Mining Impact and Indigenous Protected and Conserved Areas

by

Chima J. Onyeneke

A Thesis submitted to the Faculty of Graduate Studies of

The University of Manitoba

in partial fulfillment of the requirements of the degree of

MASTER OF NATURAL RESOURCES MANAGEMENT

Clayton H. Riddell Faculty of Environment, Earth, and Resources

Natural Resources Institute

University of Manitoba

Winnipeg, Manitoba

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Abstract

Gold mining on pristine land that Indigenous people use for sustenance is a common practice in Canada, despite some of these lands being designated as Indigenous-protected areas. This study explores traditional land use protection versus natural resource extraction, looking at the Red Sucker Lake First Nation (RSLFN) region. I applied geographic information system mapping, analysis of transcribed audio interviews, and literature review methods in this study. Based on 21 map biographies of traditional land use of RSLFN interviewees' transcripts focussed on the preservation of traditional ecological knowledge (TEK), mining impacts, and traditional land use and occupancy (TLUO) of these 21 RSLFN people. Summary maps of the traditional land uses of 21 RSLFN people show sustenance and cultural activities on greenstone belts, designated by the province for mining. The interview analysis reveals exploration and mining activities impacting RSLFN's traditional land and practices, causing spills and destroying personal property. The interviews also reveal community members' desire to protect their land from mining activities for Indigenous knowledge preservation, ecosystem preservation, and traditional land use protection towards realizing *Mino Bimaadiziwin* (the good life). A change in governments' policies on greenstone belts being restricted to mining development, which interferes with the traditional land use practices of affected Indigenous peoples, is needed.

Keywords: Mining impacts, Indigenous knowledge, Traditional land use, Land conservation, Land-back, *Mino Bimaadiziwin*

Acknowledgments

Gratitude to the Chief and Council, Elders, and esteemed members of Red Sucker Lake First Nation for accepting to work with me on this research on their homeland. Immense appreciation to my amiable supervisor, Dr. Shirley Thompson, for her invaluable support throughout my thesis process. Her vast knowledge and experience were useful guides on my academic research journey. I would also want to extend my gratitude to Dr. Sarah Cooper and Dr. Jill Oakes- I am favoured to have them on my committee. Bruce Harper and the late Norman Wood provided guidance and led my work, providing constant feedback and direction. I also appreciate the support and guidance from Darren Harper of Maawandoon Inc. Their enthusiasm, dedication, and meticulousness inspired me and improved my thesis.

I also want to thank all the staff members of the Natural Resources Institute, especially Tamara Keedwell and Dalia Naguib for their kind administrative support. Not forgetting my departmental director, Dr. John Sinclair, for his encouraging words and leadership. And the University of Manitoba graduate tutors for their editorial guide. And to my research team members and friends, especially Tanzim Ahmed, Keshab Thapa, Bruce Harper, and John R. Monias- I say thank you for all the encouragement.

Eternal indebtedness to my late parents, Mr. J. Onyeneke and Mrs. C. Onyeneke, for all the parental care and support I received from them and for their continued spiritual backing. To my loving wife, Judith Onyeneke, and my adorable sons, Jason and Justin Onyeneke, and my siblings, you are the best. Thank you for the love, support, encouragement, patience, and prayers.

Finally, special thanks to my sponsors, the University of Manitoba, and Mino Bimaadiziwin Partnership/Mitacs, for funding this research through their generous scholarships

and stipend. I owe the success of this master's program to the bigheartedness of the funding bodies-Social Sciences and Humanities Research Council (SSHRC), Faculty of Graduate Studies (FGS), and Mitacs.

Dedication

This work is dedicated to all the departed Indigenous people who committed their lives to the preservation of traditional land use practices and protection of Indigenous rights, especially the Late Vincent N. Wood.

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Chapter One: Introduction

Should gold mining be allowed on pristine land that Indigenous people use for sustenance and want designated as an Indigenous Protected and Conserved Area (IPCA)? And who should decide whether Native land is used for mining? The Canadian mineral tenure law sees mining as the first and best use of land (Kuyek, 2005). Recent on-site exploration and drilling operations within the Red Sucker Lake First Nation (RSLFN) territory have confirmed high-grade gold ore (Manitoba Government News, 2018). Exploring the estimated one billion dollars of gold and other precious metals at Monument Bay is Agnico Eagle Mines Ltd.'s (previously Yamana Gold Inc. until 2023) interest in the area. However, many negative impacts of mining activities from exploration to development are felt by the RSLFN community members with few or no benefits (Thompson et al., 2020). My research focuses on analyzing the impacts of these mineral development-related activities on the traditional land use of RSLFN.

Monument Bay, near the RSLFN reserve and part of the RSLFN traditional territory, has approximately 136 mining claims (Integrated Mining and Quarrying System, 2022). The use of this pristine land for mining competes with the traditional land use of the *Anishiniwuk* (Thompson et al., 2020). Other traditional land use areas of RSLFN also have mining claims. The Lingman Lake mine in Ontario, which is approximately 66km from Red Sucker Lake, is known for its high-grade gold minerals with about 1,452 staked/patented claims. Exploration and mining activities by Signature Resources Ltd. have resulted in complaints from RSLFN. Signature's land tenure covers about 85% of Lingman Lake's greenstone belt. (Denbow, 2021; Signature Resources, 2022). The issues and impacts of mining activities on RSLFN's traditional land use are explored in this study.

Contrary to the popular perception that nearby communities derive economic benefits, such as jobs, training, and business opportunities from mineral development, RSLFN has limited or no

economic benefits from nearby mining. The development activities of Agnico Eagles and other mining companies have resulted in negative impacts (Thompson et al., 2020). Further, the Land Use Planning Act Regulation 81/2011 section 8.1.1 limits development on greenstone belts to mining: “The provincial government sees only mining interests in this land” (Thompson et al., 2020, p.25). This regulation seems to deprive the Indigenous people of RSLFN the right to fulfilling their sacred role of keeping the land and water as the Creator made it.

Self-determination is a common aspiration of Indigenous peoples globally (Barsh, 2004), and RSLFN is no exception. The cultures and livelihoods of Indigenous peoples are rooted in their lands, and land use priorities are crucial to self-determination. Consequently, in response to racism and deprivation, Indigenous peoples demand their right to self-determination (Huff, 2005). Thus, in contribution to the knowledge base of the importance of Indigenous land-based protection to self-determination, my research work aims to identify, analyze, and document the impacts of mining development activities on the land use of RSL people. Self-determination requires ownership, control, access, and possession (OCAP) in First Nation research (Schnarch, 2004). In this research the Anishiniwuk people, primarily Norman Wood, Bruce Harper and Darren Harper, led each step and guided the research approach.

Considering RSLFN traditional ecological knowledge and the current *Impact Assessment Act 2019* of Canada (CEAA, 2019), this study explores traditional land use protection issues versus natural resource extraction in the RSLFN region. The community-specific impacts identified in this study and the land use mapping/analysis will guide the determination of Indigenous-led protection measures, as wanted by the Indigenous peoples of RSLFN. Further findings from analysis of the impact assessment records and audit archives (Canadian Impact Assessment Registry, 2022; Impact Assessment Agency of Canada, 2020; Eagle Gold Mine Environmental

Audit, 2020) are considered in assessing the environment and land guardianship of the RSL's traditional territory.

1.1. Statement of Problem

Mining developments have implications for the environment, community, and people who reside or use the resources there (MiningWatch Canada, 2001). Indigenous communities have endured widespread social, economic, and environmental challenges due to mineral development activities since the early twentieth century (Keeling & Sandlos, 2009). A key challenge of mining in Canada's north is the risk posed to the Indigenous peoples' culture and heritage, thereby degrading Indigenous well-being (Downing et al., 2002). Thus, Island Lake people oppose industrial development that interfere with their traditional practices (Thompson et al., 2019). Further, mineral development reduces wild food consumption by reducing abundance (Gibson & Klinck, 2005). Habitat loss and degradation from developmental activities affect wildlife abundance by altering migration routes, breeding grounds, and nesting areas (Buehler, 2012).

Also, mining activities within RSLFN's traditional territory have the potential to contaminate the water bodies that serve as drinking water sources for wildlife, fish source, and transportation means (Thompson et al., 2020; Salomons, 1995). During Yamana Gold Inc.'s era, before Aginco took over in winter 2023, a diesel spill occurred at Monument Bay during exploration. The contractors in camp hid the spill from the company and the community. After community members brought this forward, despite fear for their job, the spill was recognized by the province, reporting and bioremediation started. Therefore, the *Anishiniwuks* of RSLFN look to create Indigenous-led protected areas and assess mining impacts at Monument Bay, and Lingman Lake (60km northeast and 66km southeast of RSLFN respectively; see Appendix 1), and other

claims. Their wish is to monitor the wildlife abundance, quality of environmental media, and natural cycles.

1.2. Research Purpose

This study aims to analyze and document the issues and impacts of mining exploration and other activities at Monument Bay and other proximal mines on the traditional land use area of Red Sucker Lake First Nation.

1.3. Research Objectives

The objectives of this research are:

1. Explore traditional land use protection issues versus natural resources extraction in the RSLFN region through mapping;
2. Identify the existing and potential impacts of exploration and mining-related activities on the traditional land use of RSL members.

My research findings will contribute to the knowledge base by informing answers to questions such as: what impacts of exploration and mining-related activities on land use are peculiar to fly-in communities such as RSLFN? How can these identified impacts be mitigated, by combining Indigenous and Western science toward the actualization of *Mino Bimaadiziwin*? How have land use policies influenced nature conservation in RSLFN?

1.4. Community Profile

The culture and identity of RSLFN (Anderson et al., 2006), are rooted in the land. Indigenous peoples, through their sustainable resource use practices and respect for nature, preserve biodiversity and ecosystem integrity (Philips, 2000). The population of RSLFN, based on the 2021 census is 725 persons; the 0-14 age group makes up approximately 35 percent (Statistics

Canada, 2022). Infants and children fall under this 0-14 age group that is about the most vulnerable to pollutants and malnutrition, as their organs are still in developmental stages (UNEP, 2018). Further, the prevalence of food insecurity is higher among Indigenous communities compared to non-Indigenous (Public Health Agency of Canada, 2022). The food insecurity and limited access to social and health amenities confronting RSLFN, largely due to the isolated nature of the community (see Figure 1), can be compounded by developmental activities if adverse impacts are not identified and managed.

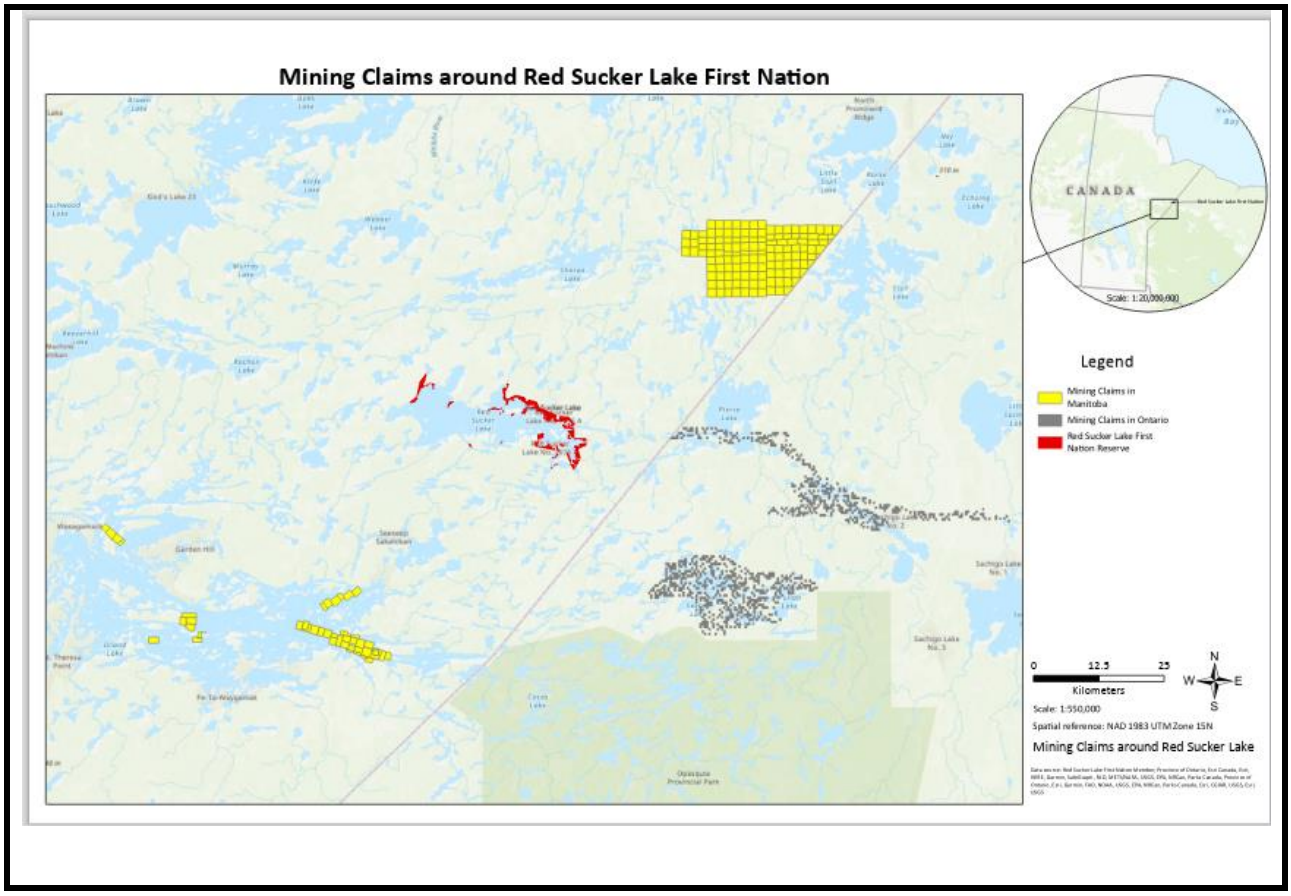


Figure 1. Map showing mining claims around Red Sucker Lake First Nation within their traditional territory
Sources: ESRI Canada, Province of Manitoba, Province of Ontario

The RSLFN community is located 350 air kilometres (km) northeast of Winnipeg and 285 air km southeast of Thompson, without road linkages except winter roads. This isolation from cities or access centres with banks, higher education, and other needed infrastructure has contributed to the economic and educational status of the community (see Table 1). The average household size in RSLFN is 4.4 people compared to 2.5 for the total Manitoba population (Statistics Canada, 2021). The RSLFN household size is higher than 3.7 people for Canada's First Nations, demonstrating overcrowding. In RSLFN, 5.3 percent have a post-secondary degree and 20 percent graduated from high school (Statistics Canada, 2021). 43.5 percent have no certificate, diploma, or degree (Townfolio, 2022; Statistics Canada, 2018), which is seven times lower than that for people off-reserve in Manitoba.

Also, the unemployment rate in RSLFN stands at 22.5 percent, almost six times the unemployment in Manitoba of 4.6 percent. RSLFN is higher than the average of 18.0 percent across First Nations (Statistics Canada, 2021), due to its remoteness, regional economy, and barriers created by the Indian Act.

Employment rates are 35.6 percent, 63.1 percent, and 46.8 percent for RSLFN, Manitoba, and First Nations respectively (Statistics Canada, 2021). This state of poverty and deprivation in RSLFN, and other First Nation communities, is due to the federal government's failure to provide adequate funding for infrastructural and economic development in these regions (Boyd, 2011) and federal control over development and all aspects of Indian reserves under the Indian Act (Olsen-Harper et al., 2023).

Table 1 summarizes the statistical information on average household size, percentage of population without formal education, and employment/unemployment rates for RSLFN compared with data on the same parameters for Manitoba province and other First Nations. RSLFN has a

higher household size of 4.4, which signals overcrowding of housing as First Nation housing is very small due to restricted funding for housing development. The RSLFN population percent without formal education (post-secondary) is very high at 43.5%, more than seven times the rate for Manitoba. Clearly, access to secondary and post-secondary education is limited in this remote community. The RSLFN employment rate at 35.6% is very low- about half that of Manitoba's with almost six times the unemployment rate at 22.5% compared to 4.6%. All indicators at RSLFN are showing poorer outcomes than for Manitoba and other First Nations.

