening up habitats for white-tailed deer in particular because they tend to be an early successional stage, that means when you cut down the forest there’s a lot of plants for them to eat, whereas when you have pretty deep canopies you lose that forage.” In such situations, the promotion of understory growth can promote ideal habitats and expand the migratory ranges of animals into new areas, which may increase susceptibility of non-infected hosts should they come in contact with contaminated environments or infected animals.

Fragmentation of land from agricultural development and connectivity into northern regions was a concern brought up by I10 who identified the encroachment and expansion of farm lands in the Treaty 8 area in northern Alberta, as a factor that has contributed to the displacement of animals and First Nations hunters: “There’s more...encroachment of agricultural lands. They’re clearing forest and covering wetlands...they drain the water...High Level is the most northern farming community in Alberta, and it’s expanding to the west and the north. There’s so much industrial activity within the last 70 years in the Northwest part [of the province] that people from the High Level area would have to go down to the Fort St. John area—which involves crossing borders—travelling probably 6 hours away. Or travelling to the Northwest Territories.” Migration of animals away from developed areas and hunter displacement are both factors that are currently contributing to decreased presence of First Nations hunters and monitoring in northern regions of the province. How this issue will develop with regards to management of CWD in northern communities of the province is yet to be determined.

Several challenges were discussed that negatively impacted the ability of managers to effectively monitor and manage CWD in Alberta. Foremost, there was a distinct focus on the collection of data used to establish an understanding of disease spread. Most interviewees were concerned about the particular difficulties and cost associated with conducting aerial surveys and cautioned about reliance on hunter head submissions for testing. Aerial surveys—one of the methods of cervid monitoring employed by the Alberta government—provide herd counts and estimates of herd decline. This type of data requires consistency and optimal weather conditions. I1 and I3 note that funding constraints prohibit the ability of scientists and managers to conduct aerial

surveys more than (on average) one Wildlife Management Unit (WMU) per 10 years, which contributes to inconsistent data from which to base management decisions on. In such situations, identifying herd declines over extended periods of time can become difficult. As I1 explains,

For deer, elk, and moose the cost of running the survey, doing the aerial surveys is prohibitive to do an adequate job. We could do a lot more, but cost is an issue. Also, the weather. You have to have good snow conditions to do the aerial surveys, and that varies depending on the season. Chinooks melt the snow and you can't really do counts, so you've got a really limited window of time when they can be done. For moose we're doing on average 10 or fewer WMUs per year. That means that on average, every WMU is surveyed once every 10 years, which is just not adequate.

Cost is an important consideration in conducting aerial surveys. I1 points out that, "it costs \$60,000 to do a single WMU and we've got 150 of them. So, we don't do a very adequate job of sampling. We have very few data on which to base management decisions." In addition to cost, the ease of collecting approximate counts is another issue that I1 addressed. White-tailed deer are consistently the most difficult to conduct aerial surveys on since they prefer to hide under cover, while mule deer data from aerial surveys can be more representative since they tend to concentrate in wintering grounds.

Effective testing was considered a crucial component of effective CWD management. Interviewees focused on increased frequency, and improved methods of testing as necessary components of an effective management strategy. When discussing opportunities for engaging Indigenous peoples in the management and monitoring of deer, moose and other cervids in Alberta, the current sampling protocol—which involves collecting and freezing cervid heads for testing—was addressed as a potential barrier that could be discouraging Indigenous peoples from providing samples. As a means of increasing samples, and to potentially support Indigenous hunters' ability to test samples for CWD in real time, I7 suggested improved testing methods, "part of what drives us is coming up with ways of testing both animals and the environment that doesn't necessarily require the provincial labs. Pie in the sky would be some sort of hand-held monitor...It would be something that would be more useful to Aboriginal people, because I'm sure that there's more issues in terms of them getting samples to the provincial labs." The general consensus from interviewees was that increased sampling and monitoring in novel areas that do not fall under mandatory surveillance would support management strategies aimed at reducing spread. I9 speculates that the disease is spreading further north and is interested in

collecting samples from regions of the province where the establishment of CWD has not yet been determined, “key opportunities from an experimental point of view is that the disease is starting to overlap [into] some Aboriginal communities. Certainly, it doesn’t appear to be in northern Alberta yet, but it will be spreading there. Having samples prior to the spread of this disease into those areas would be quite valuable. Challenges have to do somewhat with the ease of getting these samples.”

Challenges identified with the current sampling protocol include: cost associated with head storage, availability of space, and challenges with collection and delivery of samples. These issues were considered for areas where no funding or plan is in place to support CWD monitoring. The goal of enabling real-time testing is an answer to the difficulties faced by Indigenous hunters who may be reluctant to provide samples in light of these challenges. Alternative methods of testing, including fecal and saliva¹ samples, are methods that could potentially help Indigenous hunters overcome the difficulties of providing large specimens, as I9 explains, “clearly, to do this really well we need to continue to improve our ability to detect for infectious prions from samples—such as fecal and saliva—that are more readily accessible.” I7 and I9 both suggest that Improved testing both in the lab and on the ground, is a key issue that may enable a clearer understanding of where and how CWD is evolving in the environment.

Risk perceptions—in this case, subjective assessments of risk regarding the potential dangers of consuming infected meat—was considered a key issue that should be examined in the management of cervids for CWD in Alberta. Safe consumption and identification of specific diseases was recognized as a crucial issue for hunters on the ground. The inability of hunters, both Indigenous and non-Indigenous, to safely identify CWD or other diseases affecting cervids, was offered as a potential barrier that could negatively impact the human intervention aspect of disease management by discouraging hunters from harvesting in known infection sites. In their experience working jointly with Indigenous communities on wildlife monitoring with the Alberta government, I6 noted that community members consistently brought forward the same concerns, “the issues that I hear from the community [regarding deer]...is, ‘can we eat it?’...In terms of...moose we hear, ‘there are no moose here, there use to be.’ And the big question that I hear,

¹ It should be noted that the method of testing saliva for PrP^{CWD} is done with live cervids, and most commonly in farmed settings. In nearly all cases, the animals are either held down, or sedated (Haley et al. 2011).

which I don't think environmental monitoring is very good at answering yet is around the quality of the meat, 'so I can catch a moose, I can hunt a moose, I can't eat it.'" I10 further echoed these concerns, "a lot of First Nations are saying [that there are] sick animals, mainly moose and caribou. They pin point, let's say for example,...cysts, or some say there's worms in the stomach...Or the moose is skinny and it's shedding hair."

By reducing engagement with certain herds believed to be CWD+, substituting one species for another, or increasing the burden of cost and travel, it is speculated that Indigenous and non-Indigenous hunters may be actively disengaging from certain herds. Human intervention through hunter harvest is a key strategy in the management of CWD in Alberta. I5 suggests that hunter preference can negatively affect disease control if hunters choose to harvest cervids from areas perceived to have lower levels of infectivity or refrain from hunting certain species at all, "we did see that some people did change their behaviours dramatically with CWD outbreak and spread, and some to the extent of stopping hunting. Others moving to other places where there wasn't CWD or changing the species they were interested in...That has its own challenge in that you've got potentially less harvest in those regions where there might be CWD. That means there's potentially more spread of CWD."

Perspectives on the Abstention of Indigenous Peoples in Cervid Management

Allocation and setting proper harvest quotas were two issues raised by interviewees. When discussing data limitations, I1 pointed out several times that First Nations harvest data was an unknown variable that continues to complicate managers ability to provide non-First Nations hunters with an accurate limit, "one major deficiency in the data that are available is the First Nations harvest. We have no information. That's a very serious limitation for managers trying to set quotas on the number of moose that can be taken from an area." I1, I2 and I5 further speculated that First Nations do not participate in management and monitoring for several reasons including: fear of potential restrictions, losing control over the resource, and not seeing the value in co-operation. As I1 explains, "we have no data on the First Nations harvest, and they don't want us to have it. They don't want the government to have those data...First Nations hunters have to demonstrate a willingness to get some input on how they're doing management...They don't want to relinquish any sort of control that they might have over harvesting...they're resistant to being engaged in anything that might even suggest that there

should be restrictions on how they do things.” The reluctance of First Nations to provide harvest samples, or monitoring data was understood as a challenge that would need to be addressed in order to set proper harvest quotas for non-First Nations hunters, and to better understand the impact First Nations have on cervid populations.

Several interviewees were unsure if First Nations would be interested in helping with CWD monitoring and management. It was made clear that invitations were open to First Nations to participate but that these invitations had been continually ignored or declined. Reflecting on personal experience as a board member for a wildlife organization, I1 notes that Indigenous representation is consistently absent at regular meetings, and no one has come forward to regularly participate, “we’ve had a First Nations guy show up maybe twice. I mean, First Nations just don’t show, and we’ve been trying. We’ve asked them if they would identify somebody...So, I guess they just don’t see that they get anything out of it.” How to engage First Nations regarding monitoring and management of CWD in Alberta, was an issue raised by all interviewees. Interestingly, I10 pointed out that First Nations generally do not work with the Alberta government due to mistrust, “some First Nations as I’ve said, collect samples and work with the Alberta government, and some don’t largely because of mistrust.” Further expanding on this remark, I10 addressed the issue of Indigenous consultation in Alberta, explaining that the reluctance of some First Nations to work with the Alberta government is grounded in past experience:

They would say “let’s have your input or participation” but then they come with pre-drafted ideas. Then they say, “this is what we have drafted, what do you think?” basically they’ve already made decisions and after the fact they ask, “what do you think?” It doesn’t really matter if you say “yes, that’s a good idea” or “no that’s a bad idea” it’s just pushed through. That was with the Conservative government for the last 44 years. Although we have the new NDP government...the technicians that work within the Alberta government have been the same as they were 30 years ago...So, there’s distrust of the Alberta government [from First Nations].

Overall, interviewees were concerned about the continued spread of CWD into northern regions of the province. In this scenario, vulnerable caribou populations, and subsistence hunters were considered at risk. For this reason, it was acknowledged that all stakeholders, managers, and scientists would eventually need to work together. Coming together, in light of current challenges to acquire First Nations harvest data and cervid samples, was a challenge identified

by I2, “right now, [managers] rely on recreational hunters, and they’re going to have to rely...less on [recreational hunters] and more on First Nations people, and I don’t know that Aboriginal people will be interested in helping... You just gotta put the political stuff aside, and you just gotta get on with the job. I don’t know if that will ever happen, and that’s a huge problem.” References were made by participants to the “political issues” (I2), “differences of opinion,” (I5) and “cultural differences” (I3) complicating First Nations participation and compliance with wildlife management and conservation. Interestingly, I2, and I3 asserted that there has been some unacknowledged work going on between the provincial government and First Nations communities specific to trapping and monitoring of certain species unrelated to CWD. However, due to the unofficial nature of this data collection and monitoring, that information was a little more ambiguous. How to overcome the issue of Indigenous non-participation, of course, was a widely acknowledged challenge.

According to I2, the issue of retrieving concise and “unbiased” data from First Nations, and the level of effort required to glean insights from Indigenous Knowledge that could supplement scientific data is, in some cases, beyond the resources for the task. In I2’s experience, “you couldn’t get any information out of anybody if they went on a trip and they didn’t shoot something. That’s really important because you’re looking at effort, expenditures, success rates, all these different things that you need to be a part of management solution.... We really need to know about the level of effort that you have to put in, in order to get anything out.” I2 further speculated that bias may be an issue when retrieving First Nations data, “there’s a great paper by Peter Usher², that points out when land claim settlements are being negotiated, Aboriginal people... would tell you that they hardly harvested anything, so they would under report what they were really doing. When there’s a land claims settlement, they tend to over report because they view it as in their best interest to over emphasize their dependence on the resource.... How do you build a system of collecting data and information... [when] you’re getting a biased perspective?”

How to construct a management strategy that incorporates different knowledge systems, paradigms, and opinions was certainly a concern for most participants. I1 recalled three separate

² Usher, Peter J., and George Wenzel, “Native Harvest Surveys and Statistics: A Critique of Their Construction and Use.” *Arctic* 40, no. 2 (March 1987): 1-16.

cases where First Nations had “shot out herds,” calling into question the ability of First Nations to properly manage wildlife. In the first case, First Nations impact on local moose populations near Conklin, AB was discovered only after an area biologist had investigated the decline. According to I1, the local biologist discovered First Nations hunters were responsible after conducting surveys and monitoring local moose populations, “I know the area biologist was keeping tabs on the harvest...All of a sudden, he noticed that the harvest tanked...He did some exploration, talking to First Nations people up there and some aerial surveys. [He discovered] there was a small group of young men who were providing moose meat for their entire band, and they just shot them out. The only way he learned about it was by monitoring the licensed hunter harvest, and when that tanked, he knew something was up.” The second case I1 discussed involved a sensitive caribou herd that migrates between Labrador and Québec. Again, as in the case mentioned above, the herd was shot out by First Nations hunters who, according to I1, had claimed it was within their rights to do so, “there’s a rather tragic story about caribou in Labrador, where they completely shot out the herd. Completely annihilated them, and they were defensive of it saying, ‘that’s our right!’ Well, it may be their right, [but] it’s kind of a dumb thing to do for the future of First Nations in that area. Why would you ever want to do that? And it may be their right, but that’s an unreasonable response in my opinion.”

