THE SOCIAL LEARNING PROCESSES INVOLVED IN INCORPORATING

WILDFIRE RISK REDUCTION STRATEGIES INTO FOREST HARVESTING

PLANS IN NORTHERN SASKATCHEWAN

by

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Dalhousie University is located in Mi'kma'ki, the
ancestral territory of the Mi'kmaq.
We are all Treaty people.

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Abstract

Increased risk of wildfires is a main concern for the Province of Saskatchewan with respect to climate change. There is an urgent need for natural resource-based sectors to make adaptive management changes to their operations to prepare for and adapt to these increases. This research project was undertaken in partnership with Sakâw Askiy Management Inc., a forestry corporation located in Prince Albert, Saskatchewan, and stakeholders and rightsholders of the Prince Albert Forest Management Area. In the field of climate change adaptation, there is an established realization that learning is an integral part of any adaptive management process. However, there is lack of consensus on how to define and measure learning, what relationships exist between social interactions and learning, and how environments shape learning This project addresses this knowledge gap by describing the learning processes that occur through the development of landscape-level wildfire risk reduction strategies in Prince Albert.

Statement

I want to begin this thesis by introducing and situating myself in the research context in which I work. I offer this introduction to my identity as an act of appreciation for the participants of my study who were kind and generous enough to share their stories with me. My name is Carly Madge, and I was born in Thunder Bay, Ontario, on the shores of Lake Superior in 1994. I was privileged enough to grow up in a household with a father who worked as a teacher and had summers off. This meant that my summers were spent at the family-owned cottage, a small shack without running water or plumbing tucked in the dense boreal forest boreal forest on Barnum Lake. Growing up spending my summers in the forest helped to shape my worldview and sparked the beginnings of my love for trees and the environment.

My passion for the environment and forestry stuck with me into adulthood, where I studied environmental science at Lakehead University, a small university that specializes in forestry studies. I spent my summers tree planting in very remote areas of the boreal forest in northern Ontario and Northern BC. Upon graduation, I accepted a job as a Forestry Technician in Smithers, BC. Working in this position truly opened my eyes to the unsustainable forestry practices that exist within Canada. Every day I went to work my morals were torn by what I saw on the landscape. This was what propelled me to pursue a higher level of education in the form of a master's degree.

I approach this research with a very deterministic, natural science worldview, which I acknowledge has its limitations. With my father working as an academic and my mother working in the medical sciences field, I grew up surrounded by very factual and analytical influences. This upbringing allowed me to experience the world in a way that has shaped

who I am today, but it does require me to work consciously and actively to understand the worldviews of others who may have a more philosophical or spiritual position. In keeping with the honesty that I have promised in this positionality statement, this difference of worldviews was not something that I whole-heartedly considered until I started conducting social science research. In my undergraduate degree, I was purely focused on natural sciences. I completed a year-long honours thesis, studying the impact of bedrock units on groundwater quality throughout drinking water wells in the Thunder Bay area. The physical and chemical interactions that I studied throughout my degree left little room for consideration for the social implications of these interactions, which were undoubtedly vast. Working in the social science field has allowed me to acknowledge my limited worldview in productive ways, by challenging my initial responses to topics and permitting me to take the time to consider the alternative ways in which realities can be perceived.

Another element that I wish to disclose is my personal connection to the study topic of wildfires. I have had the experience of working as a forest fire fighter in northern British Columbia during the wildfire season of 2018. This experience helped to shape my understanding of the realities of wildfire and the hardships it imposes on the communities it affects. There were many days throughout the wildfire season where the smoke in the town in which I lived was so dense that it appeared to be nighttime in the middle of the day. I was fortunate enough to be able to reside in my own home for the entire wildfire season and avoid evacuation. The town I lived in did, however, serve as a community for many folks who were evacuated from surrounding areas where fire conditions made remaining in their residence unsafe. Although these experiences were not my own, and I can not even begin to imagine the physical, emotional, and mental hardship imposed by

evacuation. I believe that seeing and speaking with the evacuees who came to my town allowed me to have a deeper empathy for the people involved in this study who wish to reduce the risks imposed by wildfire.

In the information that I have provided about myself through this positionality statement, I believe that I have introduced myself as a person who can empathize with the differing views of the participants who graciously offered their time and thoughts through this research process. Through the data collection, analysis and writing processes of this thesis, I continually engaged in reflection and self-critique to ensure that I had given fair consideration to all the information provided to me by the participants. I hope that this positionality statement, and my continuous acts of reflexivity throughout this study, ensure all who are affected by this topic of the sincerity and seriousness with which I have approached this research.

Lastly, I would like to thank my friends and family who provided me with support and lots of laughs through this rewarding, but very challenging process. Without their support, I wouldn't have been able to complete this project.

Chapter One: Introduction

1.1 Statement of Problem

Climate change has been referred to as a "super wicked problem". These problems, as defined by Rittel and Webber (1973), have several unique aspects that contribute to the increased complexity of their solutions (Lazarus, 2010). These include time sensitivity; the potential for current greenhouse gas emissions to create positive feedback loops of carbon emissions that may make reaching future emission goals even more challenging; the realization that people in the best positions to do something about the problem have the least incentive to do so; and the lack of frameworks that would enable governments to develop, implement, and enforce laws required to address climate change (Lazarus, 2010). There are at least two distinct approaches that can be taken to address climate change. First, climate change can be treated as a technical challenge. Technical challenges can be solved through skill improvement, better management practices, increased allocation of resources to the problem, or more innovation (Heifetz et al., 2009). Although technical problems can be challenging to address, solutions for such problems can be identified, developed, and applied (Kegan & Lahey, 2009 as cited in O'Brien & Selboe, 2015). Due to society's overwhelming success solving technical challenges, if climate change were only a technical problem, we would have good reason to feel confident in our ability to develop a solution (O'Brien & Sleboe, 2015). However, climate change is also an adaptive governance challenge characterized by wicked complexity (Rittel & Webber, 1973).

Adaptive governance refers to flexible and iterative learning-based collaborations and decision-making processes involving actors from different societal levels with the goal of coordinating the management of social-ecological systems and ecosystem services

(Schultz et al., 2015). Adaptive governance challenges have no pre-defined solutions and often require changes in behaviour, mind-set, and priorities (O'Brien & Selboe, 2015). As climate change solutions are developed both technical and adaptive governance challenges must be considered, or any pursuits will very likely fail. Adaptive governance and social learning have been identified as necessary components of governing complex social-ecological systems during times of abrupt changes, such as those imposed by climate change (Folke et al., 2005; Pahl-Wostl, 2007).

Impacts of climate change are prominent throughout Indigenous and northern communities in Canada (Government of Canada, 2021). Studies conducted by the Intergovernmental Panel on Climate Change (IPCC) show that while mean global temperatures are expected to increase by between 1.4°C and 5.8°C by 2100, the temperatures for boreal regions (e.g. northwestern Canada) are projected to increase by more than 40% of these global trends (IPCC, 2007). Climate change impacts are occurring at unprecedented rates; therefore, the implementation of adaptation strategies must become an urgent priority for these communities to maintain their resilience in the face of these impacts (Natural Resources Canada, 2018). This is especially true in renewable resource sectors such as forestry, which is clearly impacted by climate change and is very important to northern community and ecosystem sustainability.

Forestry is an essential component of the Canadian economy and is an important source of prosperity and livelihood for people and communities throughout the country (Natural Resources Canada, 2020c). This industry is especially prominent in the western provinces of Canada, with British Columbia, Alberta, Manitoba, and Saskatchewan all predicted to experience growth in employment and revenue in this sector for the

foreseeable future (Government of Canada, 2014). Forestry is the second largest industry in northern Saskatchewan, generating over $1 billion annually and supporting nearly 8000 direct and indirect jobs (Government of Saskatchewan, n.d.-a). The large economic role that forestry plays in Saskatchewan makes the province especially susceptible to the abovementioned impacts of climate change on forest ecosystems. Northern Saskatchewan is located within the boreal forest biome (Figure 1-1).
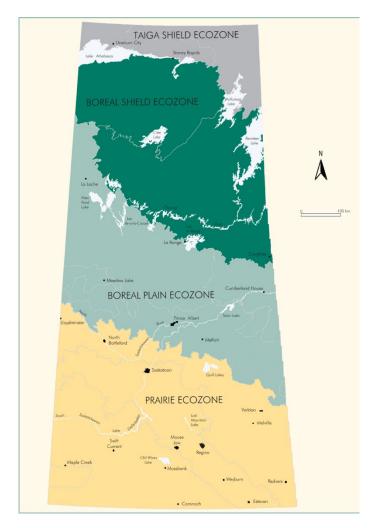
Figure 1-1: Map of the Forest Ecozones of Northern Saskatchewan (from esask.uregina.ca)

The boreal forest has experienced some of the most drastic climate change-induced temperature rises in Canada, with average winter temperatures increasing by 3°C since

1948 (Johnston et al., 2010). Wildfire is the primary disturbance present in boreal forest ecosystems. Wildfire helps to maintain the health of boreal forest ecosystems by releasing nutrients that are stored on the forest floor, opening the forest canopy to allow for more sunlight exposure, and allowing some fire-adapted species (such as pine) to open their cones and release seeds for reproduction (Government of Canada, 2020b). Increased risk of wildfires is one of the main concerns for the Province of Saskatchewan with respect to climate change. Although fires are a naturally occurring process and they are crucial to maintaining a healthy boreal forest ecosystem, the extent, severity, and frequency of fires are projected to increase in most areas of Canada due to climate change, with northern areas of the country experiencing the worst of these impacts (Wotton et al., 2010; Balshi et al., 2009).

All forest management organizations, regardless of their land use objectives, have the desire to reduce the amount of area burned by unwanted fires to reduce damages to property and renewable resources, eliminate the threat to life, and reduce the cost of firefighting endeavors (Alexander, 2000). At the same time, the ecological benefits of fire are well recognized and so the challenge for forest managers becomes finding a fire regime that minimizes the impacts on society while still reaping the ecological benefits. This is a complicated process that involves understanding the outcomes of fire over a broad range of economic, environmental, and social values (Gazzard et al., 2020).

Adaptive management is an approach to natural resource management that both acknowledges and tries to account for the embedded uncertainties of natural systems through experimentation. Adaptive management often requires a unique set of social and economic factors to allow for its implementation, including aspects of pre-existing adaptive

governance (Gunderson & Light, 2006). It is well-established that learning is an integral part of any adaptive management process (Armitage et al., 2008). However, the consensus on how to define and measure learning, what relationships exist between social interactions and learning, and how environments shape learning is still lacking (Crona & Parker, 2012). My Master's research addresses this knowledge gap by observing and explaining the learning processes that occurred through collaborative discussions to incorporate wildfire risk reduction strategies into forest harvesting plans undertaken by Sakâw Askiy Management Inc., located in Prince Albert, Saskatchewan, in partnership with stakeholders and rightsholders of the Prince Albert Forest Management Area.

Sakâw Askiy is Cree for "forest land". Sakâw Askiy Management Inc. is a multi-party forest management corporation that operate in the Prince Albert Forest Management Area, located in Treaty 6 territory, the homeland of the Woodland Cree, Plains Cree, Swampy Cree, Dene and the Dakota and Métis Nations (City of Prince Albert, n.d.). Sakâw Askiy hold the Prince Albert Forest Management Agreement, providing them with the rights to harvest wood in the management area (Sakâw Askiy Management Inc., 2018). The General Manager of Sakâw Askiy has expressed interest in employing wildfire risk reduction strategies at the landscape-level as a way of reducing risk to communities through harvesting patterns that emulate natural disturbances, such as wildfire (Diane Roddy, pers. comm., February 21, 2020). In the past in Saskatchewan, forest harvesting activities employed as a method of reducing wildfire risk have been seen as a thinly veiled excuse for forestry companies to cut down more trees in communities in and around the forest ecosystem. Therefore, community and stakeholder support and involvement are required for successful implementation of harvesting and renewal strategies aimed at reducing the

vulnerabilities of forest communities to wildfires and adapting to the impacts of climate change (Sakâw Askiy Management Inc., pers. comm., February 21, 2020).

My research examines the learning processes that occur while Sakâw Askiy Management Inc. works to develop community-informed and supported wildfire risk reduction strategies as a method of adapting to climate change and improving their adaptive capacity. This will occur through a process of adaptive governance, in iterative and learning-based collaborations and decision-making processes involving actors from different societal levels (Schultz et al., 2015). Adaptive capacity is the ability of communities and resource sectors to adjust to climate change, moderate potential damages, take advantage of opportunities, and cope with consequences (IPCC, 2001). This research uses the definition of community as "a group of people with diverse characteristics who are linked by social ties, share common perspectives, and engage in joint action in geographical locations or settings" (MacQueen et al., 2001, p.1929).

1.2 Research Objectives

The purpose of this thesis is to address the research question: "how do social learning processes occur when a forestry corporation and its shareholders work with forest stakeholders and rightsholders to discuss the incorporation of wildfire risk reduction strategies into forest harvesting plans?" For this research project, shareholders are defined as the seven forestry companies that are a part of the Sakâw Askiy Management Inc. corporation and which conduct forest operations within the Prince Albert Forest Management Area. The stakeholders are defined as persons/organizations who hold stakes in the Prince Albert Forest Management Area (i.e., properties, businesses, tourist

attractions), and rightsholders are defined as persons who have a right to the Prince Albert Forest Management Area (e.g., Treaty rights and Indigenous rights). The objectives of the research are four-fold:

1. Describe the learning processes that occur among the seven shareholders of Sakâw and the stakeholders and rightsholders deemed to hold key knowledge on wildfires while discussing and developing wildfire risk reduction strategies as a method of climate change adaptation.

2. Examine the extent to which social learning outcomes enable Sakâw to incorporate community-informed wildfire risk reduction into forest harvesting plans.

3. Describe the adaptive capacity of Sakâw using several pre-defined determinants; and

4. Make recommendations for practice to Sakâw based on the information gathered from interview participants to improve the corporation's ability to achieve a social license to operate.

The knowledge gained from this research will be used to improve the understanding of the role of social learning in building partnerships that enable more informed, multi-perspective, and inclusive views of natural resources, which may allow for the implementation of more effective adaptation strategies in the natural resource sector. Results and conclusions will also contribute to the larger body of literature on learning and adaptive capacity, and the connections these hold to obtaining a social license to operate. Information obtained from this research can also be used to inform decision-making in other communities learning through partnerships and implementing adaptation strategies.

1.3 Thesis Overview

In chapter two I will provide a more detailed context for the research project, including a description of the theoretical framework that will be used to guide the study. In chapter three I will provide an overview of the case study of the research, Sakâw Askiy Management Inc., and the methodology employed to describe social learning processes and adaptive capacity. In chapter four I will provide an overview of the social learning processes that occurred and may continue to occur through the development of community-informed wildfire risk reduction strategies. Chapter five provides a description of the factors both enhancing and hindering the adaptive capacity of Sakâw Askiy Management Inc. and the recommendations for practices and changes that interview participants would like to see made by Sakâw. Lastly, chapter six provides the concluding remarks of the study, as well as avenues for future research in the field of social learning and community-informed wildfire risk reduction strategies.

Chapter Two: Literature Review

2.1 Introduction

The purpose of this literature review is to ground the study in current and relevant literature on adaptive governance, social learning, and fire management. Accordingly, this chapter begins with an overview of the currently observed and predicted future impacts of climate change on the boreal forest, focusing on the predicted increases in wildfire throughout the forest biome (section 2.2.1). This section is then followed by a description of the fundamentals of wildfire risk reduction, with a reference to the fire triangle (section 2.2.2). Next, section 2.2.3 provides a brief history of wildfire management in Canada, describing the phenomena known as the "fire paradox" (Arévalo & Naranjo-Cigala, 2018) which has led to the overabundance of fuels and increased risk of wildfire throughout much of the forests in Canada where fire suppression is practiced. Section 2.2.4 introduces FireSmart, which is a program that exists throughout Canada, helping private landowners reduce the risk of wildfire on their properties (Ergibi & Hesseln, 2020). Section 2.2.5 introduces the concept of landscape-level wildfire risk reduction strategies that can be employed to further reduce the risk of wildfire and protect values that exist within forested ecosystems. This is then followed by a brief overview of wildfire management in Saskatchewan, with a focus on the city of Prince Albert, the case study location of this thesis research (section 2.2.6). Section 2.2.7 introduces the concept of the "let it burn" policy which exists in Saskatchewan (Poole et al. 2020).

The following sections focus on the concepts used to develop the theoretical framework for this study. Section 2.2.8 describes the concept of a "social license to operate" which describes the "ongoing acceptance and approval of an operation by those

local community stakeholders and rightsholders who are affected by it, and those stakeholders who can affect its profitability" (Moffat et al., 2016, pg.480). Section 2.2.9 provides a description of the need for the inclusion of community members in the development of wildfire management practices, including the need to engage with local and First Nations communities in the decisions that influence the development of these practices.

Section 2.3 then describes the theories of learning that are applied throughout the research. Section 2.3.1 describes organizational learning theory, followed by section 2.3.2 which outlines the models of loop learning. Section 2.3.4 describes social learning theory, which is the main theoretical framework used to assess the learning processes that occur in this study. Section 2.3.5 provides a current state of knowledge for adaptive capacity, the capacity of communities and resource sectors to adjust to climate change, moderate potential damages, take advantage of opportunities, and cope with consequences (IPCC, 2001), and its connection to social learning processes. The following section, 2.3.6, describes the assessment of adaptive capacity. Section 2.3.7. describes social capital, the existence of relationships of trust, reciprocity, and exchange (Adger, 2003). Section 2.3.8 discusses conservation learning networks, which are an emerging strategy that can address complex resource management challenges, including wildfire risk reduction (Goldstein et al., 2010). Section 2.4 describes the research gap that exists within the area of community informed and supported wildfire risk reduction strategies, and the social learning processes involved in their development. Lastly, section 2.5 gives a summary of the literature review.

2.2 Setting the Context

2.2.1. Climate Change in the Boreal Forest

The boreal forest is the most northernly forest biome in Canada (Brandt et. al., 2013) and extends from the Alaskan border all the way to Newfoundland (Weber & Stocks, 1998; See figure 2-1). The boreal forest encompasses a variety of soils, wetlands, water bodies and vegetation types that have evolved together since the end of the most recent continental glaciation period (Brandt et. al., 2013). The biome is characterized climatically by short, warm summers and winters that are long and incredibly cold, with mean annual temperatures ranging from –10 to –4.5 °C in the Yukon, 1 to 5.5 °C in northern coastal British Columbia, and –4 to 5.5 °C in the boreal shield ecozone (Weber & Stocks, 1998; Hall et al., 2002). As a disturbance-driven ecosystem, climate, fire, disease, insects, and the interactions that occur between these factors are the most significant drivers of change within the boreal forest biome (Brandt et. al., 2013).

Figure 2-1:Boreal Forest Coverage of Canada (from Boreal Birds.org)

The predicted impacts of climate change that are expected to occur within the boreal forest biome are immense. These impacts will not only affect boreal ecosystems but also the socio-economic values that exist throughout these ecosystems (Lemprière et. al., 2013). Studies conducted by the Intergovernmental Panel on Climate Change show that while mean global temperatures are expected to increase by between 1.4°C and 5.8°C by 2100, the temperatures for northern boreal regions (northwestern Canada) are projected to increase by more than 40% of these global trends (IPCC, 2007). Because the boreal forest covers such a large area, alterations in natural disturbance regimes and forest resilience will have global impacts. For example, this biome holds approximately one-third of the

world's terrestrial carbon stocks and is the source for one-third of the world's timber supply (Hart et. al., 2019).

The changing climate is predicted to have the greatest impact on disturbances that occur within the boreal forest, including the frequency and severity of disease and pest outbreaks, windstorms, and especially fire. In North American boreal forests, wildfire is an essential driver of forest composition, structure, and function (Hart et. al., 2019). Boreal forests are shaped by wildfires, with the individual characteristics of fire (i.e., size, shape, and severity), and the landscape's local fire cycle playing key roles in the temporal and spatial occurrences of fire (Nielsen et. al., 2016). Wildfire in the boreal forests of North America is characterized by a regime consisting of small-scale wildfires and more, yet infrequently occurring, large, high-intensity fires which have a disproportionately greater impact on the landscape (Parisien et al., 2020). Although fire plays a crucial role in maintaining the health of boreal forest ecosystems, the extent, severity, and frequency of fires are projected to increase in most areas of Canada due to climate change, with northern areas of the country experiencing the worst of these impacts (Wotton et al., 2010; Balshi et al., 2009). This increase will trigger negative consequences for the ecosystem and the values it provides for humans.

2.2.2 Fundamentals of Increasing Wildfire Risk Reduction

All forest management organizations, regardless of their land use objectives, have the desire to reduce the amount of area burned by fire to reduce damages to property and renewable resources, eliminate the threat to life, and reduce the cost of firefighting endeavors (Alexander, 2000). The fire triangle describes the three elements that can be controlled to accomplish fire suppression. To stop fire from growing and spreading, you

can either: remove the fuels ahead of the spreading combustion zone; decrease the temperature of the burn; and/ or exclude oxygen from the fire through smothering (Alexander, 2000) (see Figure 2-2). One of the most effective methods for reducing major wildfire risks is to create fuel situations in which the energy output rate of a fire is minimized to the point that conventional firefighting methods can be effectively implemented (Alexander, 2000).