Table 1

Comparison of Economic and Educational statuses of Manitoba, Red Sucker Lake FN, and First Nations

	Manitoba	Red Sucker Lake FN	First Nations
Average household size	2.5	4.4	3.7
% Population without formal education	6.8	43.5	28.9
Employment rate (%)	63.1	35.6	46.8
Unemployment rate (%)	4.6	22.5	18.0

*Note***.** Statistics Canada, 2018-2022 & Townfolio, 2022

1.5. Value Proposition

My research work provides the following to RSLFN:

- Traditional land use biographies of RSLFN's interviewees for the preservation of the traditional ecological knowledge system;
- Service and advice on the Indigenous-led protected area expression of interest;
- Documented impacts of mining and exploration on the traditional land use of the community; and,
- Evidence-based protection against industrial developments on their traditional land.

1.6. The Importance of this Study to Me and How I Connect to This Research

Environmental monitoring for community development and protection has always been my passion, and I have practiced environmental management for over seven years. My educational background includes earning a Bachelor of Technology, specializing in Microbiology, and a Master's in Environmental Management. As an Indigenous person from Obibiezena in eastern Nigeria, I am familiar with Indigenous struggles for self-determination, which impacted me.

My research is an appendage of a larger Indigenous community engagement and capacity-building project organized by the *Mino Bimaadiziwin* Partnership and RSLFN and funded by the Mitacs-SSHRC joint initiative and the University of Manitoba. This research, I believe, will contribute to the actualization of self-determination by the people of RSLFN. The RSLFN is a remote fly-in community accessible only via winter road and Perimeter Airlines. During this research, I have learned about their own unique culture and traditions. As an Indigenous person, I understand the pertinence of language and culture, and the sacredness of the land as handed down by our ancestors. I also understand the uniqueness of our beliefs in the potency of traditions and rituals. The colonists, on the other hand, historically deprived Indigenous peoples of their rights to these values and resources.

While acknowledging that research on an Indigenous community is best executed by Indigents of the community (Wilson in Thapa, 2018), I committed to undertaking a fair and trustworthy narration and analysis by seeking guidance and triangulation by Indigenous community members. I employed the guiding principles of reciprocity, diversity, relationship building, and respect for culture, while I worked with the Indigenous peoples of RSLFN (Maiter et al., 2008; Harry et al., 1999). I have at each stage asked for guidance and provided the database

and reports back to the community, after their approval, asking for changes and direction. This research is in partial fulfillment of my degree requirements.

1.7. Organization of the Thesis

My thesis is structured into five chapters. **Chapter One** gives a contextual overview of the research and states the rationale for the research and thus the purpose of the research. Chapter one also itemizes the objectives of the research, describes RSLFN's community profile, enumerates the values of research to RSLFN, and the importance of this study to me and how I connect to this research- my positionality, and research limitations. **Chapter Two** comprises a review of literature on traditional land use, emphasizing land use perspectives and spatial planning tools. Also, colonialism to land-back, focussing on Indigenous self-determination, data sovereignty, consent and participation in resource extraction, and Indigenous-led conservation. The literature also included impact assessment highlighting community engagement, regional assessment, and the critiques of impact assessment in Canada. Lastly, chapter two covers mining impact- mining and environmental effects. **Chapter Three** describes the research methods and provides information on data collection, analysis, limitations encountered in my work, and trustworthiness. **Chapter Four** presents the research results and discussion in four sections. The first addresses land use and occupancy of Red Sucker Lake First Nation buttressed with maps showing their different land uses, densities, and hot spots. The second section summarizes the discussions on land uses. The third section explains the findings of semi-structured audio interviews with the community concerning the impacts of mining/exploration and land protection. Also, this third section presents the outcome of the systemized review of archival reports on mining impacts. Policy implications are discussed in the fourth section. **Chapter Five** concludes my thesis and offers recommendations for the application of my findings and for future research.

Chapter Two: Literature Review

The literature reviewed, relevant to my thesis, includes the following areas:

1. Traditional land use
2. Colonialism to land-back
3. Impact assessment
4. Mining impacts

2.1. Traditional land use

2.1.1. Land use perspectives of First Nations and traditional land use planning

Understanding the First Nations' land system is fundamental to sustainable land management within traditional territories. Land use is the economic and cultural uses of land practised by humans at a given place (USEPA, 2022). Indigenous concepts of land and land management differ considerably from those of Western worldviews (Brinkhurst, 2013). To the Indigenous peoples, the land is their source of existence, language, and survival (Thompson et al., 2020; Desmarais & Robbins, 2019). The Indigenous worldview of land, as illustrated in the Syilx philosophy, refers to land as a "lifeforce place" inseparably bound to humans in relationships necessitating reciprocity, respect, and humility rather than a mere location or ecology type (Atleo, 2022).

Notably, the regenerative land ethics of the Indigenous peoples hinges on the willingness to uninterruptedly sustain and respect the land, rather than management as of utility (Brinkhurst, 2013). The characteristically pristine territories of Indigenous peoples cater to their traditional land uses including hunting, trapping, gathering, and ceremonial activities (Statistics Canada, 2020; Thompson et al., 2020). Content with the pristine nature of their traditional territories and opposed

to industrial developments, an Elder from Wasagamack FN, in *Let's Keep our Land Sacred as the Creator Taught Us*, stated: "The land is our medicine; the land is perfect the way the Creator made it (Thompson et al., 2020, p.1)." The actualization of this land preservation desire requires the cooperation of colonial governments with First Nations towards Indigenous planning, which is planning designed by Indigenous peoples for their own purposes and needs (Booth & Muir, 2011).

Globally, Indigenous communities are adopting planning as a strategic tool to achieve social, economic, and political goals based on Western ideology. Indigenous participation in state-sponsored planning processes is framed as an endorsement of the planning and development process, without Indigenous inputs influencing or being part of decision-making. Rather, Indigenous knowledge is extracted without benefiting the communities. Indigenous communities are often thought of as lacking the requisite capacity to conduct planning activities, with government and industry unappreciative of Indigenous knowledge systems. Arguably, self-determined Indigenous planning requires a critical understanding of "planning tools," and the accommodation of Indigenous visions and goals for the protection of cultural, social, political, and economic rights and interests in future planning processes (Walter et al., 2013).

2.1.2. Spatial planning tool

Many Indigenous communities have adopted participatory land use mapping. Participatory land use planning is a territorial planning tool for supporting inter-generational communication of land-related knowledge, and mapping community space and ancestral territories (McCall, 2003; Barlindhaug, 2013). In Canada specifically, mapping spatial information to represent Indigenous knowledge (IK) and Indigenous rights dates to the 1970s (Olson et al., 2016). Traditional land use maps have helped communities in analyzing and ameliorating land and resource conflicts (McCall, 2003).

In negotiating land and resource rights, oral histories of Indigenous people are not considered to have legal standing or credibility and fail to yield desired results. Tobias (2000) emphasized that "possession and control of cultural data translate into considerable political power, at both the negotiating table and in court (p.1)." This importance of land use mapping is exemplified in the 1997 landmark Supreme Court of Canada ruling in *Delgamuukw*. Land use and occupancy mapping provides a pictorial testimony of land uses, territorial occupancy, and the impact of anthropocentric activities on the livelihood and culture of traditional landowners (Tobias, 2000). However, Indigenous leadership is needed to guide the TLU mapping process to better aid negotiations on territorial resource developments (Olson et al., 2016).

2.1.3. Indigenous knowledge in environmental assessment

Indigenous knowledge (IK) is part of a larger worldview that influences the perception and definition of reality. Increasingly, IK is becoming an integral part of environmental assessment (Stevenson, 1996). Indigenous peoples' in-depth knowledge of the land particularly plays a vital role in environmental assessment through tactical differentiation of project-related changes from natural environmental changes. Some authors opine that Indigenous knowledge being recognized as a necessary component of environmental assessment is relatively nascent (Stevenson, 1996). Other authors argue that Indigenous knowledge has informed environmental management decisions for millennia and needs to be considered in law and environmental impact assessment processes (Eckert et al., 2020).

The Indigenous peoples' intimate knowledge of resource distribution, ecosystem functions, and the relationship between the environment and their culture can significantly contribute to environmentally sound and sustainable development practices (Stevenson, 1996). The Impact Assessment Act 2019 of Canada recognizes a role for Indigenous knowledge (IK) in environmental

assessment. To assess the impacts of developmental activities on Indigenous communities, Indigenous knowledge is needed to ensure that Indigenous people's concerns are meaningfully and adequately considered in decision-making. Obstacles such as financial limitations, knowledge incompatibilities, and the effects of colonization often limit the outcomes of IK in the IA Act (Eckert et al., 2020; Stevenson, 1996). The guidelines of the new IA Act 2019 of Canada (see Appendix 3) seek to address these through attempts to make the public engagement processes inclusive and meaningful with decisions based on science, IK, and other sources of evidence (CEAA, 2019).

Indigenous knowledge is a way of life inseparable from the people who hold and live this knowledge. Hence, the societal systems and people from where this knowledge emanates are integral to the understanding and adequate incorporation of IK (McGregor, 2021). Consequently, knowledge seekers are challenged to apply Indigenous and Western science in a manner that respects Indigenous knowledge systems (IKS) and Indigenous people (McGregor, 2021; Kimmerer, 2013). To this end, Indigenous people have criticized public engagement strategies as inappropriate to consider Indigenous knowledge in environmental assessment processes on their Native land (O'Faircheallaigh, 2007; Ballard & Banks, 2003).

In line with the United Nation's Declaration on the Rights of Indigenous Peoples (UNDRIP), the basic principles of self-determination, Indigenous peoples' authority, autonomy, and jurisdiction should respect both IKS and Western sciences (McGregor, 2021; Woons, 2015). To enhance the accessibility of IK for EA purposes, colonial governments need to support and finance Indigenous peoples in their bid to formalize IK protection systems and sharing protocols. The IA Act 2019 demonstrates the Canadian government's acknowledgment of the rights of

Indigenous peoples and the integration of IK into public reviews and regulatory processes (McGregor, 2021; CEAA, 2019).

2.2. Colonialism to land-back

An unprecedented period of colonial expansion, which started in the mid-fifteenth century and lasted for more than 500 years, saw a large portion of the world succumb to the administration and control of a few European countries. This process of colonialism created the present metamodern world characterized by colonialism (Harrison & Hughes, 2010; Vermeulen & Van Den Akker, 2010). The term colonialism, as defined by Harrison and Hughes (2010), refers to the "process by which one nation extends its sovereignty over another nation's territory and establishes either settler colonies or administrative dependencies between the host nation and colonial metropole (p. 235)." The Indigenous peoples challenge the politics of colonial ownership and control. Recently, Indigenous communities are using traditional land use mapping to help enforce their territories, cultural heritage, and traditional knowledge in courts (Thompson et al., 2020; Thapa, 2018; Doyle et al., 2017; Harrison & Hughes, 2010). Subsequent discussions highlight some of the terminologies and indices of the land-back struggle.

2.2.1. Indigenous Self-determination

Over the years, states all over the world have either permitted or turned blind eyes to the usurping of lands originally occupied by Indigenous peoples (Linde, 2009). Indigenous peoples have been entangled in struggles with governments over land claims, culture, and political recognition, all geared towards the actualization of self-determination. Governments and transnational corporations, nonetheless, see such claims as barriers to accessing and extracting natural resources from Indigenous lands for state-building (Woons, 2015). This quest for Indigenous self-determination was strengthened by the UNDRIP in 2007, suggesting an attitudinal

change internationally. Specifically, articles 3 and 33 of the UN Declaration endorse the right of Indigenous peoples to self-determination (UN General Assembly, 2008).

Despite the seeming robustness of UNDRIP, its devolution of power to Indigenous peoples to challenge the colonial power imbalance is limited. This power limitation is clearly stated in Article 46, "Nothing in this [UNDRIP] Declaration may be interpreted as implying for any state, people, group or person any right to engage in any activity or to perform any act contrary to the Charter of the United Nations or construed as authorizing or encouraging any action which would dismember or impair, totally or in part, the territorial integrity or political unity of sovereign and independent States (Woons, 2015; UN General Assembly, 2008)." Indigenous peoples' uniting factor, globally, hinges on a common desire to address historic and ongoing injustices perpetrated by imperial and colonial dominations. Histories of child removal and community dislocations, and, more recently, the reductions in resources per capita increase the need for self-determination (Britain & Blackstock, 2015; Woons, 2015).

2.2.2. *Mino Bimaadiziwin* (The Way of a Good Life)

The Indigenous Inaakonigewin [law] of *mino bimaadiziwin* is rooted in self-determination and decolonization (Daigle, 2019; Craft, 2014). The Anishinaabe word "*mino bimaadiziwin"* embodies the past, present, and future of good, healthy, and respectful approaches to life (Nightingale & Richmond, 2022; Debassige, 2010). To the Indigenous people, the land is the source of local knowledge systems that fosters *mino bimaadiziwin*, and well-being (Nightingale & Richmond, 2022; Bell, 2016).

Indigenous land use planning has been identified as a means of fulfilling community priorities for *mino bimaadiziwin* (Thapa, 2018). Consumption of natural foods from gardens,

fishing, and hunting is one of the landmarks of *mino bimaadiziwin* enjoyed by Indigenous peoples before colonial impacts (Thompson et al., 2019; Manitowaabi & Marr, 2018). The Indigenous government of old was characterized by an intersection of "reciprocity, egalitarianism, community-centredness, and connection to the land and Indigenous knowledge (Manitowaabi & Marr, 2018, Pp. 15-16)." To re-attain *mino bimaadiziwin*, the Island Lake First Nation communities wish to protect their aki (land), culture, biodiversity, sustainable livelihoods, and threatened species according to Indigenous-led Anishininew ways of land-based conservation. This concept of good life also favours natural cycles and habitat protection. For instance, the natural water flow in the Hayes watershed [the only watershed in Manitoba void of hydro development or diversions] allows wildlife abundance and greater biodiversity (Wood et al., 2022).

Mino bimaadiziwin is the ideal future that the Indigenous peoples envision, irrespective of where they live (Craig & Hamilton, 2014; Thompson et al., 2019). According to *Sacred Harvest, Sacred Place*, the Wasagamack people of Island Lake region "prioritize culture, ecological integrity, and wild food over gold and other riches (Thompson et al., 2019, p. 268)." *Mino bimaadiziwin* breeds modesty, respect, and an awakening of one's obligation to others' well-being (Grover, 2017).

2.2.3. Indigenous data sovereignty

Indigenous data sovereignty (IDS) is the right of the Indigenous peoples, communities, and Nations, to participate, steward, and control data generated from, with, or about them. Indigenous data includes but is not limited to information on Indigenous peoples' languages, knowledge, lands, resources, customs or traditions, intellectual property, and ideas. IDS provides a framework for deriving optimal benefits from open data for both Indigenous and scientific data users (University of Toronto Libraries, 2022; Kukutai & Taylor, 2016). The era of colonization saw

researchers often digitizing Indigenous knowledge and information and making them available on open sources without the express permission of the Indigenous peoples. Regardless of how well-intentioned, these acts result in the co-opting of Indigenous knowledge without the inclusion of the Indigenous peoples in the data governance processes (De Beer, 2016). This anomaly can be curbed by IDS, as enshrined in Articles 3 and 18 of the UNDRIP (see Appendix 2), which encompasses Indigenous data governance (IDG) in support of the land-back struggle of the Indigenous peoples (Davis, 2016).