The third example of First Nations wildlife mismanagement I1 discussed involved the Wind River Indian Reservation pronghorn rehabilitation case. This example provided a more positive perspective on what was perceived to be proper co-management of wildlife. Again, Indigenous hunters were responsible for shooting out local pronghorn but had worked with wildlife biologists to monitor and responsibly allocate harvest quotas, “there are native groups in other places that have actually engaged wildlife biologists to work with them and to develop management plans and sustainable yield harvesting and that sort of thing. For example, the Wind River Indian reservation in Wyoming has a full-time biologist on staff. They completely shot out their pronghorn but they’ve now re-introduced pronghorn and the pronghorn are doing really well...They police themselves as to how many they’re going to take, and they limit the harvest that way.” These accounts were framed within a broader discussion of appropriate management strategies that emerge from having reliable harvest data, hunter compliance, and respect for the resource. In each case, it was suggested that First Nations hunters do not meet the criteria of

sustainable harvest allocation and proper management alone, and as a result, would benefit from working with managers.

The Perceived Role of Indigenous Hunters and Indigenous Knowledge in Cervid Management

Nearly all interviewees acknowledged that detection of CWD in more remote regions of the province (i.e., outside of the mandatory surveillance area), could be determined by Indigenous hunters who, it was speculated, would be more perceptive of changes in both the landscape and in wildlife populations. According to I3 “I think it will be the First Nations people, or aboriginal peoples that will first detect it in moose. We have one detection but when it’s really becoming a problem, they’re going to be the ones that tell us that.” Similarly, I5 suggested that Indigenous hunters would be specifically attuned to changes in the local environment, “Those are the first people who would be informed of unusual behaviours, of evidence, of seeing things that are different on the landscape.” The early detection of CWD in remote regions of the province by Indigenous hunters was acknowledged as a key advantage. It was speculated that those hunters who are on the land more frequently, and who have a more intimate level of knowledge of changes both in the environment and within wildlife (due to consistent and repeated trips out on to the land), would be in an ideal position to provide early detection of the disease should it spread into Indigenous harvesting territories outside of the endemic zone. I9 explains what they perceive to be the fundamental difference between non-Indigenous and Indigenous hunter’s relationship to the land and local wildlife and how this relationship can be potentially advantageous for early detection of CWD:

A hunter who is in the field on a regular basis has a much better eye for animal behaviour than one who is only occasionally out there, and whether there’s also been a change in how, if there’s some perceived change in how the animals are interacting with each other, or the environment...I mean in no way arguing with CWD you’re going to see large scale major shifts, but clearly the ability to identify a clinical animal differs from if you’re a hunter with a long history of hunting and that knowledge base, versus more of a novice...Clearly with this disease you’ve got an infectious agent that doesn’t show an impact on the animal until very, very late in the disease, and it’s a gradual change. Someone looking at an animal in the field might not identify maybe perhaps something a little bit wrong or different with it. Whereas if you’re out there on a daily basis, you may start to be able to suspect there’s something wrong months earlier than others would.

Likewise, I7 made a similar assessment of the capacity Indigenous hunters have to observe changes in the local environment, “I think that, any group that’s interacting more with the animals is probably more likely to then see early clinical signs. Or see things that...If you show up to go hunting, for one week a year, you’re not intimately involved in the herd populations and noticing things like whether there’s more females or males, or generally younger animals.” As well, I6 suggested that Indigenous hunters would be a wealth of knowledge “Well I think it plays a huge role, and it only makes sense to me that people actually live on the land, who are actually monitoring the land on a daily basis, are a massive resource for information.” In terms of recovery, I5 notes that local knowledge holders would be ideally suited to contribute relevant observations “Are there signs that things are recovering? I think that’s an important piece that people [who] are in the environment have a much better sense of, [and] that they’ll be able to help provide information or insights on those things.” The theme that Indigenous hunters are more attuned to the environment and wildlife around them was an idea that nearly all interviewees shared, and one that was suggested as an advantage towards the early detection of CWD in free ranging cervid herds should the disease continue to spread into traditional hunting territories that are not currently under mandatory surveillance.

In terms of assessing the potential role of Indigenous Knowledge in the monitoring and management of cervids in the province, two respondents acknowledged that Indigenous Knowledge could provide a baseline status of herds, and Indigenous hunters themselves could also assist in providing monitoring data (i.e., number of animals in herd), more akin to passive methods of surveillance. Other respondents suggested that Indigenous hunters could continue the monitoring efforts used by non-indigenous hunters in other areas of the province where hunter-harvest samples are provided as part of the mandatory CWD surveillance strategy. According to I3, Knowledge holders who are out on the land, in areas not being monitored, could fill the observational gaps for management, “they can play a very important role in monitoring because the first time we ever find out we have a problem on the health side is through this term that I mentioned before ‘passive surveillance,’ and it’s picking up the first case, or seeing a cluster of animals, and it could be that we miss a lot of those, so the more people who tend to report those, I think in terms of monitoring, Traditional Knowledge could play a very important role there.” Further to this point, I7 recommends that Indigenous hunters could alert management to

observed changes in herd status which could then inform subsequent surveillance efforts, and as a result, alert management to new clinical cases:

Based on what I do know, or what I think that I know, I think that [Indigenous Knowledge] would provide information as to differences that are occurring within those herds, and so at the very least, we would know which populations to target for more surveillance. If there's reports of wasted deer, then I think that says something very significant about what might be happening to that population. There are other diseases besides CWD that can cause wasting in deer. So, it would suggest something about the health about the population in general but if any group that's monitoring deer starts seeing clinical deer, then we've got a serious problem.

Collecting data for the purpose of determining the prevalence and spread of the disease in areas of the province where surveillance is currently not being undertaken, is a critical advantage towards containing the disease and limiting spread. I6 recommends Indigenous Knowledge be used as a historical baseline to assess the status of, for instance, the local environment, by taking advantage of the longitudinal nature of local knowledges:

One of the problems that we have in the oil sands that we talk about a lot is baseline, or pre-industrial condition, and we can get that through paleolimnology and doing lake cores, we can also get that by talking to the elders who have lived there and have generational knowledge....I would like to see us get to a point where we've validated [Indigenous Knowledge] enough and we can then say, "okay, we know that this community can go and tell us where the fish population is changed, what the health of that fish population is today, what it was before, how the ecosystem has changed, and then we can focus the science, the hard science on answering the question of why? What can be done about it?"

Admittedly, I6 acknowledged the controversial subject of knowledge validation—a subfield of analysis that has been the methodological focus of more technical management research and suggested that getting to a point where Indigenous Knowledge can be used without further verification or scrutiny, as a starting point to assess change in wildlife, for example, would be ideal. I8 further elaborates on this point by proposing Indigenous Knowledge form the foundation of knowledge regarding environmental health “Traditional Knowledge/Indigenous Knowledge of the land and wildlife management, movement of wildlife, key areas, that should form the basis. Traditional Knowledge/Indigenous Knowledge perspectives on the land should form the basis of all the environmental monitoring and resource management that we do.”

Establishing an understanding of disease spread in cervids is a critical aspect of CWD management, especially in free ranging herds. Having observations from as many areas as possible helps to confirm where the disease is emerging and has potentially become established. I3 recommends Indigenous hunters could assist in establishing the range of white-tailed deer, for example, as a means of determining the range expansion of these herds, “Other ways that [Indigenous hunters] might play [a role] in monitoring and management of moose deer and elk? I think there’s all kinds of what I’ll lump under citizen science where understanding how range expansion occurs in certain species, for example, we know that white tailed deer are moving northward, and just how far and where and where they’re being seen first, again I would argue that First Nations have a lot of capability of adding to that body of knowledge.” Here I3 advocates the role of citizen scientists, while I4, making a similar suggestion, reiterates this role, “It could also be observations and empirical data that they have that one could consider citizen science.” It has been speculated that the likelihood of CWD spread into more remote northern regions of the province could be made possible by optimal weather conditions (i.e., climate variability), and reduced ground cover. I3 suggests that climate change may be playing a role by supporting optimal conditions for cervid migration in conjunction with understory growth, linear disturbance, and agricultural development, “so, we think climate change is also allowing the snow to not come down as far south and is melting earlier so that the deer can handle those habitats.” Although inconclusive at this time, I3 does believe that variability in snow accumulation and seasonal melting could allow for ideal conditions for cervids to migrate further north along open corridors, potentially contributing to northward spread of CWD into novel areas. Although mule deer are the dominant carriers of PrP^{CWD} in Alberta, their home ranges are smaller than white tailed deer who, as I3 explains, largely benefit from the optimal migration conditions provided by both linear disturbance and optimal winter conditions. Even though climate change could have a positive impact on cervid migration—by enabling non-clinical infected deer ease of movement into uninfected areas—it remains unclear if seasonal variability due to climate change will contribute to increased or decreased mortality of infected cervids over an extended period of time.

It is clear that respondents feel confident that Indigenous hunters and their Knowledge are well suited to furthering the contributions of non-indigenous hunters by providing harvest samples, observations on the range of cervids, and changes in herd status. Although, respondents were

mixed when deciding if Indigenous hunters were qualified to make assessments of animal health post-mortem. I2 makes the distinction that Indigenous Knowledge holders would be less suited to identifying the disease in animals and more appropriate for determining disease prevalence on a large scale, “You know, CWD is a new disease, and I don’t know that Traditional Knowledge is going to help with the disease part but looking at the condition and the status of the herds of animals, well obviously.” Alternately, I8 indicates that Indigenous hunters are already familiar with physiological signs of disease in animals by butchering carcasses, making quality assessments, and providing tissue samples in other areas of the province, therefore, Indigenous hunters would be able to provide key indicators of health by observing fat, tissue quality, and noting any abnormalities “looking at the [animal’s condition] when they’re butchering the animal, looking at the organs and noting the level of fat on it, and indicators of health. And I know they are doing tissue sampling...I think around Swan Hills they do tissue samples as well. I think a lot of that is done in conjunction with the provincial government where they do share that information and data, and they do send those sample kits in.” In addition to noting abnormalities in the carcass, I10 suggests that Indigenous hunters could facilitate more novel testing methods, and notes that a key issue for hunters on the ground is not being able to differentiate between CWD and other diseases that may have infected the animal, “Testing earlier...testing fecal matter, testing brain [tissue], different [types] of sampling...A lot of what they see visually, if they kill a moose and they cut it open and there are different cysts, some sort of growth or something in the stomach, they would know what it is. But we can’t [differentiate between a] prion disease or something else. But out in the field [Indigenous hunters] do recognize different sick animals and so on. In that sense, they would bring that knowledge.” Being able to assess whether an animal is infected with CWD, or another disease is critically important for hunters who subsist on harvested animals. Although Indigenous hunters are able to determine whether an animal is generally safe for consumption, CWD does not always present observable symptoms, and may result in people unknowingly consuming infected meat should they decide not to submit a sample for testing.

Knowledge Integration: Differing Perspectives on Indigenous Knowledge

There were two distinct perspectives that emerged between respondents regarding the documentation of Indigenous Knowledge: (1) that Indigenous Knowledge needs, in some way, to be more accessible and usable to Western scientists; and (2) that Western scientists are inclined

to misunderstand the nature and cultural complexity of Indigenous Knowledge, and therefore have the tendency to invalidate it. I2 explains that Indigenous Knowledge needs to be more functional for Western scientists, “I think what they need to do is start come up with ways of going beyond oral histories so that the information can be used by scientists and researchers and so on.” I3 expands on this point and explains that Indigenous Knowledge needs to be refined, shared, and integrated in a way that makes it more approachable, “Filtering it up to the integration of many different sources. And I don’t know if there are barriers there or not. It’s one thing to know about it; it’s another thing to share it, and how we do that, some ways are easier than others...So, I think there’s a real role for Traditional Knowledge. How to better integrate it I think is the challenge.” Regarding knowledge extraction and validation, I6 touches on a critical point in the debate surrounding Indigenous knowledges and Western scientific perspectives regarding acceptance of Indigenous Knowledge in research and management; that knowledge validation through verification can be an end game towards acceptance of this Knowledge without future confirmation, “I see what’s happening now is that western science is being used to validate Traditional Knowledge or Indigenous Knowledge quite a lot, and I think although I’d like to see us further along, I think that it’s a good thing. We’re getting there and it’s kind of part of convincing western scientists that Indigenous Knowledge is valid.” A key challenge then, according to these respondents, is making Indigenous Knowledge accessible and workable for Western scientists and wildlife managers.

Diverging from these perspectives, I4 suggests that the issue isn’t so much about making Indigenous Knowledge work, but is instead about having Western scientists and managers acknowledge the disadvantages and inadequate relations between Indigenous communities and government organizations that seek input from Indigenous communities:

So, for me, I think it sounds like it’s not a matter of the difficulty of incorporating local or traditional knowledge, it’s the bureaucratic structure and the cultures of these provincial organizations are probably a huge disincentive to indigenous communities participating. If the relations don’t exist, if there are feelings that people are being patronized, those kinds of things are at the forefront...And the idea that you’re supposed to incorporate what you do into their structure...They’re just at a total disadvantage...I’m not surprised that they’re not coming to the table. You can’t just say “the invitations there, come into my house,” when it’s a completely different, very different culture and the power dynamics are so skewed.