The reduction of fuels in an area can be accomplished through several pathways, including the application of prescribed burns for forests that can cope with type of disturbance, and other methods such as fuel breaks composed of relatively non-flammable vegetation for forests that are not suitable for prescribed burns (Alexander, 2000). The challenge for forest managers is finding a fire regime that minimizes the impacts on society. This is a complicated process that involves understanding the outcomes of fire over a broad range of economic, environmental, and social values (Gazzard et al., 2020).
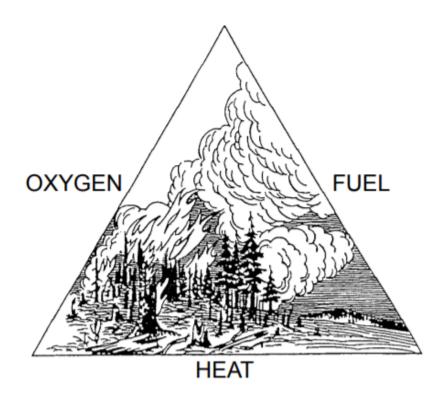
Figure 2-2:The Fire Triangle (Parisien et al., 2020)

Increasing wildfire risk can be attributed to a set of complex and intertwined variables which include: an overabundance of flammable vegetation accumulation resulting from the over-application of fire suppression activities in the past, forest management practices, and climate change; increased settlement in forested areas; and social policies, values, and decisions that influence human behaviours and tendencies (Fischer & Jasny, 2017). Adapting to increases in wildfire risk requires changes to be made to reduce the likelihood of a fire occurring and to reduce the impacts of wildfire on the built environment, timber, biodiversity, and other values that exist within the area (Fischer & Jasny, 2017).

2.2.3 History of Wildfire Management in Canada

Wildfire, which in this thesis is defined as all unwanted fire that is caused by humans or lightning in any vegetated land cover types, is an essential component of forest ecosystem health throughout Canada (Tymstra et al., 2020). Between 1970 and 2017, over 8,000 wildfires have occurred throughout the forests of Canada, and approximately 2.25 million hectares of land are burned annually (Tymstra et al., 2020). Wildfire has the potential to lead to negative alterations in wildlife habitat, increases in carbon emissions, negative impacts on public safety, and economic losses to an industry already struggling with a changing resource base and increasing pressure from export markets (Brenkert-Smith et al., 2006; Bogdanski, 2008). The continually increasing population throughout Canada's wildland-urban interface[1] also leads to concerns for the predicted increases in fire severity, intensity, and occurrence throughout most of Canada (Wotton et al., 2010). With high value assets at stake, including human life, infrastructure, and economic investments, the increasing threat of wildfire requires an extensive and all-inclusive approach to management that considers the biophysical, sociodemographic, and sociocultural contexts involved (Parisien et al., 2020; Gordon et al., 2018).

Wildfire risk management, like other emergency management protocols, is composed of four integrated phases: prevention and mitigation, preparedness, response, and lastly, recovery (Public Safety Canada, 2017). In Canada, decisions regarding wildfire management are conducted using a risk-based approach, which allows for multiple response levels to be deployed concurrently, reducing risk to values while allowing wildfire

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[1] The wildland-urban interface is any area where houses and public infrastructure exist within and are intertwined with undeveloped wildland vegetation (Radeloff et al., 2005).

to occur as part of a natural and necessary ecosystem process (Tymstra et al., 2020). The response levels that can be deployed are characterized as full, modified, or monitored. A full response to wildfire is characterized by a fast and aggressive initial attack on a fire and/or continued action against the fire until it is determined to be under control (Tymstra et al., 2020). A modified response to wildfire refers to the approach taken when tactics are used to contain and manage the fire within a designated maximum perimeter, which is determined by assessing the environment in which the wildfire is occurring and taking characteristics such as fuel, weather, and topography into consideration (Tymstra et al., 2020). Lastly, a monitored response is where the wildfire is closely observed to determine whether action is required to suppress the fire (Tymstra et al., 2020).

Wildfire management strategies employed throughout Canada always prioritize the protection of human life and property (Parisien et al., 2020). In the late 19th and early 20th centuries, the focus of Canadian forestry and the dominant euro-centric view of the country caused fire to be viewed as "the enemy" (Hirsch et al., 2001). Wildfire was seen this way due to its witnessed ability to damage and destroy communities and infrastructure, and its ability to wastefully consume timber that was readily accessible for harvesting. Foresters of the time, who had a desire for completely regulated forests, sought to eliminate fire from the forested ecosystems (Hirsch et al., 2001). This "fire as the enemy" attitude continued for much of the 20th century, where suppression of all fires was the primary method employed to reduce the risk imposed by wildfire on human life and property (Natural Resources Canada, 2020b). This method of wildfire management has significant impacts on fire regimes throughout Canada, especially in the areas closest to communities (Parisien et al., 2020). The desire to control all fire held by early foresters was rooted in the attitude

of human dominance over nature (Hirsch et al., 2001). This form of "command and control" is prevalent in increasingly managed natural ecosystems when the behaviour of nature does not meet the desires or expectations of society (Holling & Meffe, 1996). The extinguishing of all wildfires, desired at the time, was also made possible due to rapid advancements in suppression technologies such as transportation (ex. helicopters and airplanes), equipment, and communication methods that allowed for accelerated detection and reporting of fires (Hirsch et al., 2001). However, there is a physical and economic limit to the effectiveness of wildfire suppression endeavors, and even greater advancements in suppression technologies would be compounded by the negative returns from having increased fuel loads on the landscape (Hirsch et al., 2001).

The legacy left behind by decades of intense fire suppression has altered forests throughout Canada, leading to the retention of older forest stands than what would naturally be observed had fire been allowed to occur uninhibited across the landscape (Parisien et al., 2020). The over-use of suppression as a method of wildfire risk mitigation and prevention has led to a phenomenon referred to as the "fire paradox" (Arévalo & Naranjo-Cigala, 2018). The fire paradox describes the situation that arises when fire suppression methods are applied in non-commercial protected forest areas where the paradox is when suppression methods are applied to all fires, the small areas that would naturally burn and regenerate are then retained, leading to fuel accumulation and the increase in risk for larger and catastrophic (>1000 ha) fires to occur. This in turn may have significant negative impacts on surrounding properties and local populations (Arévalo & Naranjo-Cigala, 2018). A prominent example of this situation is the fire that occurred in 2016 in Fort McMurray, the costliest natural disaster in modern Canadian history, where fire spread

through the decaying and stagnant forests of the area that had not burned since prior to the 1940's (Parisien et al., 2020).

The reduction of wildfire across landscapes leads to increased fuel loading and continuity, and increased probability of the occurrence of the most intense and dangerous form of wildfire, known as crown fires (Westhaver, Revel, & Hawkes, 2007; Natural Resources Canada, 2020a). Ongoing wildfire suppression around communities without the application of subsequent forest modification methods, including harvesting, fuel treatment, and the allowance of other disturbances, have led to fire deficits that pose great risks to communities and livelihoods (Parisien et al., 2020).

By the 1970's, the realization that not all fires should be suppressed, and the importance of the inclusion of fire on the landscape, had become more widely acknowledged (Natural Resources Canada, 2020b). Today the decision of whether a fire should be suppressed is based upon a hierarchy of priorities or values that have been designated by the agencies within the Government of Canada responsible for fire management (Natural Resources Canada, 2020b). The methods employed by wildfire agencies can range from complete suppression to no action depending on the values that are exposed and at risk from the impending wildfire (Natural Resources Canada, 2020b). In Canada, agencies involved with the management of wildfire aim to employ a balanced approach, allowing for the inclusion of wildfire to reach ecological benefits, while also protecting people, properties, and commercial timber resources (Natural Resources Canada, 2020b).

2.2.4 The FireSmart Program in Canada

Conventional fire management strategies throughout Canada have focused on the treatment of public lands through fuel management activities, such as prescribed burning and mechanical thinning. However, greater emphasis is now being placed on citizens to take an active role in fire mitigation and prevention activities on their own private lands (Ergibi & Hesseln, 2020). Modern improvements in training, response, and structural resistance to fire employed by fire managers are all important prevention and mitigation methods, but the most effective method remains the reduction of fuels that lead to fires in the wildland-urban interface (Westhaver et al., 2007). As the ecological benefits of wildfire on forested landscapes have been recognized (described in section 1.1), the challenge for fire managers has now become how to learn to live with this natural disturbance. Part of this challenge requires that the owners of private lands take responsibility for the structural and vegetative modifications required to reduce wildfire risk on their land (Ergibi & Hesseln, 2020). FireSmart is a program that helps private landowners to reduce wildfire risks on their properties (Ergibi & Hesseln, 2020).

The FireSmart program formed out of wildfire research conducted in the 1970's. Through a series of case studies, it was determined that structures that had survived fire events had done so through a combination of their building characteristics (ex. roof materials) and the defining aspects of the structure's surrounding environment (ex. vegetation clearance) (Ergibi & Hesseln, 2020). This research indicated that the risk of a wildfire event destroying a home, or, at the larger scale, a community, could be reduced using fire resistant building materials and vegetation and fuel removal around the properties. These findings were then used to implement the FireSmart program, in which

fire professionals work with homeowners to determine fire mitigation activities used to treat the private land and property at the homeowners' expense (Ergibi & Hesseln, 2020). The current Canadian standards for fuel management practices carried out in the wildland-urban interface were developed by the nonprofit organization *Partners in Protection.* This organization published the first FireSmart manual, "FireSmart: Protecting your Community from Wildfire", in 1999 (Westhaver, Revel et al., 2007).

The guidelines for homeowners included in the FireSmart manual help to reduce the intensity of wildfires, aid in suppression efforts, and prevent the ignition of structural complexes on private properties (Westhaver et al., 2007). These guidelines work by employing the principles of removal, reduction, isolation, and/or conversion of fuels to reduce the likelihood of fire ignition or the likelihood of the propagation of crown fires if ignition does occur (Westhaver et al., 2007). Although there is evidence of the effectiveness of FireSmart procedures, the implementation of this program on private land has been low on a country-wide scale. Shortcomings of the implementation of this program could be due to lack of program knowledge, low perception of wildfire risk, lack of ability, funds, or time to implement the program, and/or conflicts that exist between the risk reduction benefits of the program and other values that are affected by its implementation (ex. wildfire, conservation, forest aesthetics) (Westhaver et al., 2007).

2.2.5 Landscape-level Wildfire Risk Reduction Strategies

Fire management agencies are compelled to prioritize wildfire risk reduction and fuel reduction activities in the wildland urban interface to best protect communities and address the most pressing public concerns about wildfire risk (Vosick et al., 2007). There

is an existing perception that if risk reduction strategies are initially focused solely on the wildland urban interface, the public may become more aware of these activities, and therefore, more accepting to the concept of fire being used as a forest management tool and an avenue towards healthier boreal forest ecosystems (Vosick et al., 2007). However, this strategy ignores the importance that landscape-level risk reduction strategies play in the protection of communities and leaves the larger landscape area outside of communities vulnerable to destruction by unnaturally large wildfires (Vosick et al., 2007). As the ecological benefits of fire have been realized, the need to reincorporate this natural disturbance into forest ecosystems has become apparent (Hirsch et al., 2001). However, due to the existing buildup of fuels that make some landscapes susceptible to catastrophic wildfires, this must be accomplished in a way that does not allow for runaway fires to occur. Using the same basic principles of FireSmart at the landscape-level, FireSmart Forest Management employs strategies that decrease the fire behaviour potential of the landscape,[2] reduce the potential for ignition of fires, and increase the effectiveness of fire suppression resources (Hirsch et al., 2001).

The objective of FireSmart Forest Management approaches are to use existing forest management practices (such as site preparation, regeneration, harvest scheduling, block layout and design, and road construction) in a proactive and predetermined manner. This allows for the area burned by large, uncontrolled wildfires to be reduced to minimize the socio-economic impacts of fire while still maximizing its ecological benefits (Hirsch et al., 2001). FireSmart Forest Management strategies comply with desirable, pre-existing sustainable forest management objectives as they follow a holistic, landscape-level

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[2] The fire behaviour potential of the landscape refers to the landscape's flammability (Cruz et al., 2017).

approach to achieving a balance between the economic, social, and environmental values that exist within forested ecosystems (Hirsch et al., 2001). Examples of FireSmart Forest Management strategies include creating large, strategically placed areas of low flammability that reduce the continuity of highly flammable fuels while also acting as points for fire suppression (Hirsch et al., 2001). These areas can consist of low flammability fuels (such as a deciduous-dominated forest stand), roads, waterbodies, or any other barrier to the spread of wildfire on the landscape (Hirsch et al., 2001).

Ecological integrity of a forest ecosystem has been suggested as a management goal that may comply with the goals of sustainable forest management (McRae et al., 2001). An ecosystem is said to possess integrity when it displays characteristics of its natural region, including the composition and occurrence of native species, rates of change, and supporting processes, such as natural disturbances (McRae et al., 2001). Because wildfire is a naturally occurring process to which some ecosystems and their species are well adapted, especially in the boreal forest, it has been suggested that forest managers should seek to emulate the patterns left behind by this disturbance on the landscape through their forest harvesting operations (McRae et al., 2001). This form of forest harvesting, which seeks to mimic the effects of disturbances that would naturally occur on the landscape, has been termed "emulation silviculture" (McRae et al., 2001).

When developing wildfire risk reduction strategies, there are many conflicting factors that need to be addressed. Forest management plans need to not only consider natural disturbances, but also other concerns including recreational land-use, wildlife habitats, and visual aesthetics. When developing landscape-level wildfire risk reduction strategies, the achievement of all the management objectives must be done in a very

strategic way as to not diminish the effectiveness of the risk reduction (Vosick et al., 2007). In the Prince Albert Forest Management Area, one of the main concerns that must be addressed by forest management operations is the conservation and creation of woodland caribou habitat (Sakâw Askiy Management Inc., 2019), a species declared as at risk within Canada (Government of Canada, 2011). The woodland caribou protection goals developed by the federal and provincial governments aim to recover woodland caribou populations by managing their habitats, while still allowing for continued industry operations to occur in northern Saskatchewan. Woodland caribou recovery goals, and the ways in which they overlap and conflict with wildfire risk reduction goals, must therefore be accounted for in the development of forest management plans by Sakâw Askiy (Sakâw Askiy Management Inc., 2019). The next section provides detailed background on wildfire management in the Prince Albert, Saskatchewan, the case study region.

2.2.6 Wildfire Management in Prince Albert, Saskatchewan

Prince Albert, Saskatchewan is in the boreal plains ecozone (Hvenegaard et al., 2015). The boreal plains ecozone has the highest tree species diversity in Saskatchewan and is characterized by mixed wood stands with the coniferous component being represented by white spruce (*Picea glauca*), black spruce (*Picea mariana*), jack pine (*Pinus banksiana*), and tamarack (*Larix laricina*), and the deciduous component being represented by trembling aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*), and birch (*Betula*) (Parisien et al., 2004; Sakâw Askiy Management, 2012a). Fire plays a critical role in the boreal forests of Saskatchewan, with this province having one of the highest rates of wildfire occurrences in Canada. The Province of Saskatchewan has over 100 communities

that are located within or close to forested areas, therefore the option to let fires burn naturally in all instances is not viable (Darwish, n.d.). As is the case for the rest of Canada, climate change-induced dryer and hotter weather patterns, declining health of aging forests, and accumulation of fuels has led to increased risk of wildfire in the forested areas of northern Saskatchewan (Darwish, n.d.).

In 1992, the Saskatchewan First Nation Forest Fire Protection Services Agreement was signed. This made Saskatchewan the first province in Canada to create an official agreement between First Nations and the federal government for forest fire protection (Zahara, 2020). This agreement was initiated by First Nations of Saskatchewan to ensure that their members would have access to adequate training to fight fires around or near their communities (Zahara, 2020). As of 2018, this agreement has led to upwards of 58 First Nations crews and 22 Métis and northern community crews being trained, largely by Indigenous instructors who were contracted by the Prince Albert Grand Council (Zahara, 2020).

In 2002, the City of Prince Albert experienced a large fire, known as the Crutwell fire, directly outside of its municipal boundary (Darwish, n.d.). In 2015, the city experienced one of its worst fire seasons, with large wildfires forcing the evacuation of over 13,000 citizens (Darwish, n.d.). Several actions were taken to reduce the risk of wildfire throughout the city. Specifically, there has been an increase in the collaboration between public and private sectors in pursuit of fuel reduction, the application of FireSmart activities throughout high-risk communities, and an improvement of fire detection methods through increased monitoring of lightning strikes throughout the area (Darwish, n.d.).

The Community Wildfire Mitigation Program has played an integral role since 2002 in reducing the risk of wildfire faced by communities in northern Saskatchewan (Government of Saskatchewan, n.d.-b). The program works with the Prince Albert Grand Council to treat areas at risk of wildfire within and around communities using funding obtained through Western Economic Development and Indigenous Services Canada (Government of Saskatchewan, n.d.-b). Since its implementation, the program has completed 151 mitigation projects in 55 northern communities, providing employment and training opportunities for residents of the communities, many of which are Indigenous, and treating over 16 km^2 of land (Government of Saskatchewan, n.d.-b). Wildfire risk reduction treatment areas are selected using the program's Community Wildfire Risk Assessment, which determines the highest priority locations. These locations are then subjected to wildfire mitigation activities, such as thinning and fuels cleanup, which provide a buffer from fires entering or exiting the communities (Government of Saskatchewan, n.d.-b). In 2018 to 2019, the program received $1.2 million CAD in funding through Indigenous Services Canada for the wildfire mitigation work to be continued. At this same time, the Saskatchewan Wildfire Management Branch and the Emergency Management and Fire Safety organization became part of the Saskatchewan Public Safety Agency, which oversees and implements wildfire mitigation activities in the province (Tymstra et al., 2020).

2.2.7 The "Let it Burn" Policy in Saskatchewan

In Canada, decisions regarding wildfire management are conducted using a risk-based approach, where the highest protection priority is given to human life and property

(Parisien et al., 2020). The other values that are deemed necessary to protect usually include community structures, public infrastructure, and commercial timber (Zahara, 2020). The selective method of employing wildfire management activities is based on the recognition that not all fires can be extinguished due to factors including the high costs of firefighting methods, and the lack of wildfire personnel, funding, and necessary equipment (Zahara, 2020). The main controversy that underlies the "values at risk" approach to selective wildfire management is that the entities deemed to hold value are designated by the government's value protection system. This hierarchy of values therefore explicitly deems that some values are expendable and not worth the associated protection costs (Zahara, 2020). This method of triaging wildfire risks and resources has led to the distinction of an unspoken, yet active, governing practice in the Province of Saskatchewan known as the "let it burn" policy (Poole et al., 2020). The priority placed on properties and structures through the "let it burn" policy while ignoring the values embodied by a landscape has unveiled the colonial roots of this hierarchical wildfire management decision-making process (Poole et al., 2020).

2.2.8 The Social License to Operate

Sakâw Askiy Management Inc. has encountered issues with gaining community support for their forest management operations. In 2019, a protest was held where three groups attended a Sakâw Askiy Management Inc. meeting, asking the company to make changes to the forest harvesting practices being conducted in central Saskatchewan (Taylor, 2019). The General Manager of Sakâw Askiy provided some clarification to the protestors that harvesting is not destruction of a forest, but the start of a new forest (Taylor,

2019). However, conflict between the citizens of Prince Albert and the forestry corporation still exists. This misalignment of views draws into consideration the concept of a "social licence to operate" (Moffat et al., 2016), which is a term used to define the continual and iterative acceptance or approval of operations by local stakeholders and rightsholders who are affected by said operations, as well as those who can affect its profitability (Moffat et al., 2016).

The push for a more proactive and positive community-company relationship has been driven in part by the realization that environmental degradation caused by a company can have a negative impact on the company's reputation, which has a direct impact on the company's financial performance (Moffat et al., 2016). The need for a social license to operate highlights the fact that society is, now more than ever, concerned with the ways in which resources are extracted, developed, and used. Any businesses whose practices are deemed to be lacking or unacceptable by the local society's standards are unlikely to receive this form of social approval (Moffat et al., 2016). It works in the company's favour to gain the social acceptance of the community which it impacts, as this increases the likelihood that the company will be able to conduct its operations relatively unencumbered (Moffat et al., 2016).

There are several ways in which a resource-based company can obtain a social license to operate in the communities they impact. Some researchers have suggested that a social license to operate may be obtained through building and maintaining a positive corporate reputation and educating local stakeholders on the details of the project (Nelsen & Scoble, 2006). As Sakâw Askiy continues to harvest forests and are given an opportunity to participate in the development taround communities of Prince Albert, it will be in the

corporation's best interest to obtain the acceptance of the individuals and organizations in these communities. Community engagement has been designated as a vehicle through which a social license to operate may be obtained (Dare et al., 2014).

2.2.9 Community-Engagement in Forest Management

In this study, the community of interest includes the shareholders of Sakâw Askiy Management Inc., and the stakeholders and rightsholders of the Prince Albert Forest Management Area who hold knowledge and experience regarding wildfire in the area. Community engagement is an essential component of forest management operations. The engagement of community members allows for forest managers to connect with stakeholders and/or rightsholders affected by the forest operations (Dare et al., 2014). There are two main types of engagement in forest management. The first type, operational engagement, describes the process by which forest managers engage with stakeholders in matters regarding their day-to-day activities. This form of community engagement generally occurs through field activities with those stakeholders directly impacted by forest management activities (Dare et al., 2014). The second type of community engagement, strategic community engagement, describes the process by which forest managers engage with stakeholders who may not be directly affected by the forest operations, but who have an interest in influencing operations (Dare et al., 2014). Operational engagement is regarded as the type of community engagement that may foster a social license to operate (Dare et al., 2014).