According to the United Nations (UN) estimate, over 476 million Indigenous people live in 90 countries across the world, representing 6.2 percent of the global population, and accounting for about 5,000 indigenous cultures (UN Report, 2021; UNSD, 2009). Indigenous peoples, defined by the United Nations Permanent Forum on Indigenous Issues (UNPFII), are persons who are the inheritors and practitioners of unique cultures and ways of relating to people and the environment. Despite their cultural disparities, Indigenous peoples, globally, share common problems associated with the protection of their rights as distinct peoples (Kukutai & Taylor, 2016). Indigenous data collection with limited input from the Indigenous communities and individuals often results in the reliance of indigenous nations on external data that largely fails to represent community needs and priorities (Rainie et al., 2017; Rodriguez-Lonebear, 2016). This data imbalance, according to Kukutai and Taylor (2016), "threatens self-determination, limits informed policy decisions, and restricts progress towards Indigenous aspirations for healthy, sustainable communities (pp. 2-5)." However, data collection requires a level of expertise and financial resources beyond the means of most Indigenous communities. Still, growing access to the internet and an increasing quest for institutional oversight of research and data collection in Indigenous communities provide a glimpse of hope for Indigenous data sovereignty (Snipp, 2016, pp. 51-53).

2.2.4. Indigenous peoples' consent and participation in natural resource extraction

Indigenous-industry relationships and partnerships have had some limited successes when agreements, such as the Impact and Benefit Agreements, occur (Natural Resources Canada, 2012). While this outcome is seemingly laudable, a few challenges related to resource extraction such as sovereignty over resources, access to justice, and local implementation remain (Gocke, 2013). "Provincial and federal authorization for extraction and development on Indigenous territories take place without Indigenous consent (Blacksmith et al., p.104)." Although many governments remain non-committal to Indigenous peoples' right to free, prior, and informed consent (FPIC), corporate entities are increasingly proactive at seeking their consent on resource extraction projects through engagement processes. However, a negotiated proponent-driven model for seeking Indigenous consent on resource extraction on their traditional lands often results in a truncated version of FPIC (Papillon & Rodon, 2017).

The Declaration on the Rights of Indigenous Peoples, adopted by the General Assembly of the United Nations, states in Article 32 para. 2 that a state shall consult and cooperate in good faith with Indigenous peoples to obtain their free and informed prior consent regarding extraction and utilization of natural resources (UN General Assembly, 2008). This section of the UN declaration accords the Indigenous peoples participatory rights regarding natural resource extraction or use on their traditional territories, as owners of the land, and with it, its resources (Linde, 2009). Therefore, the principles of FPIC aim to protect Indigenous peoples from coercion or intimidation and ensure that their consent is sought and freely given prior to the approval or commencement of any development activity (Ward, 2011). This FPIC requires that Indigenous people have complete knowledge of the scope and potential impacts of a proposed project, for their choices to accord or retain consent to be respected (Ward, 2011).

2.2.5. Indigenous-led nature conservation

Indigenous people in Canada's boreal forest have cared for their forest homes since time immemorial. Indigenous peoples worldwide share historical connections to land and water that provide biodiverse ecosystems (Vogel et al., 2022). The vital ancestral knowledge, eco-centric values, ethics, worldviews, and expertise held by Indigenous peoples make them exceptionally positioned to lead in protecting the land. As a result, global recognition of the role Indigenous Protected Areas and Indigenous peoples can play in biodiversity conservation and the protection of cultural heritage is mounting (The World Bank, 2022; Webb, 2019; IUCN, 2018).

A third of the global forests, crucial for mitigating climate change and accounting for an estimated 80 percent of the planet's biodiversity, are within traditional Indigenous territories (The World Bank, 2022). Therefore, through the protection, conservation management, and restoration of natural landscapes that serve as important carbon sinks (e.g., forests, fields, and wetlands) and biodiversity hotspots, Indigenous-led conservation will be instrumental in tackling the climate crisis ravaging the world (Vogel et al., 2022; Webb, 2019). A report by the World Resources Institute [WRI] suggests a 2.8 times reduction in deforestation in Indigenous lands of the Bolivian Amazon than outside Indigenous lands, thereby averting 8.04 Mt CO_2 annually (World Resources Institute, 2022; Webb, 2019). Also, authors have suggested that Indigenous-led Nature-based solutions for climate crises are a win-win concept having diverse co-benefits, including creating ethical space for conservation collaborations and reconciliation (Vogel et al., 2022).

Further, intact and thriving ecosystems are pivotal to virtually all aspects of health and culture for the Indigenous peoples. Food, water, medicines, and housing materials are obtained from the forests for basic needs. Other co-beneficial environmental and socioeconomic adaptations

offered by Nature-based solutions (NbS) include soil health, reduced risks of extreme events, and slowing biodiversity loss (Webb, 2019; Vogel et al., 2022).

The impacts of NbS transcend beyond the immediate vicinity where the NbS is practiced. The Hudson Bay Lowland, the world's third-largest wetland and home to a vast population of polar bears (Peacock et al., 2010; Abraham & Keddy, 2005), will benefit from Nature-based conservation actions that happen around that region. The recent decline in the Western polar bear subpopulation has been attributed to prolonged ice-free seasons and industrial activities, including mining (Peacock et al., 2010). Nonetheless, achieving NbS co-benefits requires "significant social innovation in conservation finance, collaborations, and policy innovations to promote widespread, rapid uptake of land protection and restoration initiatives (Vogel et al., 2022, p.4)." Conservation, to the Indigenous peoples, means protecting the Indigenous cosmovision, which views the forest as a living being encapsulating natural spaces for the spirit population (Webb, 2019).

Indigenous Protected and Conserved Areas (IPCAs) are a pathway to Indigenous-led conservation where Indigenous lands and waters are protected and conserved by Indigenous governments using Indigenous laws, governance, and knowledge systems. The Canadian extractivist approach, in the guise of national interest, remains a tool to ensure the state's unrestrained access to land-based resources (Arnold, 2017). However, the recent Indigenous-Led Area-Based Conservation (ILABC) funding program, which includes IPCAs, is indicative of a significant change in conservation planning and management by Canada (Conservation through Reconciliation Partnership, 2022; Environment and Natural Resources Canada, 2022; Godden & Cowell, 2016); though the ILABC funding prohibits greenstone belts (Environment and Natural Resources Canada, 2022). The Seal River Watershed Initiative exemplifies IPCAs' role of conserving ecosystem and biodiversity while supporting sustainable and culturally appropriate

human uses (Thorassie et al., 2022). In line with the UN sustainable development goals and addressing the integrated Global Agenda 2030 in this UN Decade on Ecosystem Restoration and beyond, it is pertinent that the science community and Indigenous peoples collaborate for societal and global benefits (Vogel et al., 2022).

2.3. Impact Assessment

Over the past two decades, employing impact assessment tools became widespread in OECD countries, particularly the US, UK, Canada, Australia, and New Zealand (Render, 2006). Impact assessment (IA) is a structured, procedural consideration of the implications (social, environmental, health) of a proposed developmental activity. In theory, the proposal can still be modified or jettisoned if inappropriate, however, rarely does this result in rejection. Nonetheless, authors have argued that IA is pro-development, due to a lack of objectivity in government and industry's assessment processes. Phillips and Edwards (2000) opined that assessment reports are functions of the assessors' story.

The 21st-century global aim of IA, in all its forms, is to support climate change mitigation, promote environmental justice, and advance a sustainable future (Bice & Fischer, 2020). Accordingly, findings reveal that participatory methods of IA can generate accurate quantitative data while considering local priorities for achieving the global aim of IA (Mayoux & Chambers, 2005). Recently, in a bid to regain public trust and introduce new fair processes, IA in Canada has evolved from an emphasis on environmental aspects to accommodating social, health, and human aspects in a broader sense regarding significant engagement and consultation with Indigenous communities (Wright, 2020). In as much as the new Impact Assessment Act (IAA) 2019 of Canada (see Appendix 3) seems to address duties to consult and accommodate, some authors have criticized the lack of justification and inclusion of IKS in its process for key IA decisions.

Nonetheless, the determination of IA aspects, such as public participation, scope, process options, and public interest, is subject to the discretion of executive members of the colonial government (Wright, 2020; Doelle & Sinclair, 2018).

Mining has many negative impacts. Globally, issues of land use change and its associated negative impacts, such as deforestation, erosion, environmental media contamination, soil profile alteration, and an increase in noise and dust levels, have been reported in communities due to exploration and mining developments (Prno et al., 2021; Haddaway et al., 2019). These concerns about the effect of mineral development on the natural environment also raise concerns about subsistence harvesting, alteration of cultural ideals, and community health and well-being (Prno et al., 2021; Hanacek & Rodriguez-Labajos, 2018), especially as Indigenous peoples have historically obtained minimal benefit from extractive developmental projects on their ancestral lands in terms of training and otherwise (El Krekshi, 2009). A recent and specific example is the continued conflict in Nunavut over uranium mining in reaction to the impacts of exploration on caribou hunting. This conflict informed the development of a land use plan to protect the caribou calving grounds in Nunavut, a brave expression of the right to self-determination (Bernauer, 2019; Huff, 2005).

2.3.1. Community engagement in the environmental assessment (EA) process

Indigenous communities have continually sought a participatory, comprehensive, and transparent environmental assessment process that delivers developmental benefits while protecting the environment and preserving traditional uses. Increasingly, authors have realized the importance of community engagement in the EA system (Udofia et al., 2015). As a result, public participation, which embodies community engagement, has become a requirement under federal, provincial, and territorial laws and land claims across Canada. Public participation, as defined by

O'Faircheallaigh (2010), is “any form of interaction between government, corporate actors, environmental interest groups, and the public that occurs as part of the EA process (p.4).” Early community engagement, accompanied by comprehensive record-keeping and reporting, offers insight into the possibility of adverse impacts of a proposed project on the Indigenous or treaty rights of an Indigenous community, thus, enabling proponents to better manage projects’ impact (Prno et al., 2021; Udofia et al., 2015). Likewise, early engagement allows for adequate dialogue between the interested and affected parties and sufficient time for relevant proponent management responses and project adjustments in the EA process (Prno et al., 2021).

Nonetheless, despite the importance of community engagement in addressing local concerns, negotiating Impact-Benefit Agreements (IBAs), and legitimizing environmental decision-making, it is pertinent to ensure that engagements effectively maintain the integrity and credibility of the EA process while supporting timely resource development decisions (Prno et al., 2021; Udofia et al., 2015). Community engagements are most effective when context-specific; therefore, proponents must structure community engagements to suit respective stakeholders directly impacted by a project. As such, in-person engagements and TK studies offer clarity on the affected community’s land use and harvesting ties to the project area (Prno et al., 2021). Relationship building between the key stakeholders, which requires time and understanding, is crucial to achieving the desired role of community engagement in EA. Conclusively, community engagement serves as a platform to address local concerns, muster community support, and meet regulatory project approval requirements (Prno et al., 2021; Doelle & Sinclair, 2018; Hanna, 2009).

2.3.2. The role of regional assessment in the impact assessment process

Regional assessments (RA), unlike project-level impact assessments, are studies in areas of existing projects or anticipated development for planning and management of cumulative impacts and to guide future projects' impact assessments towards efficiency and effectiveness in a way that protects the environment and health, cultural, social, and economic conditions for sustainable development. Such regional contexts can emphasize broader impacts, which are often challenging to address solely through project-level assessments and decisions (Canadian Impact Assessment Registry, 2021). Under the IAA 2019 of Canada, a RA was initiated, under the IAA in February 2020 in response to requests for a regional assessment in the Ring of Fire mineral deposit area of northern Ontario. On the other hand, project-level IAs are broader in the scope of "Assessment Priorities" than RA. The "Assessment Priorities" in RA are subject to Indigenous and public engagement outcomes (CEAA, 2019).

2.3.3. Impact assessment vs mine development in Canada's north

Canada's impact assessment process claims to protect the environment, safeguard the progress of sustainable projects, and ensure public confidence in the government's decision-making on major developmental projects. However, Canada's impact assessment operates within a colonial, capitalist system of values, against the self-determination interest of Indigenous people.

The Canadian impact assessment process focuses on a broad range of factors including environmental, health, sociocultural, and economic in the determination of the potential effects and impacts of a designated project. Attempting to foster some reconciliation with Indigenous peoples and encourage job creation and economic advancement for Indigenous people. Efficient and credible assessments aid decision-making and are critical to attracting investment in the mining sector. The meticulous nature of this assessment process ensures that vulnerable remote

communities, e.g., RSLFN lacking all-season roads, including their reserves and traditional territories, are not negatively impacted by mining projects and associated activities (Impact Assessment Agency of Canada, 2020).

The mandatory planning phase of the assessment process, in line with the Free, Prior, and Informed Consent [FPIC] rule of UNDRIP, requires engagement and consultation with affected Indigenous communities. This planning phase ensures the determination of potential community-specific impacts and hence corresponding mitigation measures to protect the rights and interests of Indigenous peoples (Impact Assessment Agency of Canada, 2020). However, for a meaningful contribution of mining proposals to sustainable community and regional futures, the focus must shift from impact mitigation to avoidance of adverse impacts (Atlin & Gibson, 2017). For instance, the troubles associated with cleaning up abandoned mine sites, as in the case of Yukon territory's contaminated sites, could be avoided during the planning phase by focusing on positive contributions to sustainability.

The new IAA, 2019 aims for meaningful and timely engagement with the public and Indigenous groups, to provide some opportunity for cultural considerations and Indigenous knowledge in decision-making. The provinces, territories, and Indigenous jurisdictions, in collaboration with the Impact Assessment Agency of Canada, support a single impact assessment, and this reduces duplication of efforts (one project, one assessment) and promotes efficiency, rigour, and certainty. This collaborative process between the provinces and the federal agency informs the project-specific Cooperation Plan, which is shared with the proponent and posted publicly for certainty and transparency. A cooperation plan may include delegation, substitution, joint review panels, and cooperation agreements with interested jurisdictions (Impact Assessment Agency of Canada, 2020).

A robust and unbiased impact assessment study provides a reliable blueprint from which impact management options are drawn and explored. Mostly impact benefit agreements (IBAs), which ask for a fair distribution of resource development revenues between proponents and Indigenous communities. Negotiated IBAs have emerged as a tool for addressing the social and economic impacts of resource development issues in Canada's north (Klein et al., 2004). Recently, Marcel Colomb First Nation [MCFN] signed a historic revenue-sharing agreement with Alamos Gold Inc. "The agreement includes commitments for jobs and training, heightened environmental protections, and revenue sharing — including a milestone payment to the band when construction begins (Cash, 2023, p.3)." Besides the trust fund benefit of this IBA, this framework hopes to provide sustainable employment opportunities for MCFN for some time- echoed Christian Sinclair, former chief of Opaskwayak Cree Nation. This IBA is the first IBA between a mining company and a First Nation in Manitoba (Cash, 2023).

The Nemaska lithium mine in northern Quebec is another example, where IBA will attract annual royalties worth millions of dollars over 30 years to the Nemaska Cree community (Blais, 2023). The outcome of such mutual agreements hinges on early and effective community engagement (Prno et al., 2021).

2.3.4. Critiques of impact assessment in Canada

The new IAA, 2019 upgraded the defunct EAA, 2012 of Canada, particularly in its attempt to incorporate Indigenous peoples' ideas and knowledge in the assessment process. However, practitioners and scholars continue to criticize the ability of environmental assessment (EA) to meaningfully engage and incorporate Indigenous knowledge (IK) in its process (Eckert et al., 2020). The government of Canada, in an attempt to find a balance between its resource extraction economic focus and the unresolved government-government relationships with Indigenous

Nations, instated the IAA of 2019 (Eckert et al., 2020; Kellam et al., 2019, p.1). The passage of the IAA revived discussions on the relationship between EA and IK.

Inequity has often been perceived in the way EAs or IAs are conducted. Infringements of constitutionally protected Indigenous rights border on the inadequate engagement of Indigenous systems in the EA process. Resultantly, EAs' decision statements are usually pro-development, and the typical outcome is project approval (Arsenault et al., 2019). Canada's EA process, as described by Arsenault et al. (2019), typifies a neoliberal system where capitalism and colonial objectives on the economy influence government decisions, often leading to environmental degradation and resource depletion. This industry control of EAs is exemplified by the delegation of studies required for environmental assessment to proponents, resulting in recurrent adverse impacts of approved projects on Indigenous communities and consequent mistrust of the EA process by the Indigenous peoples.