The challenge instead, according to I4, is a matter of addressing the bureaucratic cultures that disincentivize Indigenous communities from participating in management efforts by establishing working relationships with communities and focusing instead on supporting equal participation in wildlife management. Importantly, I4 makes the distinction that Indigenous Knowledge does not signify “non-science,” thus providing an entry point into the larger discussion of knowledge validity, “My definition of Traditional Knowledge isn’t just ‘non-science’ it’s whatever knowledge the community has through whatever means they’ve developed that. So, that could be oral knowledge and on the land knowledge...I don’t use the term Traditional Knowledge, I use the term Indigenous or Local Knowledge and I acknowledge anybody who’s embedded in place can have that from a variety of sources.” Further to this point, I8 characterizes Indigenous Knowledge as a dynamic, changing body of knowledge, thus positioning it as flexible and adaptable to new knowledge rather than static, “Traditional Knowledge is a process, Traditional Knowledge is on the land learning, Traditional Knowledge is the knowledge of species and distributions, there’s so many different components to it. The part that I stick with the most is that it’s a process, it’s about transmission of knowledge and ways of doing and being in our relationships and how we relate to one another, and the land and the animals.” These two definitions are clearly in disagreement with the idea that Indigenous Knowledge can or should be relegated to non-empirical thinking, and instead, offer a description of Indigenous Knowledge that is antithetical to a fixed historical narrative.

Social Scientific Perspectives: Capacity, Reflexivity, and Local Governance

Alternately, several interviewees chose to focus on the need for non-Indigenous managers and scientists to acknowledge their deeply embedded biases and beliefs to enable successful co-operation with First Nations. It was suggested that an understanding of the history of colonization in Canada, in addition to recognition of historical dispossession and the myths of cultural superiority that underpin this historical dispossession would be necessary in order for non-Indigenous peoples to be able to work with First Nations in an equal manner. I8 explains, “I think the barrier has been that non-Indigenous people do not have a common understanding of the history of colonization and the myths around cultural superiority; [as in] ‘the western way is the better way, is the civilized way,’ [and] ‘First Nations people wouldn’t have survived if we didn’t come save them.’ It comes down to issues around the land, people being removed from the land, dispossessed, marginalized, oppressed and dependent on the state. All of that history that a

wildlife biologist does not think applies to him doing his job, actually does.” I4 further expands on this notion, “there are cultural differences that are about who has cultural authority and power and political control. And I think Indigenous communities understand that very well, that they’re at a political disadvantage, they’re at a cultural disadvantage in terms of who has cultural authority in this country.”

Intercultural competency training or cultural capacity training—programs developed to support cultural, and political education for non-Indigenous individuals—was seen as an opportunity for non-Indigenous managers and scientists to engage meaningfully with First Nations. As I6 explains that as of 2017, all public servants in Alberta, undergo such training, “we have them go through intercultural competency training. In the past we’ve focused on colonial history, but we’re trying to bring in a little bit of the intercultural competencies outside of whether you’re Indigenous or not. This is a skill set that you can develop that [is intended to help] you relate to people who are not of your culture.” I4 further echoes the need for scientists or managers working with First Nations communities to undergo some kind of cultural capacity training, “[scientists and managers] need cultural and political capacity. They don’t understand colonial history, they have no systematic critique, almost never of the settler colonial structures because politics are weeded out of their training. Indigenous people know so much more about the colonial histories of some of these scientific fields than the people trained in those fields know because they’re not trained in the mistakes of their fields. You need people that have knowledge in both areas to be sitting at the table.” I6 explains that the co-construction of what is called “ethical space,” where participants are guided by an Indigenous wisdom panel, is a method of overcoming the barriers established between Indigenous and non-Indigenous peoples in a wildlife managerial and monitoring setting, “so that’s our first challenge is to create what our Indigenous wisdom panel calls the ‘ethical space.’ The space to come together and acknowledge that there are other knowledge systems, there are other ways of looking at the world that are equally valid...After generations of colonialism it’s very challenging to crack people’s heads. I mean, I struggle with it. I have listened to many elders, and you know I think I understand maybe 50 percent of what’s being said because my context is not indigenous.”

The capacity of government to address Indigenous communities’ concerns is a serious issue that complicates the ability of researchers and community officials to engage with one another to

address concerns brought forward by government. I6 illustrates a common example of meetings between Indigenous communities and scientists that is reflective of this tension:

There are scientists that we work with that have always been interested in the perspectives of indigenous people but have not known how to reach out ... you go to a community meeting, the scientist gets up to the front of the room, does their western science presentation, and then gets hammered by community elders about treaty rights and colonial issues and it scares scientists...and I completely understand why the communities are angry, and I completely recognize and acknowledge their right for a voice and opportunity to express that, but then I think that there's a perspective in the science community that's going to happen to them. So, people don't know how to approach communities. I think that through trying to build that capacity with the scientists so that they have the answers, because ultimately, the community just wants somebody to listen to them and then do something with their concerns. And so often they feel like they're talking to a brick wall because, as government employees, we have our mandate, we have our pocket of work, and it's kind of difficult sometimes to figure out their concerns, which are holistic, and big, really difficult to try to answer.

Part of the issue according to I6, is the lack of capacity Western scientists have to deal with and address these holistic and large-scale issues, and part of the issue is that Indigenous communities in many cases, are extremely limited in their ability to engage with government and researchers outside of issues that are the most pressing and necessary. "So, the problem is the capacity of the communities, they're bombarded with all of these opportunities, requests for review, it would be great if we could figure out ways to streamline that and give the communities the capacity that they need to participate in a comprehensive program that addresses their concerns. I don't know the answer to that. You could put a pot of millions of dollars and I don't know if that would be enough?" Ultimately, Western scientific researchers and managers lack the ability to meaningfully address issues related to colonialism and treaty rights, and Indigenous communities lack the funding, technical capacity, and manpower to engage on issues beyond the scope of what their funding will allow, and clearly, these ineffective meetings are the result. Additionally, pathways to consultation are critically lacking in cases where Indigenous consultation is not mandated. As I10 points out in the Treaty 8 area, technicians are required to redirect inquiries to individual communities, "Anything that deals with land and water, we're asked to redirect that to First Nations, all 24 of them if possible...Every First Nation in Treaty 8 is different. Northwest Alberta is different from Dene, is different from Chipewyan, from Ft. McMurray area. They have different concerns, they have different interests."

To address these capacity issues, both intercultural capacity training and funding are critically important but, as I4, I6 and I8 point out, other methods of engagement can also play a part in accommodating working relationships between government and Indigenous communities. I8 advocates for community-based methods as a way of supporting equitable relationships with Indigenous community members and partners in research:

So, the relationship building came first, working with the communities to address some of the more immediate needs that they have, and with my skill set, it was around archiving and digitizing existing research data that they had not had the capacity to do. In other areas it might be around education or health, but you have to start by addressing some of the needs of the community. Then as you get to know people you understand what the concerns are and what the frame is. They define what they want to do and what the questions are, because they are the people on the land. We didn't bring the scientific monitoring stuff in until after we had framed out what the questions were, and how we wanted to look at them. Then I started looking for scientific methodology that would work within that and would help us not only collect Traditional Knowledge data set of oral histories and interviews, and place names and maps, but to have some quantitative data that fit within that framework as opposed to coming in with 'this is the way we're going to measure things' and trying to fit Traditional Knowledge around it.

By working collaboratively, it is suggested that the needs of the community become apparent and can be addressed by employing scientific methods in an effort to provide solutions for the community rather than for government or researchers. As well, building relationships and providing capacity for communities eases the burden placed on them and fosters trust between groups. Part of the process of trust building, as I6 points out, is working collaboratively to support equal participation rather than simply extracting knowledge:

The work that we've done around researching the way you braid knowledge systems or researching Indigenous knowledge as its own body of work, it comes down to two components: you have to have the people who hold the knowledge, you have to have that expertise to figure out how to braid it, and then you have to have the openness for each of those knowledge holders to learn the other perspective. And those are tricky. We quite often have interpreters who go and collect the knowledge and bring it back, but we need to create a system where the knowledge holders themselves feel that they have a place and they're not just handing their wisdom off to somebody who's then going to break it down and take the meaning out of it.

As I6 points out, addressing knowledge extraction necessitates the ability of knowledge holders to feel confident in their role as co-researchers. I8 goes further and suggests that Knowledge holders can use their expertise to train Western scientific researchers and managers in a reciprocal way, while learning Western scientific methods to support Indigenous capacity, “So, the role that Traditional Knowledge could play is in the training of biologists and resource managers, including youth and elders in the work, so that you are building additional capacity of young indigenous people who have both the training and indigenous knowledge but also an understanding of the western management frameworks to help bridge the gap, because that’s how it will happen.” As an example, I4 suggests having Indigenous peoples and scientists working together with one another to develop the technical capacity to monitor wildlife in an autonomous way, as another way of supporting the ability of communities to develop and administer research independently in the future, “Handheld technologies...to me that’s a better way of getting indigenous input into solving this problem [is] having them work with the engineers and the scientists that are doing that and then doing that work on the ground, because that’s a form of local governance, instead of dealing with these big monstrous bureaucratic systems that the province is [going to] have. It’s gonna make you push paper and travel and take up all your time, right?” By providing communities the opportunity to develop capacity in this way, working relationships are strengthened, and Indigenous communities are empowered rather than being discouraged.

Conclusion

The intent of this chapter was to present, as accurately as possible, the opinions of various experts regarding key considerations for cervid management, especially in regard to CWD, and the potential involvement of Indigenous communities and their knowledge. The rationale for consulting experts on these issues is to gain a clearer understanding of the concerns that need to be addressed. These results are informed by the comprehensive expertise of participants consulted for this research, and therefore constitute a level of understanding and consideration that is the result of extensive research and experience. While some of the opinions presented here deviate from a more textual understanding of wildlife management and Indigenous engagement, they are nonetheless part of the overall narrative of Indigenous relations and wildlife management in Alberta.

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CHAPTER 4 - DISCUSSION

Introduction

Research has suggested that Indigenous harvesters might support monitoring and management of CWD in areas where the disease has become established (Parlee et al. 2014). Indigenous populations are not only a key stakeholder but stand to be negatively impacted by the continued encroachment of CWD into traditional harvesting areas. The goal of this research was to elicit the opinions of experts regarding (1) *what are the key issues that need to be considered in the management and monitoring of deer, moose and other cervids in Alberta*; and (2) *what are the key opportunities and challenges with respect to greater involvement of Aboriginal peoples in management and monitoring of deer, moose and other cervids in the province*? (3) *who is currently involved in the management and monitoring of moose, deer and other cervids in the province, and what their roles and contributions are*; and (4) *what roles experts think Indigenous Knowledge could play in the monitoring and management of moose, deer and other cervids in the province*. Expert opinions were sought for this thesis in a preliminary effort to better understand the major concerns surrounding cervid management, specifically for CWD, and the potential role that Indigenous communities and their knowledges can play in supporting management efforts towards containing the disease. There are six major themes that comprise this discussion: (a) Active organizations; (b) Managerial and scientific considerations; (c) Indigenous non-participation; (d) Potential roles for Indigenous hunters and their knowledge; (e) Potential challenges; and (f) Social Scientific considerations. Several sub themes are discussed within these broader categories and will be addressed in turn.

There has been a noticeable increase in the number of cervids that have tested positive for CWD in Alberta since 2015. Results from the 2017 and 2018 hunting season indicate that the range of disease spread has advanced north and west of the CWD endemic zone (AEP 2018). Indigenous communities in the Treaty 6 area of the province, within WMUs 500, 258, 254, have been in the mandatory surveillance zone since at least 2015. The results of this chapter reveal that there are challenges regarding the representation of Indigenous hunters in the management of cervids in Alberta. It is suggested that Indigenous hunters are ideally positioned to support identification of disease spread into new areas, but Western science experts' limited perceptions of the role that Indigenous Knowledge can play in wildlife management is a barrier. Importantly, the results

indicate a need for meaningful collaboration with Indigenous peoples as partners to support management efforts and to provide capacity in an effort to support local governance.

Active organizations

Organizations and groups that are in some way part of or engaged in the process of cervid management in Alberta, fall into two main groups: those that are represented by the provincial government and have an avenue to express their concerns (i.e., the Alberta Conservation Association, the Alberta Professional Outfitters' Society, and the Alberta Fish and Game Association); and those who mostly do not (i.e., Indigenous groups). Groups with formal representation such as APOS, AFGA, and the ACA, all support the ideology of conservation and responsible stewardship which are reflective of the wildlife management priorities set by the provincial government (APOS n.d.; AFGA 2017a; ACA 2018a). Non-Indigenous hunters, wildlife recreationalists, and conservationists all share a disproportionate level of representation in wildlife management in Alberta. This is clearly evidenced by the very structure and approach the provincial government has taken with its administration of support for these groups.

Organizations under the direction of the Ministry of AEP as DAOs include the ACA, APOS, and AFGA (ACA 2018a; APOS n.d.; AFGA 2017a). These organizations operate as administrative extensions of the provincial government but are funded by public dollars and represent, primarily, the economic interests of non-Indigenous, recreational hunters. The information collected by each group is used to inform AEPs directives and management efforts, for example, data generated by the ACA “feed[s] directly into AEP management plans and form[s] the basis for fishing and hunting regulation changes and evaluations of new management strategies” (ACA 2018).