Community-engaged forest management has been acknowledged as a potential method of achieving sustainable forestry goals (Pagdee et al., 2007). Community

participation in forestry can lead to more socially robust decisions by including local sources of information and examining different management strategy techniques. Including communities in forest management processes also has the potential to reduce uncertainties, conflict, and legal costs (Krishnaswamy, 2012). Community engagement in forest management processes is often mandatory with organizations such as the Canadian Standards Association and the Forest Stewardship Council requiring extensive community-engagement as part of their certification criteria (Krishnaswamy, 2012). There is a widespread acceptance that community members being engaged in wildfire risk reduction strategies can help reduce the impacts of future wildfire events (McGee, 2011). In Canada, there has been considerable government efforts focused on providing information to homeowners with the aim to promote understanding of local wildfire risk and mitigation efforts people can undertake on their own properties to become more fire resilient (McGee, 2011).

The engagement processes employed must also consider the concerns and perspectives of First Nation communities. It has been noted by various governments, First Nations organizations, federal commissions, and Senate committees that First Nations people have not been adequately involved in natural resource extraction endeavors, including forestry, that have been carried out on their traditional lands (Stevenson & Perreault, 2008). There is an urgent need to include First Nations peoples, and traditional knowledge sources, in meaningful roles natural resource management, including decision-making processes (Shaw, 2019). In the case of Sakâw Askiy Management Inc., three of its seven shareholder organizations are owned by First Nation communities. These three companies have allocations of wood within the Prince Albert Forest Management Area that

provide many benefits to the communities in which the companies operate, including employment and training opportunities for First Nation citizens. Companies and governments too can benefit from proper community engagement by gaining access to new forms of information and knowledge, stronger networks, and public trust, for example, which has been shown to improve management and planning and reduce costly social conflict (Krishnaswamy, 2012). Community involvement can also support social learning among organizations and individuals involved in management and planning processes, leading to positive outcomes for wildfire management (Goldstein et al., 2010; Hayward et. al., 2007).

Tensions exist between citizens of Prince Albert and forest operations employed by Sakâw Askiy Management Inc. (Taylor, 2019). There have been attempts to quell this conflict, including information pages on the corporation website dedicated to highlighting the difference between forest harvesting and deforestation. This section makes the distinction that deforestation is a permanent loss of a forest due to a conversion in land usage, including forested land being converted to farmland, permanent roads, or communities (Sakâw Askiy Management Inc., 2012b). After forest harvesting activity, the trees will begin to grow again through a combination of natural and facilitated forest processes (ie. root suckering, natural seeding in, and tree planting) (Sakâw Askiy Management Inc., 2012b). Most roads that are constructed for forest harvesting activities are non-permanent fixtures and will be removed after the harvesting operations are completed. Some forestry roads remain in use for longer durations but will eventually be reclaimed when they are no longer needed to access timber harvesting areas (Sakâw Askiy Management Inc., 2012b). Although these clarifications have been made, contention

remains between Sakâw Askiy Management Inc. and some of the stakeholders and rightsholders of the Prince Albert Forest Management Area. Fueling some of this contention is also the debate as to how effective the employed reclamation processes are, as there is little information available for natural resource managers for which reclamation and restoration approaches should be employed to achieve ecosystem recovery (Lloyd et al., 2013).

Public sentiments for old forests are a barrier to Sakâw Askiy Management Inc. being able to implement the most effective and efficient wildfire risk reduction strategies. In Prince Albert, the forest stands have been described as "unnaturally old" (Diane Roddy, pers. comm., July 13, 2020). Figure 2-3 shows the 55-year fire return cycle that has historically existed in the Prince Albert Forest Management Area. The dashed red line indicates what the natural age of the forest would have been historically under a 55-year fire return cycle. Historically, there would have been an abundance of young recently burned forest, but increasingly there is less area in 80- to 140-year-old forests. The green bars show the current age of the forest. Most of the land base is comprised of age classes younger than 50 years or between 80 and 140 years. The significant area in the older age classes (80 to 140 years) suggests that disturbance from fire has been reduced by suppression activities, leading to landscapes that are generally older than what they would be without fire suppression (Sakâw Askiy Management Inc., 2018). Over-mature forests increase the wildfire hazard risk of a landscape. Trees not only release carbon back into the atmosphere through burns, but also through the process of decaying and dying as they become over-mature (Government of Saskatchewan, 2019). Through harvesting and allowing wildfire to occur on the landscape, younger and healthier forest stands, which

capture more carbon, can dominate the landscape (Sakâw Askiy Management Inc., 2019).
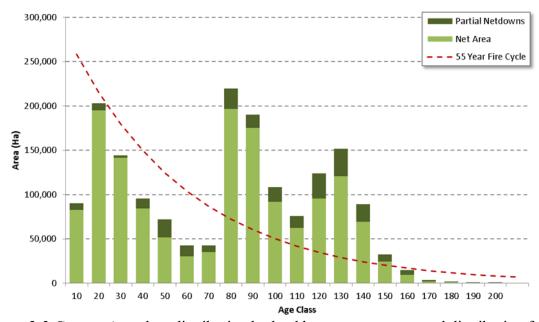
Figure 2-3:Current Age class distribution by land base type vs. expected distribution from a 55-year fire cycle (Sakaw Askiy Management Inc., 2018)

There are many reasons that emotional attachment to old forests may arise, however, the main sentiments that have been proposed to explain this phenomenon are that old forests are viewed as being venerable and unchanging areas (Sharpe et al., 1986 as cited in Vosick et al., 2007). This perception of old forests as stable and permanent entities leads to the belief that if left alone, they will be able to persist (Vosick et al., 2007). This common misconception stems from the notion that prior to human intervention and development, forests were static and long-lived. However, in the boreal forest, fire has played a dominant role in shaping forest regimes and ecosystems, and therefore, the trees and vegetation that grow throughout these ecosystems undergo dynamic and sporadic changes (Brandt et. al., 2013; Vosick et al., 2007). Other values placed on old forests include the economic values of old trees, the species habitat that they provide, and their ability to be used for researching

human impacts on the forests in which they occur (Moyer et al., 2008). A necessary component required to shift social perception of the harvesting of old forests in the Prince Albert Forest Management Area, and other forest management decisions, is continued engagement and collaboration with the stakeholders and rightsholders (Friedman, 2006).

2.3 Defining Learning

Learning is essential for altering business as usual practices towards a more climate change-resilient future and for creating a knowledge base among stakeholders facing the challenges and uncertainties imposed by a changing climate (Gonzales-Iwanciw et al., 2020). Approaching natural resource management through the lens of learning allows interventions and new practices to be treated as opportunities for learning. This contributes to continual improvement and greater understanding of the interactions that occur between people and the natural environment (Keen & Mahanty, 2006). As learning is a fundamental attribute of adaptive management (Keen & Mahanty, 2006), it is an appropriate lens to use to study the development of wildfire risk reduction strategies pursued by Sakâw Askiy Management Inc.

To assess learning processes, a functional definition of the term must be established. However, there is no consensus on a definition of learning or on the necessary requirements to establish that learning has occurred (De Houwer et al., 2013). This lack of consensus, however inconvenient, is entirely logical because of the difficulty in defining a concept as broad and varying as learning (De Houwer et al., 2013). Learning can be defined in many ways depending on the context in which it is being discussed. Early definitions of learning developed in the 1960's and 1970's stated that learning was a change in behaviour,

with behaviour being an observable and measurable indicator that included all responses, reactions, or movements by any organism in a situation (Hergenhahn & Olson, 2001). However, this definition of learning received criticism since not all changes in behaviour are derived from a learning-based situation, and a change in beliefs or attitudes because of a learning-based experience does not guarantee a change in behaviour (Muro & Jeffrey, 2008). A more comprehensive and clear definition of individual learning developed by Saljö (1979) states that learning must include at least one of the following components: (1) gaining and increasing knowledge; (2) memorizing; (3) acquiring facts, skills, and methods; (4) making sense of abstract meaning; and (5) interpreting and understanding reality in a different way by reinterpreting it (Saljö, 1979 as cited in Muro & Jeffrey, 2008). This is the definition of learning used for the purposes of this project.

The extent of learning that an individual or organization experiences, or the nature of what is learnt, can be determined by many factors. These include where the motivation to learn has come from (i.e., external, or internal motivations); the preferred style of learning of the individual or organization; the beliefs and attitudes held by the individual or organization, and the social-cultural setting in which the learning process occurs (Bandura 1977; Ryan & Deci, 2000). The proposition that learning can occur at either the individual level or on larger scales, such as through organizations, introduces the idea of organizational learning.

2.3.1 Organizational Learning Theory

Although many definitions for organizational learning exist, the core component of all these definitions is the presence of a change in the organization that occurs as it acquires

experience (Argote & Miron-Spektor, 2011). Debate occurs among researchers around what change is experienced by an organization during learning. Most agree that the change involves gaining knowledge. Gaining knowledge can present itself in easily detectable or more subtle cognitive or behavioural changes (Argote & Miron-Spektor, 2011). Organizational learning theory considers the social context of acquiring knowledge, the influence of the learning environment on knowledge application, and the impact that the learning experience has on future learning processes (Berta et al., 2015).

Organizational learning theory highlights the social aspects of learning. Individuals who make up the organization interact to develop meaning and knowledge relevant to action-outcome relationships and the effects of the organization on these relationships (Berta et al., 2015). Organizational learning includes the sum of the knowledge of the individuals who make up the organization and can exist long after the tenure of said individuals (Berta et al., 2015). The information learned can also exist within an organization in more formal repositories including formal policies and procedures, or in databases. This knowledge can also exist in less formal repositories, including the cultural and behavioural norms that exist within the organization (Berta et al., 2015). The changes and learning that occur within organizations through social interactions can occur on different levels, which can be described using the models of loop learning (Argyris & Schon, 1978).

2.3.2 The Models of Loop Learning

Learning occurs on different levels, but it can also affect individual or collective understanding in different ways (Evely et al., 2011). One way that this can be reflected is

through the models of loop learning. In this model, learning can be classified using three different "loops"; single-, double-, or triple-loop learning (Evely et al., 2011).

2.3.2.1 Single-loop Learning

Single-loop learning is the simplest form of learning and refers to learning the consequences of specific actions (Argyris & Schon 1978; Fazey et al. 2005; Reed et al. 2010). This rudimentary form of learning aims to improve performance through error detection and correction without making any deeper changes to underlying and pre-existing beliefs, assumptions, and values (Hargrove, 2002). This type of learning is concerned with effectiveness and how best to achieve goals and objectives without having to undergo any changes in structure, culture, and/or organizational systems (Garcia-Morales et al., 2009). In this sense, single-loop learning leads to reflections on how certain processes are achieved, but not why the achievement of these processes is desired (Garcia-Morales et al., 2009). This results in the development of incremental changes to the established operating procedures that either maintain or adapt the status quo (Garcia-Morales et al., 2009). Evidence of single-loop learning for this project was presented in the form of acquiring new knowledge or skills centered around wildfire, wildfire risk, or risk reduction strategies and/ or the development of a different understanding of any of these topics.

2.3.2.2 Double-loop Learning

Double-loop learning is a characterization of learning that occurs at the level of rules, insights, and principles (Argyris and Schön, 1978). This more complex form of

learning involves acquiring more knowledge or finding better problem-solving methods during the learning process (Hwang & Wang, 2016). In double-loop learning, new feedbacks and perspectives are identified through the engagement of different stakeholders (Ananda et al., 2020). This allows for the rationale behind a set of actions to be questioned, where networks of actors are deemed to play an essential role in dealing with change and uncertainty (Folke et al., 2005). Social learning supports building trust through collaboration and deliberation where stakeholder and rightsholder perspectives are considered an essential component of double-loop learning (Pahl-Wostl, 2009). The stakeholders and rightsholders involved in social learning processes at the double-loop level help to question and explore the reframing of structural constraints within existing governance frameworks (Pahl-Wostl, 2009). Evidence of double-loop learning in this research was presented in the form of the incorporation of different perspectives or views of wildfire, wildfire risk, or risk reduction strategies.

2.3.2.3 Triple-loop Learning

There is a consensus among researchers regarding the processes that entail single- and double-loop learning, but triple-loop learning still lacks clear articulation (Kwon & Nicolaides, 2017). There is, however, a consensus that triple-loop learning is the most complex classification of learning following the loop learning models. Triple-loop learning questions and challenges the values and norms which underlie the assumptions we make and the actions we take (Kwon & Nicolaides, 2017; Argyris & Schon 1978; Fazey et al. 2005; Reed et al. 2010). This form of learning can create the greatest changes in how an individual or organization understands and reacts to a specific situation (Evely et al., 2011).

Triple-loop learning increases the time scales for change by taking into consideration the diverse governance and management measures that provide guidance and direction in social contexts (Pahl-Wostl, 2009). In triple-loop learning processes, the factors that determine the frame of reference within an organizational or governance regime undergo transformation, which results in the transformation of the regime entirely (Pahl-Wostl, 2009). The transformations that occur through this deeper form of learning require acknowledgement that the underlying paradigms and structural framework that exist within the governance regime impede the ability to achieve the most effective resource management solutions. Therefore, processes of triple-loop learning imply a change in the values and norms that underlie management practices (Pahl-Wostl, 2009; see figure 2-4). Evidence of triple-loop learning for this research was presented in the form of the building of relationships/networks with the focus of wildfire risk reduction and the challenging of values and norms which underlie existing wildfire risk reduction strategies.

Triple-loop learning is required for solving super-wicked problems and involves questioning the underlying causes and contexts of a problem, reframing, relearning, and unlearning what we have learnt in the past (Gupta, 2016). Although triple-loop learning is explained as the deepest and most profound form of learning, it must also be acknowledged that there is no hierarchy of importance between single-, double-, and triple-loop learning. Learning loops occur through simultaneous, iterative, and dynamic processes, not in a sequential order. Therefore, the importance of triple-loop learning must not be overemphasized, as single- and double-loop learning too can lead to changes throughout a management regime that provide the learning required to make beneficial shifts within the

regime (Kwon & Nicolaides, 2017). In fact, too much triple-loop learning can be a destabilizing force if values and norms are constantly in flux.
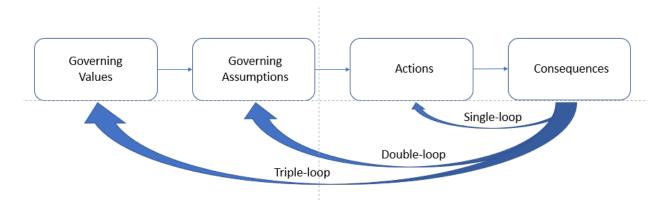
Figure 2-4:Schematic of single-, double-, and triple-loop learning (adapted from Argyris & Schön, 1996)

2.3.3 Typologies of Learning Effects

The framework provided by Baird et al. (2014) provided further insight into loop learning. Single-loop learning be reflected through gaining new knowledge, or restructuring of existing knowledge (Baird et al., 2014). Double-loop learning can be reflected through changes in norms, values, and/ or paradigms, or convergence of group opinions. Lastly, triple-loop learning is reflected through an improved understanding of differing mindsets, building of trust and relationships, and enhanced cooperation (Baird et al., 2014). (See Table 2-1). The complexity of climate change problem solving, and consequences requires an approach that focuses on learning, with social learning theory being one of the mechanisms proposed (Baird et al., 2014).

Table 2-1:Typology of Learning Effects (Influenced by Baird et al., 2014)

	Single-loop	Double-loop	Triple-loop
Definition	Acquiring new knowledge or restructuring of existing knowledge	Change in norms, values, paradigms, or convergence of participant opinions	Improved understanding of the mindset of others, enhanced trust, and building of relationships
Project-relevant indicators	New knowledge of wildfire, wildfire risk, or risk reduction strategies. Development of a different understanding of any of these topics	Incorporation of different perspectives or views of wildfire, wildfire risk, or risk reduction strategies	Building of relationships/networks with the focus of wildfire risk reduction.

2.3.4 Social Learning Theory

"*No one person has the whole answer, we all have a piece of the truth and there is a pressing need to come up with imaginative solutions*" (Lonsdale et al., 2010).

My research project works within the theoretical framework of social learning. The varied nature of social-ecological problems has led many writers to call for a wider use of this theory when addressing the complexities of sustainable natural resource management (Muro & Jeffrey, 2008). Social learning incorporates theories from psychology, collaborative action theories from political science and sociology, as well as theories from organizational development to understand how learning that occurs in groups can result in the building of knowledge, trust, and collective action (Biedenweg & Martha, 2013; Schusler et al., 2003).

Social learning theory, as developed originally by Bandura (1971), provided a framework for how learning can occur through observation. Bandura stated that although

people are capable of learning through a process of trial and error, this is a time-consuming and, at times, hazardous process that is not feasible for learning complex activities such as a new language (Bandura, 1971). He therefore postulated that social learning occurs through observation and modelling. To learn a new behaviour, an individual must pay attention to the desired behaviour, remember the behaviour, and be able to reproduce the behaviour (Bandura, 1971). In this sense, Bandura's theory of social learning involved learning that occurs on the individual level but is influenced by social norms in a social context. However, this definition was lacking as most learning that occurs can be attributed to some form of social context (Reed et al., 2010). The view of social learning occurring solely at the individual level is also too restrictive to be able to evaluate the various learning processes that occur in managing socio-ecological systems (Berkes, 2009).

Social learning is a widely researched topic, and yet, there is still no universally agreed upon definition for the processes that entail this form of learning (Ananda et al., 2020). Definitions stemming from different research backgrounds highlight concepts such as reflection, experimentation, shared understandings, and the incorporation of diverse perspectives as playing an important role in the process. A commonality among definitions of social learning is the key element of gaining new knowledge to enable change through social interactions (Ananda et al., 2020). A more recent and broad definition of social learning used for this research is "a change in understanding that goes beyond the individual to become situated in wider social units or communities of practice through social interactions between actors within social networks" (Reed et al., 2010, p. 6). In this definition, the community of practice is a network that develops around a shared understanding or identity (Crowley et al., 2020). This collective perspective of social

learning postulates that consideration of how people learn collectively is as important as the influence social context has on the learning processes (Ananda et al., 2020).

Social learning has gained increasing traction as a method of addressing environmental problems. This is because of the realization that the complexity and uncertainty of these often "wicked problems" (Rittel &Webber, 1973) requires input and knowledge of non-conventional actors (such as Indigenous community members, industry workers, citizens, and members of NGOs). Such input creates solutions that would not be possible through the more traditional top-down, hierarchical, and structured management approaches (Hayward et al., 2007). Social learning in natural resource management focuses on overcoming conflicts and integrating diverse perspectives and views (Scholz & Methner, 2020). A diversity of perspectives may result in increased adaptive capacity for managing resource systems as the different views and perspectives provide greater sensitivity to change and an enhanced ability to come up with different solutions and strategies for action (Maarleveld & Dabgbégnon, 1999). In fact, social learning and adaptive capacity are considered intertwined factors needed for effective multi-scale collaborative governance (Plummer et al., 2013). Successful social learning is that in which the learning processes that occur through interaction lead to new knowledge, understanding and trust among participants, and ultimately, collective or concerted action (Lebel et al., 2010).

Keen et al. (2005) propose that there are five main "braids" of social learning that are crucial to environmental management. These are reflection, systems orientation, integration, negotiation, and participation. Other researchers suggest that the presence of a third-party facilitator is necessary to ensure the five braids are fulfilled as well as some

additional aspects which include a democratic structure to decision making, open communication, and constructive conflict (Biedenweg & Martha, 2013). Therefore, if participants from a diverse background share ideas openly and reflect upon these ideas to integrate them into new knowledge, conflicts can be managed constructively through deliberation and a democratic structure that allows the participants to influence the learning process. Social learning thus has the potential to result in acquisition of new knowledge and skills, self-efficacy, trust among participants, reconciliation of diverse views and interests, resolution of basic conflicts, and the development of shared understanding of problems and potential solutions (Biedenweg & Martha, 2013; Hayward et al., 2007).

Beyond acquisition of new knowledge and understanding, social learning must go beyond the individual and impact members throughout wider social units, either through direct (conversations) or indirect (ex. media, telephone) social interactions (Reed et al., 2010). Social learning scholars argue that not all forms of learning result in the acknowledgement of new perspectives or shared understanding of a particular issue (Scholz et al., 2014). Scholz et al. suggest that for a learning process to be classified as social learning, there must be a degree of similarity that is evident throughout the mental models of the participants involved, where mental models refer to the "personal interpretation of the surrounding world" (2014, p. 577). If a similarity is detected, the direction of learning can be classified as convergent, meaning that through the learning processes participants integrated concepts and perspectives from each other and/ or developed new, shared concepts (Scholz et al., 2014).

Social learning processes can be further classified as either designed or emergent learning processes (Lumosi et al., 2019). Designed social learning processes are purposely

set up and focus on elements that could hinder or enhance learning processes, such as the introduction of external influencers, or facilitators, to achieve pre-defined goals (Lumosi et al., 2019). Emergent social learning processes are defined as being dynamic, long-term, and continuous where goals are defined and re-defined when intermediate outcomes are reached or realized (Lumosi et al., 2019). Emergent social learning processes either occur naturally or through a self-organized manner that arises in response to a specific need (Lumosi et al., 2019

Several roles exist throughout social learning processes. Anyone taking part in the social learning process is considered a participant. However, a participant can be either passive or active, a distinction that can have significant effects on the entire learning process. A passive participant is someone who does not engage actively in the learning process and is simply a bystander to the process. An active participant is engaged with the learning process and contributes by adding content, structuring actions, or by influencing results (Scholz et al., 2014). A participant is considered to play the convener role if they take the formal lead of the learning process. This includes deciding on the nature of the participation and setting the agenda. The facilitator role is typically filled by an external person and helps by using their expertise to lead the process and elicit participant knowledge. A technical expert may be included in a social learning process and is someone who uses their expertise on the topic to add a perspective that has not been addressed. Lastly, a leader is a role filled by a participant who can connect people, support the merging of opinions and perspectives, and encourage the engagement of all participants. This is a role that may be realized as the learning processes progress (Scholz et al., 2014). In this

sense, social learning can be experienced either at the individual level, or it can be experienced as learning that occurs throughout a collective such as an organization.