The Native people in Canada, under the Indian Act land trust, have little power regarding land rights or resource benefits in Canadian courts compared to industry. Industries are typically favoured in litigations on Indigenous peoples' land and water protection. These injunctions granted to companies promote extraction and pollution (Blacksmith et al., 2021). "Approximately 82% of the 100 injunctions filed against corporations and the Canadian government were denied. In contrast, 76% of injunctions filed against Native people by corporations were granted (Blacksmith et al., 2021, p.104)." The BC Supreme Court recently granted an injunction to Coastal GasLink Ltd. against members of Wet'suwet'en regarding the construction of a pipeline in their homeland. In 2021, the BC Supreme Court ruled against West Moberly First Nations in litigation regarding the scope of the territory included in Treaty 8 (Gilbride et al., 2021).

These injunctions violate UNDRIP Articles 26-2 and 19. UNDRIP Article 26-2 states: "Indigenous peoples have the right to own, use, develop and control the lands, territories, and resources that they possess because of traditional ownership or other traditional occupation or use, as well as those which they have otherwise acquired". UNDRIP Article 19 reads: "States shall consult and cooperate in good faith with the Indigenous people concerned through their representative institutions in order to obtain their free, prior and informed consent before adopting and implementing legislative or administrative measures that may affect them (UNDRIP in Blacksmith et al., 2021, p.104)." Samson Cree Band in Alberta and other bands in Western Canada have endured prolonged court battles with the Crown to take past and future revenues, worth several hundred dollars, into their trust funds (Blacksmith et al., 2021) with many still waiting.

In as much as the IAA, 2019 of Canada has successfully institutionalized Indigenous participation, the ultimate influence of IK on the decision-making phase of the assessment process has remained questionable due to obstacles preventing the Act from meaningfully engaging IK systems. Some of these obstacles are financial limitations, knowledge incompatibilities, effects of colonization, and failure to engage in best practices (Eckert et al., 2020). To this end, for improved decision outcomes that meaningfully recognize Indigenous rights, authors have expressed a need to develop and implement a different set of people and place-specific methods for assessing environmental and ecosystem health. Augmenting laboratory analysis with testing methods, such as bioassays, deployable to Indigenous communities to undertake their own toxicological assessments is an option. Bioassays, biomonitoring, and other analytical methods improve data sets and measure the cumulative effects of developmental projects (Arsenault et al., 2019; Booth & Skelton, 2011).

The EA process structure has regulators financially independent of proponents but reliant on studies commissioned by the proponent. This creates a bias for the proponent. Therefore, the impact assessment phase (phase 2 of the IAA, 2019); when environmental studies are conducted and processed into an environmental assessment report, should be done through a third-party independent transparent analysis (Arsenault et al., 2019; Singh et al., 2019; Booth & Skelton, 2011).

2.4 Mining impacts

Mining poses environmental challenges. Environmental and land use-related impacts are basic mineral development issues that affect the human health and rights of the affected communities. Mineral development is the process of exploring and extracting mineral resources from the earth and converting them into marketable commodities to generate wealth (Filer & Imbun, 2009). Typically, minerals exploration and mining often generate emissions and waste materials technically called “tailings”; one tailing area could contain over 150 million tonnes of material (Natural Resources Canada, 2019). Gold mine tailings characteristically contain elevated concentrations of harmful elements, such as mercury, cadmium, nickel, lead, copper, zinc, cobalt, and arsenic, which contaminate the ecosystem and adversely affect physiological processes in living organisms (Fashola et al., 2016; Draszawka, 2014). The strategic management of the benefits and impacts of mineral development is key to avoiding the “resource curse” syndrome in minerals-endowed communities (Thompson et al., 2023; Mancini & Sala, 2018).

2.4.1. Mining and its environmental effects

Mining is one of the three stages of mineral development; preceded by exploration and succeeded by the processing of mined raw materials. Therefore, mining is central to mineral development and is responsible for various environmental damages including ecological

disturbance, destruction of natural flora and fauna, air/land/water pollution, soil and rock masses instability, landscape degradation, and radiation hazards (Aigbedion & Iyayi, 2007). Mining interests between Manitoba and Ontario shifted Manitoba's boundary to include Monument Bay, which contains greenstone belts; Monument Bay is within the trapline area that comprises RSLFN's territory (see Appendix 1), and greenstone belts are rocky constituents rich in gold and other valuable metals (Thompson et al., 2020). The magnitude of environmental impact from a mining activity can be huge compared to the relatively small area affected.

Diesel spillage from operational activities at mines can spread beyond the incident site and leach into adjacent waterbodies. Diesel spillages are thus harder to contain. The storage of fuel in collapsible bladders, as an innovation over the longstanding practice of fuel storage in barrels at mineral development sites in Canada's north, does not rule out the possibility of spillage/leak. Monument Bay site in the Twin Lake area of Manitoba sits on swamp land, which further raises environmental concerns (Marolda & Department of the Navy Washington DC, 1996; Kuyek, 2019; SEI Industries, n.d.).

Metals are essential for life functions and mining is one of the pathways through which metals enter the environment. The environment, in this context, comprises the external condition in which organisms exist, the organisms themselves including flora and fauna, and the physical surroundings such as landforms. Acid mine drainage (AMD) and erosion from waste dumps and tailings deposits are the primary pollution of metals occurring from mining sites. Mine tailings and waste rock deposits containing sulfides become oxygenated to form AMD (Salomons, 1995).

Mineral development processes often adversely affect components of the aspects including "air, water, land, vegetation, animals including human, landscape, and geomorphological features. In Nigeria, for example, large-scale mining of tin and associated minerals in the Jos Plateau

resulted in severe degradation of arable land, vegetation, and landscape including other environmental problems (Aigbedion & Iyayi, 2007). Another common example is coal mining wherein the first phase of its filthy lifecycle causes deforestation, the release of methane and particulate matter into the air, and toxic amounts of minerals and heavy metals into the soil and water, which can persist for several years. Further, the relatively large expanse of land required for surface mining comes with characteristic environmental challenges including soil erosion, noise, and impact on local biodiversity (Dontala et al., 2015).

2.4.2. Sociocultural impacts of mining

The material impact of mining on society can be positive, facilitating technological innovation and stimulating economic development, as well as negative including adverse environmental and social impacts. Notably, the importance of the impact of mining transcends beyond local socio-economic development into national economic stability, hence the inability to effectively manage these impacts throughout the life of a mine can trigger socio-cultural risks. However, the numerous national-level positive effects of mining often amount to costly adverse environmental and socio-cultural impacts at the local level (Smith & Brooks, 2018). Mining can also be a source of succor, cultural reproduction, and redefinition as exemplified by the informal diamond economy in Zimbabwe, wherein new cultural forms and identities have emerged with knock-on effects on overall perceptions of social and economic success, and thus lifestyles are based on a mix of luck, thrill, threat, fear, and violence (Katsaura, 2010). The mining industry, however, is labor-intensive and largely gender-sensitive favoring males over females (Romanus & Michael, 2012).

2.4.3. Health risks of exposure to heavy metals from mining

Contamination of water, soil, and plants by mining processes is basically of concern because of the effects on human health. Heavy metals such as As, Ba, Co, Cu, Hg, Cr, Ni, Pb, and Se are often associated with mining tailings and their ingestion, through the consumption of food and water, or inhalation, poses human health risks (de Souza et al., 2017; Martin & Griswold, 2009). These heavy metals have high potential toxicity and persist in the environment, and thus termed Potential Toxic Elements (PTEs) and classified as pollutants by the Agency for Toxic Substances and Disease Registry (de Souza et al., 2017). Several authors have confirmed a relationship between mortality and living near mining sites (Song et al., 2015); hunting and gathering activities can also impose high risks of exposure and health impact (Martin & Griswold, 2009).

Accordingly, studies near a gold mine at Obuasi municipality in Ghana revealed levels of As, Cd, Cr, Hg, Fe, Mn, As, and Ni above the permissible standards; unacceptable non-cancer health risk levels of As, Pb, and Hg were found in vegetables analyzed (Bempah & Ewusi, 2016). Accordingly, hazard index (HI) calculation based on USEPA guidelines showed that soil ingestion was the exposure route with the highest contribution to human health risk; for water, Pb and As contributed the most to the hazard quotient for children and adults (de Souza et al., 2017). Also, exposure to natural radiation from some minerals, such as monazite, pyrochlore, and xenotime, which are by-products of tin mining is a health hazard. The mysterious deaths of the inhabitants of buildings constructed with monazite-rich sand in villages near tin mining sites in Jos Plateau in Nigeria have been attributed to the high-level radiations from the monazite (Aigbedion & Iyayi, 2007).

The non-biodegradable nature of heavy metals makes them persist in the environment and bioaccumulate in living organisms. Toxicity mechanisms comprise the inhibition of enzyme activity, protein synthesis, variations in nucleic acid function, and changes in cell membrane permeability (Briffa et al., 2020). The physiological effects of some heavy metals are discussed as follows:

- **Arsenic (As)-** Inorganic arsenic is a known carcinogen and can cause skin, liver, lung, and bladder cancers. Lower-level exposure can cause nausea and vomiting, reduced levels of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a pricking sensation in the hands and feet. Long-term low-level exposure can cause skin darkening, whereas ingestion of very high doses can result in death.
- **Barium (Ba)-** Short-term exposure to barium can cause vomiting, abdominal cramps, diarrhea, difficulties in breathing, high or low blood pressure, numbness around the face, and muscle weakness, whereas elevated amounts can cause paralysis and possibly death.
- **Cadmium (Cd)-** Cadmium and its compounds are human carcinogens and breathing high levels of cadmium can cause severe lung damage. Ingesting high levels severely irritates the stomach causing vomiting and diarrhea, whereas prolonged exposure to lower levels results in "buildup in the kidney and possible kidney disease, lung damage, and fragile bones (Martin & Griswold, 2009)."
- **Chromium (Cr)-** Chromium (VI) compounds are toxins and carcinogenic, whereas chromium (III) is an essential nutrient. Inhaling high levels can irritate the nasal membrane, and cause nose ulcers, runny nose, and breathing problems, such as asthma, shortness of breath, cough, or wheezing. Long-term exposure can damage the kidneys, liver, circulatory, and nerve tissues, while skin contact can cause skin ulcers.

- **Lead (Pb)-** Exposure to high levels of lead can damage the brain and kidneys severely and ultimately cause death, miscarriage in pregnant women, or damage to men's scrotum.
- **Mercury (Hg)**- The nervous system is highly sensitive to all forms of mercury. Mercuric chloride and methylmercury are categorized as possible human carcinogens by the EPA. Exposure to high levels can cause permanent damage to the brain, kidneys, and developing fetuses. Short-term exposure to high levels of mercury vapour can cause lung damage, nausea, vomiting, diarrhea, an increase in blood pressure, eye irritation, and skin rashes.
- **Selenium (Se)**- Short-term ingestion of high levels can cause nausea, vomiting, and diarrhea, while chronic consumption can result in selenosis characterized by hair loss, nail brittleness, and neurological abnormalities. Inhalation can cause respiratory tract irritation, bronchitis, difficulty in breathing, coughing, and stomach pains (Martin & Griswold, 2009).

2.4.4. Impact determination using systematized review

Systematized reviews are offshoots of the systematic review. A systematic review employs rigorous and transparent methods to generate empirical answers to focused research questions (Paez, 2017), whereas a systematized review stops short of the rigor of systematic reviews (Grant & Booth, 2009). Like most other reviews, systematized review involves search, appraisal, synthesis, and analysis of findings. A systematized review may or may not include comprehensive searching; however, some analysis of uncertainty around findings, and limitations of methodology-all coded and analyzed in a systematic manner is gauged. The shortage of quality assessments however, predisposes systematized reviews to the likelihood of bias (Grant & Booth, 2009).

The preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) are often employed for systematized reviews. These protocols enable planning and

documentation of review methods, guard against arbitrary decision-making and selective reporting, and prompt collaboration due to the quality of the review (Shamseer et al., 2015). The PRISMA statement comprises a 27-item checklist and a four-phase flow diagram geared toward ensuring the trustworthiness of the findings (Page et al., 2021).

2.4.5. Climate change and mining in Canada

Mines across Canada are significantly affected by climate change hazards. The long-term success and prosperity of the mining sector hinges on its ability to mitigate its own impacts and adapt to climate change (Pearce et al., 2011). The mining sector is arguably one of the major emitters of greenhouse gases (GHGs), producing fossil fuel resources that contribute significantly to global CO_2 emissions. The GHGs are emitted directly during the actual mining and indirectly from energy-intensive mining equipment used for ore transport and processing (Liu et al., 2021). The increasingly declining ore grade will require more water for processing as well as generate more mine waste, thereby increasing energy consumption and the resultant climate footprint.

Climate risks confronting mining companies and countries that depend on the mining sector for their development can potentially affect every nation. Exposure of the global supply chain to risks or vulnerabilities can potentially cause social, economic, and geopolitical disruptions. Accordingly, climate change will pose a multiplier effect on supply chain risks by compounding the complexity of existing risks; therefore, there is an increasing need to employ robust measures toward ensuring that supply chains and other aspects of mining are resilient to climate change (Ruttinger & Sharma, 2016).

2.4.6. Mitigating the impacts of mining

Minings' negative impacts require mitigation and remediation to limit impacts, protect ecosystems, and restore systems. In addition to pre-mining and mining operation impacts on soil

and air qualities, water resources, flora and fauna, social values, and serenity, post-mining activities, including mine abandonment, decommissioning, and repurposing can cause loss of jobs and local identities, or create opportunities for new economic activities (Haddaway, 2019; Singh et al., 2016). However, mitigation measure implementation helps to avoid, reduce, eliminate, control, or compensate for the negative impacts and restore affected systems. Impact mitigation can be very sensitive as mitigation in one system can influence other systems (Haddaway et al., 2019).

Mitigation measures to ameliorate impacts and protect the ecosystem include impact assessment (IA). Also, soil remediation can include the treatment of heavy metal-contaminated soil with chitosan to reduce the bioavailability of the metals to plants. Air quality improvement may involve employing the dust attenuation capability of broad-leaved native plant species, such as *Tectona grandis*. Water quantity and quality improvement often require rainwater harvesting, mine water recycling, and the use of sedimentation ponds. Noise and vibration control may involve using vegetation as biological noise attenuator. Biodiversity conservation often includes minimizing footprint and translocating native species to ecosystem reconstruction sites. Socio-economic development includes corporate social responsibility (CSR) delivery to ensure environmental sustainability and maintain ecological balance (Singh et al., 2016).

2.4.7. Green mining initiative

The Canadian mining sector, to maintain its leading position on the global scale, must be innovative and invest in sustainable mining. The Green Mining Initiative [GMI], a product of the collaboration between the Canada Mining Innovation Council [CMIC] and Natural Resources Canada [NRCan], launched in 2009 to stimulate innovation in the mining sector and improve environmental performance. The initiative covers the complete mining lifecycle from design to

closure and beyond, considering footprint reduction, innovation in waste management, mine closure and rehabilitation, and ecosystem risk management (CIM, 2011). The following projects are some of the outcomes of the initiative:

- Development of an alternative binder process for mine backfill
- Investigating the feasibility of growing energy crops (e.g., canola, corn) on tailings
- Development of Ventilation on Demand technologies for underground mines
- Development of a cyanide-free gold-leaching process
- Development of automated equipment, by "CanmetMINING", to improve productivity and enhance mining operations safety (Natural Resources Canada, 2018; CIM, 2011).