As indicated by I10, Indigenous groups in the Treaty 8 area largely ignore, decline, or otherwise do not engage with the provincial government on the issue of cervid management and tissue sampling. This could be, as I8 speculates, due to the fragile nature of competition between Indigenous and non-Indigenous hunters' access to harvesting sites, or as reflected in the literature, a result of capacity limitations (Mills 2017, 168; McKay and Johnson 2017, 22). Why Indigenous groups are not as engaged—even though they implicitly participate in management by harvesting animals and have some level of presence at meetings—is certainly an issue for further exploration. What is clear is that Indigenous hunters (i.e., First Nations and Métis

communities) are not afforded the same level of representation as their non-Indigenous counterparts. There is some indication that Indigenous participation in groups such as the ACA is mandated but this alleged participation is predicated on a vague sense of consultation and engagement; as I4 put it “You can’t just say ‘the invitation is there, come into my house,’ when it’s a completely different, very different culture and the power dynamics are so skewed.” The role of Indigenous peoples in cervid management is not clearly defined, and as the remainder of this discussion will suggest, it may be an intentional oversight and part of the ongoing depoliticization of Indigenous concerns over the status of subsistence species such as moose, elk, and deer.

The Effective Management of CWD in Alberta: Some Considerations

In keeping with the literature on the ecology of PrP^{CWD}, findings here indicate that the complications associated with environmental infectivity of prions in soil (Hannaoui, Schätzl and Gilch 2017; Zabel and Ortega 2017; Wyckoff et al. 2016; Saunders, Bartz and Bartelt-Hunt 2012; Walter et al. 2011), are factors that negatively impact the effective management and containment of CWD in environmental reservoirs and within the CWD endemic zone in southern Alberta. Regional environmental challenges including industrial development and the associated impacts to Indigenous subsistence practices are issues that may potentially impact future efforts towards management of CWD spread into northern Alberta but were not addressed here (McLachlan 2014; Parlee, Geertsema and Willier 2012). As indicated in the literature (Fisher et al. 2017; Dawe and Boutin 2016), optimal conditions for cervid migration associated with linear features and reduced snow cover add to the ability of potentially infected white-tailed deer to transmit CWD further north. These issues were raised by respondents as key considerations for cervid management and monitoring in the province.

Funding constraints and the cost associated with conducting aerial surveys were cited as a prohibitive factor that is contributing to inadequate surveillance (herd counts), which complicates cervid monitoring, and may therefore lead to encroachment of CWD into new areas. This finding is consistent with research conducted in Alberta on aerial surveys of cervid populations which indicates that the most cost-effective method of cervid monitoring, in this case moose, is hunter surveillance (Boyce, Baxter and Possingham 2012, 340). Therefore, relying on hunter

surveillance of cervids through sample submissions, especially in the mandatory surveillance zone, is in keeping with funding constraints of cervid management overall.

In terms of the ease, effectiveness, and cost associated with methods of testing for PrP^{CWD} in hunter harvested samples, I7 and I9 both suggested that researchers need to continue developing new ways of testing that don't necessarily involve submitting heads. Sample collection in Alberta relies on hunter submissions to test for PrP^{CWD}, yet other methods of detection, including fecal samples (Henderson et al. 2017; Cheng et al. 2016; Pulford et al. 2012), rectal mucosal biopsy (Haley et al. 2016; Haley et al. 2011), urine samples (Henderson et al. 2015), and saliva samples (Mathiason et al. 2006) are emerging methods of detection that may allow for ease of collection in the future. Identification of the disease in the field was a theme discussed by I6, I7, and I9, as a means of helping hunters (both Indigenous and non-Indigenous) to quickly and correctly identify an infected animal in the field, and potentially enable a sense of autonomy. The absence of Indigenous hunter samples is an issue that I7 suggested could be addressed with newer approaches to sample collection. Should these methods of collection emerge as alternatives, it may allow for increased participation of Indigenous hunter populations who have thus far remained absent from CWD surveillance.

One important aspect of effective wildlife disease management is the incorporation of public risk perceptions associated with exposure to wildlife diseases, potential impacts to human health, and the communication of risk to key stakeholders and the public (Decker et al. 2012; Decker et al. 2006; Hanisch-Kirkbride, Riley and Gore 2013). I6 and I10 both referenced prior discussions with Indigenous community members who were concerned about the potential dangers associated with consuming meat that may be diseased and being able to differentiate between specific diseases. It was noted that Indigenous hunters in the field are likely unable to make the distinction between CWD and other diseases that may be affecting cervids in the area. Moose health, a key species for Indigenous communities, was a particularly salient point of discussion referenced by I6 and I10 (McLachlan 2014, 112; Van Oostdam 2005). Going forward, special consideration should be made to address concerns about moose.

As mentioned earlier by I10, some Indigenous hunters are travelling longer distances to harvest animals due to increased industrial and agricultural development, and even travelling across

borders in search of animals to harvest. Coupled with the impact of wildlife disease already present in local herds and the perceptions of risk associated with consuming diseased animals, there could be increased disincentive to continue harvesting animals in regions where CWD has become established and in locations that are vulnerable to the emergence of the disease. Although the risk associated with CWD transmission to humans still remains low, risk communication programs should be implemented—if they haven't been already—to inform Indigenous hunters about necessary precautions, and symptoms associated with CWD (Driedger et al. 2013; Friendship and Furgal 2012; Myers and Furgal 2005). Reduced public engagement with herds resulting from perceived risk (Vaske and Lyon 2011; Zimmer, Boxall and Adamowicz 2012; Truong, Adamowicz and Boxall 2018) was considered a management issue by I5 in respect to hunter harvested sample submissions and the reliance on these samples for identification of CWD in specific herds. Should hunters perceive a risk to human health, it is speculated that they may relocate. As indicated by I10, some Indigenous hunters appear to be relocating to other areas to hunt ahead of any immediate CWD threat in the Treaty 8 area. By reducing engagement with important subsistence species, making dietary substitutions—which we're already observing in northern Alberta communities (McLachlan 2014, 117; Parlee, Geertsema and Willier 2012), and increasing the burden of cost associated with increased travel, Indigenous hunters stand to be negatively impacted should CWD become established in an already sensitive area for cervid populations (Hoberg et al. 2008, 15). Taken together, these perspectives reflect the need for (1) cost effective methods of data collection to consistently and adequately identify CWD in cervids, in the environment—perhaps even the development of real-time testing; and (2) to work more closely with stakeholders, especially Indigenous hunters, to address concerns regarding cervid health. To do this, both managers and Indigenous communities will need to work together, and long-standing issues will need to be addressed (McKay and Johnson 2017, 16).

Research on the management of wildlife diseases, specifically CWD, is a multi-faceted endeavour. Effective wildlife disease management focuses on the identification of the disease in wildlife and the environment, is attentive to public needs surrounding impacts and communication, and is continually trying to improve management objectives and actions by engaging stakeholders and investigating conditions associated with wildlife disease. Nearly all participants agreed in varying ways that management and researchers need to pay attention to

and address issues of prion ecology, pathogenesis, and halt encroachment of the disease into newer areas. Interestingly, there were two diverging perspectives presented by participants that pointed to the larger issue of Indigenous engagement and participation that have been widely discussed in literature on natural resource management. As indicated here and elsewhere, conflicts associated with cross-cultural engagement and the necessity of Indigenous consultation within the broader framework of wildlife management are not unique; they are in fact, quite common (Plummer, Armitage and de Loë 2013; Berkes 2009; Brook et al. 2009, 267; Nadasdy 2005; Castro and Nielsen 2001). More participatory methods of research and engagement have been suggested as potential bridges towards establishing good working relations between Indigenous communities and government (Ferrazzi et al. 2018; McKay and Johnson 2017; Angelbeck and Grier 2014; Brook et al. 2009; Natcher 2001). Community-based participatory methods of management and monitoring have shown advantages towards making social links and supporting good working relationships between Indigenous and non-Indigenous partners (Trimbel and Berkes 2013). Examples of more equitable power sharing within wildlife co-management boards have shown that increased Indigenous participation at all levels of governance, relationship building, and conflict resolution are important for achieving effective wildlife management (Armitage et al. 2011; Berkes 2009; Carlsson and Berkes 2005). Although, as I2, I1, I3, and I6 point out, cost and time constraints can be potential barriers for researchers and managers who may be working on limited timeframes and under financial constraints. In consideration of cost in monitoring cervid populations for CWD in Alberta, hunter sample submissions are the most financially effective and “cheap” option comparatively (Boyce, Baxter and Possingham 2012). Owing to such constraints, it would be particularly advantageous to engage Indigenous hunters who likely spend a significant amount of time on the land.

Indigenous Abstention: *Refusal?*

Interviewees I1 and I2 made a point of discussing the absence of Indigenous hunters/community members in the monitoring and management of cervids in Alberta. The absence of First Nations harvest data was cited as a complicating factor towards management of cervids, impeding adequate harvest quotas for non-Indigenous hunters. Comments suggesting Indigenous peoples are “disinterested,” or somehow wilfully disengaged places the onus of participation and engagement squarely on Indigenous communities, requiring them to bring their concerns to the government or particular agency. According to wildlife disease management frameworks, the

provincial government (AEP) should be actively seeking consultation with Indigenous communities on the issue of CWD, especially those communities who are within the mandatory surveillance zone, to better understand the situation, and to improve management of the disease (Langwig et al. 2015; Siemer, Lauber, Decker and Riley 2012; Decker et al. 2006). It was not made clear by interviewees whether or not the province has taken any steps towards engaging communities on this matter.

Speculation from participants over why Indigenous communities decline participation or choose to be disengaged pointed to a perceived fear and loss of control over the resource—an issue related to Indigenous sovereignty and one that has been discussed in co-management literature (Suluk and Blakney 2008, 67). Interestingly, I10 points out that Indigenous communities largely don't engage with the Alberta government on matters of land use and harvest data collection due to mistrust. A review of the literature illustrates that the government of Alberta, in its interpretation of the duty to consult, has to a great extent, damaged its relationship with Indigenous communities in the province, especially in the oil sands region (Mills 2017, 178; Laidlaw 2016, 66; MacKinnon, Apentiik and Robinson 2001). The Alberta government determines when consultation with Indigenous communities should be triggered, how the process will unfold, the timelines communities have to fulfill requirements of consultation, and has the ability to override a decision should a community fail to meet the set requirements. This interpretation of consultation has been largely criticized for its paternalistic approach, harsh time constraints, and for its disregard for meaningful engagement (Baker and Westman 2018; Mills 2017; Laidlaw 2016; Passelac-Ross and Potes 2007).

Consultation in situations involving wildlife disease management is much different than those involving community consultation and resource development. Joly et al. (2018) explore the theoretical concept of indigenous reluctance or non-participation in Métis communities in Alberta subject to Traditional Land Use (TLU) mapping as a method of *Ethnographic Refusal*. By actively choosing to withhold information, or refuse participation, Indigenous communities assert their sovereignty through one of the few remaining forms of resistance available to them (Joly et al. 2018). I1 and I2 alluded to the overt non-compliance of Indigenous communities in providing monitoring data and the associated complications. However, as the literature will attest, the central concern may not be a careless disengagement by Indigenous communities, but

rather, an active and politically charged *refusal* in response to the continuing disappointment associated with Indigenous consultation and engagement in Alberta (Simpson 2007, 2014, 2016). Ultimately, the relationship with Indigenous communities has been damaged, and the provincial government has a responsibility to engage Indigenous communities in an effort to protect the health of community members. As well, this “disengagement” can be further understood as a consequence of limited capacity since many Indigenous communities operate with restricted budgets, inadequate manpower, and insufficient technical training (Baker and Westman 2018, 149; Mills 2017, 168; McKay and Johnson 2017, 22; Udofia, Nobel and Poelzer 2017, 170; Youdelis 2016, 1384; Suluk and Blakney 2008, 67; Natcher 2001, 117). Taken together, the climate of distrust emerging from inadequate consultation policies, the limitations of Indigenous community capacity and the enactment of limited sovereignty could be complicating the engagement and compliance of communities on the issue of CWD and cervid management.

The Potential role of Indigenous Hunters and Indigenous Knowledge in Cervid Management

Participants identified the frequency and duration of time Indigenous hunters spend on the land, and their resulting knowledge as a key advantage that could be used to potentially help detect CWD. This idea has also been recognized elsewhere (McKay and Johnson 2017, 22; Berkes 2018; Natcher 2000, 367). It was widely acknowledged by participants that Indigenous hunters would be more attuned to less noticeable changes in the environment and in cervids compared to non-Indigenous hunters who spend less time out on the land. Because of this, I3, I6 and I7 felt that Indigenous hunters would be well suited to filling observational gaps, alerting management to changes in herds, and ultimately facilitate data collection as citizen scientists. In addition to CWD monitoring, I3 suggested that Indigenous hunters in northern areas of the province could provide supplementary data that would contribute to ongoing research regarding white-tailed deer range expansion, and the encroachment of CWD into northern regions of the province (Fisher et al. 2017; Dawe and Boutin 2016; McLachlan 2014; Parlee et al. 2014; Gallana et al. 2013; Parlee, Geertsema and Willier 2012; Saunders, Bartelt-Hunt and Bartz 2012).