The social learning that can occur in an organization relates to the theory of organizational learning, which is learning through experience that results in changes being made by an organization (Argote & Miron-Spektor, 2011). The knowledge gained through experiences can present itself in changes of behaviour, cognition, or both and can include explicit and obvious changes, or ones which are tacit and more difficult to articulate (Argote & Miron-Spektor, 2011). The experience that leads to acquiring new knowledge accumulates when an organization performs a task (Argote & Miron-Spektor, 2011). In the context of this research, the task performed by the organization, Sakâw Askiy Management Inc., is the development and implementation of wildfire risk reduction strategies. These social learning processes encompass aspects of individual and organizational learning (see figure 2-5)
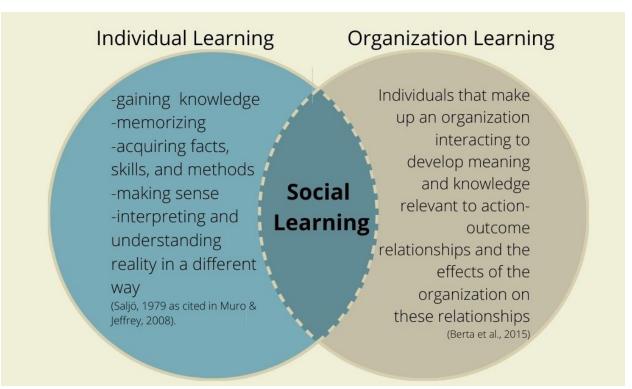
Figure 2-5:Comparison of Individual, Organizational, and Social Learning

2.3.5 Adaptive Capacity

There is a clear link between the process of social learning, bringing members of different social networks together to collectively address a problem, and increased adaptive capacity (Adger, 2003). Adaptive capacity, in its most fundamental sense, is the ability to adapt (Engle, 2011). This concept has roots within sociology, physiology, and organizational and business management, but has more recently gained increasing attention in the context of climate change adaptation (Engle, 2011). Adaptive capacity is a unique property in the sense that it can be structured and manipulated by human beings, but it impacts both the social and ecological components of a system (Engle, 2011). The adaptive capacity of a system describes the ability of said system to utilize available resources to predict future stressors or respond in a reactive way to current stress. This characteristic makes adaptive capacity an essential component of the development and implementation

of options for sustainable adaptation (Engle, 2011). Understanding adaptive capacity involves acknowledging the importance of many abstract processes including the structures of decision-making and governance, cultivating innovation and experimentation, and the fabrication of institutions and entitlements (Jones et al., 2011).

Adaptive capacity is recognized as a property of a system that can be translated to decision-makers through its emphasis on components of governance, institutions, and management (Engle, 2011). The factors that contribute to high levels of adaptive capacity when facing a particular problem, such as climate change, will often overlap with factors that make a system more resilient to a wide array of shocks and disturbances (Jones et al., 2011). When addressing the complexities of climate change, adaptive capacity may help to facilitate the development of solutions through its potential to be focused on the evaluation of policies and management and organizational or governance regimes that threaten the ability of a system to successfully implement adaptations (Engle, 2011). Adaptive capacity involves a broad, complex, and intertwined set of variables that are not equally distributed and vary depending on the context and systems in which they operate (Adger et al., 2007). It is, therefore, a difficult and yet critically important process to identify the variables that work to build, and alternatively limit or decrease, adaptive capacity within a system (Adger et al., 2009).

The adaptive capacity of a system is a characteristic that is hard to describe due to its latent nature (Engle, 2011). Despite this complexity, the importance of describing adaptive capacity remains. The adaptive capacity of a system can be described using a variety of methods including case studies, modeling, and mapping (Engle, 2011). Although adaptive capacity is a context-specific and non-generalizable property of a system (Engle,

2011), its description and analysis require the establishment of identifiable elements that contribute to its properties.

2.3.6 Determinants of Adaptive Capacity

Defined determinants of adaptive capacity are assets that make adaptation possible (Williamson & Isaac, 2012). Several determinants of adaptive capacity are identified and described by the Intergovernmental Panel on Climate Change. These include the array of technological options accessible, economic resources, institutional design and structure, human and social capacity of the adaptors, and knowledge and ability to access information (IPCC, 2001). Other factors that have been identified as contributing to the adaptive capacity of a system are climate change knowledge (ex. scientific, local, traditional, Indigenous) and knowledge mobilization (ex. education, awareness, knowledge exchange) (Williamson & Isaac, 2012), and the ability to develop and implement new management and policy strategies, or restructure existing ones, in response to environmental changes (Fischer & Jasny, 2017). The adaptive capacity of a system or organization depends on these determinants, which interact and can vary given the space and time of the assessment (Smit & Pilifosova, 2003).

Along with the variety of determinants that exist for assessing adaptive capacity, there also exist several methods for assessing these determinants. Given the complexity and multitude of factors that contribute to adaptive capacity, there is no single correct way to assess this trait of an individual or organization (Williamson & Isaac, 2012). The scope and method chosen to assess adaptive capacity differs based on several factors including: the subject of the assessment; the reason for the assessment; the depth in which the

assessment is conducted; and the spatial and temporal scale of the assessment (Williamson & Isaac, 2012). The determinants outlined above are applied in description of the adaptive capacity of Sakâw Askiy Management Inc. with respect to their vulnerability and resilience in the face of wildfire risk.

An analysis of the determinants of adaptive capacity of an organization can highlight the deficits or barriers that inhibit said organization from adapting (Williamson & Isaac, 2012). Once these deficits have been identified, efforts can be undertaken to remediate them. Depending on the areas of adaptive capacity that need improvement, these efforts can include increasing knowledge of the impacts and adaptations required, developing strategies and tools which support decision-making at multiple levels, including climate change experts in natural resource management, raising awareness of the risks and vulnerabilities related to climate change, and developing and supporting organizations or communities of practice who focus on climate change (Williamson & Isaac, 2012).

2.3.7 Social Capital

Social capital, the existence of relationships of trust, reciprocity, and exchange, has the potential to be increased and strengthened through the collective action of social learning (Adger, 2003). Social capital facilitates co-operation and allows participants to have the confidence to invest in collective activities knowing that others will do so as well. The social capital that exists between individuals or organizations also lessens the likelihood that participants will engage in unfettered self-serving actions that can result in negative environmental outcomes, such as resource degradation (Pretty & Ward, 2001).

Social structures and networks that engender adaptive capacity are those that improve the availability and access to resources, the ability to act collectively, the generation of new knowledge, and the attachment to or understanding of local ecosystems (Fischer & Jasny, 2017).

Organizational networks that bring individuals together may act to enhance adaptive capacity by providing a platform through which learning and collective action can occur. Interactions between individuals and actors of different organizations may promote access to new information, which in turn, may affect their ability to generate new knowledge and act collectively, making decisions based on the newly acquired knowledge (Fischer & Jasny, 2017). This models the processes of organizational learning previously mentioned, where an organization acquires new knowledge, learns through experiences, and makes changes accordingly (Argote & Miron-Spektor, 2011). As wildfires continue to increase in frequency and severity, interest in understanding the role of social factors in shaping fire management objectives has grown markedly and will continue to do so with increases in funding to this area of research (McCaffrey, 2015). The importance of interagency collaboration and community engagement, which have the potential to improve social capital, highlight the relevance of social and organizational learning to wildfire management efforts in Canada.

2.3.8 Conservation Learning Networks

Conservation learning networks are an emerging strategy that can address complex resource management challenges, including wildfire risk reduction (Goldstein et al., 2010). To solve contemporary conservation challenges, new strategies are required that promote

adaptive management, facilitate the development of networks and collaboration within and across boundaries, and build a community of practice. There is promising evidence that conservation learning networks can address these needs (Goldstein et al., 2010). Conservation learning networks follow a more participatory approach than other learning strategies and they allow for more open reflection, autonomy, adaptability, and self-coordination, which has the potential to lead to the establishment of relationships through the acknowledgement of mutual work and concerns (Goldstein et al., 2010).

Like any community of practice, a conservation learning network has three components: (1) a domain, which is the main issue that the network focuses on; (2) a community, which encompasses the participants who operate in the domain and share a common goal; and (3) a practice, which is the expertise, skills, and methods used by the community to solve the issue (Goldstein et al., 2010). Learning that occurs through the community while solving the domain, or issue, may be considered a social learning process. A community of practice, which a learning network can foster, has been defined as a group of people who interact frequently with the purpose of deepening their knowledge and expertise on a shared topic of interest (Wenger et al., 2002 as cited in Watkins et al., 2018).

A community of practice can provide an avenue for interdisciplinary engagement that leads to the creation and sharing of new forms of knowledge and leadership (Watkins et al., 2018). Through social learning, a community of practice can improve decision making processes by allowing for iterative and meaningful interactions to occur that work to strengthen relationships and increase the problem-solving capabilities of the community (Watkins et al., 2018). This sort of process can be seen, for example, where researchers

work with practitioners to shape and re-shape research questions focused on on-the-ground issues to disseminate the findings in a more meaningful way and improve management processes (Watkins et al., 2018). Through this lens, Sakâw Askiy Management Inc. can be seen as a conservation learning network as learning occurs among shareholders of the corporation and the rightsholders and stakeholders of the Prince Albert Forest Management Area to iteratively develop wildfire risk reduction strategies. This learning network can promote the growth of a community of practice among the main individuals who are involved in the learning and decision-making processes entailed in developing the strategies.

2.4 Research Gaps

There is a need to employ wildfire risk reduction strategies at the landscape-level to protect communities and the values contained within forested ecosystems from the destruction that can be caused by natural disturbances. There is also a need to engage citizens from affected communities and interest groups in the development and implementation of risk reduction strategies. There is a clear link between social learning and adaptive capacity, however, there is a need for more clarity on how to define and measure learning, what relationships exist between social interactions and learning, and how environments shape learning (Crona & Parker, 2012). This lack of consensus may diminish the potential benefits of social learning processes. Community participation in forest management and planning, and specifically wildfire risk reduction strategies, can lead to more socially robust decisions by including local sources of information and examining different management strategies and techniques. Including communities in

forest management also has the potential to reduce uncertainties, conflict, and legal costs (Krishnaswamy, 2012). This research project addresses the gaps in knowledge that exist within the processes of social learning and the development of community-engaged and supported wildfire risk reduction strategies. Research completed in this area has mostly occurred in the United States and Australia and on community-level wildfire risk reduction strategies (Jakes & Sturtevant, 2013; Reid et al. 2018; Steelman & Nowell, 2019). As community engagement in forestry management processes is often mandatory with organizations (Krishnaswamy, 2012), having a more comprehensive understanding of the learning that occurs throughout these processes and best practices in terms of effectively and equitably engaging with community members is becoming increasingly important. The results and conclusions that are drawn from this research can be used to inform future endeavors in the field of community-engaged natural resource management and contribute to the understanding of the social aspects of landscape-level fire management approaches employed in Canada.

2.5 Summary

This chapter provided a review of the topics relevant to developing community-informed wildfire risk reduction strategies by setting the context of wildfire management in Canada and explaining the existing research that has been conducted on community-informed wildfire management. The literature review also introduced the theory of social learning, which is used throughout this thesis to describe the learning processes that have occurred while Sakâw Askiy Management Inc. works towards developing wildfire risk reduction strategies as a method of improving the corporation's adaptive capacity. The interaction and engagement of the shareholders of Sakâw Askiy Management Inc. with the

stakeholders and rightsholders of the Prince Albert Forest Management Area through the development and implementation of wildfire risk reduction strategies allows for the processes of social learning to occur and contributes to building of the corporation's adaptive capacity. These interactions also have the potential to alleviate some of the conflict that exists between the parties invested in the Forest Management Area, allowing Sakâw to work towards obtaining a social license to operate. The main purpose of this chapter was to ground this research in relevant literature and lay out the main framework used to guide the case study of wildfire management learning, hone the research question, objectives, and find knowledge gaps. Having done this, the next chapter will describe the study area in which the research was conducted, and methodology used.

Chapter Three: Study Area and Methodology

3.1 Introduction

Sakâw Askiy Management Inc. was chosen as the natural resource management partnership for this thesis. This case study is one of many that will be prepared in a larger Social Sciences and Humanities Research Council (SSHRC) project entitled Climate Learning and Adaptation for Northern Development (C-LAND). The C-LAND project was developed with three objectives:

1. Assess awareness and multi-scale learning about climate change adaptation;

2. Gain insights into how these learning processes occur in innovative organizational models; and,

3. Explain how learning processes can support and enhance adaptive capacity in complex governance settings (Environment and Society Research Group, 2020).

The C-LAND project team aims to create an inventory of collaborative resource governance arrangements or partnerships involving Indigenous and non-Indigenous partners working in climate vulnerable sectors (Environment and Society Research Group, 2020).

For a project to be included as a C-LAND case study, there must be an element of collaboration which includes components of conflict and debate. The organization must also be a resource-based community, with the recognition that community can be defined in many different contexts (Environment and Society Research Group, 2020). The organizations must display aspects of innovative organizational models. For C-LAND's criteria, these can be recognized as an emphasis on local knowledge, values, and

accountabilities in the renewable resource sector. These innovative organizational models must also make governance decisions regarding adaptation needs (particularly those with respect to climate change) and include perspectives from a diverse group of actors in these decisions (Environment and Society Research Group, 2020). The cases chosen to be included in the C-LAND project also need to be comparable in terms of broad policy implications for climate change adaptation in Canada. This means that the cases chosen must be similar in aspects of innovative partnerships, regions impacted by climate change and adaptation options available, and lastly, have a government that has identified adaptation assessments in these sectors as high-priority policy matters (Environment and Society Research Group, 2020).

The cases chosen will differ in levels of exposure to impacts of climate change, level of adaptive capacity, and vulnerability to climate change (Environment and Society Research Group, 2020). The scale of the project must also be taken into consideration when determining if it is an appropriate case study. The scale must consider the number of actors involved, project stage and progress, and how long the partnership has been in place (Environment and Society Research Group, 2020). The last aspect considered when determining if a project is suitable as a C-LAND case study is the mechanisms for resource access for Indigenous partners involved, including through Impact Benefit Agreements and environmental assessments. These organizations may also obtain a social licence to operate when communities participate in their activities (Environment and Society Research Group, 2020).

Through correspondence initiated by the project leadership/supervisors during Fall 2019, the General Manager of Sakâw Askiy, Diane Roddy, expressed interest in joining

the larger project as a partner. Based on existing shareholder and community input, she further indicated that their interest was in the development and implementation of community-informed and supported wildfire risk reduction strategies at the landscape-level throughout the Prince Albert Forest Management Area as a method of increasing the corporation's adaptive capacity as defined in section 2.3.2. Thus, Sakâw was involved early on in shaping the research question, data collection methods, and participant sample frame in keeping with my community-partnered research approach (outlined below in section 3.3.2)

In recent years, forest harvesting methods employed by Sakâw have been a cause of concern for some citizens of Prince Albert. In Saskatchewan, forest harvesting as a method of reducing wildfire risk has been seen as a "wood grab" by some citizens (Diane Roddy, pers. comm., February 21, 2020). Therefore, community support and involvement are required for successful implementation of harvesting and renewal strategies aimed at reducing the vulnerabilities of forest communities to wildfires and adapting to the impacts of climate change (Diane Roddy., pers. comm., February 21, 2020). Involving citizens in the development of risk reduction strategies enables social learning processes to occur, where the corporation shareholders and stakeholders/rightsholders of the Prince Albert Forest Management Area come together to address the environmental issue of climate change–induced increases in wildfire risk.

This chapter includes an introduction to the case study corporation, Sakâw Askiy Management Inc., the community-wildfire risk reduction strategies that are currently employed in Saskatchewan, and lastly, a description of the methodology employed to assess the social learning processes and adaptive capacity of the corporation.

3.2 Study Area and Forest Governance Context

The origins of the Prince Albert Forest Management Agreement began in 1965, when a Forest Management Agreement between the Province of Saskatchewan and the Saskatchewan Pulpwood Ltd. Division of the new Prince Albert Pulp Mill was signed. In 1981, the Province of Saskatchewan became the full owner of the pulp mill and holder of the Forest Management Agreement. In 1986, Weyerhaeuser bought the pulp mill, and the Forest Management Agreement was transferred to Weyerhaeuser Canada. Weyerhaeuser operated the mill and held the Forest Management Agreement until 2008, when the forestry sector crashed due to the world economic crisis (Bullock & Reed, 2020). On November 1, 2010, the Prince Albert Forest Management Agreement was assigned to Sakâw Askiy Management Inc., to manage on behalf of shareholders holding wood allocations and harvesting rights within the area (Hvenegaard et al., 2015; Sakâw Askiy Management, 2019).

The Prince Albert Forest Management Agreement Area is located north of Prince Albert in central Saskatchewan (Sakâw Askiy Management Inc., 2019) (see Figure 3-1). The total area encompassed within the Forest Management Area, including land, water, and wetlands, is 3.5 million hectares, with 1.83 million being forested land and 1.7 million hectares of this forested land available for harvesting (Sakâw Askiy Management Inc., 2018). Sakâw Askiy Management Inc. is a forestry corporation located in Prince Albert, Saskatchewan. Sakâw Askiy hold the Prince Albert Forest Management Agreement (PAFMA), providing them with the rights to harvest wood in the management area (see Figure 3-1).

Figure 3-1:Prince Albert Forest Management Area (adapted from Sakâw Askiy Management Inc. 2018).

Part of the Prince Albert Forest Management Agreement requires that Sakâw Askiy manage the forest resources located within the Prince Albert Forest Management Area in a sustainable manner (Sakâw Askiy Management Inc., 2019). One of the objectives of the formation of Sakâw Askiy Management Inc. was to create economic and employment opportunities for First Nation communities. As a result of this, three of the Sakâw Askiy shareholders are First Nation-owned companies. These are:

1. AC Forestry - AC Forestry is a First Nation run forestry company that operates from their office in the Big River First Nation. This company was established in 1996 and has always been 100% owned by Big River First Nation, Pelican Lake

First Nation, and Witchekan Lake First Nation (the First Nation communities that make up the Agency Chiefs Tribal Council) (Sakâw Askiy Management Inc, 2014).

2. Montreal Lake Business Ventures - Montreal Lake Business Ventures is a First Nation run forestry company located in Montreal Lake. The company harvests wood through their own volume allocations, and for Carrier Forest Products (Sakâw Askiy Management Inc, 2014).

3. NorSask Forest Products - NorSask is based out of Meadow Lake, Saskatchewan and owned by Meadow Lake Tribal Council. NorSask has one of the largest First Nation-owned sawmills in Canada (Sakâw Askiy Management Inc, 2014).

Sakâw Askiy also have four other forestry company shareholders:

4. Carrier Forest Products - Carrier Forest products have operations in both Saskatchewan (Prince Albert and Big River) and British Columbia (Prince George). Carrier Forest Products purchased the sawmill of Big River in 2011 and now operate with approximately 60 employees (Sakâw Askiy Management Inc, 2014).

5. Dunkley Lumber (Edgewood Forest Products) - Edgewood Forest Products operates in Carrot River and Hudson Bay and has approximately 120 people working at their mill and 120 people working in forest operations including logging and hauling (Sakâw Askiy Management Inc, 2014).

6. Meadow Lake Mechanical Pulp Mill - Meadow Lake Mechanical Pulp Mill is located near Meadow Lake, Saskatchewan and produces hardwood pulp for European and Asian markets (Sakâw Askiy Management Inc, 2014).

7. Meadow Lake OSB Division - Meadow Lake OSB Division is located in Meadow Lake, Saskatchewan and is owned by Tolko industries. This mill produces Oriented

strand board (OSB) panels and sheathing, among other products, from hardwood species (Sakâw Askiy Management Inc, 2014).

Sakâw Askiy brings together shareholders with proven sustainable forest management track records (including meeting environmental requirements and community engagement activities) and incorporates the traditional knowledge and interests of First Nations (Sakâw Askiy Management Inc., 2018).

Along with the seven shareholders of Sakâw Askiy Management Inc., there are many communities in and around the Forest Management Area that benefit from the use of the forested land. Prince Albert is the largest population center near the Forest Management area. Big River, Meadow Lake, and Carrot Lake are other city centers with connections to the Forest Management Area through forestry industry operations (Sakâw Askiy Management Inc., 2014). There are also several municipalities such as Dore Lake, Candle Lake, and La Ronge (Sakâw Askiy Management Inc., 2020a).

Cree, Dakota, Dene (Chipewyan), Nakota (Assniboine) and Saulteaux people collectively make up 16.3% of the population of Saskatchewan (Statistics Canada, 2017). There are many First Nation and Métis communities located in or near the Prince Albert Forest Management Area or those which have connections to the forest operations that occur within the area. These include the communities of Ahtahkakoop First Nation, Pelican Lake First Nation, and Witchekan Lake First Nation (Sakâw Askiy Management Inc., 2020a). These communities use the land within the Forest Management area for activities including hunting, trapping, commercial fishing, and wild rice production. As users of the Prince Albert Forest Management Area, it is the obligation of Sakâw Askiy Management Inc. to include community members and forest management area stakeholders and

rightsholders in the processes of developing mutually accepted operating plans and activities (Sakâw Askiy Management Inc., 2020a).