2.5. Summary of literature review

The reviewed literature revealed that Indigenous people, despite global interventions such as UNDRIP (UN General Assembly, 2008), continue to face age-long deprivation from lands they originally occupied and cared for. Understanding the disparity between the Indigenous concept of land and those of the Western worldview (Brinkhurst, 2013) is fundamental to the sustainable management of land within Traditional territories (USEPA, 2022). The Indigenous peoples desire to maintain the pristine nature of their territories for traditional land uses (Statistics Canada, 2020; Thompson et al., 2020). The information documented via land use mapping often translates into political power (Tobias, 2020).

Despite recent global recognition of the role Indigenous Protected Areas and Indigenous peoples can play in biodiversity conservation and the curbing of the global climate crisis, governments remain non-committal to Indigenous peoples' right to FPIC (Vogel et al., 2022; Webb, 2019;). As a result, resource extraction projects often breed clashes between both parties. Indigenous peoples are desirous of intact and thriving ecosystems because their basic needs- food,

water, medicines, and housing materials come from the forests. In fact, the Indigenous cosmovision views the forest as a living being (Webb, 2019).

Land use change and its attendant adverse impacts such as deforestation, erosion, environmental media contamination, soil profile alteration, and an increase in noise and dust levels often clash with this Indigenous worldview (Prno et al., 2021; Thompson et al., 2020; Haddaway et al., 2019). The impact assessment process, which ought to advance a sustainable future (Bice & Fischer, 2020) is pro-development towards creating an unsustainable future (Philips & Edwards, 2000). Mitigation measures implemented to avoid, reduce, eliminate, control, or compensate for the negative impacts, influence and can cause harm for other systems.

Mines are one of the major emitters of GHGs (Liu et al., 2021). Exploration and mining typically produce noxious emissions and huge amounts of waste materials called 'tailings' (Natural Resources Canada, 2019), including non-biodegradable heavy metals (Fashola et al., 2016; Draszawka, 2014) and sulfides that form AMD (Salomons, 1995). These pollutants often have adverse effects on environmental components including air, water, land, flora, fauna, and geomorphological features. Hunting and gathering activities near mining sites pose high risks of exposure and health impact (Martin & Griswold, 2009).

The literature also reveals that mining impacts on national society, in terms of technological advancement and economic development, can be positive. However, the adverse environmental and social impacts at the local level are overwhelming (Smith & Brooks, 2018). Recent innovations in the Canadian mining sector, such as the Green Mining Initiative, promise footprint reduction, innovation in waste management, and ecosystem risk management (CIM, 2011).

Chapter Three: Research Methods

My research study has a mixed-methods design. The comparison of qualitative and quantitative data offered by this method (see Table 2 & Figure 2) aids the cross-verification of data for validity and reliability (Creswell, 2018). Secondary data from traditional ecological knowledge [TEK] interviews and traditional land use [TLU] mapping study by Dr. Shirley Thompson and Ph.D. candidate Keshab Thapa was used. I witnessed the mapping process at RSLFN and was employed in this study.

I undertook the qualitative analysis of the transcripts- using the tapes from these interviews transcribed by myself using the artificial intelligence (AI) of Otter.ai. The mapping component of the study forms the quantitative aspect. I analyzed this data using formulas and models [kernel density formula and hotspot function] to use this data quantitatively (Thapa, 2018). The semi-structured interviews and the archival report's data (see Table 2) make up the qualitative aspect of the study. Table 2 reiterates my research objectives and data sources, summarizes the corresponding methods adopted for data analysis, and describes my research outputs. I undertook a thorough analysis of the transcripts by thematic analysis using the following steps:

- Familiarize with the data; Generate initial codes; Search for themes; Review themes; Define themes; and Write-up results.

Table 2

Summary of the research objectives, data source, and analytical method to achieve outputs for the mapping research with Red Sucker Lake First Nation

S/N	Research Objectives	Data Source	Methods	Outputs
1	- Explore traditional land use protection issues versus natural resources extraction in the RSLFN region through mapping;	- Secondary data of semi-structured land use mapping interviews (n=21): ➢ Scanned copies of territorial maps showing interviewees' land use.	- Digitizing and mapping using ArcGIS to prepare the location map, aerial map, thematic maps, density maps, and hotspot maps.	- Map biographies depicting the traditional land use of RSLFN interviewees for the preservation of TEK.
2	- Identify existing and potential impacts of exploration and mining-related activities on the TLU of RSLFN.	- Secondary data of land use study and semi-structured interviews (n=21): ➢ Audio interviews/questionnaires, photos, and video footage - Archival data from the Canadian Impact Assessment Registry, Impact Assessment Agency of Canada, Environmental Audit report of mining company in northern Canada, previous land use studies within Island Lake Grand Council, and any other relevant accessible document.	- Transcribing interview using artificial intelligence - Thematic analyzing of transcripts into codes, sub-themes, and themes using NVIVO - Systematic reviewing of archival reports using PRISMA	- Documented impacts of mining and exploration on the TLU of RSLFN.

Note. Thesis process manual

Identification and enrollment of human participants in the interview, as I witnessed, were approached with equity, diversity, and inclusion to ensure that every stakeholder group's contribution and opinion were valued and respected (SSHRC, 2022). As a community-based participatory study, the contact community members assisted with the dissemination of the Interview Participant's Recruitment Poster, Interview Recruitment Letters, and Consent Forms to community members. In-person clarification of grey areas in the consent forms was also ensured.

Regarding the systematized study, I accessed a few records to augment and triangulate the secondary data from the participatory interview outcomes. The public repository of impact assessment reports from 2012-2022 was reviewed (Canadian Impact Assessment Registry, 2022; Impact Assessment Agency of Canada, 2020). Previous traditional land use mapping reports were considered (Thompson et al., 2019; Thompson & Thapa, 2018). An environmental audit report (Eagle Gold Mine Environmental Audit Report, 2020) was also accessed. Specifically, the following methods were employed to achieve the research objectives:

1. **Interview analysis using Otter.ai and NVIVO**

   The qualitative aspect of data collection included audio recordings, video footage, and photos from Dr. Thompson, my faculty advisor. Interviews were coded using PINs {101-108 & 301-313}, rather than the actual names of participants to ensure confidentiality. The selection of interviewees was done by Bruce Harper, an RSLFN community member, based on availability and non-participation in previous land use mapping exercise in the community to cover fresh/undocumented traplines. The interviewees consist of 16 males and 6 females- 18 youths/adults ($\leq$64 years old), and 4 Elders ($\geq$65 years old).

The audio interviews were transcribed using artificial intelligence and analyzed using NVIVO (Welsh, 2002). Secondary data [n=21] from key informant interviews (see Appendix 4 for the semi-structured questionnaire) documenting traditional ecological knowledge [TEK] and land use and occupancy [TLUO] of RSLFN members considering trapping, hunting, fishing, berry picking, medicinal plants gathering, timber harvesting, community/recreational areas, cultural/sacred sites, and youth training areas were used. Authors recommend a minimum of 8-12 interviews as adequate for exploring community perspectives (Marshal et al., in Thapa, 2018; Hesse-Biber, 2012).

2. **Mapping using ArcGIS**

I digitized scanned copies of territorial maps showing interviewees' land uses and prepared map biographies using ArcGIS Pro. Also, density and hotspot maps were created using ArcGIS Pro (Thapa & Thompson, 2020). The format for data publishing was determined by the community representatives, chief, and council of RSLFN.

3. **Systematized review of previous reports**

The systematized study of impact assessment reports, environmental audit report, and previous land use mapping reports of Island Lake communities employed the PRISMA method and involved locating, evaluating, systematizing, and analysis of sources found in the archives (Lewis-Beck et al., 2003). Meta-data were extracted from eligible sources, including project title, link to the assessment report, description of mining activity, location of mine, possible adverse impacts, and mitigation measures.

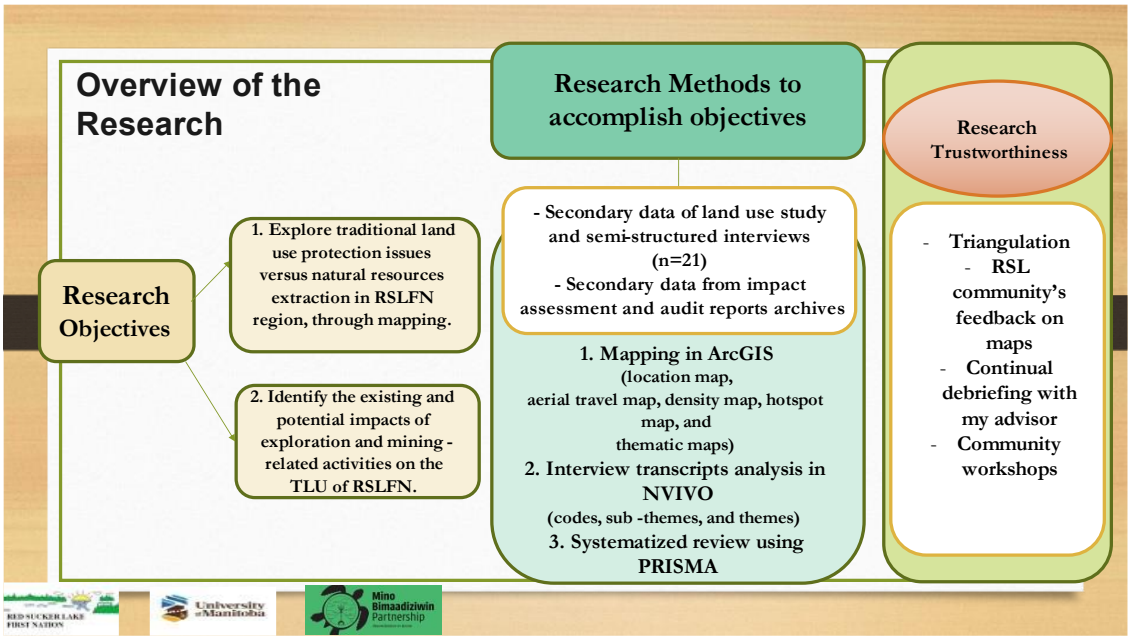


Figure 2. Overview of Mapping Research with Red Sucker Lake First Nation for interviews, maps, and archival study

3.1. Data Analysis

A combination of qualitative and quantitative data interpretation helped establish the impact of mining and exploration activities on the RSLFN traditional territory. Land use data [n=21] were analyzed in ArcGIS, while NVIVO was used for the semi-structured interview data [n=21]. Findings from the land use and interview data were triangulated with data from a systematized review of archival reports on mining impacts in northern Canada (see Figure 2 and Table 2).

I undertook the following activities to prepare and analyze the data to achieve the research objectives:

Audio recordings of the key informant interviews obtained as secondary data were transcribed, formatted, coded, and categorized to generate themes (Thapa, 2018). Artificial intelligence was used to generate raw transcripts prior to clean-up in Microsoft Word. The resulting cleaned transcripts were analyzed using NVIVO, and a word cloud was generated. Irrelevant or

unnecessarily common words were expunged prior to Word Frequency query for Word Cloud creation. Following the cleaning-up of transcribed interview transcripts, codes were generated in this thematic analysis approach, using the description-focused coding method. The coding process involved perusing the transcripts to identify significant information that will help address my research questions, and then dropping the information into respective nodes/containers hitherto prepared in NVIVO based on my research questions. Themes and sub-themes to address my research questions emanated from the categorization of these codes i.e., grouping the codes based on shared relationships (Adu, 2019). So, Figure 3 summarizes the process of themes generation.



Figure 3. Qualitative data processing- refining raw data to form themes

For the land use data, interviewees' land uses obtained as secondary data on territorial maps were digitized on ArcGIS Pro using North American Datum 1983 (NAD 83) Universal Transverse Mercator (UTM) Zone 15 projection system. Map biography of each interviewee was prepared using shapefiles from the digitized maps. Then, thematic maps, hotspot maps, density maps, and summary maps were prepared to show locations of specific land use concentrations and an overall view of the land use by RSLFN community members. Also, spatial analysis was done using location mapping and aerial distance calculations. The summary maps aided in understanding the spatial relationship between traditional land uses and resource extraction.

The kernel density mapping, which uses the kernel function to create regular density areas from point data in raster form, was employed to map the pattern of changing landscape from point locations (Thapa, 2018).

$$\text{Kernel function } f(x,y) = \frac{1}{nh^2}\sum_{i=1}^{n} K\left(\frac{di}{h}\right)$$

Where *h* is the bandwidth, d_i is the distance of the variable from the center in the bandwidth, *k* is the kernel density function, and *n* is the number of observations (Shafabakhsh et al., 2017 in Thapa, 2018). Also, Optimized Hot Spot mapping, which uses the hotspot function to identify whether the distribution of land use spots is random or statistically significant, was employed. The null $\{H_0\}$ and alternative $\{H_1\}$ hypotheses were:

H_0: At a 95% level of confidence, the distribution of land use features of the 21 RSLFN members was random. In other words, the output features are statistically non-significant.

H_1: At a 95% level of confidence, the distribution of land use features was significant i.e., output features are statistically significant. Optimized Hot Spot Analysis uses incident points; in this case the land use spots, to create a map of statistically significant high TLU and medium TLU spots using the Getis-Ord Gi statistics (Esri, 2023; Grubesic & Murray, 2002).

The systematized review of archival reports (see Table 2) followed the steps shown in figure 4.

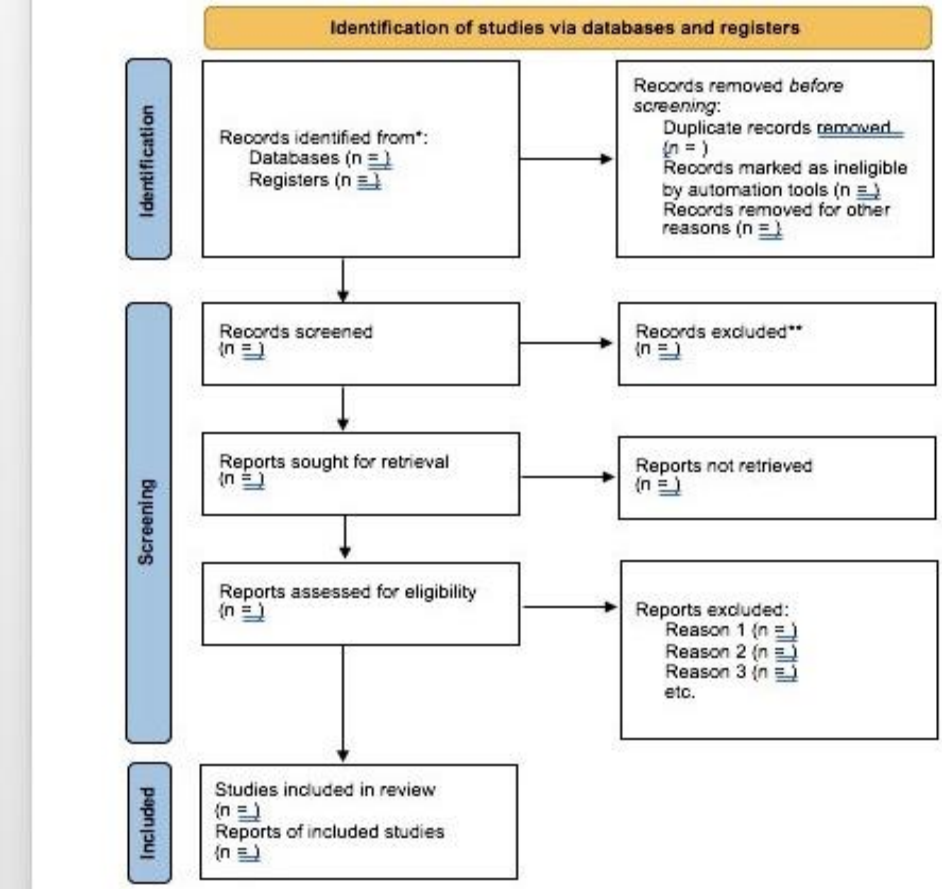


Figure 4. Prisma guide for a systematized review of database
Source. Zen Flowchart

The methods employed for this review include a desk search on the Canada Impact Assessment Registry on May 20, 2023, using "gold and rare earth and assessment" as keywords. Out of the 9870 assessment documents on the Canadian Impact Assessment Registry, the search yielded 498 results from which I narrowed the list, using the filter for "public participation", to 71 assessment documents, i.e., assessment documents that did not cover public participation were excluded. Further, from the pool of 71 documents, I screened further to select four large-scale and new mining projects in Canada's north as cases for review. The inclusion criteria in detail were project location (with and/or near Indigenous territories), scale, and overall description (new and needing access road construction/upgrade). The review involved tabulating the identified potential

adverse impacts of the mining projects into environmental, social, health, and cultural categories among other project specifics, and notes about land use and species at risk.