Going further, I6 advanced the notion that Indigenous Knowledge is capable of providing insight into the observed changes in herd status over time and the current status of herds, which requires a move away from the validation of Indigenous Knowledge towards a mode of acceptance. I8

further suggests that Indigenous Knowledge form the basis of management and act as the starting point for inquiry. Although I2 and I10 both noted that Indigenous hunters may not be able to differentiate between CWD and another disease affecting a cervid by examination, I8 and I10 believed that Indigenous hunters would be capable of providing an indication of abnormalities and physical signs of disease which already inform hunters whether the animal was safe for consumption. There is an expanding body of literature on health indicators used by Indigenous hunters that demonstrates the usefulness of this information in helping to assess cervid health (Tomaselli et al. 2018; Parlee et al. 2014; Lyver and LKDFN 2005; Moller et al. 2004). It is clear that Indigenous communities rely on cervids as a subsistence resource and place social and cultural significance on these species as well (McLachlan 2014). Providing samples, and Knowledge of overall cervid health then, could help support traditional lifeways associated with cervid harvesting.

Western Scientific Perspectives: Challenges?

Participants working within Western scientific fields predominantly focused on issues of compliance, bias, cultural differences, “political stuff,” effort versus expenditures, and disengagement when considering Indigenous engagement in monitoring and management of cervids. Although no further clarification was given for what constitutes “political stuff,” this thesis speculates that this category is largely constitutive of Indigenous cultural, social, and economic concerns that are generally considered inconsequential to the larger discussion of technical management issues. Drawing from personal experience engaging First Nations communities in the north, I2 explains that one of the most significant barriers researchers face when working with Indigenous peoples is the amount of effort required to extract data. Expanding on these challenges, I2 discussed bias in harvest reporting as an example. This example illustrates the point that Indigenous people can be self-interested and dishonest when providing harvest data if they believe it will suit their interests, and these potential falsehoods may not be reflective of actual harvests. In the case of Beluga whale harvests in Nunavut, researchers were aware prior to data collection that *strategic bias*—hunters under-reporting their reliance on a resource due to the misconception that the data collected were intended to limit harvest quotas, coupled with the cultural tendency not to brag, and the historical precedent of certain species being illegal to hunt—may be an issue (Suluk and Blakney 2008, 64; Priest and Usher 2004, 7; Usher and Wenzel 1987). Although the data collected in the Nunavut case was

not reflective of actual harvests, it did illustrate the point that Inuit were cautious and refused to comply with data collection due to the perception that researchers and government officials were there to further “number, regulate, restrict, impose quotas, and take away Inuit control over their livelihoods” (Suluk and Blakney 2008, 67). The fear over potential harvest restrictions and harsh quotas is, according to historical evidence, a part of the record of Indigenous/state relations in Alberta as well (Hall 2015; Sandlos 2007; Loo 2006; Fumoleau 2004; Calliou 2000). Fear of potential restrictions on harvesting in Alberta may be another catalyst for what is perceived to be Indigenous non-participation in cervid monitoring, and yet another reason why communities engage in refusal (Simpson, 2007, 2014, 2016).

I1 discussed “shooting out herds” or “poaching” which brings focus to the issue of political ontology, that suggests the understanding of nature is simultaneously multi-faceted and imbued with power (Gombay 2014, 3). It is productive to contextualize the underlying ontologies and epistemologies of individuals in control of resource management—in this case CWD management—as a means of drawing our attention to the underlying power imbalances that exist between Indigenous communities and the state. Existing research asserts that provincial/territorial wildlife management is an extension of settler colonial control which results in the continued denial of Indigenous land sovereignty (Coulthard 2014; Sandlos 2007; Loo 2006; Beinart and Hughes 2007; Asch 1989). As the North American Model of Wildlife Management asserts, wildlife is a public trust resource through which science and the state administer access and control (Organ et al. 2012). CWD management falls under the purview of the province and scientists. Ultimately, the references to strategic bias in harvest reporting and herd mismanagement by Indigenous peoples are intended to call into question the legitimacy of Indigenous harvesting practices and provide clarity on the Western scientific perspective that may view these methods as “dumb,” “unreasonable” or unscientific (Nadasdy 2005; Stevenson 2004). I1 may perceive the “shooting out” of moose or caribou to provide for the community as a miscreant act; alternatively, it could be understood as an exercise in self-determination (Gombay 2014). Interestingly, cases of Indigenous stewardship (i.e., unregulated hunting) over moose in Alberta, for example, have proven to be productive while simultaneously being perceived as biased (Lynch 2006). Legitimate forms of wildlife management then, as I1 explains in the case of the Wind River Indian reservation in Wyoming, are those that include more government and scientific oversight. Suffice to say, discrepancies over the “correct” method of wildlife

management is not a discussion that helps ascertain any clarity on the issue of CWD management and Indigenous engagement.

Social Scientific Perspectives: Capacity, Reflexivity, and Local Governance

Social scientific perspectives reflected in this research tended to focus on the need for wildlife managers and scientists to engage meaningfully with Indigenous communities, educate themselves on the colonial histories of Indigenous peoples they engage with, and engage in systematic critiques of their own fields (Brummans 2015). Issues such as “cultural superiority,” “cultural authority,” and “political control,” were referenced in discussions that turned the focus towards a need for non-Indigenous researchers and managers to reflexively engage with their own fields in order to move forward with Indigenous peoples in a meaningful way. The Truth and Reconciliation Commission calls to action #57 recommends that “the federal, provincial, territorial and municipal governments...provide education to public servants on the history of Aboriginal peoples, including the history and legacy of residential schools, the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), Treaties and Aboriginal rights, Indigenous law, and Aboriginal-Crown relations. This will require skills-based training in intercultural competency, conflict resolution, human rights, and anti-racism” (TRC 2016). In Alberta, intercultural capacity training has recently been mandated as a requirement for all public servants in the province. As indicated here by I6, and I4, this training is a necessary primer for engaging with Indigenous communities. Research indicates that scientists and managers working in Indigenous contexts generally have a poor understanding of the cultural and political conditions in Indigenous communities (Baker and Westman 2018, 149; Suluk and Blakney 2008, 67) and would benefit from intercultural capacity training that places emphasis on cultural or epistemological differences between Western scientific and Indigenous perspectives (Natcher, Davis and Hickey 2005). To do this well, according to I6, requires the co-creation of a space where both groups can come together and work from a place of respect where other ways of knowing are valued and accepted (Gratani et al. 2014; Lynch, Fell and McIntyre-Tamwoy 2010; Turnbull 2009; Tester and Irniq 2008). Working together then, may require more effort from management rather than Indigenous communities.

Reflective of the literature on Indigenous Knowledge and knowledge integration, Interviewees stated that (1) Indigenous Knowledge needs to be more accessible to Western scientific

researchers and managers; and (2) that Indigenous Knowledge is generally misunderstood and invalidated by Western scientists. I2 and I3 both felt that Indigenous peoples need to go beyond oral history as a method of data sharing and methods of integration need to be explored to make better use of Indigenous Knowledge. What these responses may indicate is the persistence of valid and invalid knowledges (Marlor 2010; White 2006; Nadasdy 2003). The underlying discrepancy between what Indigenous Knowledge is and what it is perceived to be by Western scientific experts interviewed here, paralleled many of the ongoing debates regarding meaningful incorporation of Indigenous Knowledge into natural resource management (Ludwig 2016, 36; Marlor 2010, 514; Nadasdy 2003; Agrawal 1995). There is a growing body of literature that criticizes Western scientists and natural resource managers for failing to accommodate the holistic nature of Indigenous Knowledge (Berkes 2018; Irlbacher-fox 2014; McGregor 2004, 398; Nadasdy 1999), and even more literature that questions the validity of research and management that seeks to integrate Indigenous Knowledge in a manner that further disempowers Indigenous peoples (Ludwig 2016; Gratani et al. 2014; Evering 2012; Henri 2012, 313; Bohensky and Maru 2011; Stevenson 2006, 172). Although I6 concedes support for the idea of ongoing Western scientific validation of Indigenous Knowledge as a resolution towards acceptance of this Knowledge, this approach has been scrutinized in the literature (Evering 2012, 363; Brook and McLachlan 2005, 2; Moller et al. 2004, 11-12; Usher 2000), and has yet to offer tangible benefits to Indigenous communities. Accommodating the Western scientific requirement that data be convenient is akin to exploitation in that the needs and requirements of the community from which the data originates, is not considered (Brook and McLachlan, 2008, 3510; McGregor 2004, 397; Nadasdy 1999; Cruikshank 1998, 53). By “filtering” Indigenous Knowledge into useable information for Western scientists, the holistic nature of the problem—how CWD is impacting the social, cultural, and economic lifeways of Indigenous communities—is ignored. By decontextualizing Indigenous Knowledge and removing these aspects from the broader discussion on cervid management and the impacts of CWD in Indigenous communities, Western scientists stand to control the ways in which this problem is understood (Nadasdy 2005).

An interesting perspective shared by I6, reveals the tension between the ability of the provincial government (scientists and managers) and Indigenous communities to engage in an effective way that is mutually beneficial to both parties. The issues of concern presented here largely represent

a deficiency in the capacity of the provincial government and researchers to address the historical inequities experienced by Indigenous communities and accept the limitations of euro-Canadian bureaucratic approaches to engaging Indigenous communities and their knowledges (Baker and Westman 2018; Marlor 2010; White 2006; Nadasdy 2005). Another option, according to I4, requires Western scientific researchers and managers take a reflexive approach to engagement with Indigenous peoples by acknowledging the systemic disadvantages, disincentives, and established hierarchies that persist between Western scientific researchers, managers and Indigenous communities. Critical reflexivity interrogates the established hierarchies and legacies attributed to specific entities or disciplines (Brummans 2015; Nicholls 2009). By engaging in a manner that incorporates a reflexive approach, it is suggested that the systemic inequities attributed to colonial projects can be acknowledged and perhaps addressed. The Alberta government has a long history of negligence in its responsibility to Indigenous communities (Mills 2017; MacKinnon, Apentiik and Robinson 2001), and over time, this has soured the relationship between these communities and the provincial government. These shortcomings point to an overt depoliticization of Indigenous concerns and epitomize the imposed limitations of inadequate funding, narrow timelines, and a general lack of interest towards engaging Indigenous on issues beyond natural resource development. Reflexive approaches then, could assist in breaking down long standing barriers that persist between Indigenous communities and the Alberta government.

As indicated here, most First Nations prefer to be consulted directly due to the varying needs and limitations of each community to respond. Although capacity (both intercultural training and funding) is necessary to bridge these gaps, in the age of reconciliation, purposeful steps are required to support both better conditions for Indigenous communities, and effective working relationships with the provincial government (TRC 2016). I4, I6 and I8 all referred to community-based participatory frameworks that could facilitate community capacity, relationship building and trust, knowledge sharing, and collaborative research. Participatory methods such as community-based monitoring have shown promising results towards informing future research, identifying impacts, supporting community capacity and local governance (Tomaselli et al. 2018; McKay and Johnson 2017; Parlee et al. 2014; Adams et al. 2014; Bell and Hardwood 2012; Brook et al. 2009). By moving away from extractive methods of engagement with Indigenous communities, an openness and acceptance of other ways of knowing will be

required. This will involve, as I6 points out, the creation of a system “where the knowledge holders themselves feel that they have a place and they’re not just handing their wisdom off to somebody who is then going to break it down and take the meaning out of it.” In so doing, Indigenous communities can become empowered rather than immobilized. The hope then, going forward, is that the provincial government will begin to take steps towards mending its relationship with Indigenous communities in the province, and initiate the process of participatory management of cervids that recognizes the validity of Indigenous Knowledge, and the expertise Indigenous communities have to offer.

Conclusion

This research sought to explore the diverse perspectives of various experts regarding cervid management, specifically for CWD, and the inclusion of Indigenous peoples and their knowledge as part of the management and monitoring process. As an investigative exercise, this research offers an outline of the key issues, according to experts, that need to be considered going forward. The insights gleaned from this data offers a clearer understanding of the challenges and opportunities with respect to management of CWD, and the involvement of Indigenous communities who are likely impacted by the disease. According to experts, the most pressing concerns regarding CWD management include environmental factors that contribute to disease spread, and the lack of data available from Indigenous communities. Taken together, these two issues serve to complicate the overall effectiveness of CWD management. While these issues are valid, they offer only a narrow focus. A more urgent concern, according to experts who generally fall outside of the Western scientific community, is the need for managers and scientists to engage with Indigenous communities in a manner that is reflective of reconciliation, and one that supports the ability of these communities to engage as equal participants. Overall, this research offers insights towards wildlife management, and the engagement of Indigenous peoples and their knowledge in management by contributing to an understanding of concerns for managers, scientists, and Indigenous peoples. The findings presented here emphasize the need for managers and scientists to reconsider their approach with Indigenous communities and engage with them in a more considerate manner.