Prior to the development of the most recent Operating Plan for 2020-2025, several community input activities were undertaken. Since gaining the rights to the Prince Albert Forest Management Area, Sakâw has sought public input through its Public Advisory Committee, which is composed of members with connections to and interests in the Forest Management Area. Members invited to participate in the Public Advisory Committee included representatives of municipalities, ENGOs, Prince Albert Model Forest, Saskatchewan Forestry Association, outfitters and trappers, and independent operators (including members from the tourism sector) (Sakâw Askiy Management Inc., 2014). Sakâw and the corporation shareholders contacted, met with, and incorporated feedback from these stakeholders (Sakâw Askiy Management Inc., 2020a). To inform all interested parties of the opportunity to review the draft forestry operation plan, letters and emails were sent out to over 660 contacts and radio ads and posters were used to further raise awareness of the meetings. These communications included the schedules for public information sessions that would be held across the Forest Management Area and provided contact information for area planning staff (Sakâw Askiy Management Inc., 2020a). The information sessions were held to gain input and feedback on draft operating maps (Sakâw Askiy Management Inc., 2020a).

Along with the community engagement efforts of Sakâw, the corporation has a special duty to consult with First Nation and Métis communities before a plan can be approved regarding any impacts that the proposed forest operating plans may have on their ability to exercise Treaty and Aboriginal rights (Sakâw Askiy Management, 2020a). This

duty is a result of the relationships that exists between Indigenous peoples and the Crown, which stems from histories, treaties, court decisions, and legislation (Smith & Ross, 2003). The leaders of First Nation and Métis communities in and adjacent to the Prince Albert Forest Management Area are consulted when developing forest operating plans. The leaders consulted from First Nation communities were those from Ahtahkakoop First Nation, Big River First Nation, James Smith Cree First Nation, Lac La Ronge Indian Band, Montreal Lake First Nation, Muskoday First Nation, Pelican Lake First Nation, Peter Ballantyne Cree Nation, Sturgeon Lake First Nation, Wahpeton Dakota First Nation, and Witchekan Lake First Nation (Sakâw Askiy Management, 2020a). Leaders consulted from Métis communities were from Nipawin, Dore/Sled Lake, Fish Lake, La Ronge, Leoville, Debden, Weyakwin, Chitek Lake, Timberland, Timber Bay, Spiritwood, Big River, Beauval Sipishik, Prince Albert, Shell Lake, and Green Lake (Sakâw Askiy Management Inc., 2020a). There are also several Memorandums of Understanding (MOU's) between the Government of Saskatchewan and First Nation groups connected to the Prince Albert Forest Management Area. These include the Agency Chief's Tribal Council Renewable Resources and Environmental Partnership Agreement, Montreal Lake Cree First Nation Service Agreement, and the Métis Nation of Saskatchewan Renewable Resources and Environmental Management Protocol Agreement (Sakâw Askiy Management Inc., 2014).

Feedback obtained from these consultations was used to make any adjustments to the plan to avoid, mitigate, or minimize the negative impacts of the forestry operations on the ability of First Nation and Métis communities and individuals to partake in culturally significant activities, such as hunting, fishing, trapping, and carrying out traditional ceremonial practices within the Forest Management Area (Sakâw Askiy Management Inc.,

2020a). Sakâw engages with individual trappers and trapper associations, Chief and Council, committees, and band members throughout the year to further minimize any negative impacts of their forestry operations on traditional land uses (Sakâw Askiy Management Inc., 2020a).

As a Forest Management Agreement holder, and under the Forest Resource Management Act, Sakâw Askiy is required to prepare a 20-year Forest Management Plan every 10 years. The current Forest Management Plan was implemented on April 1, 2018, and will be in place until March 31, 2038 (Sakâw Askiy Management Inc., 2018). This plan includes an assessment of the sustainability of the forested area and associated sustainable rates of harvest over a 200-year planning horizon (Sakâw AskiyManagement Inc., 2012a). Before the implementation of the current Forest Management Plan, a multi-year planning process was completed based on public and First Nation input (Sakâw Askiy Management Inc., 2018). The Forest Management Plan outlines several sustainable forest management objectives and principles that Sakâw and its shareholders are committed to following. These include ecosystem-based management, adaptive management and continual improvement, public involvement and transparency, and accountability to government and stakeholders (Sakâw Askiy Management Inc., 2018).

An additional requirement outlined in Sakâw's shareholder agreement is that shareholders must pursue a voluntary certification for their forest management practice. Currently, all Sakâw shareholders are certified through the Sustainable Forestry Initiative program (Sakâw Askiy Management Inc., 2018). The Sustainable Forestry Initiative provides forest management standards that must be met for companies to remain certified. These standards are outlined through 13 principles, 15 objectives, 37 performance

measures, and 101 indicators. Some examples of principles outlined by the standard are related to forest health and productivity, protection and maintenance of water resources, and responsible fiber sourcing practices (Sustainable Forestry Initiative, 2015). Examples of objectives outlined by the standards include management of visual quality and recreational benefits, conservation of biological diversity, and recognizing and respecting Indigenous rights (Sustainable Forestry Initiative, 2015).

Participants in the certification program must partake in annual surveillance audits that are administered by an independent certification body. The third-party certification bodies that perform these audits must be accredited before they are approved to perform any audits for any Sustainable Forest Initiative standards (Sustainable Forestry Initiative, 2020). The organizations conducting these audits must be independent, objective, and qualified. Depending on which Sustainable Forestry Initiative standard the organization is auditing, they must complete an accreditation program through one or more independently, internationally recognized accreditation bodies (ex. Standards Council of Canada) (Sustainable Forestry Initiative, 2020). The audits must be submitted back to the Sustainable Forestry Initiative for review, and the report must be posted on the Sustainable Forestry Initiative website before the organization can make any claims of being SFI certified (Sustainable Forestry Initiative, 2020). In a study that compared several sustainable forestry certification programs in Canada, it was determined that the Sustainable Forest Initiative strengths were in maintaining forest productivity to ensure long-term economic stability, with much less focus placed on social and ecological standards compared to other certifications such as the Forest Stewardship Council (Clark & Kozar, 2011).

The Prince Albert Forest Management Plan outlines effects of climate change that must be considered throughout the Forest Management Area, with the main impacts being increases in frequency and severity of droughts and fires. It is also expected that warmer winters, higher precipitation levels in spring and winter, hotter and drier summers, and increases in storms will have both negative and positive effects on forest ecosystems throughout the area, including impacts on disturbance regimes, impacts on the species best suited for certain biomes, and economic impacts including the possibility of increases or decreases in timber supply (Sakâw Askiy Management Inc., 2018; Brecka et al., 2018).

3.3 Overview of Methodology

3.3.1 Research Methods

This research was conducted using a case study approach. Case study approaches are particularly useful when addressing "how" and "why" oriented research questions (Yin, 2018), as is the case for this project. Furthermore, a case study approach is appropriate when studying a contemporary event (i.e., an event that has occurred in the past and continues to occur in the present) over which the researcher has little to no control (Yin, 2018). Case study research is particularly useful for allowing a relativistic perspective to be employed in which it is acknowledged that multiple realities with different meanings exist depending on the positionality of the observer (Yin, 2018).

Qualitative research methods were deemed appropriate for this study because they allow the researcher to experience issues from the perspective of the participants and to understand the meanings and interpretations they associate with specific behaviours, events, or objects (Hennink et al., 2011). Qualitative research methods can also be

especially useful in clarifying the values, languages, and meanings attributed by people who hold different roles in organizations and/ or communities (Sofaer, 1999). This characteristic of qualitative methods is important for this project as it involves the sometimes-differing perspectives and concerns of participants from communities, government, and industry. This qualitative case study approach was also appropriate given my focus on developing understandings of phenomena that cannot be isolated from their real-world context. Qualitative research methods in the form of purposeful interview questions and observations were used to describe social learning and adaptive capacity and build on the work that has previously been conducted in this field (Huitema et al., 2010; Haug et al., 2011; Munaretto & Huitema, 2012).

3.3.2 Partnered-Research Approach

Community-engaged research exists as a continuum which is defined by different levels of community involvement and input (Schwartz, 2012). A key component of this project is the application of a partnered-research approach, which exists along the community-engaged continuum. A partnered-research approach addresses local knowledge, values, and concerns to determine priorities of the community members. It also engages with external sources, such as scientists, industry workers, and government officials to provide any information required for local partners to make informed decisions (Timko et al., 2015). Through this partnered-approach, local knowledge was considered in aspects of the project when determined appropriate by the partner, Sakâw Askiy. The final outcomes of projects that address concerns of local citizens and enable citizens to play an important role in decision making are far less likely to face resistance upon implementation

and are more likely to account for the concerns and preferences of all parties involved (Timko et al., 2015). This project was developed through consultations with the General Manager of Sakâw Askiy Management Inc. to find an area of research that fit within the requirements of the Climate Learning for Adaptation and Northern Development project and provided meaningful results and information for Sakâw. As Sakâw had already expressed interest in developing community-informed wildfire risk reduction strategies, this interest was used as a starting point to further develop the research project. The General Manager of Sakâw was consulted frequently throughout the duration of the study to provide input and to ensure that the academic objectives being pursued also aligned with the objectives that the corporation wished to see achieved through the research.

3.3.3 Ethical Considerations

As this research project involved interactions with human participants, there were many ethical considerations that had to be attended to. The proposed research methods had to be approved by the Dalhousie Research Ethics Board (DREB). To obtain this approval, a detailed interview guide (see Appendix A) was submitted for DREB review, which outlined interview questions, research agreements from all parties involved in the study, and consent forms that outlined the potential risks of participating in the study (see Appendix B for DREB approval letter). Participants were informed about the details of the study and had chances to ask questions of the interviewer and supervisors prior to any interviews. They were also made aware of their right to skip any questions they did not want to answer as well as their right to end the interview entirely at any time. Participants were also given the opportunity to vet interview transcripts before February 1, 2021, which

gave all interview participants at least four months post interview to decide whether they wanted to have their data included in the study.

Through the project consent form sent to participants prior to the interview, each participant was able to indicate whether they were comfortable with quotes that could identify them being used in the thesis, whether they were comfortable with quotes that could not identify them being used in the thesis, or if they were not comfortable with either. If the participant indicated that they were comfortable with their quotes being used in the thesis, whether identifying or not, the quotes which were chosen to be included were sent to the participants and they were given two weeks to review the quote and make changes they saw fitting. Therefore, all quotes included in the thesis with both identifying and non-identifying information were reviewed by the participant prior to their inclusion.

3.4 Interview and Workshop Data Collection

3.4.1. Semi- Structured Interviews

Semi-structured interviews enable the participant to discuss issues they feel are pertinent to the topic while also following a set of pre-planned questions and topics, or interview guide, to ensure that the information required to fulfill the research objectives is obtained (Bernard, 2018). Following a set interview guide for each participant is optimal for studies that require reliable, comparable qualitative data (Bernard, 2018). Semi-structured interviews are an ideal approach for the researcher to demonstrate to the participants that they are prepared for the interview and have knowledge of the topic area, but that the participant also has some level of control over which topics will be discussed (Bernard, 2018). This characteristic of semi-structured interviews is ideal for a partnered

research approach, as it allows participants to play a role in the decision-making processes of what information will be included in the study. Moreover, while measuring social learning can often be difficult because it requires the researcher to rely on the participant to engage in self-reflection about to the learning processes they have experienced, in-depth and retrospective interviews have been identified as a suitable method able to cope with these challenges (Brummel et al., 2010).

In total, 17 semi-structured interviews were conducted. Interviews delved into the social learning processes that occur through efforts by Sakâw Askiy, the corporation shareholders, and Prince Albert Forest Management Area stakeholders and rightsholders (See table 3-1). All interview participants had demonstrated knowledge and/or experience with wildfire in the Prince Albert area. The interview guide contained questions addressing learning processes, relationships established, climate change, adaptive capacity, wildfire management, and governance, with room left for participants to discuss topics they felt were important. Several key informants and knowledge holders of wildfire risk were identified prior to the beginning of data collection. These participants were interviewed and then asked if they had any recommendations for other participants who may hold knowledge relevant to the research project. To ensure a broad range of participants were included in the study, several different networks were mined for the snowball sampling (Hennink et al., 2011). These networks started from participants from the forest industry, government, and stakeholders of the forest management area (including members of cottage associations and Indigenous citizens).

Table 3-1:Description of Interview Participants as Shareholders, Stakeholders, or Rightsholders

Affiliation with Sakâw or Connection to the Prince Albert Forest Management Area	Number of Participants
Shareholder (working for AC Forestry, Carrier Forest Products, Dunkley Lumber (Edgewood Forest Products, Meadow Lake Mechanical Pulp Mill, Meadow Lake OSB Division, Montreal Lake Business Ventures, or NorSask Forest Products)	5
Stakeholder (persons/organizations who hold stakes in the Prince Albert Forest Management Area (i.e., properties, businesses, tourist attractions))	10
Rightsholders (persons who have a right to the Prince Albert Forest Management Area (e.g., Treaty rights and Indigenous rights))	2

Prior to the interview, potential participants were sent a project information package as well as a consent form (see Appendix C). The consent form gave an outline of the research project, the reasoning for the interview, a description of the risks and benefits of participating in the project, and a list of questions regarding information from the interview and the ability of this information to be used in publications. Potential participants were asked to review the information contained within the project package and consent forms and return a signed copy prior to the interview.

The interview guide was divided into questions based on participant-specific context, such as the connections the participant held to the Prince Albert Forest Management Area (employment, leisure, others) which was then followed by a set of questions addressing social learning. The social learning questions started with a direct question of what the participant felt they had learned relating to wildfire and wildfire risk reduction. This was then followed by questions regarding whether the participant had gained any new knowledge or skills about wildfire risk and risk reduction and whether they

had gained any new views or perspectives about wildfire through social interactions. Lastly, participants were asked questions regarding the adaptive capacity of Sakâw Askiy Management Inc. These questions addressed topics including the economic resources available for implementing wildfire risk reduction strategies, the awareness of wildfire risk, and access to knowledge and social networks centered on wildfire risk. With the consent of the participant, the interviews were audio recorded, and notes were taken throughout. Interviews were transcribed verbatim, and the transcript was sent to the participant in a secure manner post-interview for their review and approval.

3.4.2 Wildfire Risk Reduction Working Group

A Wildfire Risk Reduction Strategy Working Group, consisting of members from government and industry, was created by the General Manager of Sakâw. This working group met twice through the course of this research project during the data collection phase for approximately one hour each session. The meetings, chaired by the General Manager of Sakâw, were held to discuss topics regarding wildfire risk, forest harvesting plans, and potential communities where the landscape-level wildfire risk reduction strategies could be employed. Notes were taken throughout these meetings and included in the data set for this research project.

3.4.3 Restructuring of Research due to COVID-19

The research proposal initially developed for this project was prepared prior to the COVID-19 outbreak. Therefore, there were several adjustments to the methodology that had to occur. Initially, I had planned to travel to Prince Albert, Saskatchewan for the summer of 2020 to conduct in-person interviews and participate in other forms of in-person

data collection, such as field visits to the Forest Management Area and conducting a participatory mapping exercise. However, due to health and safety concerns and travel restrictions, my project switched to remotely based methods. My in-person interviews transitioned to phone interviews, and the mapping exercise was deemed inappropriate for an online platform. Qualitative interviews conducted remotely through phone calls or video conferencing platforms have received criticism in research studies, however, there are many studies that show they can be just as effective, if not more so, as in-person interviews in certain situations (Johnson et al., 2019).

3.5 Data Analysis

The data collected from the semi-structured interviews and the wildfire risk reduction working group notes were analyzed to address the research objectives of this project. After this process was completed, the transcribed data were deductively coded for pre-determined themes derived from the social learning and adaptive capacity literatures. The predetermined themes for assessing social learning included:

- Learning new skills and knowledge through social interactions (single-loop learning);
- Acknowledging and incorporating differing views and perspectives on wildfire or risk reduction strategies (double-loop learning) and;
- Questioning of values and norms underlying wildfire policies or risk reduction strategies (triple-loop learning).

The predetermined themes for assessing adaptive capacity included the determinants of adaptive capacity:

- Awareness;

- Range of technological options available;

- Economic resources;

- Institutional design and structure (with a focus on the ability to adapt different management and policy strategies in response to environmental changes, Fischer & Jasny, 2017);

- Human and social capacity and;

- Knowledge and access to information (Williamson and Isaac, 2012; IPCC, 2001).

Lastly, to gain community input on risk reduction strategies, the analytical framework included the predetermined theme of changes that participants would like to see made by Sakâw'.

An inductive coding process was conducted, allowing themes to emerge directly from the data (Fereday & Muir-Cochrane, 2006). Examples of themes that emerged through the data included the concept of "values at risk" designated by the Province of Saskatchewan, barriers to implementing wildfire risk reduction strategies, and the concern of participants around the age of the forest with respect to wildfire risk. Three rounds of coding were conducted through NVivo software using this inductive and deductive approach. Once the coding was completed, an analysis of the general themes expressed through the interviews and workshop meetings was conducted to determine the main evidence of social learning and aspects contributing to the adaptive capacity of Sakâw

Askiy. The results from both the interviews and the working group notes were combined to allow for the findings presented in the following chapters.

Chapter Four: Describing the Social Learning Processes that occur through the Development of Wildfire Risk Reduction Strategies

4.1 Introduction

This chapter presents a description of social learning processes that occurred among Sakâw Askiy Management Inc shareholders, and the stakeholders and rightsholders while developing wildfire risk reduction strategies (objective 1). This chapter will also assess the impact these learning processes have on the ability of Sakâw Askiy Management Inc. to incorporate community-informed wildfire risk reduction into their forest harvesting plans (objective 2). The social learning processes that were observed throughout this project were analyzed and described using the models of loop learning (single-, double-, or triple-loop learning) (Argyris & Schon 1978; Fazey et al. 2005; Reed et al. 2010).

The next section describes the learning centered on wildfire risk reduction strategies (section 4.2). This is followed by a description of the learning processes that occur through the development of wildfire risk reduction strategies through a single- (4.2.1), double- (4.2.2), and triple-loop learning lens (4.2.3). The chapter also describes some challenges that may impede social learning in the development of wildfire risk reduction strategies, and how these challenges can be mitigated (section 4.3). The final section (4.4) summarizes the chapter and the implications of the social learning processes for development of community-informed landscape-level wildfire risk reduction strategies.

4.2 Description of Learning Centered around Wildfire Risk Reduction Strategies

Natural systems, such as the boreal forest, are heterogeneous and dynamic. These characteristics lead to great uncertainty in how these systems will respond to certain interventions (Berkes, 2009; Rodela, 2011). Learning from past and current changes in the environment and using this knowledge to adapt to such changes can allow individuals and organizations to develop and implement anticipatory actions that prepare them for future changes (Fischer & Jasny, 2017). As learning is recognized as an essential component of any adaptive management process (Armitage et al., 2008), it stands to reason that identifying and analyzing the learning processes experienced by Sakâw Askiy Management Inc., the corporation shareholders, and the stakeholders and rightsholders of the Prince Albert Forest Management Area is a key component in identifying wildfire risk reduction strategies that work with the goals and objectives of all parties involved.

4.2.1 Description of Social Learning through a Single-loop Learning Lens

Single-loop learning has been classified as the simplest form of learning and refers to learning the consequences of specific actions (Argyris & Schon 1978; Fazey et al. 2005; Reed et al. 2010). This more rudimentary form of learning works to improve performance through error detection and correction without making any profound changes to underlying and pre-existing beliefs, assumptions, and values (Hargrove, 2002)., The evidence of single-loop learning prevalent throughout the interview participants of this study was the acquisition of new knowledge or skills or the restructuring of existing knowledge.

The Saskatchewan Public Safety Agency is a government branch responsible for provincial emergency management actions, fire safety measures, and wildfire management throughout Saskatchewan including within the Prince Albert Forest Management Area (Government of Saskatchewan, n.d.-a). Throughout this project, it was apparent that there are several key knowledge holders of wildfire risk reduction in Saskatchewan. These knowledge holders are employees of the Saskatchewan Public Safety Agency and are the main sources of information in terms of factual knowledge on wildfire risk reduction strategies. These employees, therefore, have become the primary influencers of the single-loop learning that occurred and continues to occur throughout Sakâw Askiy Management Inc. and the shareholders of the corporation, for example:

> *One of the biggest influences for me is working with the Saskatchewan Public Safety Agency. Working with them and getting knowledge from them that has influenced me or where I've… any of the knowledge that I would have [on wildfire risk reduction] would be from those guys.*
>
> -Chris Brown, Ministry of Environment Saskatchewan, Forest Operations and Compliance

The General Manager of Sakâw Askiy described how the corporation had initially learned of the idea of incorporating wildfire risk reduction strategies into their forest management plans through conversations with the Saskatchewan Public Safety Agency:

> *I became interested in the idea because I was at a meeting with an employee of the Saskatchewan Public Safety Agency…and there was a map on the wall of the fires in Saskatchewan and he said you can look at that and see the direction fires typically go… and then he said, you know I think we could use planning in light of some of these landscape-level things and we could help reduce wildfire through planning.*
>
> -Diane Roddy, General Manager of Sakâw Askiy Management Inc.

Several participants discussed skills they had acquired through social interactions with experienced wildfire personnel. One participant, through their involvement in wildfire-related work in Prince Albert, was able to participate in a fire fighting certification course (Type 3 wildfire training). Through this training, the participant gained knowledge and skills specific to Saskatchewan, and skills that could be employed at the national and international level:

> *I learned in firefighter training that you use all the different senses in order to detect hot spots to do clean up. One of the things that you can use I know is like looking for swarms of flies… if you see a bunch of flies swarming around and they aggregate above the heat.*
>
> -Alex Zahara, PhD Student and researcher in wildfire policy and practice in Prince Albert, Saskatchewan

Single-loop learning addresses the existing status quo of wildfire risk reduction strategies in the Prince Albert Forest Management Area. However, the more complex form of double-loop learning must occur to address the broader goals of Sakâw Askiy Management Inc., to gain the support of the stakeholders and rightsholders of the Prince Albert Forest Management Area.