The impact assessment documents reviewed were those of the Valentine Gold Project near Valentine Lake, Newfoundland; Whabouchi Mining Project near Nemaska, in Quebec, Brucejack Gold Mine Project adjacent to Brucejack Lake in British Columbia, and Akasaba West Copper-Gold Mine Project near Val-d-Or in Quebec. The daily capacities of these mines range from 2,700 to 10,960 tonnes. This review categorized the possible impacts of these mining developments on the communities into environmental, health, socio-economic, and land use (Table 3).

Summarily, the records/reports identification and screening process is detailed below.

In the identification process, keywords identified the following records:

-Records identified from database/registry (n) = 498

In the screening process, there were different levels of screening:

First, duplicate records were removed, then ineligible records and records that did not cover public participation were removed- (n)=427 removed with (n)=71 remaining.

-Exclusion reason:

1. Mining project not for Gold and rare earth;
2. Scale/size of project not large enough (minimum 2700 tonnes/day);
3. Not a recent project.
4. Proximity to an Indigenous community

-Records screened (n) =71

-Records excluded (n) =67

The applicable reports that met the criteria were (n) =4

All methods were in accordance with the University of Manitoba's ethical protocol and the Island Lake Traditional Land Use and Occupancy Survey Data Collection Manual (Thompson et al., 2020; Tobias, 2000). In compliance with the ethics, I was committed to reporting my research findings to the community. A debriefing meeting with Mawaandoon Inc., partners to this research,

and a representative member of RSLFN was held on August 15th, 2023. The report that was presented at the meeting, detailing my research process and findings, was then forwarded to the Chief and Council, and Elders of RSLFN seeking their feedback. Also, base map biographies of the interviewees were delivered to them in their community by Bruce Harper for their comments and to keep their copy. Feedback from the community was positive.

3.2. Limitations to My Work

Limited length of study: Impact assessment studies are usually conducted to cover all seasons to gather robust data that considers the influence of climatic variations on the outcome of events, thereby capturing all possible impacts. However, my research focused on the traditional land use aspect of the developmental activity's impacts, thereby negating the need for biophysical data collection and all-season data gathering. Also, due to the nature of Canada's weather, the fall season arguably records the highest activity rate (Tucker & Gilliland, 2007); hence, my research questions may not have received any better answers during any other season. Nonetheless, these reasons may not completely justify my mono-periodic sampling that, in most parts, is due to the limited academic period for the submission of deliverables.

Limited publishing: Publication is also restricted to what RSLFN wants to be published. In line with the First Nations principles of OCAP {Ownership, Control, Access, and Possession}, which asserts that First Nations have control over data collection processes, they own the data, and control its usage (First Nations Information Governance Centre, 2023).

Limited sample size: The number of RSLFN community members interviewed [n=21] influenced the proportion of land use areas documented. Though 21 is scientifically a robust sample size, I realize if more community members were interviewed more land use sites would have emerged on the summary land use map.

Chapter Four: Results and Discussions

This chapter presents and discusses my findings from this research. The results and discussions are presented in three parts. In the first part, maps show the outcome of location, thematic, and spatial analysis of land use by RSLFN members in their traditional territory. The second part documents the potential and existing impacts of mining and exploration on the traditional land uses of RSLFN members. In this part, community members' perspectives, as extracted from the interviews, are documented. Again, maps are used to show the spatial relationship between greenstone belts/mining claims and the traditional land use of Red Sucker Lake First Nation people. Also, the outcome of the systematized review of archival reports on mining impact is presented and discussed. The last part addresses the policy implications of designating greenstone belts for mining developments, arguing for Indigenous-led land protection.

4.1. Land use of Red Sucker community members

Land use activities of 21 RSLFN members, including bird/egg harvesting, cultural sites, fishing, hunting, overnight stay, plants/wood/earth material harvesting, sacred sites, and trapping are shown in a summary map biography (Figure 5). The aerial map (Figure 6) shows how extensively RSLFN members travel away from their reserve land and within their traditional territory engaging in land use activities. Aerial distance measurements using the Distance and Direction function in ArcGIS Pro showed a maximum of 90 km, 43.65^0 NE direction. The actual distance covered is supposedly longer than the aerial distance as walking and canoeing involve twists and turns to reach specific destinations.

The spatial distribution of land use sites extends beyond RSLFN's reserve areas, traplines, and provincial boundaries. It covers as far as the North Prominent Ridge; beyond Monument Bay, and Stull Lake in Ontario in the north-east direction, beyond Ponask Lake near Sachigo Lake area

in Ontario in the south-east direction, and Banksian River towards Island Lake in the south-west direction. The spatial extent of land use activities across the 'imaginary' provincial boundary measures up to 84 km aerially to Sachigo Lake in Ontario. This corroborates the response of one of the elders interviewed {PIN 313} when asked to show places he had harvested fish- "All over", he replied. Overall density and optimized hot spot maps are shown in Figures 7 & 8. Thematic, location, density, and hot spot maps of each category of land use listed are presented in Figures 9-16.

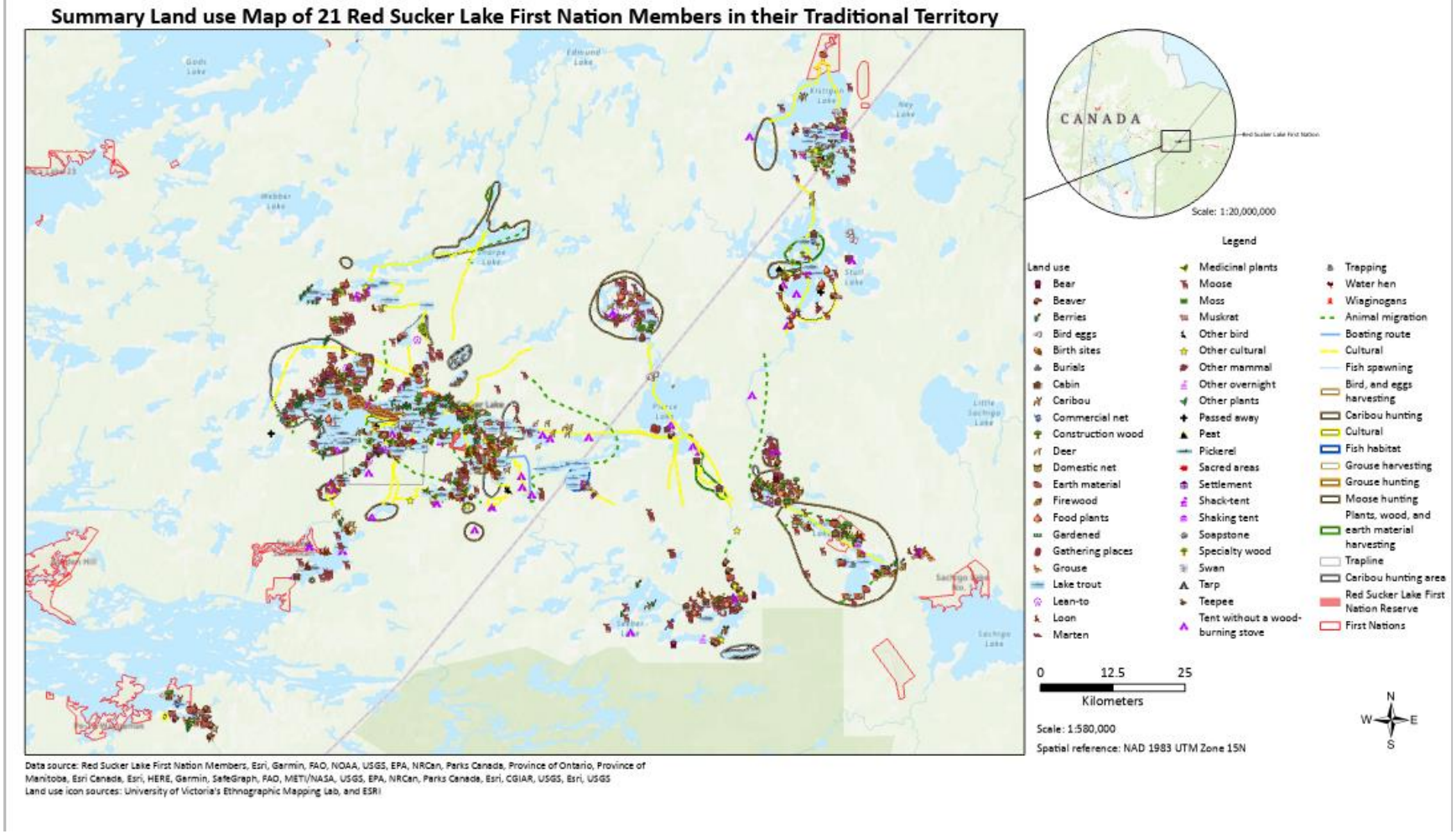


Figure 5. Summary map showing land use activities of 21 Red Sucker Lake First Nation members in their traditional territory

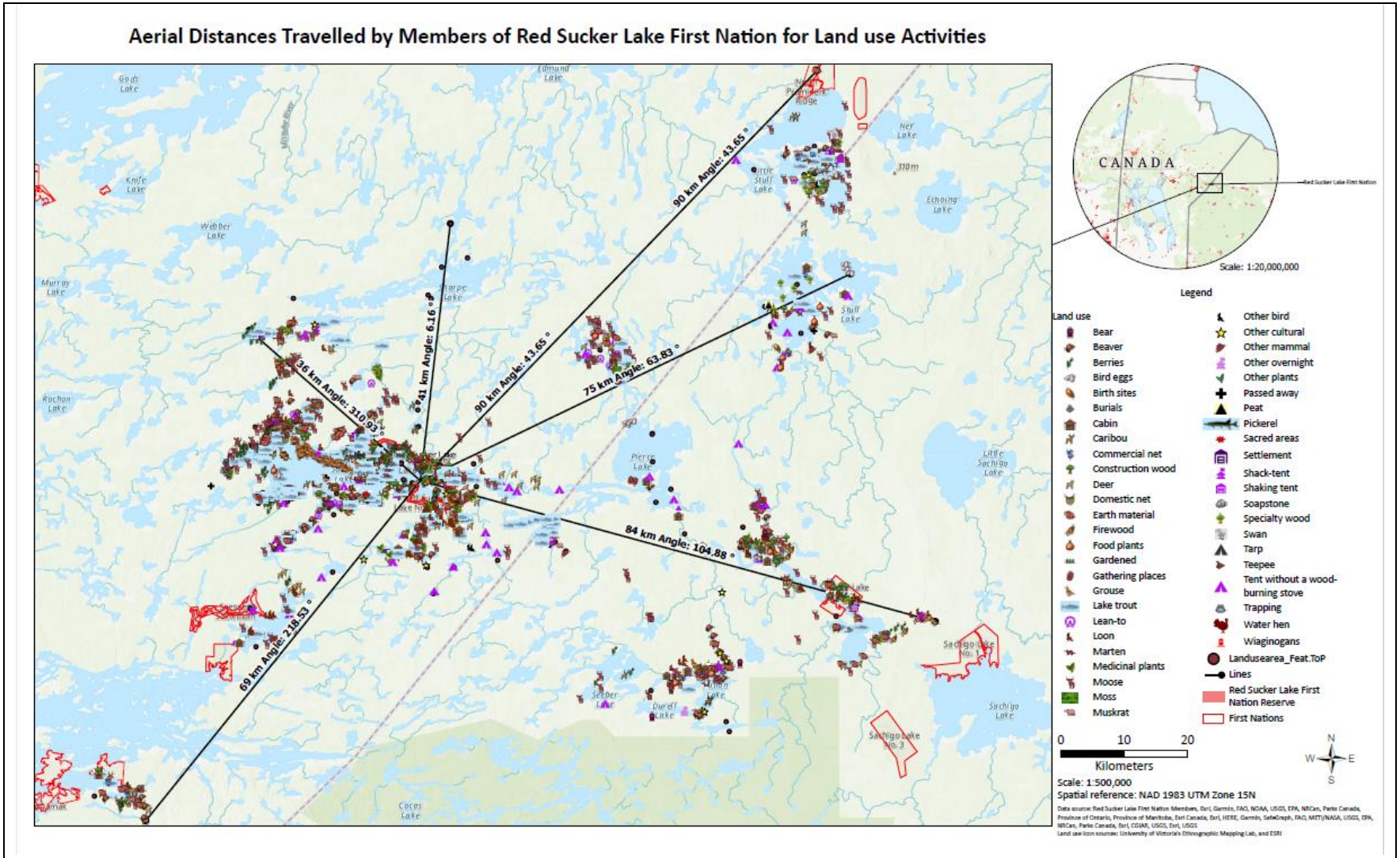


Figure 6. Aerial distances traveled by 21 Red Sucker Lake First Nation members in their traditional territory

The overall density map [or heat map] depicting land use concentrations (Figure 7) distinguishes high-density regions from low ones using a colour spectrum {solar yellow/lime green to shades of purple} resulting from the kernel density function application. Figure 7 reveals high land use density around Red Sucker Lake, Rorke Lake, Lenover Lake, and Ponask Lake. High-density regions are represented by solar yellow/lime green color. Land use density around Richardson Lake, Stull Lake, Sachigo Lake, Banksian River, Angling Lake, Seeber River, Pullan Lake, and Durell Lake is moderate. Purple shades represent moderate density.

The summary optimized hot spot map (Figure 8) reveals regions where a combination of land uses is random (null hypothesis) or statistically significant (alternative hypothesis). In other words, this process identifies statistically significant clusters of high and low incident counts. Lime green output features represent high traditional land use (TLU) spots where high incident counts cluster, while fuchsia pink output features represent medium TLU spots where low incident counts cluster. The 373 output features are statistically significant based on an FDR (False Discovery Rate) correction for multiple testing and spatial dependence. The optimal fixed distance band is based on peak clustering found at 13600 metres. Statistically significant high TLU spots with 90-99 % confidence were recorded within and around Red Sucker Lake. Significant medium TLU spots with 90-99 % confidence were recorded around Pierce Lake and Stull Lake. Seeber Lake and Angling Lake regions recorded significant medium TLU spots with 90 % confidence. These statistically significant high and medium TLU spots represent a minimum of 1 site to a maximum of 29. High TLU spots were significant at 95-99 % confidence levels for bird/egg harvesting, fishing, hunting, plants/wood/earth materials harvesting, and trapping. In other words, these land uses are statistically and significantly more concentrated in and around Red Sucker Lake.

In this study, “not significant” does not imply “not traditionally important or significant”. Rather, as seen in the summary land use map (Figure 5), these locations marked as “not significant” have many culturally and traditionally important land uses. The “not significant” spots refer to not statistically significant incident counts [of land use activities other than travel routes] that are not statistically significant based on an FDR correction for multiple testing and spatial dependence, i.e., the cluster of land use features in these locations occurred randomly for the limited sample [n=21].