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CHAPTER 5: CONCLUSION

Summary

This thesis focused on the opinions of various experts from a range of disciplinary, social, and cultural backgrounds. These opinions were elicited in an effort to better understand the landscape of wildlife management in Alberta. A secondary literature review was conducted to determine the potential for co-management of cervids for CWD between the province of Alberta, researchers, and Indigenous communities. A primary concern regarding Indigenous engagement in cervid management is a consideration of the role that Indigenous hunters and their knowledge can play in the monitoring and management of cervids, with special attention paid to CWD. Ultimately, this thesis, as a preliminary investigation into the aforementioned objectives, poses more questions than it answers. The most compelling results from this research point to certain persistent tensions between the opinions of various experts regarding, foremost, the level of involvement Indigenous peoples and their knowledge can play in monitoring of cervids for CWD. While nearly all interviewees agreed that Indigenous peoples are primed to provide early indications of the encroachment of CWD into newer areas, a canary in the CWD coal mine so to speak, participants whose backgrounds were associated with STEM fields tended to position the level of participation Indigenous peoples can have as limited. On the other hand, interviewees whose backgrounds were more aligned with social science disciplines tended to diverge from these opinions, and instead focused on the need for reflexive approaches, intercultural capacity training for scientists and managers, and the need for Indigenous peoples to play more than a cursory role in the monitoring and management of cervids, especially for CWD.

One of the primary goals of this thesis was to better understand who is involved in cervid management and monitoring in the province, and what their roles and contributions are. This research finds that there is a somewhat nebulous assemblage of groups who are involved in cervid management and monitoring in Alberta. Further investigation into the organizations identified by experts reveals that the majority of the groups involved in cervid management and monitoring in Alberta, largely operate as extensions of the provincial government. Organizations such as the ACA, AFGA, and especially APOS, represent the interests of non-Indigenous stakeholders involved or in some way invested in wildlife. The feedback provided by these groups (i.e., research, surveys, member meetings) is used to inform management decisions made by the provincial government. Although Indigenous participation is mandated by some of these

groups, seats remain unfilled. With this in mind, it is important to note that consultation with Indigenous communities requires more than just an open door. Although informal linkages are being made across Indigenous and government groups regarding cervid management, more effort needs to be made to actively and meaningfully engage Indigenous communities to monitor for CWD.

Western science experts interviewed for this research recognize two main concerns regarding cervid and CWD management in Alberta: (1) the need for further scientific knowledge regarding disease infectivity, uptake, mobility, and spread; and (2) the need to address social aspects of disease transmission and ameliorate issues of risk. As indicated here, Indigenous hunters may already be relocating from local hunting sites to locations further away due to stressors in the environment and the quality and availability of animals to hunt. Being able to test animals on the ground, in real-time, and being able to discern between specific diseases in harvested animals, with some level of certainty, may give Indigenous hunters the confidence to continue harvesting in traditional territories and potentially lead to co-operation with sample submissions.

Ultimately, Western scientists interviewed were concerned about the level of engagement Indigenous peoples have in monitoring and management of cervids, especially for CWD. Opinions between interviewees from Western scientific and social scientific backgrounds diverged when considering greater involvement of Indigenous peoples in cervid monitoring and management. Key challenges identified by Western scientific experts highlighted the need for Indigenous communities to “demonstrate a willingness” to participate, while social scientific experts focused on the need for Western scientists and managers to recognize their inherent biases and deeply discriminatory beliefs. The perception that Indigenous communities are disinterested, intentionally non-compliant, biased, distrustful, irresponsible, and working with them can be time consuming and costly was seen as a challenge towards engaging these communities. The charge that Indigenous peoples are irresponsible, and mismanage herds goes back to a time before treaty when RCMP officers and Indian agents, who presided over Indigenous peoples and their lands, scrutinized their every move (Hall 2015; Sandlos 2007; Loo 2006; Fumoleau 2004; Calliou 2000). Many of these administrators were harsh in their condemnation of Indigenous peoples and in the subsistence practices that have sustained them for centuries. These sentiments were picked up again by conservationists and park managers and

used to reinforce the narrative, albeit false, that Indigenous peoples should be further restricted, regulated and ultimately denied access to “the resource.” These claims have a history, and they have been consistently used to delegitimize, remove, and further disenfranchise Indigenous peoples from the lands and animals critical to their survival. These same scripts are used to further legitimize western scientific hegemony over management and conservation as the only responsible and efficient means of controlling wildlife.

Indigenous peoples choose to disengage in some circumstances because the climate of consultation and accommodation in this province is hostile and not conducive to making space for conflict resolution and supporting good working relationships. Refusal in this context is not an act of insubordination against sensible management and science; rather, refusal is a response to the inadequacies of consultation, the lack of meaningful engagement, the limitations of capacity and the desire to be heard. In this sense, refusal draws our attention to what is not being said (Simpson 2007), and instead, places focus on the reasons for inaction (Tuck and Yang 2014, 20; Baker and Westman 2018, 145; Simpson 2016, 328). There is a critical need for Western scientist and managers to engage with Indigenous communities by undertaking intercultural capacity training and supporting the development of a space where both knowledge groups can come together and accept that other ways of knowing are valid in an effort to work together.

Experts overwhelmingly acknowledged that Indigenous hunters would be attuned to small scale changes that intermittent hunters may not notice, and as a result, would potentially inform management that CWD was present in traditional territories. However, beyond providing an early indication that CWD may be present, Western scientific experts mostly suggested that Indigenous Knowledge would be more appropriate for filling gaps in scientific knowledge by providing animal sightings to support research on range expansion, or as citizen scientists—a role that provides little opportunity for capacity development or any measurable degree of political change. Other experts suggested more involved roles that Indigenous hunters could facilitate such as, supporting newer methods of testing, and providing post-mortem health indicators such as body condition, and visual abnormalities. Interestingly, Western science experts mostly defaulted to the position that Indigenous Knowledge was not suited for disease diagnosis, which resonates with the level of confusion hunters have been expressing—according to I10 and I6—out on the land. As a result, it is speculated that hunters may be observing

irregularities in cervids that they are unfamiliar with and may be overwhelming their ability to determine what the underlying causes are.

The uncertainty over how to integrate Indigenous Knowledge came down to the following central issues: that Indigenous Knowledge should fit within Western scientific frameworks and be accessible to scientists; and that Western scientists need to be more accepting of Indigenous ways of knowing and acknowledge that existing systems of management and research do not accommodate such holistic knowledge. Furthermore, non-Indigenous researchers and managers require additional training on cultural, social and political issues relevant to Indigenous communities, while communities require the technical and financial capacity necessary to have their concerns adequately addressed. Participatory methods of research and engagement have a demonstrated ability to enable more equitable partnerships between Indigenous communities and their government counterparts. Undoubtedly, there are underlying tensions between the provincial government and Indigenous communities in Treaty 8 and Treaty 6. To ameliorate these pressures, relationship building and increased involvement with communities will be necessary to develop trust.

Areas for further research

This research was intended to provide a preliminary understanding of the key issues regarding cervid management (for CWD), and considerations towards the potential involvement of Indigenous communities in Alberta. The findings here indicate that there is a demonstrated need to reconceptualize the current pathways to engagement between Indigenous communities in Alberta, and the provincial government in its various capacities as administration and research. Future research could focus on bridging the divide between Indigenous communities and the provincial government by taking a community-based participatory approach to research (e.g., harvest-based monitoring, or participatory action research). As suggested here, participatory methods of engagement place researchers and scientists within the community and offer the opportunity for co-learning between groups, in addition to fostering trust and developing good working relationships. Further, since this research was limited to eliciting the opinions of experts through qualitative methods, an approach to research that seeks to engage critically with Indigenous communities as co-researchers, could support political or social change.

As indicated here, Indigenous hunters may be moving further away, even crossing provincial or territorial boundaries to hunt. Reasons why hunters are relocating is a potential avenue for future research since the focus in this thesis was to gather the opinions of experts, not community members. Understanding the social, economic, and cultural impacts of relocation on Indigenous hunters is an important first step towards understanding the needs of Indigenous communities. As well, addressing any underlying issues Indigenous hunters may have towards working with the provincial government, or research bodies affiliated with CWD, could help to clarify concerns hunters may have regarding engagement with the province since Indigenous communities are largely absent from management and monitoring efforts in Alberta. Organizations affiliated with cervid management and research, especially related to CWD, should take steps towards engaging Indigenous communities as partners rather than assuming that consultation is the responsibility of the community. Many communities in Alberta simply do not have the capacity to take on additional portfolios, even though they may be critically important to the community. The provincial government, with oversight on wildlife disease management and research, should be actively seeking input from stakeholders to inform policy directions and areas for future research. It is unclear whether AEP or any affiliated organization has consulted with Indigenous communities in the Treaty 6 or Treaty 8 area on CWD. Therefore, it is the recommendation of this research that these organizations, in an effort to re-establish good working relations with Indigenous communities, take the first steps towards consultation.

Concluding Thoughts

In Alberta, management efforts are primarily focused on containing the spread of CWD. These efforts are challenged by the limited resources available to assess the extent of the disease in the environment and in wild herds. Bringing together all stakeholders to support the common goal of protecting cervids is important. It is also important to acknowledge that there are other user groups (such as Indigenous peoples), who rely on cervids and have a fundamentally different relationship to the resource than non-Indigenous stakeholders. The focus on Indigenous communities as irresponsible or untrustworthy is not conducive to establishing good working relationships. Neither is relegating Indigenous Knowledge to anecdotal or supplementary data to support the ambitions of a state that wilfully chooses to ignore the current dilemmas many Indigenous communities face. It is hoped that future efforts will place an emphasis on reconciliation and engaging Indigenous communities as partners to wildlife management.

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Appendix A — Ethics Approval, Project Summary and Consent Form

Notification of Approval

Date: September 15, 2017
Study ID: Pro00074979
Principal Investigator: [Brenda Parlee](#)
Study Title: Tracking Change - Traditional Knowledge and Wildlife Health Monitoring in Alberta
Approval Expiry Date: September 14, 2018

Approved Consent Form: Approval Date 9/15/2017 Approved Document [Consent Form](#)

Sponsor/Funding Agency: Northern Scientific Training Program NSTP
PrioNet Canada (NCE) 7902

Sponsor/Funding Agency: CBAR

	Project ID	Project Title	Speed Code	Other Information
RSO-Managed	RES0020783	Alberta Innovates		
Funding:	RES0015443	NSTP Travel Award - KJansen	CG440	New Speedcode Pending

Thank you for submitting the above study to the Research Ethics Board 1. Your application has been reviewed and approved on behalf of the committee.

A renewal report must be submitted next year prior to the expiry of this approval if your study still requires ethics approval. If you do not renew on or before the renewal expiry date, you will have to re-submit an ethics application.

Approval by the Research Ethics Board does not encompass authorization to access the staff, students, facilities or resources of local institutions for the purposes of the research.

Sincerely,

Anne Malena, PhD
Chair, Research Ethics Board 1

Note: This correspondence includes an electronic signature (validation and approval via an online system).

PROJECT SUMMARY:**Tracking Change - Traditional Knowledge and Wildlife Health Monitoring in Alberta**

Researcher: Brenda Parlee, Arlana Bennett**Affiliation:** University of Alberta.**Working Title:** *Expert Opinions on the Potential Role of Indigenous Peoples in Wildlife Management in Alberta.*

Summary: Due to the evolving status of CWD in North America, and specifically Alberta, the research focus of this project has been amended. Although the original questions and interview data remain unchanged, the analysis and key literatures have been altered to reflect recent updates in CWD management and research. In keeping with ethical guidelines and standards, a new project summary and consent form have been developed to keep participants informed as to the changing nature of this project.

This research builds off of a previously funded Alberta Prion Research Institute (APRI) project led by Dr. Brenda Parlee in collaboration with Treaty 8 First Nations of Alberta. The goal of this research is to better understand how local Indigenous Knowledge of First Nations hunters could inform the monitoring and management of cervids (deer, moose and elk specifically) in relation to CWD in Alberta. Originally, this project sought to understand, more generally, the role Indigenous peoples could play in cervid management, broadly. The research questions, as mentioned above, have not changed and no further interviews will be required as a result of this update. The following is a list of the original interview questions:

1. *What is your current research area?*
2. *What are the key issues that you think need to be considered in management and monitoring of deer, moose and other cervids in the province?*
3. *Who is currently involved in the management and monitoring of moose, deer etc. and what are their roles and their contribution?*
4. *What are the key opportunities and challenges with respect to greater involvement of Aboriginal peoples in management and monitoring in the province?*
5. *What role do you think Traditional Knowledge could play in this monitoring and management?*

Interview transcripts have been forwarded to your email address. As well, a copy of the final thesis will be emailed to you once completed. Should you have any further questions, please feel free to contact either myself, Arlana Bennett, or Dr. Brenda Parlee.

Dr. Brenda Parlee
Office (780) 492-6825
email: brenda.parlee@ualberta.ca

Arlana Bennett
email: bennettc@ualberta.ca

CONSENT FORM:**Tracking Change - Traditional Knowledge and Wildlife Health Monitoring in Alberta**

Researcher: Brenda Parlee, Arlana Bennett**Affiliation:** University of Alberta.**Funding:** Alberta Innovates**Purpose:** The purpose of the project is to learn more about perceptions of challenges and opportunities regarding the management of cervids (deer, moose, and elk) potentially affected by Chronic Wasting Disease (CWD) in Alberta, and the potential involvement of Indigenous communities and their knowledges.**Timeline:** Initial scoping interviews were carried out summer 2017. Project completion is expected November 2018.