4.2.2 Description of Social Learning through a Double-loop Learning Lens

Double-loop learning involves acquiring more knowledge or finding better problem-solving methods during the learning process (Hwang & Wang, 2016). In double-loop learning, new feedbacks and perspectives are identified through the engagement of different stakeholders (Ananda et al., 2020). With influences of Baird et al.'s (2014)

framework, double-loop learning was recognized based on a participant's displayed incorporation of different views and perspectives on wildfire or wildfire risk, and/or a convergence of participant opinions on these topics.

FireSmart is a program employed throughout Saskatchewan in which fire professionals work with homeowners to determine the best activities that reduce wildfire risk on their private land and property (Ergibi & Hesseln, 2020). One initiative by FireSmart is a home development guide that provides an outline for the best fire-resistant construction materials and designs that can be used by homeowners to reduce the risk of structural damage or home loss due to wildfire (Government of Saskatchewan, n.d.-d). The claims of this program are most related to the protection of homes and infrastructure from wildfires entering the community. However, as one participant described, a different view of the benefits of this program is the protection of the surrounding forests from fires that may escape from within the community, having the potential to cause wildfires:

> *It's a different thought when we think, 'well we are using fire to reduce the risk of fire.' So that's definitely a new perspective I would have gotten from those guys [Saskatchewan Public Safety Agency Employees]. Even the aspect of community FireSmarting. A lot of time, probably before working with those guys I always thought it was to prevent the communities from burning up, and although like I said several times, that it gives you a point to try to attack the fire, because when you're cutting around the communities and you're bringing the fire to the ground instead of crowning. But the piece that I never really realized until talking to them is that another big part of it is preventing fire from coming out of the communities. So, when you have that fire guard or fire break around the community, it'll prevent campfires or other fires from escaping and getting into the forest. So, I never thought of that aspect or perspective before working with those guys. It is kind of a two-way street that you are reducing the risk not just for just, but also protecting the communities.*

> -Chris Brown, Ministry of Environment Saskatchewan, Forest Operations and Compliance

This new perspective of "using fire to reduce the risk of fire" was gained through conversations about wildfire risk reduction strategies with employees of the Saskatchewan Public Safety Agency. This new knowledge not only questions *how* the FireSmart program works to protect communities from the risk of wildfire, but also *why* it is employed (Garcia-Morales et al., 2009), signifying a deeper form of learning.

Several participants (four in total) described their thoughts on the 'fire paradox'. The fire paradox refers to a situation where suppression measures intended to eliminate fire increase fire risk due to fuel accumulation that would have naturally burned off had smaller fires been allowed to occur (Arévalo & Naranjo-Cigala, 2018). This is present throughout Saskatchewan and the Prince Albert Forest Management Area:

> *I grew up on the west side north of Meadow Lake in Dorintosh and my family has a trap line in the bush. 20 years ago, if I would have seen a cut over in an area like the trap line, I'd have probably been upset...Now, I come with a different mindset. Now I'd think more like we're going to get some renewal here. I go through the area now and I'm like 'oh, this either needs a fire or it needs to get cut.' It needs something, you know, there's mistletoe, and things have been left for a long time without any disturbance, and you're starting to see a real decline in forest health in some areas.*
>
> -Chris Dallyn, Government of Saskatchewan, Fire Science Specialist

The new perspective on the benefits of the inclusion of wildfire signifies the questioning of the rationale behind decisions and specific actions that is characteristic of double-loop learning (Folke et al., 2005).

Several participants (five in total) discussed the importance of including Indigenous and traditional knowledge of wildfire on the landscape in developing new wildfire risk reduction strategies. The use of fire has been a central component to the maintenance and

improvement of specific habitat conditions as well as the production of important plants and animals that support livelihoods for human societies (Turner, 1999). The important role fire plays to support and enhance ecosystem processes is known widely throughout Indigenous knowledge (Turner, 1999).

> *Some First Nation Elders speak historically about how fire could have a role on the land base before fire management took a Smokey the bear approach, fight it until it's put out.*

-Amy Carrier, Government of Saskatchewan, Manager of Planning, Policy and Protection

Although the complete suppression of all wildfires is not the strategy used by wildfire management today, the importance of reintegrating fire on the landscape in appropriate ways calls for the inclusion of Indigenous perspectives which includes deep knowledge of and relations to the land, and wildfire expertise (Zahara, 2020).

An area of contention that must be addressed for Sakâw Askiy Management Inc. to implement the most effective and efficient wildfire risk reduction strategies is the emotional sentiment that exists surrounding old forests. In Prince Albert, the forest stands have been described as "unnaturally old" (Diane Roddy, pers. comm., July 13, 2020), which contributes to the wildfire risk of the Prince Albert Forest Management Area:

> *People will probably be surprised to hear we are trying to create a younger forest. They probably won't be aware of a lot of the caribou things and the other strategies we are trying to achieve on that landscape. So over time, as we work with that group, they come to understand better, and we come to understand how possible it actually is going to be to harvest in events.*

-Diane Roddy, General Manager or Sakâw Askiy Management Inc.

Conversations and debates must occur regarding the conflicting views and emotions attached to old forests within the Prince Albert Forest Management Area and related management goals. These goals must consider wildfire, wildlife habitats (i.e., protecting the at-risk woodland caribou population), recreational uses, and visual aesthetics (Vosick et al., 2007). The conversations regarding these goals foster the processes of social learning (Scholz, & Methner, 2020). Through conversations and exchange of information regarding the importance of forest renewal through disturbance and harvesting, a change in views and perspectives (ie. Double-loop learning) among the public may reduce their aversion to the cutting of old and decaying forest stands.

In social learning processes, and learning classified at the double-loop level, networks of actors are important for addressing uncertainty and change (Folke et al., 2005). Interviews displayed the importance of several key networks that play roles in the development of wildfire risk reduction strategies proposed by Sakâw Askiy Management Inc. For example, since gaining the rights to the Prince Albert Forest Management Area, Sakâw Askiy Management Inc. has sought input and advice from a Public Advisory Committee. The members of this committee hold connections to and interests in the Forest Management Area. Members invited to participate in the Public Advisory Committee included municipal representatives, ENGOs, the Prince Albert Model Forest Association, the Saskatchewan Forestry Association, and outfitters and trappers that operate through the management area (Sakâw Askiy Management Inc., 2014). Sakâw Askiy Management Inc. and the corporation shareholders contact, meet with, and incorporate feedback from these stakeholders and rightsholders (Sakâw Askiy Management Inc., 2020a). The objectives of the Public Advisory Committee (PAC) are to provide insights into the development of the

forest management strategies, support in the implementation and review of the forest management plan, and ongoing insights and advice about the forest management plan (Sakâw Askiy Management Inc., 2020b). Overall, the purpose of PAC meetings is "to discuss various stakeholder interests that support the long-term sustainability of our shared forest resource and find mutual consensus that improves forest management under the forest management plan" (Sakâw Askiy Management Inc., 2020c, p.2). Given the interest groups involved, the PACs are model aspects of learning networks, which increase learning reach and advantage because the company has an institutional feature with potential to enhance social learning.

The desire to implement wildfire risk reduction strategies at the landscape level through forest harvesting proposed by Sakâw Askiy Management Inc. led to the development of a Wildfire Risk Reduction Strategy Working Group. This group is composed of members who are either shareholders of Sakâw Askiy Management Inc., or belong to the Saskatchewan Research Council, Saskatchewan Forest Service, or the Saskatchewan Public Safety Agency. The group was formed to develop and explore potential methods of incorporating wildfire risk reduction strategies into forest harvesting plans to prepare for the more frequent and catastrophic wildfires that are predicted to occur because of climate change impacts (Wildfire Risk Reduction Working Group, 2020). This working group creates an avenue through which information on wildfire risk reduction strategies can be shared and debated through processes of open reflection, adaptation, and self-coordination. Learning processes in this network increase the potential for the establishment of effective working relationships through the acknowledgement of collective work and common concerns (Goldstein et al., 2010).

The diverse views that participants presented in the interviews which they gained through social interactions indicate double-loop learning has occurred. Likewise, the formation of networks that directly address the concerns of community members and incorporation of wildfire risk reduction strategies into forest harvesting plans signify the presence of social learning at the double-loop level. Moreover, participants paid attention to the rationale for why certain risk reduction methods were employed and the problem-solving that occurs during these learning processes to build knowledge and pursue collective action. Such reflection demonstrates that a more complex form of learning has occurred and continues to occur through social interactions between actors from diverse social networks (Hwang & Wang, 2016; Biedenweg & Martha, 2013; Schusler et al., 2003; Reed et al., 2010).

4.2.3 Description of Social Learning through a Triple-loop Lens

Processes of triple-loop learning imply a change in the values and norms that underlie management practices (Pahl-Wostl, 2009). Differences in the values placed on entities at risk between Indigenous and non-Indigenous stakeholders and rightsholders through the "let it burn" policy were discussed in several interviews (three in total).

> *I know for years they had what they call a values protection policy within wildfire management branch. In most of our communities, it was referred to as a "let it burn" policy… A lot of First Nation people were pretty upset by you know, depending on the geographic area and what the values were, they would let fires go in some of those areas where they wouldn't even suppress it. It's interpreted in different ways in terms of benefit. If it's old decadent forest, well, it's probably better to let it burn, but when you talk about the connection to the land of Indigenous or First Nation people, their values seem to be a little bit different.*

-Cliff Buettner, Program Director, Prince Albert Grand Council

There is an acknowledgement that the values and norms which underlie wildfire management decision-making processes are rooted in a colonial epistemology and require a shift to be more inclusive of the inherent value of land. However, this acknowledgement of the need for changes to the system does not guarantee that corrective action will be taken. The application of suppression resources is a costly endeavor, which is an important factor that must be considered when determining where resources are allocated:

> *If we go into a landscape that has evolved with fire and there's no structures or human lives there, to try to put it out will be very costly to fly people in. It's all done by aircraft, and you've got to set up camps and really, in the end, you could be harming the actual ecology of the forest by taking that disturbance out and by taking natural fire out of the natural landscape. We've seen the negative effects of taking that disturbance out which is a huge buildup of fuel, a decline in health in some of the forest causing bigger, more intense fires.*

> -Chris Dallyn, Government of Saskatchewan, Fire Science Specialist

For triple-loop learning to occur, a paradigm shift is required in a management regime. This paradigm shift requires that a frame of reference within that regime must undergo a change which results in the transformation of the regime entirely (Pahl-Wostl, 2009). The corrective action required to change the management regimes that underlie the "let it burn" policy require a conscious effort to change our way of being that shapes our ways of knowing and doing (Kwon & Nicolaides, 2017), while still acknowledging the limited availability of wildfire suppression resources that are available for any given fire. Until these corrective actions are taken, it can not be stated that triple-loop learning was observed through this research project.

Table 4-1: Evidence of single-, double-, and triple-loop learning related to wildfire risk reduction (Influenced by Baird et al., 2014 and Pahl-Wostl, 2009)

Learning Classification	Evidence of Learning
Single-loop Learning	Acquisition of new knowledge or skills related to wildfire or wildfire risk reduction strategies, and/ or the restructuring of existing knowledge.
Double-loop Learning	Participant's displayed incorporation of different views and perspectives on wildfire or wildfire risk, and/or a convergence of participant opinions on these topics
Triple-loop Learning	A change in the values and norms which underlie management practices

4.3 Addressing the Challenges that may Impede Social Learning through the

Development of Wildfire Risk Reduction Strategies

Engaging with differing views and perspectives regarding wildfire and risk reduction strategies involves complex processes such as balancing trade-offs between a multitude of conflicting benefits and objectives, navigating existing power relationships, and overcoming conflicts (Eastwood et al., 2017). Trade-offs that must be considered when developing wildfire risk reduction strategies impose many challenges as they require a cost and benefit analysis to be conducted. Cost-benefit analyses are exceptionally complex and cognitively demanding in social-ecological systems. The entities considered in the trade-offs may also hold emotional or moral value to participants, which further complicates negotiations and ultimate solutions (Eastwood et al., 2017).

> *From a selfish perspective, every time you ask a question to a group, you don't accomplish what you set out to do. The problem is, as your group gets bigger, each of them has their own opinions and their own views on how things should be done. So often you appease no one and you appease all slightly. The risk there is when you add a whole bunch of people to the group, it complicates things. So, I like to get feedback, do not get me wrong, from all sorts of groups, but when you*

do plans in a group, it's not a good thing [for accomplishing what the group set out to do].

-Interview participant 101

Although social learning has the potential to incorporate diverse views and overcome conflicts and build trust among participants, these are not guaranteed outcomes of the process (Scholz et al., 2020; Lebel et al., 2010). Several methods may be undertaken to increase the likelihood that social learning processes achieve these desired outcomes, and lead to the development of new knowledge and collective action (Lebel et al., 2010). Engaging with shareholders, stakeholders, and rightsholders in meaningful ways helps to increase the potential for success of social learning processes. For example, Sakâw Askiy Management Inc. uses the Public Advisory Committee to engage with those who wish to contribute their views and perspectives towards the corporation's forest operating plans (Sakâw Askiy Management Inc., 2014). This group meets through an information session platform to discuss the plans and concerns they may have regarding the proposed operations (Sakâw Askiy Management, 2020a). Sakâw Askiy also holds a special duty to consult with First Nation and Métis communities prior to the implementation of any operating plans that may impact the community's ability to exercise Treaty and Aboriginal rights. Sakâw Askiy Management Inc. consults the leaders of First Nation and Métis communities in and adjacent to the Prince Albert Forest Management Area when developing forest operating plans (Sakâw Askiy Management Inc., 2020a). Engaging with stakeholders and rightsholders has the potential to reduce conflicts between Sakâw and these individuals/organizations, which was a barrier to social learning discussed by many interview participants.

Public information sessions, meetings, and consultations are all valid and appropriate forms of engagement that may lead to the desired social learning outcomes. However, several other processes have been suggested by natural resource management, which may hold value when it comes to more meaningful engagement. Outdoor workshops and site visits have been suggested as exceptionally useful tools in engaging with stakeholders and rightsholders. These forms of outdoor education and learning have been suggested to hold more value, in some cases, than indoor presentations and information sessions (Leavell et al., 2018). Although site visits and outdoor workshops may be more complicated to facilitate than public information sessions, the value they contribute to meaningful engagement and education may outweigh these challenges for Sakâw Askiy Management Inc.

4.4 Summary

In this chapter, I described the social learning processes regarding wildfire risk reduction strategies as observed by stakeholders, shareholders, and rightsholders. The social learning processes that have occurred through the development of wildfire risk reduction strategies have led to the acquiring of new knowledge and skills on wildfire risk reduction strategies, and the incorporation of new views and perspectives regarding wildfire, wildfire risk, and the risk reduction strategies employed throughout Saskatchewan. The social learning processes that occur through the development of community-informed wildfire risk reduction strategies by Sakâw Askiy Management Inc., the shareholders of the corporation, and the stakeholders and rightsholders of the Prince Albert Forest Management Area holds aspects of both designed and emergent processes

(Lumosi et al., 2019). The social learning is designed because there are meetings that occur with the specific purpose of addressing wildfire and sharing knowledge in this area. The social learning processes can also be classified as emergent, as they are dynamic, long-term, and self-organized, where goals are fluid and redefined as different outcomes are achieved. Learning processes and outcomes were classified as either single-, double-, or triple-loop learning. Evidence of single-loop learning was shown through participants acquiring new knowledge on wildfire and risk reduction, mainly provided by key wildfire personnel through the Saskatchewan Public Safety Agency. This classification of learning involves learning about the consequences of specific actions and the detection and correction of errors through incremental changes (Roux et al., 2008; Evely et al., 2011). Evidence of double-loop learning through the social learning processes was presented by participants who discussed incorporation of new views and perspectives in terms of wildfire and risk reduction strategies. These new views and perspectives included considerations of why the FireSmart program in Canada is employed, why certain fires are supressed, and others can burn, and why it is important to allow for disturbance and renewal in old forest stands. Through double-loop learning, corrective actions are performed, but there is also a questioning of underlying policies and goals of the actions (Argyris, 1977). Lastly, the interviews were analyzed for evidence of triple-loop learning. Triple-loop learning involves questioning and challenging the values and norms that underlie the assumptions we make and the actions we take (Argyris & Schon 1978; Fazey et al. 2005; Reed et al. 2010). Several participants brought up an unspoken policy that exists in Saskatchewan fire management practices, known as the "let it burn" policy (Poole et al. 2020). This policy highlights the entrenched colonial roots that underlie wildfire

management decision-making processes throughout Saskatchewan, and how higher priority is given to non-Indigenous values than Indigenous (Poole et al. 2020). Changes to this policy would also give clear indication that the group is engaged in and acting upon higher level learning. However, as triple-loop learning requires the transformation of the regime entirely (Pahl-Wostl, 2009), not just the acknowledgement of the need for a transformation, this higher form of learning was not observed in this research study. Single- and double-loop learning were the most predominant classifications of learning expressed by the interview participants (Pahl-Wostl, 2009; Evely et al., 2011).

The social learning processes observed and described through this chapter have currently and will likely continue to impact the wildfire risk reduction strategies that will be employed by Sakâw through their forest operations at the landscape-level. Sakâw Askiy Management Inc. initially learned of methods of large-scale, landscape-level wildfire risk reduction strategies through communications with wildfire personnel from the Saskatchewan Public Safety Agency, a form of social learning. The social learning processes have also allowed the corporation to gain new knowledge on risk reduction strategies that can be applied at this larger scale, and to learn of new perspectives and views that must be considered when they are able to implement these strategies.

Whether social learning processes will change colonial values and norms which are rooted in wildfire management decision-making processes is yet to be determined as this is a very complex challenge. However, the problem has been acknowledged through discussions and social interactions, which is an important process in the initial implementation of corrective actions. Existing social networks that help Sakâw to develop and implement wildfire risk reduction strategies, including the Public Advisory Committee

and the Wildfire Risk Reduction Strategy working group, will increase the likelihood that social learning continues as the corporation develops the community-informed risk reduction strategies to be implemented at the landscape-level.

Chapter Five: Describing the Adaptive Capacity of Sakâw Askiy Management Inc. and Recommendations for Management Practices

5.1 Introduction

This chapter presents my description of the adaptive capacity of Sakâw Askiy Management Inc. (objective 3). This chapter begins with a description of the determinants used to assess the adaptive capacity of Sakâw (section 5.2). The following sections presents the results regarding each of the determinants discussed by the interview participants. Section 5.3 presents a description of the changes that Sakâw Askiy Management Inc. shareholders, stakeholders and rightsholders would like to see made by the corporation regarding forest management practices and wildfire risk reduction to enhance the social capital and contribute to the improvement of the corporation's social licence to operate (objective 4). I conclude with a discussion of the impact the determinants have on either enhancing or hindering the corporation's adaptive capacity, and the strategies the corporation can employ to help enhance the social licence to operate within the Prince Albert Forest Management Area (section 5.4).

5.2 Describing the Determinants of Sakâw Askiy Management Inc.'s Adaptive Capacity with Respect to Wildfire Risk Reduction

In this section, the results pertaining to the adaptive capacity of Sakâw Askiy Management Inc. with respect to wildfire risk are presented. The determinants used to describe the adaptive capacity of Sakâw are: the array of technological options accessible; economic resources; institutional design and structure with a focus on the ability to adapt different management and policy strategies in response to environmental changes (Fischer

& Jasny, 2017); human and social capacity of the adaptors; knowledge and ability to access information, knowledge on forestry practices and wildfire (ex. scientific, local, traditional, Indigenous knowledge) and knowledge mobilization (focusing on the awareness of wildfire risk that knowledge mobilization facilitates) (IPCC, 2001; Williamson & Isaac, 2012). It is acknowledged that these determinants alone do not dictate the adaptive capacity of an organization, but the interactions between these variables can create opportunities that either enhance or diminish adaptive capacity (see Figure 5-1). Therefore, understanding the individual determinants is an important aspect in the building and application of adaptive capacity (Drennan & Rasheed, 2020). The determinants of adaptive capacity were assessed through interview questions asked directly of the participants as well as through topics that arose organically through the conversations and through the Wildfire Risk Reduction Strategies Working Group meeting notes.
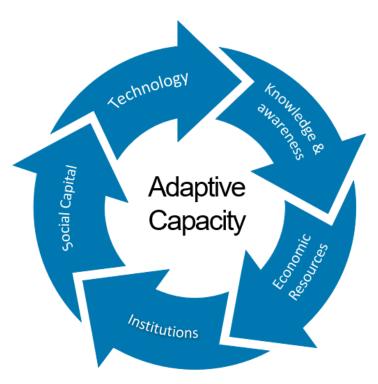
Figure 5-1:The Interconnected Determinants of Adaptive Capacity (adapted from Drennan & Rasheed, 2020)

5.2.1 Technological Options Available

There are many technological options that can be employed in the pursuit of implementing wildfire risk reduction strategies and increasing adaptive capacity throughout the Prince Albert Forest Management Area. To implement the most effective strategies, the areas at highest risk must first be identified (Dallyn et al., n.d.). In Saskatchewan, wildfire risk assessments are a technology employed to assess the risk and identify the communities most threatened by wildfire (Dallyn et al., n.d.). These risk assessments have been conducted for over 100 communities throughout the province (SaskAdapt, n.d.). A potential opportunity exists to include the risk assessment results when considering where landscape-level wildfire risk reduction strategies should be implemented.