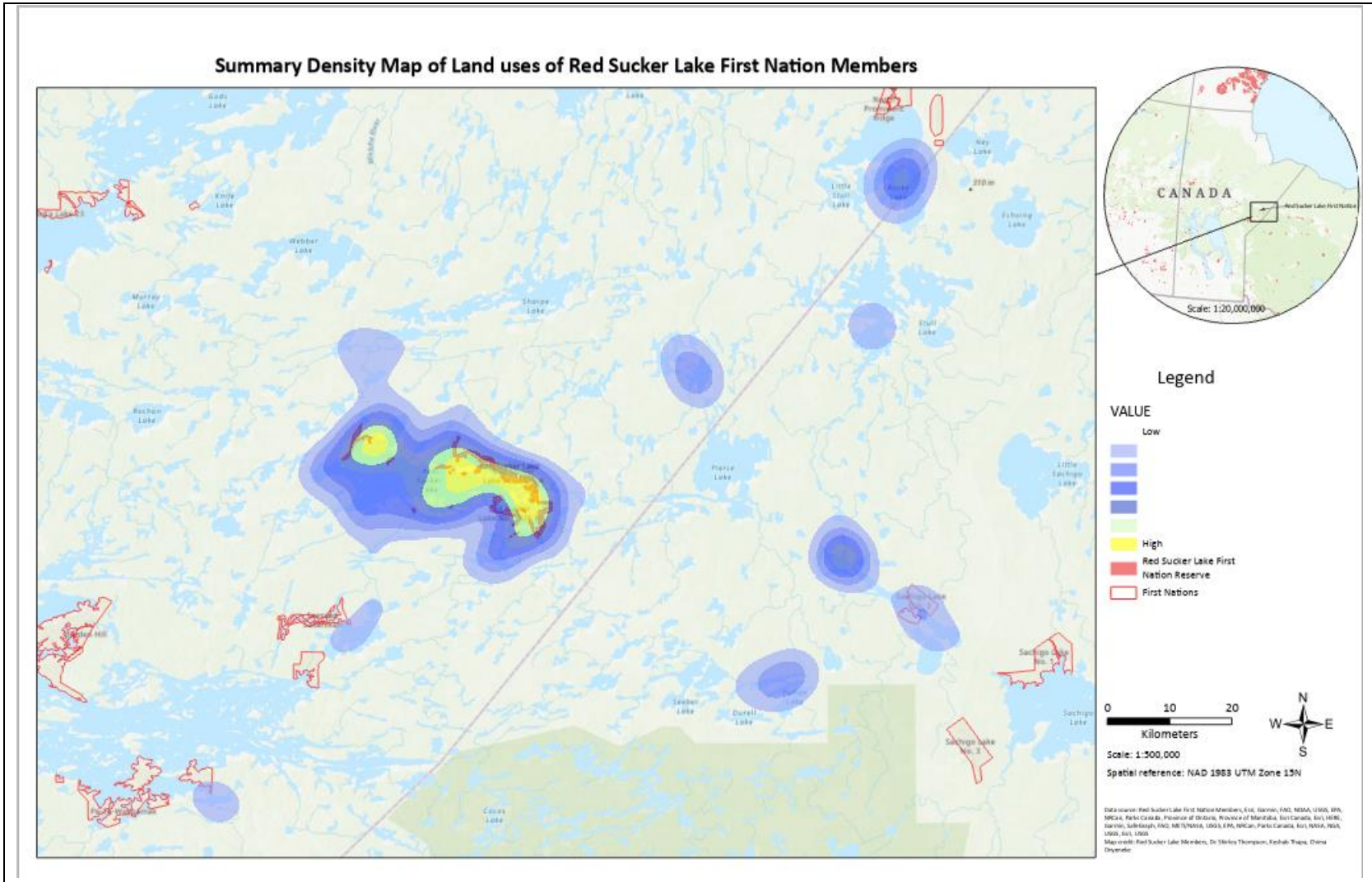


Figure 7. Summary density map of land uses of 21 Red Sucker Lake First Nation members.

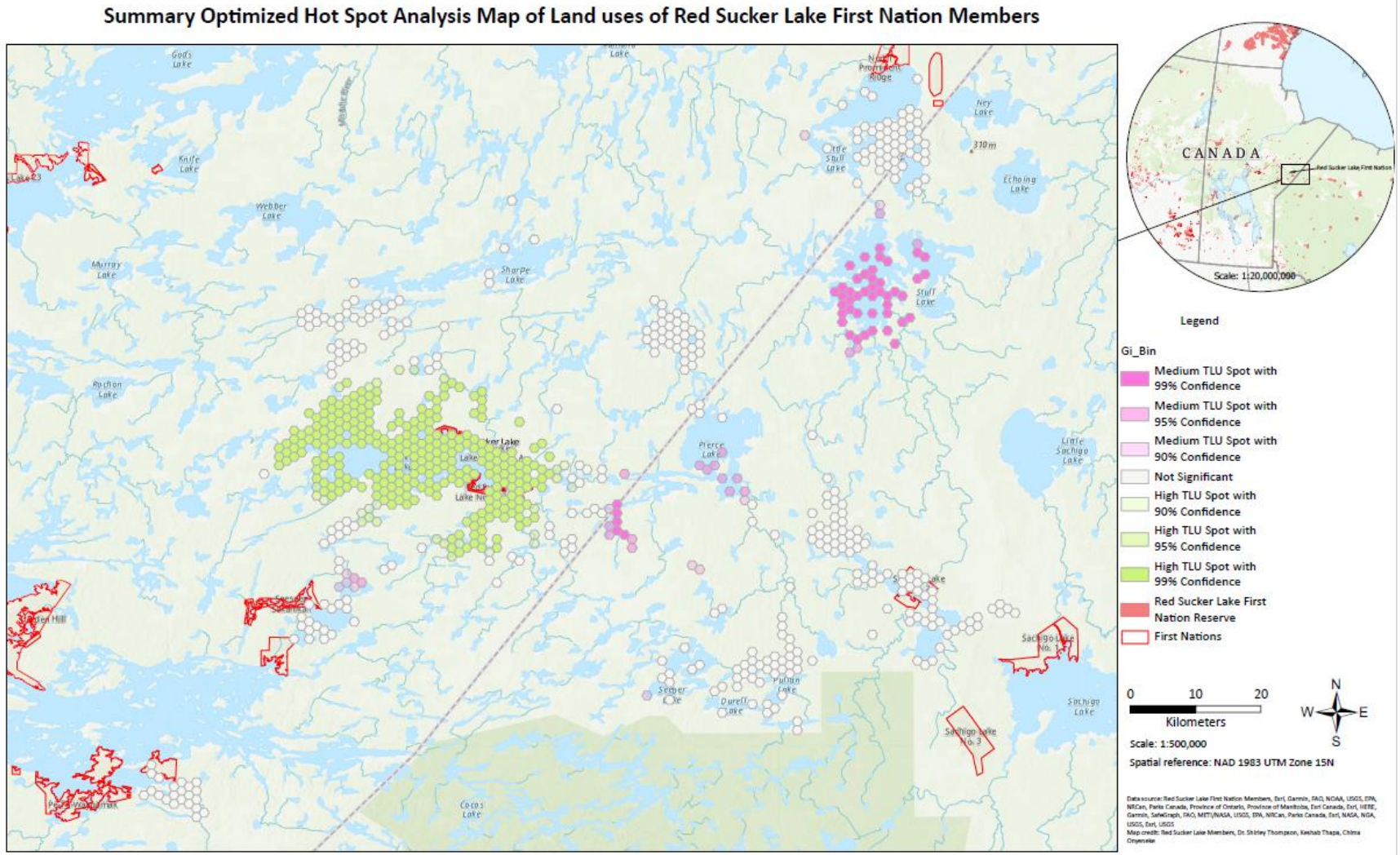


Figure 8. Summary optimized hot spot map of land uses of 21 Red Sucker Lake First Nation members.

4.1.1. Location, density, and hot spot of bird and eggs harvesting sites.

Bird hunting and egg gathering are common among the 21 community members. Common among members' bird harvesting is loon, goose, and grouse. Other birds listed are swan, duck, waterhen, and other bird species. Bird and egg harvesting mostly occurred in and around Red Sucker Lake (Figure 9b). Other bird and egg harvesting sites include Kistigan Lake, Rorke Lake, Ponask Lake, Sachigo Lake, and Banksian River (Figure 9). Statistically significant high TLU spots are observed in Red Sucker Lake (Figure 9c).

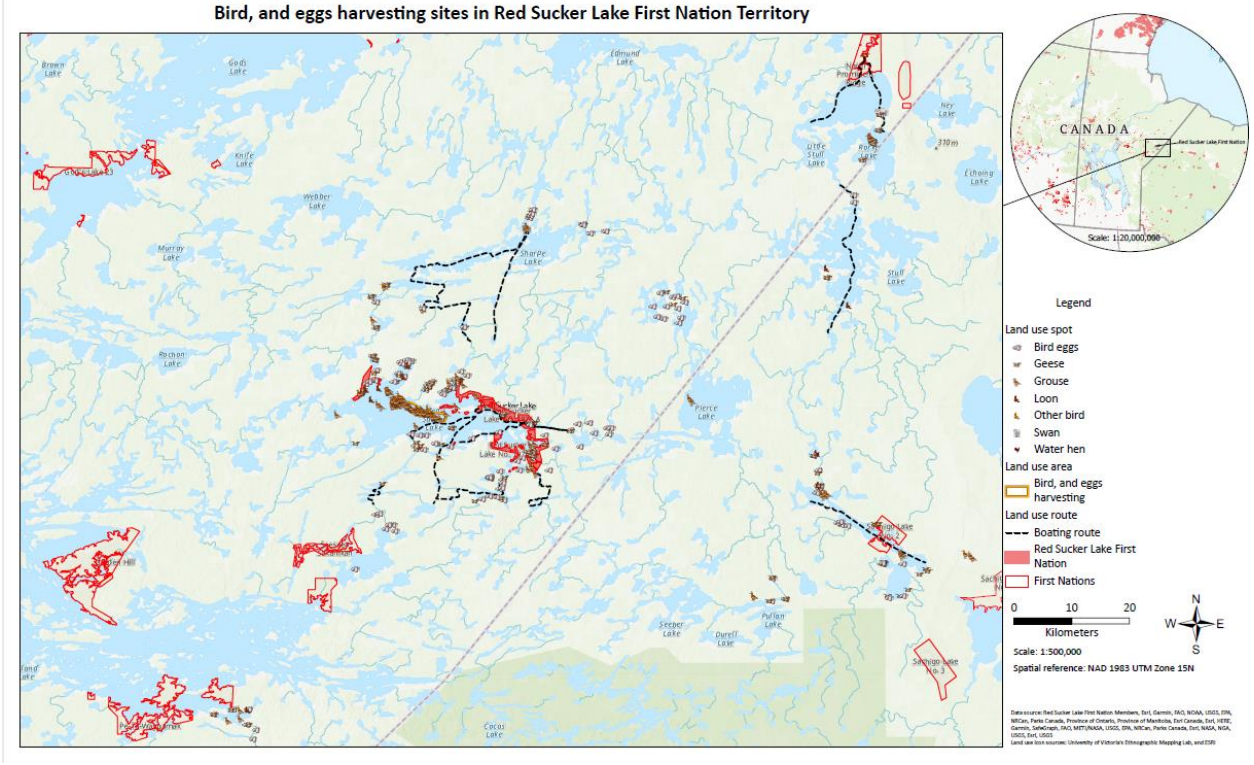


Figure 9. Bird and eggs harvesting sites of 21 Red Sucker Lake First Nation members in their traditional territory.

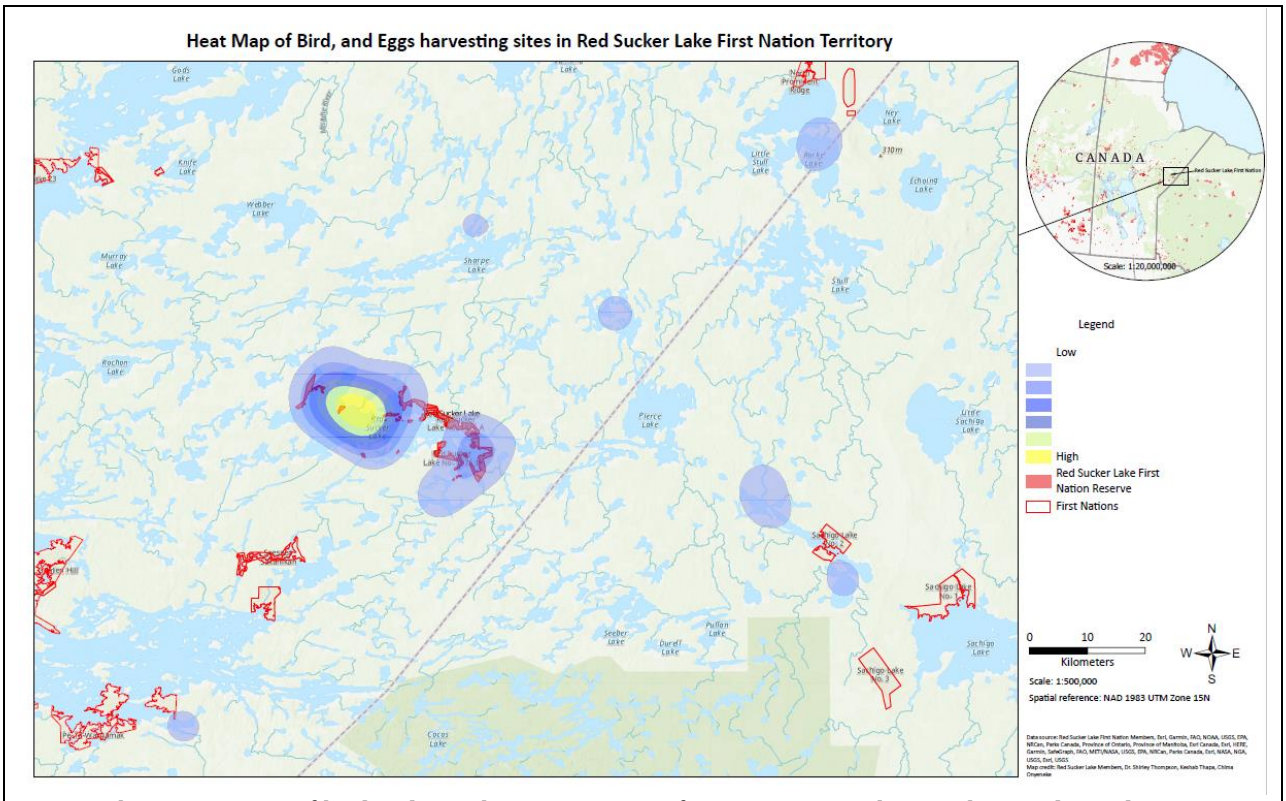


Figure 9b. Density map of bird and eggs harvesting sites of 21 RSLFN members in their traditional territory.