1. I would like to carry out an interview with you for our project. Have you understood the attached project summary as you have read it or as I have read it to you?Yes No The interview will last about 1 hour or less. Information will be recorded in hand-written notes and on audio/video recording equipment.

2. Have all of your questions about the interview or research project been answered?Yes No **3. Consent to Interview:** Do you understand and agree to participate in this research project as outlined above. Do you understand that you are not required to participate in this research project? You can choose not to answer questions that are asked and can stop the interviews or withdraw (quit) the project at any time without prejudice or consequence.Understand and Agree Disagree

4. Consent to Use your Name in Public Documents: I would like to use the results of this research in a report and or publications such as journal articles. These will all be public documents. A copy of the final report will be housed at the University of Alberta. Interview data will not be used in any public exhibition without your permission.

I would like to acknowledge you by name in all research documents and materials, or if you prefer the results of your interview can be coded to Person A or 001 etc. so that the public does not know who shared the information. If there is any information that you would not like to share publicly, please let me know.

I DO ___ want my name to be shared in public documents/ presentations.

I DO NOT ___ want my name to be shared in public documents/ presentations.

5. Consent for Storage of your Interview Results

I will share a copy of your interview transcript with you. I will also keep a copy of any audio/video recordings and / or transcriptions for the purposes of reporting and publication. To ensure that your information is valued over the long term, we would also like to store copies at the University of Alberta

I DO ___ want my information stored at the University of Alberta.

I DO NOT ___ want my information stored and would prefer that it be destroyed once the research project is completed.

By signing below, I am acknowledging that I have read, understand and agree to the above terms and conditions for this interview.

Interviewee _____ Date: _____

If you require additional information or have any concerns about this project, please contact:

Brenda Parlee
Faculty of Agriculture, Life and Environmental Sciences
507 General Services Building.
University of Alberta, Edmonton Alberta T6G 2H1
Tel: (780) 492-6825
Fax: (780) 492-0268
brenda.parlee@ualberta.ca

The plan for this study has been reviewed for its adherence to ethical guidelines by a Research Ethics Board at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Research Ethics Office at (780) 492-2615

Appendix B — Project Background

PROJECT BACKGROUND

CWD spread in Alberta extends as far north as Wildlife Management Unit (WMU) 500, which is just south of Cold Lake, Alberta. Following preliminary research conducted with Łutsël K'édene First Nation, in the Northwest Territories regarding a rare sighting of a white-tailed deer, and community concern over the potential spread of the disease in the north, it was recommended that subsequent research investigate the potential role Indigenous communities could play in the monitoring and management of cervids in Alberta where CWD has become more established (Parlee et al. 2014). Potential disease spread into already vulnerable caribou populations in the circumpolar north is a concern going forward. It has been suggested that CWD may spread outside of the endemic zone through white-tailed deer, since their home ranges can be considerably far (Fisher et al. 2017; Dawe and Boutin 2016). As the research here indicates, it remains unclear whether Indigenous harvesters in Treaty 6 or Treaty 8 are providing samples to be tested for CWD. As such, it would be especially prudent for future research to consider the potential roles that Indigenous communities and their knowledge can play in the monitoring and management of cervids for CWD in Alberta.

The Current Status of CWD in Alberta: Progression and Spread

CWD was first confirmed in a wild mule deer in 2005 outside Oyen, Alberta (AEP 2018a; Merrill et al. 2013). Since 1998, the government of Alberta has been closely monitoring CWD in both captive and wild cervid populations. Unfortunately, CWD continues to spread across wild cervid populations in the south east portion of the province and across the central United States. Efforts are largely focused on limiting spread of CWD among wild cervid populations in the hopes of containing the disease. As part of the mandatory surveillance program, hunters in Alberta can submit samples for testing at either designated 24-hour freezer locations (found within the mandatory surveillance zone), or at fish and wildlife offices throughout the province (AEP 2017a). Heads can only be submitted at 24-hour freezer locations during rifle season, while sample submissions to fish and wildlife offices are available year-round. As of the 2017/18 hunting season, there has been a sharp increase in the number of CWD+ cases confirmed from harvested samples (figure 2). Alberta Environment and Parks has confirmed that CWD is spreading westward along the Red Deer/South Saskatchewan/Bow watershed, and Battle

watershed (AEP 2018a). As well, new cases of CWD have been confirmed in WMUs 242 and 156 which are adjacent to previously recorded cases.

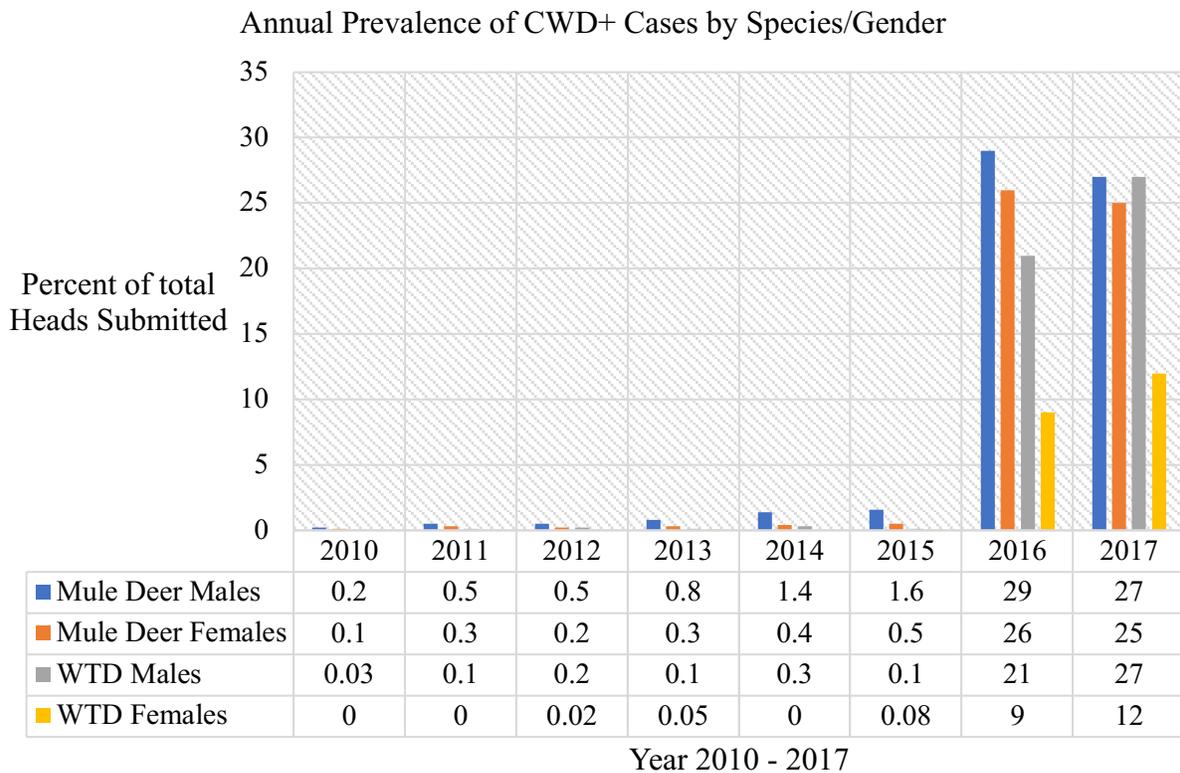


Figure 2. Percent total of hunter harvested samples that have tested positive for CWD by species and gender in Alberta. Sources: Data for gender specific CWD+ cases from 2005-2010 from AEP (2018c), 2011-2016 from AEP (2017b), 2017 from AEP (2018d).

According to the United States Geological Survey (USGS), the extent of disease spread across North America has increased both in range and the number of confirmed positive cases (Carlson et al. 2018). It has been determined that elimination of CWD in wild cervid populations where the disease has become established is likely unfeasible, therefore, management and conservation efforts have been focused on containing the disease and limiting spread. The detection of disease in new areas is critical at an early stage of disease prevalence since elimination may be possible at >1% levels (NYSDEC 2013; Saunders, Bartelt-Hunt and Bartz 2012, 373). Areas of focus for monitoring would be WMUs adjacent to confirmed cases, and along watersheds. The mandatory surveillance zones in Alberta reach as far north as WMU 500, 258, 254 which falls well within the Treaty 6 and Métis settlement territory. Communities such as Frog Lake First Nation, Kehewin First Nation, Fishing Lake Métis settlement, and the Elizabeth Métis settlement have

been impacted by the spread of CWD since at least 2015. Areas under special concern as of 2017/18 include WMUs 260, 252, and 250. As of the 2018/19 hunting season, WMUs 260, 252, and 250 will be within the Mandatory Surveillance Zone. Saddle Lake First Nation, the largest First Nation reserve in the Treaty 6 territory, falls within WMU 260. It would be particularly advantageous for managers and scientists to begin the process engagement with these communities, if they have not already, since these communities are most likely observing CWD+ cases.

Areas of Consideration: Treaty 6 and Treaty 8

Treaty 6, signed in 1876, extends across the province of Alberta and into Saskatchewan. As table 6 shows, the community of Frog Lake First Nation has a registered population of 3,377 members, with 1,531 members living on reserve (INAC 2017a). Three settlement areas comprise the Frog Lake First Nation community: Blue Quills First Nation which is 3 km west of St. Paul Alberta; Puskiakiwenin that is 65 km east of St. Paul, and Unipouheos which is 32 km southeast of Bonneyville, Alberta (INAC 2017a). Frog Lake First Nations are within WMU 500 as shown in figure 3. Kehewin Cree Nation is 20 km south of Bonneyville, and borders WMU 501 and WMU 258 (INAC 2017b; AEP 2017). Kehewin Cree Nation has a registered population of 2,204 and 1,170 living on reserve (INAC 2017b). In total, these four First Nation communities have an estimated on-reserve population of 22,817 people.

Table 5: Demographic Data for First Nations in WMU 500, WMU 260

First Nation	Registered population	Wildlife Management Unit
Frog Lake First Nations	3,377	WMU 500 ^a
Kehewin Cree Nation	2,204	WMU 500 ^a
Onion Lake First Nation ^b	6,374	WMU 500 ^a
Saddle Lake First Nation	10,862	WMU 260 ^c
Total	22,817	

Source: INAC 2017a, b, c, d

^a Within the mandatory surveillance zone

^b Onion Lake First Nation sits on the border of Alberta and Saskatchewan, but primarily rests in Saskatchewan (INAC 2017c).

^c Special concern area

Fishing Lake Métis Settlement (FLMS), was established in 2003 and, as figure 3 shows, is located east of Frog Lake First Nations, adjacent to the Saskatchewan border and is within WMU 500 (FLMS 2018). The Elizabeth Métis Settlement (EMS) was established in 1939. EMS is north

of FLMS, borders Saskatchewan and is also within WMU 500 (figure 3). On settlement population figures are unavailable through INAC, and the FLMS and EMS websites, so the number of residents living in this area is unclear. According to the Government of Alberta, portions of Treaty 6 are within the Lower Athabasca, North Saskatchewan, and upper Athabasca land use planning area (GOA 2012; AEP 2012a; AEP 2012b). Treaty 8 is within the Lower and Upper Athabasca, and upper and lower Peace land use regions (GOA 2012; AEP, 2012a; AEP 2012c; AEP 2012d).

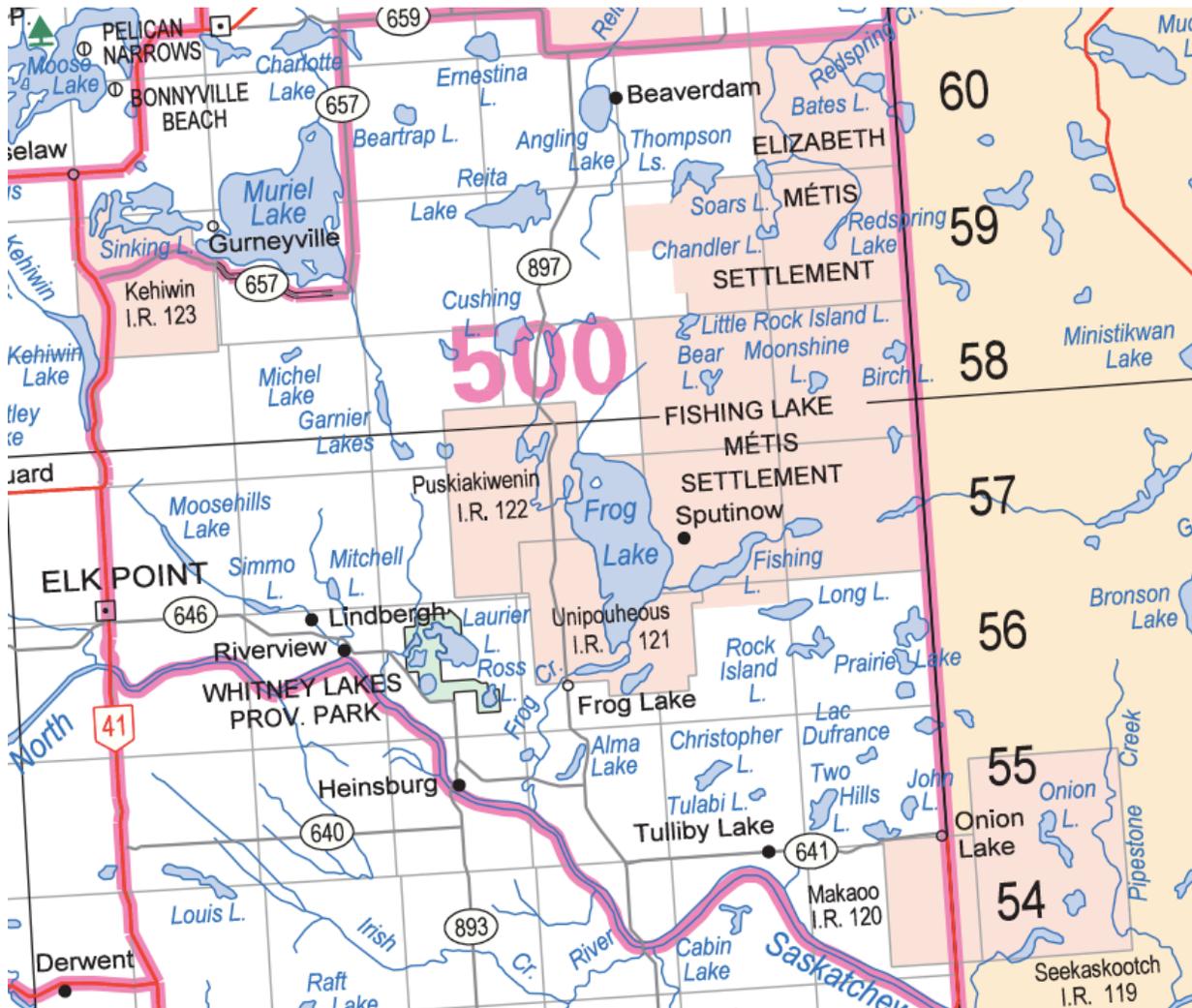


Figure 3. WMU 500 showing First Nations and Métis Settlements within the mandatory surveillance zone.
 Source: AEP 2015.