For community wildfire risk, I think it would be good to tie in better with forestry companies and look at their ten year, twenty years plans and then look at the areas that are close to communities or tied between communities where maybe those could be harvested sooner than something that's farther away from the values that are at risk for wildfire.

-Chris Dallyn, Government of Saskatchewan, Fire Science Specialist

These risk assessments are the main form of technology employed in the prevention phase of wildfire risk reduction throughout Saskatchewan. Other technologies employed include the use of fire towers which are used as surveillance to detect wildfires, and suppression technologies used in the response phase (ex. transportation, equipment, and communication).

5.2.2 Economic Resources Available

The Disaster Mitigation and Adaptation Fund is a 2-billion dollar, Canada-wide merit-based program which provides funding for large-scale infrastructure projects aimed at helping communities to better cope with the risks imposed by natural disasters including flooding and wildfires (Government of Canada, 2020a). In Saskatchewan, the provincial budget for 2020-2021 provided 85 million dollars in funding to the Saskatchewan Public Safety Agency (SPSA). This funding allows the SPSA to establish and implement wildfire risk reduction activities throughout the province (Government of Saskatchewan, 2020). Although community protection activities are currently the sole focus of the Disaster Mitigation and Adaptation Fund (Government of Saskatchewan, 2020), four interview participants described how they believe there is the potential for this funding to be used to finance landscape-level wildfire risk reduction strategies, as these also work to protect communities.

The Disaster Mitigation and Adaptation Fund is currently the largest source of funding for the implementation of wildfire risk reduction strategies in Saskatchewan, however, there are several smaller funding sources that exist within the province for these activities:

> *At Agency Chiefs Tribal Council here, I've signed a couple of small agreements for protection for Pelican Lake and Witchekan Lake. And it's fairly small amounts, I think it's $72 000 for these two communities. That enables them to hire some fire suppression people and they go around cutting down the underbrush next to houses and around the community and they are designed to be an early response to forest fires. For example, if there was a tower and somebody sees something around our community, we can activate these crews that are local, that have been trained and it's worked quite well.*
>
> -Ken Thomas, Chief Executive Officer for Agency Chiefs Tribal Council President and Member of the Board of Directors

Another source of funding for wildfire risk reduction strategies discussed in interviews was the cost sharing agreement signed by the Prince Albert Grand Council and the provincial government:

> *Our [Prince Albert Grand Council] suppression activities are supported by a contract funded through Indigenous Services, and the provincial government through the Saskatchewan Public Safety Agency as a 50/50 cost-sharing agreement.*
>
> -Cliff Buettner, Program Director, Prince Albert Grand Council

5.2.3 Institutional Design and Structure

An important aspect of the institutional design and structure of Sakâw Askiy Management Inc. and the corporation's ability to implement community-informed wildfire risk reduction strategies is the flexibility that exists within policies and plans to allow for

the integration of new adaptation strategies. The general opinion expressed regarding the ability of current legislation and policies governing forest management practices to integrate new adaptation strategies was that it is possible, but would take considerable time:

> *I think that if regulations or requirements got in the way with the current legislation that it would take some time, but I think they are flexible to look at adapting. You know your thinking around forest management does change throughout your career, and it takes a long time to change legislation, but it's certainly not impossible. I've seen it changed to the ecosystem-based management strategy we are using now and I'm sure it will evolve again as people learn and think about these things more.*

-Diane Roddy, Sakâw Askiy Management Inc., General Manager

There have been instances in Saskatchewan where the implementation of new forest management strategies that would have gone against existing legislation were allowed through deliberations and negotiations involving the relevant government agencies. An example is a forest management practice which dictates that the same species harvested from a forest management area must be replanted there. There have been documented instances where exceptions have been made to this policy to allow for the creation of fuel breaks, replanting with a less flammable tree species, such as aspen. The flexibility that exists within the institutional designs and structures governing the implementation of wildfire risk reduction strategies in the Prince Albert Forest Management Area plays a key role in the enhancement of the adaptive capacity of Sakâw Askiy Management Inc.

5.2.4 Human and Social Capacity

There are several important social structures and networks that work to strengthen relationships and enhance the adaptive capacity of Sakâw Askiy Management Inc. The interactions and communications between individuals and organizations involved in these

networks can lead to mutual benefits for all parties. The importance of implementing wildfire risk reduction strategies for both communities and forest industry has been recognized.

> *I think there are spinoff benefits in working with communities on an issue like the FireSmart initiatives. You are building relationships that go beyond just that immediate project.*
>
> -Mark Doyle, Saskatchewan Ministry of Environment, Forest Management Planning Coordinator

One of the main spinoff benefits related to wildfire risk reduction initiatives discussed by four interview participants was the potential for employment opportunities in the communities where the work is conducted. The communities at the highest risk of wildfire are often remote and hard to access. Interview participants discussed the potential for the work that is required to implement wildfire risk reduction strategies to be completed by citizens of these remote communities, who often have limited access to employment opportunities:

> *We're supplying jobs in remote locations within communities. Normally you have to travel to find work in all these communities. They are doing work and helping their communities, the communities are looking nicer, we see training, certified chain saw training to do the work. So, it's a win on the social side as well.*
>
> -Interview participant 202

Providing meaningful employment opportunities in remote communities has the potential to build social capital between wildfire personnel and citizens. The relationships that exist and are built around the development and implementation of wildfire risk reduction strategies also have the potential to increase social capital:

> *Whenever you are sharing ideas or frustrations, you are building on your knowledge base. I am learning something, and I can turn around and pass it*

along to someone else who may not know what I know. So, I think it's all of benefit.

-Mark Doyle, Saskatchewan Ministry of Environment, Forest Management Planning Coordinator

Although several participants discussed the strengthening of relationships they felt were attributed to the development and implementation of wildfire risk reduction strategies, this was not a unanimous conclusion, for example:

Right now, we're [Wahpeton Dakota Nation] not really involved except with the Ministry of Forestry. But somewhere in between we should be working with other people, like the Municipality or you know, these little areas, little towns around.

-Darlene Goodvoice, Wahpeton Dakota Nation, Lands Manager

Whether or not participants felt that enough communication and engagement were occurring to strengthen the relationships that exist throughout the Prince Albert Forest Management Area, the realization of the importance of these factors in developing and implementing community-informed wildfire risk reduction strategies was expressed:

You've got to have government, Sakâw, industry and industry partners, and stakeholders all at the same table. If you do not have that collaboration, we are all going to go in different directions. It's absolutely necessary to have the local experts and the industry stakeholders all addressing the same thing and working as a collective communal outcome.

-Robert Follett, Mistik Management LTD., General Manager

5.2.5 Knowledge and Access to Information

Knowledge and access to information is a determinant linked to social capital that exists between Sakâw Askiy Management Inc., the corporation shareholders, and the stakeholders and rightsholders. Industry and government personnel who have ties to the

Prince Albert Forest Management Area hold a wealth of knowledge and experience regarding forest management practices, wildfire risk, and risk reduction strategies. The General Manager of Sakâw Askiy possesses extensive knowledge of and experience with working in the Prince Albert Forest Management Area:

> *I worked for Weyerhaeuser in the Prince Albert Forest Management Agreement area for 27 years before the tenure was transferred to Sakâw. So, I was familiar with the area and knew some of the stakeholders and issues, which has been good background to have.*
>
> -Diane Roddy, Sakâw Askiy Management Inc., General Manager

The knowledge and experience gained through extended time working in the Prince Albert Forest Management Area, and the insight into the concerns of the stakeholders of the area, allows for better decisions to be made regarding future management practices. There are several other key actors involved in the process of developing and implementing wildfire risk reduction strategies that have a wealth of knowledge regarding forest management practices in Saskatchewan, with several interview participants (three) having employment experience in the forestry industry for more than 20 years.

Interview participants discussed their experience and knowledge regarding wildfire risk in Saskatchewan. Forestry and government personnel that Sakâw engages with frequently through the development of wildfire risk reduction strategies hold careers in the field of wildfire and are employed through the Saskatchewan Public Safety Agency. The knowledge of past and current wildfire risk held by these individuals is invaluable in Sakâw's pursuit to develop community-informed and supported wildfire risk reduction strategies. An important aspect of the enhancement of adaptive capacity is also the ability to access the knowledge that exists surrounding wildfire and wildfire risk reduction

strategies. Knowledge sharing and access to resources on wildfire risk reduction is directly related to social capital and the networks that exist, which can facilitate this sharing. Knowledge and information regarding wildfire, wildfire risk, and community input have been shared through the formal social networks that exist in the realm of wildfire work in Saskatchewan (including the SPSA, Sakâw's Public Advisory Committee, and the Wildfire Risk Reduction Working Group), as well as through informal communications pathways.

A resource which several participants (three) described as being extremely helpful in the development of their knowledge on wildfire risk reduction strategies was a series of case studies documented by an employee of the Saskatchewan Public Safety Agency, which highlight the effectiveness of implemented fuel breaks:

> *Larry [Fremont, employee of Saskatchewan Public Safety Agency] sent us all those different case studies for fuel break effectiveness and I was looking through that and a lot of information he shared, and it was, I really didn't have a good feel for the science they were putting behind it before, so I've been learning a lot.*
>
> -Diane Roddy, Sakâw Askiy Management Inc., General Manager

The Wildfire Risk Reduction Working Group was also described as being an important agent in knowledge and access to information:

> *There has been in the past and there will continue to be some joint wildfire workshops with industry and government and the Saskatchewan Public Safety Agency. And I think that is a great opportunity to share learnings and to share different perspectives. How do you know what's out there unless you do these workshops? Who is the expert and who has experience and who can I go to when I have a question? I think all those things become more apparent when you have these workshops.*
>
> -Mark Doyle, Saskatchewan Ministry of Environment, Forest Management Planning Coordinator

Access to knowledge and information regarding wildfire risk and the conversations that facilitate this knowledge sharing have the potential to directly impact the perceived risk of wildfire in the Prince Albert Forest Management Area, and the capacity that exists to respond to these risks.

5.2.6 Awareness

Study participants expressed a broad range of awareness of the risk wildfire imposes on the Prince Albert Forest Management Area and surrounding communities. Exposure to large-scale wildfires in areas throughout Canada, including the 2018 British Columbia wildfire season and the Fort McMurray wildfire of 2016, increased awareness of wildfire risk for some participants:

> *In the last ten years or so, I have really started to gain a true appreciation for the risk that some of these northern communities are facing from wildfire management, or from wildfire itself. Some classic case examples that everybody is familiar with is Cold Lake or Fort McMurray. And just realizing that that could be replicated in almost any community in the boreal forest. We have these fires burning in California right now and I think more and more forest management is one of the solutions for wildfire risk reduction.*
>
> -Michael Bendzsak, Saskatchewan Research Council, Research Scientist

Although the increase in large-scale wildfires throughout Canada, and specifically in western Canada, has increased the awareness of some shareholders, stakeholders and rightsholders regarding wildfire risk, this increased awareness was not seen by all individuals:

> *In spite of all the fires, and there is a major fire almost every year or every second year, there just seems to be no higher awareness or higher fear. People just seem to think fire is a natural part of the cycle and we will always have fires. You know, who can stop lightning anyway? It's just going to keep going, we will put it out as best we can when it comes.*

-Ken Thomas, Agency Chiefs Tribal Council, President and Member of the Board of Directors

Several factors contribute to the lack of wildfire risk awareness described by interview participants. In the past several years, Saskatchewan has experienced rainy and wet summer months, minimizing the need for forest managers to be concerned about wildfire risks:

> *Well, I think industry is a little more complacent [in terms of wildfire risk] because we've been fighting water for four years straight. [Wildfire risk] is not at the forefront of our conversation because it's been so wet. With all our blocks, it is just not our focus. We are always discussing where to put contractors and fighting with the wet ground.*
>
> -Rod Pshebnicki, Tolko Meadow Lake OSB Division, Forest Planner

The awareness and perception of wildfire risk that is held by Sakâw Askiy Management Inc. has implications for adaptive capacity, as perceived level of risk is directly related to the level of risk reduction strategies and activities that individuals and organizations are willing to employ (Martin et al., 2009).

Table 5-1:Summary of the Analysis of Adaptive Capacity of Sakâw Askiy Management Inc. regarding Wildfire Risk

Determinant of Adaptive Capacity	Evidence of Determinant
Technological Options	Wildfire risk assessments, fire towers, and suppression technologies used in the response phase (ex. transportation, equipment, and communication).
Economic Resources	The Disaster Mitigation and Adaptation Fund and cost sharing agreement arranged between the Prince Albert Grand Council, the Government of Saskatchewan, the SPSA, and Indigenous Services
Institutional Design and Structure	Flexibility exists within policies and plans to allow for the integration of new adaptation strategies, but it is a time-consuming process
Human and Social Capacity	Building social capital by creating jobs in remote communities; need for more communication and engagement between forestry personnel and communities in which their operations are conducted
Knowledge and Access to Information	Experienced wildfire and forestry personnel, formal social networks that exist in the realm of wildfire work in Saskatchewan (the SPSA, Sakâw's Public Advisory Committee, and the Wildfire Risk Reduction Working Group), case studies of landscape-level wildfire risk reduction strategies
Awareness	Some interview participants felt that awareness had increased, however, other observed a general lack in awareness of and concern for wildfires on the part of stakeholders and rightsholders of the Prince Albert Forest Management Area

5.3 Recommendations for Practice

To enhance the social capital and work towards gaining a social license to operate, Sakâw intends to include the views and perspectives of their shareholders, and the stakeholders and rightsholders of the Prince Albert Forest Management Area in the development of community-informed wildfire risk reduction strategies. The most desired change discussed by participants was the need for more communication, engagement (including education) between Sakâw and Prince Albert community members regarding

the intentions and rationale dictating Sakâw's employed forest management strategies. Most participants (fourteen) discussed how the lack of engagement and meaningful communication contributed to the conflicts and contention which exist between Sakâw and the citizens of Prince Albert:

> *If Sakâw and the provincial government approach this problem in an open, communicative way, I think that a lot of those conflicts can be resolved. If people truly understand the objectives of their work…and when I talk about communication, I am also talking about listening and truly understanding the other perspective, not just coming in with your forest management plan, and just kind of ramming it down people's throats. I think sitting down and talking with people where they are comfortable and really trying to understand their perspective and have a ton of empathy, I think that's a winning solution.*

> -Michael Bendzsak, Saskatchewan Research Council, Research Scientist

Several methods for this meaningful engagement were suggested including open houses, providing documentation and examples of existing implemented risk reduction strategies (ex. the case studies held by the Saskatchewan Public Safety Agency), and using road signs to indicate when harvesting occurred and for what purpose.

More directly related to the implementation of effective wildfire risk reduction strategies, there was an expressed need for the inclusion of wildfire experts in the development and review of forest management plans.

> *I think you have to have the local experts, whether it be Larry or somebody with wildfire come talk to you or review our plans. Right now, that operating plan gets submitted for the 1st of November for approval by March 31st, and I couldn't tell you that there's very many eyes, if any, from wildfire management that are looking at that plan to see if there are opportunities to make it a FireSmart plan or to tweak it and plan the right way to reduce fuel types. So, having the approach from somebody in the industry at the approval level to ensure that there is a FireSmart plan where there can be.*

> -Robert Follett, Mistik Management LTD., General Manager

The inclusion of community views and perspectives in the development of wildfire risk reduction strategies is an important aspect, for both adaptive capacity and the ability of Sakâw to obtain a social license to operate, that will be discussed further in the following section.

5.4 Discussion

The factors that contribute to either the enhancement or hindrance of the adaptive capacity of Sakâw Askiy Management Inc. with respect to climate change-induced increases in wildfire were presented in the previous sections. The description of these factors demonstrates the ability of the corporation to implement adaptation strategies. A lack of technological options can hinder an organization's adaptive capacity and limit the range of adaptation responses they are able to employ (Scheraga & Grambsch, 1998). Through the development of the wildfire risk reduction strategies and their incorporation into forest harvesting plans, Sakâw has access to technology in the form of risk assessments that can identify the communities and areas experiencing the greatest threats from wildfire. Establishing the areas that are the most at risk allows Sakâw to implement the landscape-level risk reduction strategies in a manner that effectively addresses the risk these communities are exposed to, as well as the risk the communities impose on the surrounding areas (which may include valuable timber supplies and myriad other timber and non-timber values). Landscape-level wildfire risk reduction strategies can be applied to reduce the threat wildfire poses to communities by creating fuel breaks near or around these at-risk areas.

Whether referred to as economic assets, capital resources, wealth or poverty, economic resources play a key role in determining adaptive capacity (IPPC, 2001; Keskitalo et al., 2011). The relationship that exists between the economic resources available to an organization or community and adaptive capacity demonstrates that more economically endowed parties will have a higher level of adaptive capacity due to their increased ability to afford adaptation options (Thathsarani & Gunaratne, 2018). As Sakâw Askiy Management Inc. operates in Canada, a developed country, they inherently possess a higher capacity to bear the costs associated with adaptation endeavors (IPCC, 2001). However, economic resources may be a limiting factor in the implementation of community-informed landscape-level wildfire risk reduction strategies in Saskatchewan. Funding available for wildfire risk reduction activities throughout the province is largely directed to community-level initiatives through the Disaster Mitigation and Adaptation Fund (Government of Canada, 2020a). These funds are not allocated to forest harvesting practices undertaken by the forest industry. The implementation of landscape-level wildfire risk reduction strategies may create extra expenses for forestry companies who already struggle with low margins of profit. This includes the financial losses of planting less flammable tree species, such as aspen, for wildfire risk reduction purposes. The market for aspen compared to spruce or pine in Canada is small and fragmented, and this wood is generally used for low quality timber products such as pulp (Friesen, 2011). To create a greater incentive for forestry companies to implement these landscape-level risk reduction strategies, subsidies could be provided by an external source (potentially the government) to account for the losses of revenue.

Institutions that must be considered in the description of adaptive capacity include the relevant formal and informal rules that exist within the governing context. Formal rules can include laws, government policies and practices, and regional or local programs whereas informal rules include the relevant existing practices, norms, and cultures (Drennan & Rasheed, 2020). There is evidence that the institutional designs and structures that govern forestry practices in Saskatchewan have the flexibility to allow for the development and implementation of new management and policy strategies, or to restructure existing ones. This flexibility acts to enhance the adaptive capacity of Sakâw Askiy, as some of the landscape-level wildfire risk reduction strategies the corporation seeks to incorporate into their forest harvesting plans may contradict existing forest management policies (ex. replanting sections of harvested blocks with less flammable tree species or leaving areas unplanted to act as fuel breaks). However, the lengthy time periods required to put policies and practices in place to allow for these new adaptation initiatives to be incorporated is a factor that may need to be addressed to further enhance the adaptive capacity of Sakâw.

Social structures and networks have the potential to enhance adaptive capacity by impacting availability of and access to resources, the ability to act collectively, the generation of new knowledge, and attachment to or understanding of local ecosystems (Fischer & Jasny, 2017). Organizational networks may act to enhance adaptive capacity by providing a platform through which learning and collective action can occur. Sakâw Askiy are part of a large network of individuals and organizations who play key roles in the development of community-informed wildfire risk reduction strategies. These include individuals and organizations that are directly focused on wildfire (e.g., the Saskatchewan

Public Safety Agency and the Wildfire Risk Reduction Strategy Working Group), those which are focused on forestry policy and forest management practices (e.g., Prince Albert Model Forest and Saskatchewan Research Council), and those which are more directly related to community interests (e.g., resort associations, hunting and trapping organizations, and outfitters). The communication that occurs between members of these organizations aids in the enhancement of adaptive capacity by providing situations that allow for learning and collective action.

The social aspect of adaptive capacity is also directly related to knowledge and access to information, as the interactions between the members of the different organizations increases flow of knowledge and information (Fischer & Jasny, 2017). Knowledge represents an important aspect of adaptive capacity because it increases the potential of an individual or organization to respond to changes in ways that will best serve their interests (Williams et al., 2015). Members of these organizations may hold knowledge and experiences which are valuable in the development of wildfire risk reduction strategies and can be used to implement effective adaptation strategies or to make suggestions on methods for achieving community support. An aspect of knowledge mobilization contributing to the adaptive capacity of Sakâw and the willingness of community members to accept the implementation of landscape-level wildfire risk reduction strategies is the awareness of the risks imposed by wildfire.

Awareness and perception of risk of citizens, stakeholders, and shareholders are an important determinant of the ability of an organization to adapt because they can dictate the actions an individual is willing to accept or employ to mitigate risk (e.g., if the perception of wildfire risk is low, there will be a lack of urgency placed on the

implementation of landscape-level wildfire risk reduction strategies around a community) (Martin et al., 2009). The factor found to increase awareness of wildfire risk most prominently in the Prince Albert Forest Management Area was the knowledge of the large, catastrophic fires occurring in areas of western Canada and California, and the realization that these destructive and devastating fires could occur in Saskatchewan. Despite this knowledge, there was still a lack of general awareness of risk expressed throughout the community members of Prince Albert. The factors that contributed to this lack of awareness were the idea that wildfire is a natural process and there is little that can be done to mitigate its occurrence and the reality that Saskatchewan has experienced wet and rainy summers in recent years, making flooding a higher priority issue. In the fire season of 2020, Saskatchewan experienced wildfire occurrences that were the lowest observed in the past ten years (650 CKOM, 2020). The forest industry workers and planners must deal with the most pressing issues impacting their ability to harvest wood, which therefore contributes to the lack of consideration given to wildfire risk.