Highlights from the Lower Athabasca Regional Land Use Plan (LARP) focus on a combination of environmental standards, including air quality monitoring, conservation initiatives intended to support both ecological habitat and recreational use, and economic development for both

industry and local Indigenous communities (GOA 2012). It is unclear however, if the LARP will provide resources for CWD management, and if development in this region will factor in disease spread over the next 50-year period.

Ecological regions within the boundaries of Treaty 6 are typified by boreal plains, boreal forest, interspersed with various mixed wood subregions, and extensive wetlands (NRC, 2006). There is a wide diversity of wildlife within these ecological regions, including wood bison (*bison bison athabascae*), boreal woodland caribou (*rangifer tarandus caribou*), moose (*alces alces*), white-tailed deer (*odocoileus virginianus*), wapiti/elk (*cervus canadensis*), various fish, and migratory waterfowl (NRC 2006). Very broadly, Indigenous language groups within the Treaty 6 area include Algonquin (Blackfoot, Cree and Saulteaux); Athabaskan/Dene (Beaver, Chipewyan, Slavey and Sarcee); and Stoney/Nakoda/Sioux (ATA 2017). Communities identified within WMU 500 are predominantly Cree and Métis language speakers.

Timeline and Spread of CWD in Alberta

CWD is not native to Canada and was transmitted from an infected captive mule deer that was moved from the Denver Zoo to the Toronto Zoo sometime in the mid -1970s (CWDA n.d.; AEP 2018e; Pybus 2012). In the latter half of the 1980s, a farmed elk was transported from South Dakota to Saskatchewan, and was later found to be a carrier of the disease (CWDA n.d.; Pybus 2012). Surveillance efforts were initiated by the Alberta government in 1998, CWD was first diagnosed in wild cervid populations in 2000, in Manitou Sand Hills, SK (Merrill et al. 2013). CWD continues to spread westward across the province, and efforts to date have proven ineffective at ceasing further transmission of the disease (AEP 2018d; Pybus 2012). The primary site of CWD infection in Alberta is found along the southeastern portion of the province that borders Saskatchewan. It is also in this area that farmed and wild cervids show a high rate of infection. For the 2016/17 hunting season, it was determined that 86% of mule deer in Alberta tested positive for CWD, the largest component of this population were male mule deer (67%), followed by white tailed deer (13%) (AEP 2018d). Following the latter half of 2017 into the 2018 hunting season, a substantial increase in positive cases has been recorded (figure 2), while the range of infected deer has mostly stayed the same. Interestingly, the number of head submissions has remained relatively consistent (figure 4). A pattern of disease proliferation along key watersheds including the Red Deer, South Saskatchewan, Bow and Battle watersheds has

been steady. Several new WMUs have also been included in the mandatory surveillance zone, having previously been of special concern. WMUs 242, 240, 228, 206 and 208 have all been added to the mandatory surveillance zone (AEP 2018f). New areas of special concern include WMUs 250, 260 and 252 which will be added to the mandatory surveillance zone in 2018/2019. According to the results in this thesis, it is unclear whether Indigenous harvesters are providing samples, therefore, the results represented in figure 4 likely represent a majority of non-Indigenous sample submissions.

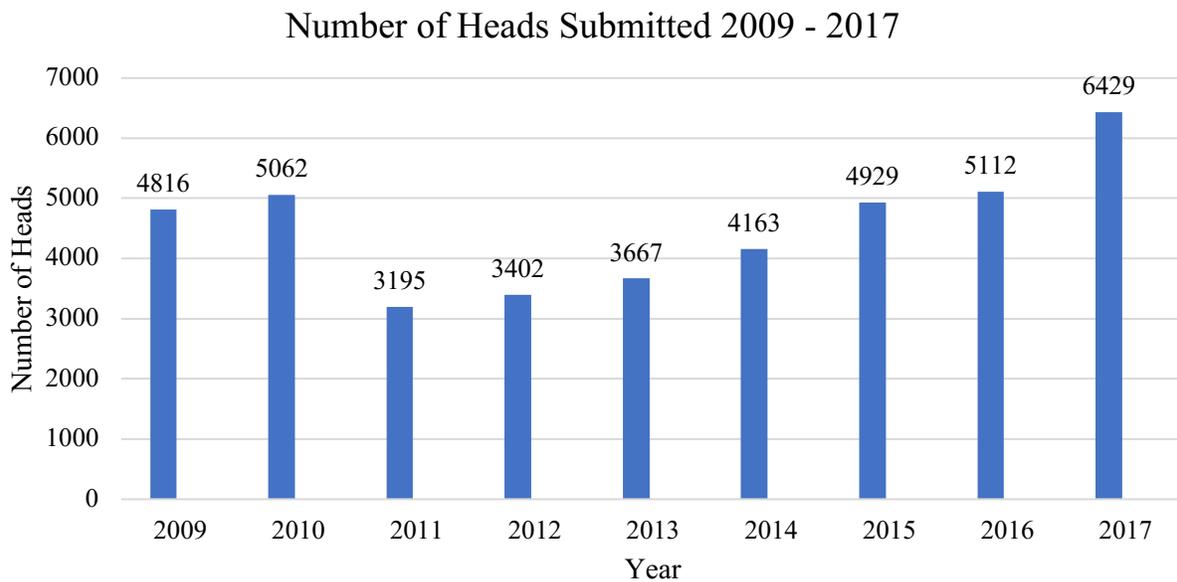


Figure 4. Hunter harvested samples provided as part of the mandatory CWD surveillance program in Alberta.
 Source: AEP, 2018d, AEP 2018g.

Spread of CWD to Moose & Caribou

One of the greatest concerns regarding continued spread of CWD amongst cervid populations in Alberta is the potential for transmission to moose and caribou (*R.t. caribou*, *R.t. groenlandicus*, and *R.t. granti*). Moose and caribou are both important subsistence species for Indigenous communities, and caribou health has been an ongoing concern in the circumpolar north. Initially it was thought that moose were resistant to CWD, though, six moose have tested positive for CWD in various locations in North America since 2005 (Haley and Hoover 2015; CWDA n.d.). In a controlled environment, one of three moose were successfully inoculated and did contract PrP^{CWD}, but due to the difficulties maintaining and observing the herd, and the widely known short lifespan of captive moose, further inquiry into the nature of CWD in moose has been advised. (Kreeger et al. 2006). Recently it was determined that reindeer (*R.t. tarandus*) are susceptible to contracting CWD from white-tailed deer but failed to contract CWD from elk

which indicates that transmission to other rangifer species is possible (Mitchell et al. 2012). Interestingly, a sub-species of *R.t* caribou, *Chinchaga*—found in north western Alberta—was determined to have a reduced susceptibility to CWD (Cheng et al. 2017). Overall, the potential for CWD transmission to moose and elk is a possibility and monitoring of these species is ongoing.

Chronic Wasting Disease (CWD): Prion Ecology, Pathogenesis, and Potential Spread to Humans

Chronic Wasting Disease (CWD), a fatal form of transmissible spongiform encephalopathy (TSE), like bovine spongiform encephalopathy (BSE) and scrapie in sheep, is a unique prion (abnormal protein) that presents distinct symptoms such as attitudinal, behavioural, and metabolic changes (CFIA 2018; Haley and Hoover 2015). Prions have been found in lymphatic tissue, excreta (saliva, mucus, urine, and feces), blood, maternal milk, and antler velvet of infected hosts (Mathiason et al. 2006; Mathiason et al. 2009; Tamgüney et al. 2009; Nalls et al. 2013; Haley et al. 2011; Haley and Hoover 2015). As well, prions shed from infected hosts into the local environment can remain infective and be made available for transmission to uninfected hosts (Haley and Hoover 2015; Miller et al. 2004; Saunders, Bartz and Bartelt-Hunt 2012; Henderson et al. 2015; Wyckoff et al. 2016). CWD is unique to cervids and detection of clinical stage symptoms can help identify infected hosts (CFIA 2018; AEP 2014; Pybus 2012). It is speculated that CWD could negatively impact cervid populations by decreasing wild herds and resulting in high economic and ecological costs by reducing the availability of healthy cervids for game hunting, farming, and sustenance (Merrill et al. 2013; DeVivo et al. 2017). How CWD could affect Indigenous harvesting is yet to be determined, though, it can be inferred that concerns regarding the perceived safety and quality of consuming cervids will present challenges for Indigenous communities. To date, there are no treatment protocols, vaccines, or immunity to the disease, and hunters in Alberta are advised to have cervids tested if they are harvested within or adjacent to the mandatory surveillance zone.

Currently, researchers are attempting to uncover exactly how CWD prions (PrP^{CWD}) are transmitted to non-infected hosts. Investigations to date have determined that PrP^{CWD} is primarily released from infected hosts into the environment through the shedding of bodily fluids, feces, and the decay of deceased animals (Miller et al. 2004; Mathiason et al. 2006; Mathiason et al.

2009; Tamgüney et al. 2009; Haley and Hoover 2015). Research suggests that CWD is spread through contact with contaminated environmental materials (i.e., soil), and physical contact involving transmission of saliva, urine, and feces between female deer and their offspring, mating between males and females, male socialization (i.e., sparring), and increased consumption of food—specifically found in male deer due to their larger body size (Saunders, Bartz and Bartelt-Hunt 2012; Potapov et al. 2013; Nalls et al. 2013; Henderson et al. 2015). Specific types of soil are noted to be more effective at harbouring and transmitting PrP^{CWD} both experimentally and in the field. As clay content increases in soil, binding capacity of prions is intensified leading researchers to conclude that transmission of PrP^{CWD} to non-infected hosts is enhanced (Walter et al. 2011; Wyckoff et al. 2016). In the CWD endemic zone in Southern Alberta (including Saskatchewan), soil content is predominantly clay rich which is believed to contribute to prion uptake, storage and transmission through soil consumption, and may provide opportunity for CWD expansion (Kuznetsova et al. 2014).

The government of Alberta has advised the public to refrain from consuming meat that is known to be infected with CWD and cautions that there is no immediate threat of transmission to humans (AEP 2018h). The Centres for Disease Control and Prevention cautions that the potential transmission of CWD to humans should not be ruled out entirely (CDC 2018). Although research in experimental settings has shown mixed results (Race et al. 2018), there is some indication that transmission to macaques, and monkeys is possible through oral or intracerebral inoculation (CDC 2018). Research has shown that transmissible spongiform encephalopathies in humans (i.e., Creutzfeldt-Jakob disease CJD) usually occur in cases with no discernable source (sporadic form) or are passed on genetically (NINDS 2018; Belay et al. 2004). Experimentally, uptake of elk PrP^{CWD} in transgenic mice expressing susceptibility to human PrP failed on two occasions to develop clinical stage symptoms which researchers speculate indicates that there is a significant species barrier limiting transmission from cervids to humans (Kong et al. 2005). Exposure of PrP^{CWD} from antler velvet through the consumption of velvet capsules as an alternative health product may be an avenue for increased exposure of PrP^{CWD} to humans, though levels of prions in antler velvet are not high (Angers et al. 2009). Overall, it is suggested that the risk of developing the human TSE CJD from consuming CWD infected meat remains low (Waddell et al. 2018; Belay et al. 2004). However, research is ongoing to monitor the possibility of

transmissibility due to extended incubation periods of the disease (Hannaoui, Schätzl and Gilch 2017; Waddell et al. 2018).

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