An objective of this project was to gain insights from the shareholders of Sakâw Askiy Management Inc., and the stakeholders and rightsholders of the Prince Albert Forest Management Area on issues they would like considered in the development and implementation of wildfire risk reduction strategies. This coincides with Sakâw's desire to obtain a social license to operate, stemming from the conflicts that exist between the corporation and Prince Albert's citizens regarding forest harvesting practices. Obtaining a social license to operate relies heavily on social capital as it is a process which requires trust, listening, providing benefits to the community, and procedural fairness (Wright & Bice, 2017). Social capital is a key element in creating a balance of power between

communities and companies/ corporations in reducing social vulnerability. If social capital is not considered in developing and obtaining a social license to operate, the process will likely fail and be seen as a thinly veiled attempt by the company to buy community respect (Demajorovic et al., 2019). When a social license to operate is obtained, and a company or corporation is seen as trustworthy in the community's where they conduct operations, the company becomes part of the community's social network (Demajorovic et al., 2019). The main explanation for the conflict expressed by all parties involved is the lack of communication between Sakâw and the communities that are impacted by their forest operations. The literature on community engagement in forest management practices highlights that conflict is not always negative and can facilitate positive outcomes including the improvement of democratic decision-making processes (Eckerberg & Buizer, 2017). However, the conflict between Sakâw and the communities in or near the Prince Albert Forest Management Area has not reached the state at which the positive benefits can be achieved. This still requires the members of the communities to feel a sense of empowerment in their ability to impact forest management operations, and the building of trust and equity between the individuals, Sakâw, and forest industry workers (Eckerberg & Buizer, 2017). Building of trust between the corporation and the stakeholders and rightsholders requires that the individuals and organizations that make up these parties can engage with Sakâw and that the contributions and suggestions they make are fairly considered and implemented when appropriate (Wright & Bice, 2017). Stakeholders and rightsholders of the Prince Albert Forest Management Area expressed a lack of awareness and knowledge of the where, when, and why of the forestry operations conducted by Sakâw. There is a need for education on these practices and to promote social learning

around wildfire risk reduction strategies. Education and social learning help to foster local capability within decision-making processes and allow for the community members to feel a sense of empowerment.

Providing information to communities on the where, when, and why of forestry operations may help to improve acceptance of these harvesting activities. Education, engagement, and meaningful communication between Sakâw and the public can occur through open houses, public advisory committee meetings, or site visits to harvesting areas within the Prince Albert Forest Management Area. Creating engagement scenarios which allow for continuous and open communication is a crucial component in the development of community-informed wildfire risk reduction strategies as it ensures progress towards a mutual objective and creates common motivation (Drennan & Rasheed, 2020).

5.5 Summary

In this chapter, a description of the adaptive capacity of Sakâw Askiy Management Inc. with respect to wildfire risk was conducted. This was conducted using several determinants of adaptive capacity identified in the literature on this topic: the array of technological options accessible; economic resources; institutional design and structure (with a focus on the ability to adapt different management and policy strategies in response to environmental changes (Fischer & Jasny, 2017)); human and social capacity of the adaptors; knowledge and ability to access information, knowledge on forestry practices and wildfire (ex. scientific, local, traditional, Indigenous knowledge) and knowledge mobilization (focusing on the awareness of wildfire risk that knowledge mobilization facilitates) (IPCC, 2001; Williamson & Isaac, 2012).

Interview questions addressing the factors that contribute to each of the determinants of adaptive capacity shed light on the elements that work to both enhance and hinder the adaptive capacity of Sakâw. Although the corporation was found to have many positive factors contributing to their adaptive capacity and ability to implement strategies to adapt to increasing wildfire risks, there are several concerns that must be addressed to increase this adaptation potential. These include the lack of funding and subsidies available for forestry companies implementing wildfire risk reduction strategies, which are often costly for the company to employ, the lack of awareness of the risk that wildfire imposes on the Prince Albert Forest Management Area and surrounding communities, and the need for more communication between forest managers and stakeholders/rightsholders. The lack of communication and education was a reoccurring issue addressed by interview participants, further highlighting the need for Sakâw to pursue activities which work to improve their social license to operate in the Prince Albert Forest Management Area.

Chapter Six: Conclusion and Recommendations

6.1 Introduction

As climate change will continue to impact the boreal forest biome and increase the intensity and frequency of disturbances, and especially wildfire (Wotton et al., 2010; Balshi et al., 2009), the implementation of adaptation strategies by forest managers must become an urgent priority. The objectives of this research were to describe the social learning processes that occur in the development of landscape-level wildfire risk reduction strategies that can be integrated in forest harvesting practices, to describe the adaptive capacity of Sakâw Askiy Management Inc., a forestry corporation in northern Saskatchewan, and to provide recommendations to the corporation about practice. The intent of achieving these objectives was to improve the understanding of the role of social learning in building partnerships that enable more informed and multi-perspective views of natural resources, which may in turn allow for the implementation of more effective adaptation strategies in the natural resource sector. Listening to the changes desired by the stakeholders and rightsholders of the Prince Albert Forest Management Area and incorporating these into future forest management operations has the potential to allow for Sakâw to achieve a social license to operate. The results and conclusions drawn from this research contribute to understanding of the processes of decision-making and learning through collaboration. This study also contributes to the literature on adaptive capacity and increases understanding of the factors contributing to the adaptive capacity and its connection to obtaining a social license to operate in communities where conflicts exist with natural resource management corporations implementing climate change adaptation strategies.

6.2 Description of Social Learning Outcomes

In this analysis of social learning processes experienced by Sakâw Askiy Management Inc., the corporation shareholders, and the stakeholders and rightsholders of the Prince Albert Forest Management Area, it was determined that single- and double-loop learning were the most common forms of learning attributed to social interactions. There was evidence of the acknowledgement of the need for a regime transformation in the form of the "let it burn" policy which exists in Saskatchewan; however, no transformation has occurred. There was, therefore, no evidence of triple-loop learning present in this study. Single-loop learning was expressed by interview participants in the acquisition of new skills and knowledge, gained through social interactions, and related to wildfire or wildfire risk reduction. Double-loop learning was expressed by interview participants in the incorporation of new views and perspectives regarding wildfire risk and risk reduction strategies, including the considerations of why the FireSmart program in Canada is employed, why certain fires are supressed, and why it is important to allow for disturbances, including harvesting, to occur in old forest stands.

6.3 Describing the Adaptive Capacity of Sakâw Askiy Management Inc. and Recommendations for Practice

For the description of the adaptive capacity of Sakâw Askiy Management Inc. to be completed, an extensive literature review was conducted to identify the appropriate determinants of adaptive capacity to be applied to this case study. The conclusions drawn from the results showed that Sakâw Askiy Management Inc. has many positive factors that

contribute to their adaptive capacity and ability to implement community-informed landscape-level wildfire risk reduction strategies into their forest harvesting plans. This can be attributed to the presence of experienced and knowledgeable wildfire and forestry personnel, social networks that encourage access to knowledge and information on wildfire risks, and adequate flexibility in the governing policies and plans to allow for the implementation of new adaptation strategies. The factors that have the potential to reduce the adaptive capacity of Sakâw and the corporation's ability to implement wildfire risk reduction strategies include a lack citizen and forestry worker awareness of wildfire risk, lack of funding for landscape-level adaptation initiatives, and a lack of social capital between the corporation and the stakeholders and rightsholders of the Prince Albert Forest Management Area.

The lack of engagement between forestry personnel and the stakeholders and rightsholders of the Prince Albert Forest Management Area, and the desire for more education and consultation on where and why forest operations will be implemented, was a common theme expressed by most interview participants. As Sakâw seeks to obtain a social license to operate to reduce the conflict that currently exists regarding their harvesting practices, it will be increasingly important for the corporation to pursue more meaningful engagement activities within the communities in which they operate. These may include, for example, field visits to sites of proposed operations or the presentation of case studies of previously employed landscape-level wildfire risk reduction strategies. Whichever engagement and education avenue the corporation chooses to employ, the overarching theme must be the presence of meaningful participation from community members, and the ability for those who wish to participate to have an active role in the

decision-making processes involved in determining forest operations, avoiding tokenistic engagement.

6.4 Future Directions and Concluding Remarks

Extensive research and studies have been conducted to determine the impacts of climate change and the implications it has for complex socio-ecological systems, such as forest biomes (Andrews-Key, 2018). However, the application of this research and examples of adaptation initiatives in real world, case study examples are limited (Halofsky et al., 2018). Further pursuing case studies and including the results drawn from these in the literature regarding climate change adaptation is essential to expand the knowledge that exists regarding this topic. As it has been established that learning is an essential component of any adaptive management process (Armitage et al., 2008), studies that provide more clarity on the definition of learning as well as the factors that both enhance and hinder the ability of individuals and organizations to learn are increasingly important.

Moving forward, there are many potential avenues for research regarding climate change, adaptive capacity, and learning, both tied to the Climate Learning and Adaptation for Northern Development project through the expanding inventory of case studies, and elsewhere. Projects such as this one that foster partnerships between industry, government, and community members (including First Nation citizens) will be important for creating solutions to problems that require innovative, bottom-up approaches, such as those imposed by climate change.

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Part 1- Broad introductory questions about Sakâw Askiy shareholders and Prince Albert Forest Management stakeholders/rightsholders.

1. What is your role within Sakâw Askiy Management Inc. (or what ties do you have to the Prince Albert Forest Management Area)?
2. How long have you worked for (or with) this corporation (or how long have you had stakes in the Prince Albert Forest Management Area)?

Part 2- Questions to address objective 1: Assess the learning processes that occur among the seven shareholders of Sakâw and the stakeholders and rightsholders deemed to hold key knowledge on wildfires while discussing and developing wildfire risk reduction strategies as a method of climate change adaptation.

1. What have you learned about wildfire risk reduction strategies and initiatives since the beginning of this project?
   A. Have you gained any new knowledge or skills while working collaboratively with the other shareholders of Sakâw Askiy or stakeholders/rightsholders?
   B. Do you think the current wildfire risk reduction strategies are working?
   C. Did you learn anything new about the consequences of specific wildfire risk reduction strategies?
   D. Did you learn of any new strategies that could work better than strategies you previously knew of since starting to work with this project?
   E. What factors influenced your wildfire risk reduction strategy preferences? Do you feel you have gained any different views or perspectives on wildfires or risk reduction strategies?

2. Do you think that working with a diverse group has led to any changes being made by Sakâw with respect to forest harvesting?

3. Has there been any conflicts encountered while developing wildfire risk reduction strategies within the company or with external stakeholders?
   A. How was the conflict dealt with?

Questions to address objective 2: Examine if and to what extent social learning outcomes enable Sakâw to incorporate community-informed wildfire risk reduction into forest harvesting plans.

1. Who do you talk to most about wildfire risk reduction strategies?
   A. What did you learn by talking to these people?
   B. What sort of topics were discussed?

C. Do you feel you these conversations have strengthened the relationships between the people and organizations independently working on these projects?

D. Are there examples of existing community-informed wildfire risk reduction strategies that Sakâw Askiy is referencing when developing forest harvesting plans?

Question to address objective 3 and 4: Assess and analyze the adaptive capacity of Sakâw using several pre-defined determinants; Make recommendations for practice to Sakâw based on the information gathered from interview participants and contribute new conceptual and empirical understandings.

1. What are some of the main concerns you have with respect to wildfire risks and climate change?

2. What changes would you like to see Sakâw Askiy made/make to prepare for the effects of wildfires? Changes to their forest management practices?

3. Do you think that the collaboration or communication with different partners and organizations has or will help Sakâw to implement effective wildfire risk reduction strategies into their forest harvesting plans (and increase adaptive capacity)?

   A. If yes, how?

   B. Have there been relationships or networks established through this process? (social capital)

   C. Has this collaboration increased the availability and access to knowledge and information on wildfire risks?

   D. Is there funding available to increase wildfire risk reduction strategy actions?

   E. Is there a primary person in charge of wildfire risk reduction decision making? What supports are available for this person (people)?

   F. Was awareness of the risk of wildfires increased?

   G. Is there adequate flexibility in policies and plans to implement new strategies?

   H. Have there been any barriers to implementing these strategies identified? if so, how were they/ will they be dealt with?

DALHOUSIE UNIVERSITY
Research Services

Social Sciences & Humanities Research Ethics Board
Letter of Approval

May 19, 2020
Carly Madge
Management\School for Resource and Environmental Studies

Dear Carly,

REB #:   2020-5125
Project Title: The Social Learning Processes involved in Incorporating Wildfire Risk
Reduction Strategies and Climate Change Adaptation Initiatives into Forest Harvesting Plans
in Northern Saskatchewan

Effective Date:
Expiry Date: May 19, 2021
The Social Sciences & Humanities Research Ethics Board has reviewed your application for
research involving humans and found the proposed research to be in accordance with the
Tri-Council Policy Statement on *Ethical Conduct for Research Involving Humans.* This
approval will be in effect for 12 months as indicated above. This approval is subject to the
conditions listed below which constitute your on-going responsibilities with respect to the
ethical conduct of this research.

*Effective March 16, 2020: Notwithstanding this approval, any research conducted during the
COVID-19 public health emergency must comply with federal and provincial public health
advice as well as directives issued by Dalhousie University (or other facilities where the
research will occur) regarding preventing the spread of COVID-19.*
Sincerely,

Dr. Karen Foster, Chair

FUNDED
SSHRC: 435-2018-0787

**DALHOUSIE
UNIVERSITY**

Project title: The Social Learning Processes involved in Incorporating Wildfire Risk Reduction Strategies as a Climate Change Adaptation Initiative into Forest Harvesting Planning in Northern Saskatchewan

Lead researcher: Carly Madge, Dalhousie University, carly.madge@dal.ca, 902-414-7411

Other researchers
Dr. Melanie Zurba, Dalhousie University, Melanie. Zurba@dal.ca, 902-494-2966
Dr. Ryan Bullock. University of Winnipeg, r.bullock@uwinnipeg.ca, 204-988-7594
Dr. Alan Diduck, University of Winnipeg, a.diduck@uwinnipeg.ca, 204-786-9777

Funding provided by: Social Sciences and Humanities Research Council (SSHRC) of Canada

This Participant Consent Form has Two Parts
1. **Informed Sheet (to share information about the study)**
2. **Certificate of Consent (for signature)**

Part 1: Informed Sheet

Introduction
We invite you to take part in a research study being conducted by Carly Madge who is a Masters student at Dalhousie University. Choosing whether or not to take part in this study is entirely your choice. There will be no impact onf your employment if you decide not to participate. The information below provides you with information on what is involved in participating in an interview related to the research, what will you be asked to do and about any benefit, risk, inconvenience, or discomfort that you might experience.
You should discuss any questions you have about this study with Carly Madge. Please feel free to ask as many questions as you like, and if you think of any questions later, please contact Carly Madge.

Purpose and Outline of the Research Study
Through this study, I hope to gain a clearer understanding of the best methods of integrating and accommodating the concerns held by each of the shareholders of Sakâw Askiy Management Inc. stakeholders in the Prince Albert Forest Management Agreement Area, and government actors with respect to wildfire risk reduction strategies. Sakâw Askiy has suggested there could be ways that forest harvesting could

reduce the risk of wildfire to communities and forests, including a coniferous-dominated forest harvesting strategy and a natural, disturbance-event style strategy. However, such strategies need to be understood and supported by local citizens, and meet the needs of forestry companies for wood products. Therefore, an understanding of the strategies most preferred by the diverse range of Sakâw Askiy shareholders, local citizens, and government actors is required to implement wildfire risk reduction strategies that appease all organizations. We ask that you partake in this study, by participating in a semi-structured interview, and answer questions related to your connection with Sakâw Askiy or the stakes you hold in the Prince Albert Forest Management Area, relationships you have established through being a shareholder or stakeholder, wildfire concerns, and climate change.

Type of Research Intervention
If you decide to participate in this research, you will be asked to partake in one interview which will occur over the phone. This interview will take approximately 45-60 minutes. During this interview, you will be asked to describe your experience working for or with Sakâw Askiy Management Inc., relationships you have established through this connection or the stakes you hold in the Prince Albert Forest Management Area, relationships you have established through being a shareholder or stakeholder, and answer questions related to wildfire concerns and climate change, with time allocated for you to elaborate on topics you feel are important for the nature of the study.

Who Can Take Part in the Research Study
You may participate in this study if you are currently employed by Sakâw Askiy Management Inc. or one of the shareholders of the corporation, AC Forestry, Montreal Lake Business Ventures, NorSask Forest Products, Carrier Forest Products, Dunkley Lumber (Edgewood Forest Products Operations), Meadow Lake Mechanical Pulp, and Tolko Meadow Lake OSB Division.

You may also partake in this study if you are a stakeholder or government representative in the Prince Albert Forest Management Agreement Area deemed to hold knowledge or experiences relevant to wildfire risk reduction strategies.

Benefits, Risks and Discomforts
Participating in the study may not benefit you directly, but the information obtained from these interviews has the potential to influence wildfire risk reduction strategies to include perspectives from Sakâw Askiy shareholders and citizens of Prince Albert, Saskatchewan.

The risks associated with this study are minimal. There are no economic, physical, or emotional risks associated with partaking in this study. Some of the risks include boredom and fatigue throughout the interview, but you will be offered breaks throughout the process to reduce these risks. When sending data over the internet, such as voice and video data as part of a Zoom or Skype call, there are always risks to

your privacy and confidentiality. However, in the case of this study, these risks are small and a data breach is unlikely to occur.

Compensation / Reimbursement
A small gift produced by a local citizen will be stored for you at the Sakâw Askiy Management Inc. office in Prince Albert which you can retrieve at your convenience, whether you complete the entire interview process or wish to withdraw at any point, to thank you for your time.

How your information will be protected
The information that you provide to us will be kept confidential. Upon completing this form, the level of confidentiality you wish for the researcher to employ will be reviewed and the appropriate steps will be taken to ensure that any information you provided or any identifying characteristics you do not wish to have disclosed will be addressed prior to the sharing of this study (ie. through de-identification, pseudonyms, and code keys). Your interview data will be stored in a file on a password protected one drive account on a password protected computer. Names associated with interviews will be removed and replaced with a participant code on this one drive file. The names and associated participant code will be kept in a password protected one drive file on a password protected computer. Any information of yours that may be included in the study will be sent to you for your approval via a secure file transfer before any submission of the study occurs. The information you provide will be accessible to the lead researcher, Carly Madge, as well as the supervisors of the project, Drs. Zurba and Bullock, another lead researcher from the University of Winnipeg, Dr. Alan Diduck, and a research assistant who may be appointed to help with data collection, all of whom will respect the privacy and confidentiality of all participants. The encrypted information will be incorporated as part of the largest project dataset, where the listed researchers will have access to it. All paper records created and collected throughout the study will be stored in a locked cabinet in the study of the lead researcher.

Once the study is over your data will be stored on a password protected one drive account on a password protected computer by the researcher for a minimum of five years. After this time period, the data will be transferred to be held by the co-supervisors of the project and stored in the Environment and Society Collaborative lab through the University of Winnipeg. Paper records will be securely locked in a desk with the lead researcher for the initial five years, and then given to co-supervisor Dr. Melanie Zurba to be stored indefinitely in a locked cabinet in her study. The data may be used by the listed researchers affiliated with this project in the future.

If You Decide to Stop Participating
You are free to leave the interview at any time. If you decide to stop participating during the interview, you can decide whether you want any of the information that you have provided up to that point to be removed or if you will allow us to use this information. Any information you provide through the interview can be removed up to February 1,

2021. After that time, it will become impossible for the lead researcher to remove it because it will already be analyzed.

How to Obtain Results
Once this study is completed, the results will be shared with participants through several forms. The results will be included in a plain-language report that will be shared with participants through e-mail (if you provide your email in the form below) and through formal documents, presentations, and/or visuals (ie. infographic/ map) created by the lead researcher for and with Sakaw Askiy Management Inc. and shareholders/ external stakeholders. The results of this project may also be used for journal publication in peer-reviewed academic literature that will be produced in partnership with the research partners.

Questions
I am happy to talk with you about any questions or concerns you may have about your participation in this research study. Please contact Carly Madge at 902-414-7411, carly.madge@dal.ca at any time with any questions, comments, or concerns about the research study.

If you have any ethical concerns about your participation in this research, you may also contact Research Ethics, Dalhousie University at (902) 494-3423, or email: ethics@dal.ca

Part 2: Certificate of Consent

Project Title: The Social Learning Processes involved in Incorporating Wildfire Risk Reduction Strategies as a Climate Change Adaptation Initiative into Forest Harvesting Planning in Northern Saskatchewan

Lead Researcher: Carly Madge, Dalhousie University, 902-414-7411, carly.madge@dal.ca

Other researchers
Dr. Melanie Zurba, Dalhousie University, Melanie. Zurba@dal.ca, 902-494-2966
Dr. Ryan Bullock. University of Winnipeg, r.bullock@uwinnipeg.ca, 204-988-7594
Dr. Alan Diduck, University of Winnipeg, a.diduck@uwinnipeg.ca, 204-786-9777

I have read the explanation about this study. I have been given the opportunity to discuss it and my questions have been answered to my satisfaction. I understand that I have been asked to take part in one interview that will occur over the phone. I agree to take part in this study and understand that my participation is completely voluntary and I am free to withdraw from the interview at any time or have the information I provide from my interview be removed from the study up until February 1st, 2021.

Options (you can still participate in the research if you select no):

I agree that my phone interview may be audio-recorded ☐Yes ☐No

I agree that direct quotes from my interview that may identify me be used ☐Yes ☐No

I agree that direct quotes from my interview may be used without identifying me ☐Yes ☐No

I agree to have the researcher contact me after the interview for clarification ☐Yes ☐No

I would like to receive a summary of the study results ☐Yes ☐No

Please provide an e-mail address and/or phone number below if you answered yes to either of the last two options.

Email address: _____

Phone number: _____

_____   _____
        _____
Name