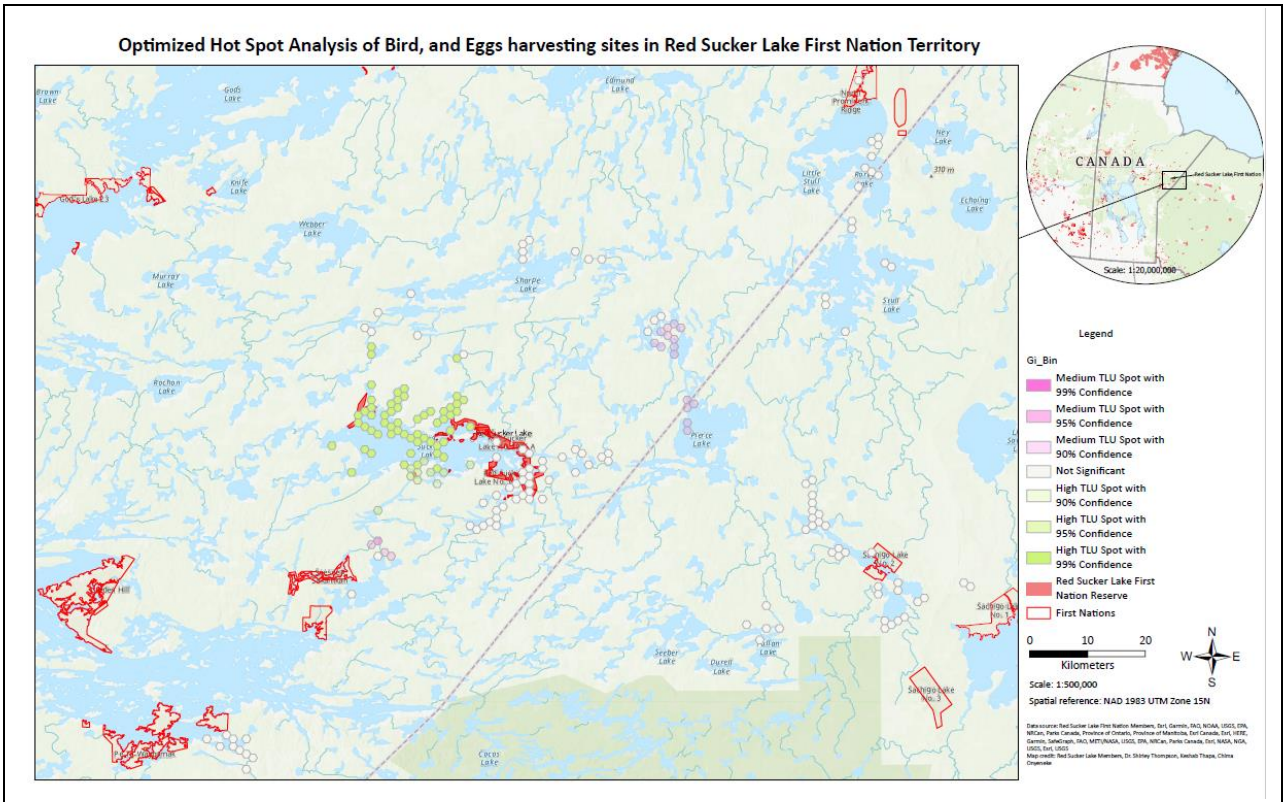


Figure 9c. Hot spot analysis of the bird and eggs harvesting sites of the 21 RSLFN members.

4.1.2. Location, density, and hot spot of cultural sites.

Cultural sites in the Red Sucker Lake First Nation community include spiritual places, locations for ceremonies, boating routes, migration corridors, birth sites, settlements, and other cultural activity sites. Most cultural sites are around Red Sucker Lake, Stull Lake, and Pullan Lake (Figure 10b). Other sites are near Pierce Lake, Sachigo Lake, Sharpe Lake, and Kistigan Lake. Hot spot analysis was not done as the entire territory is culturally significant.

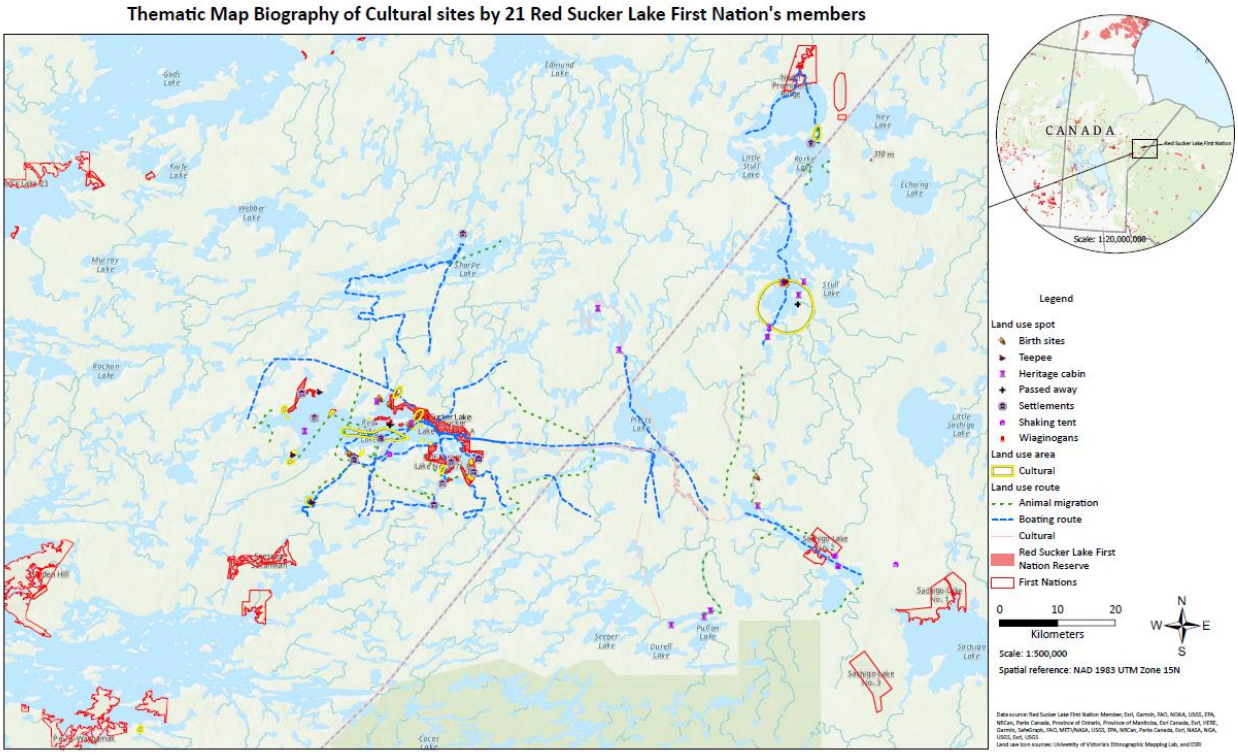


Figure 10. Cultural sites used by 21 Red Sucker Lake First Nation members.

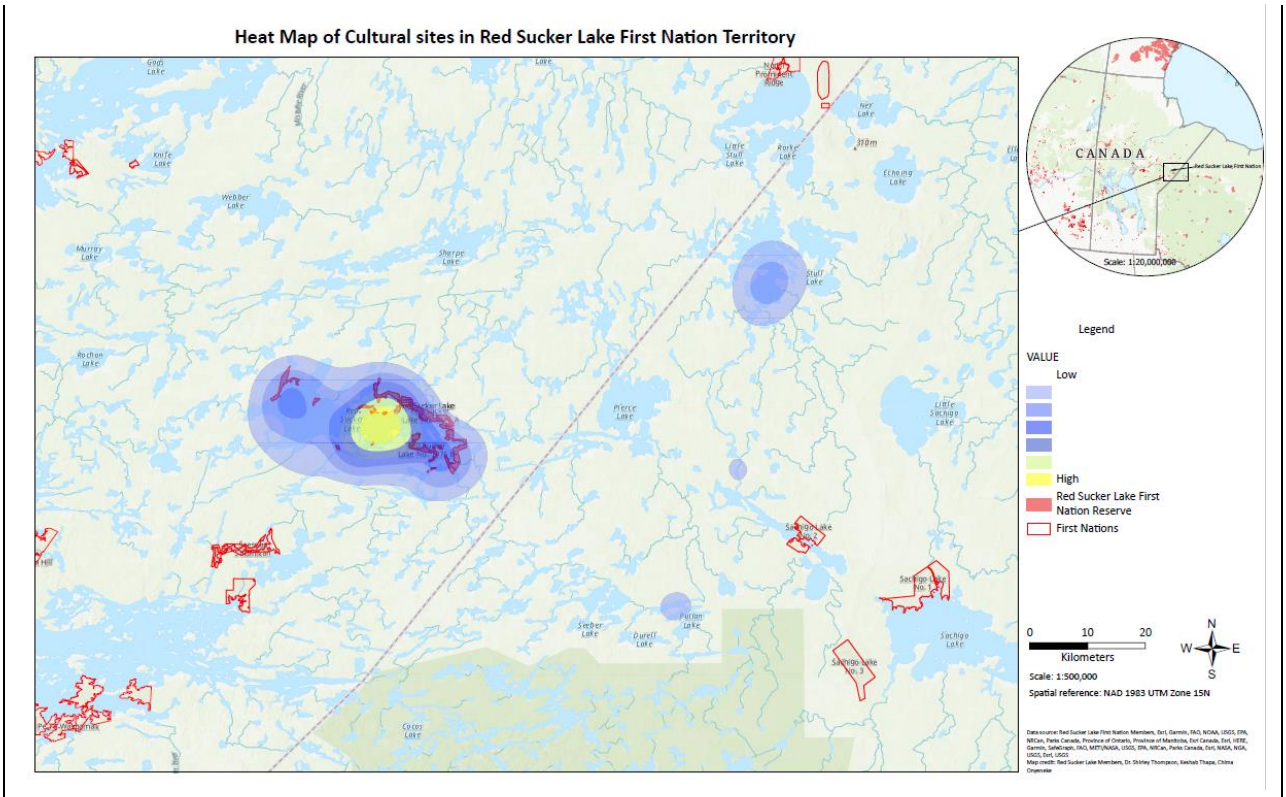


Figure 10b. Density map of cultural sites used by 21 RSLFN members in their traditional territory.

4.1.3. Location, density, and hot spot of fishing sites and fish habitats.

Fishing sites for the sustenance of 21 RSLFN members and their families are shown in Figure 11. Fishing locations include Ponask Lake and Sachigo Lake to the east, Pe-Ta-Waygamak to the south, Rorke and Stull Lakes to the north-east, Sharpe Lake to the north, and Angling Lake to the south. The density map (Figure 11b) confirms that most of the fishing occurred in and around Red Sucker. Fishing high TLU spots are statistically significant around Red Sucker Lake at a 90% confidence level (Figure 11c).

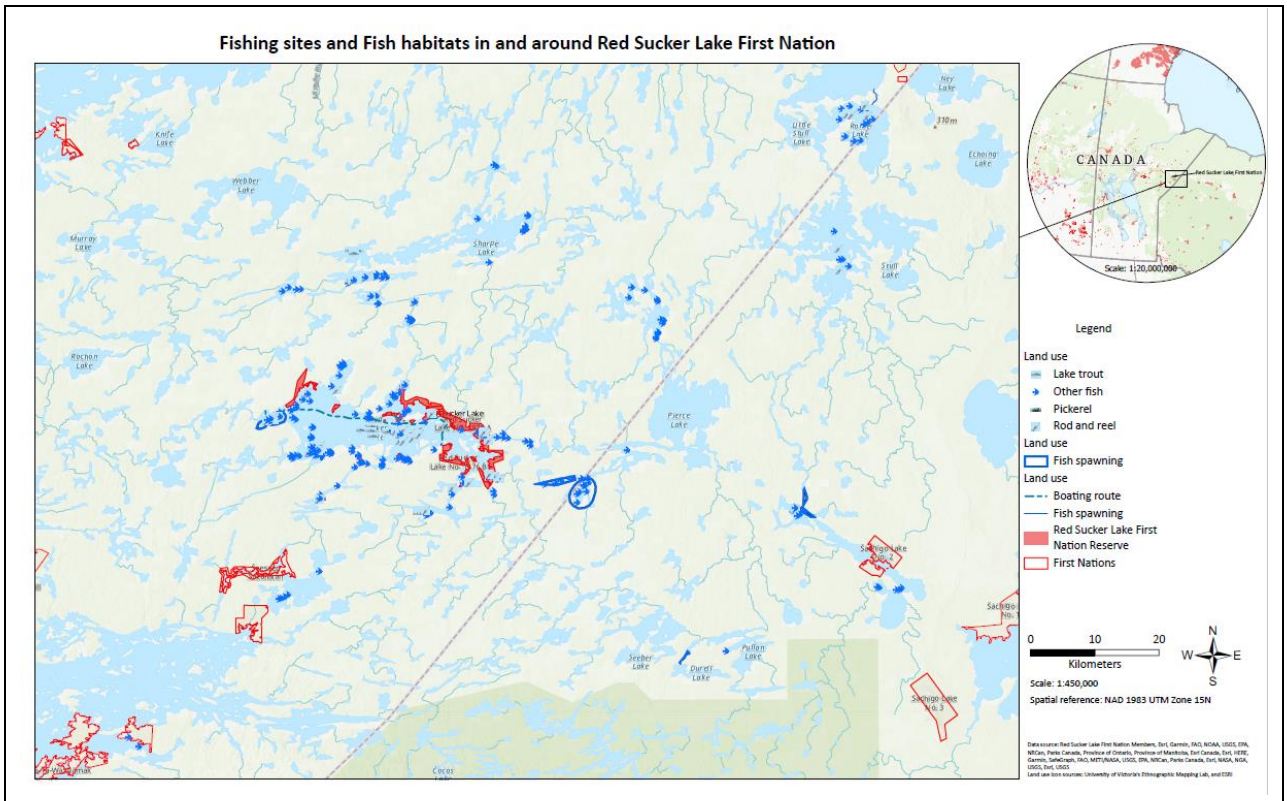


Figure 11. Fish harvesting sites of the 21 interviewees and some spawning sites in/around RSLFN.

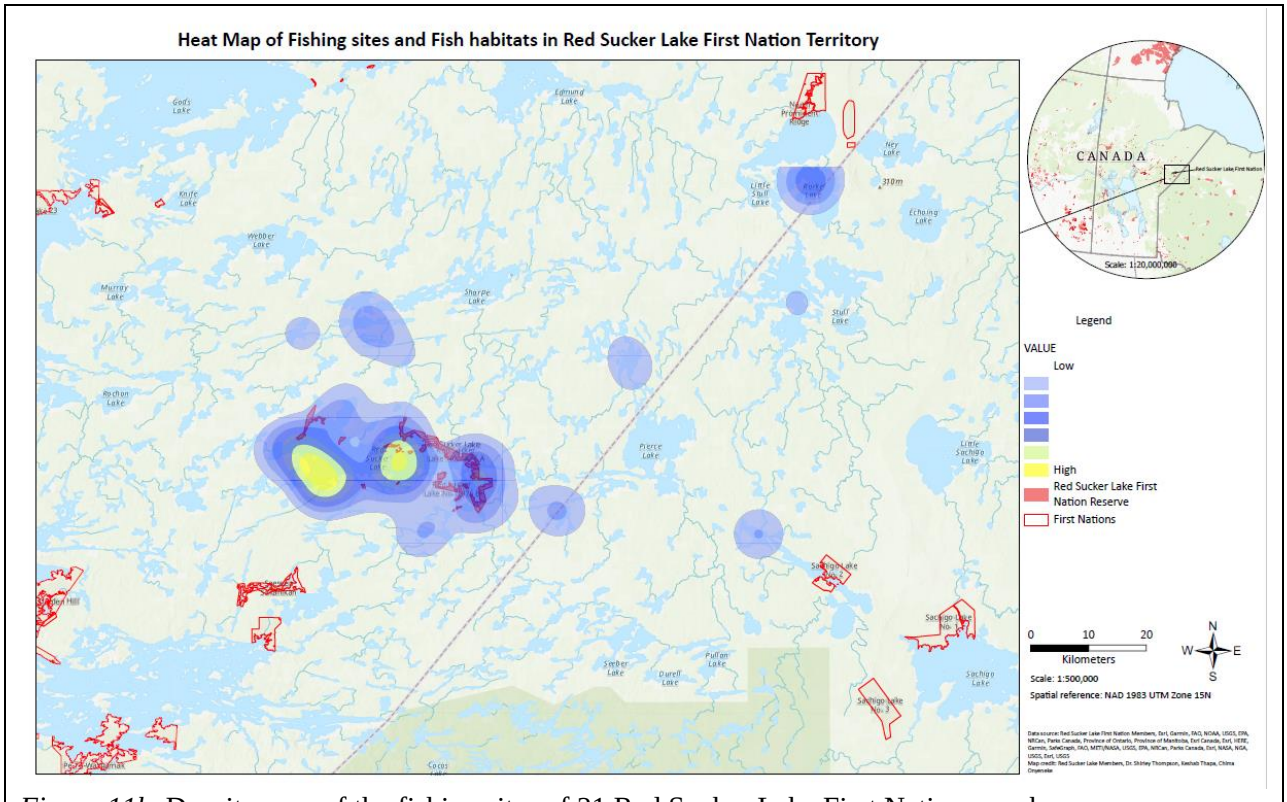


Figure 11b. Density map of the fishing sites of 21 Red Sucker Lake First Nation members.

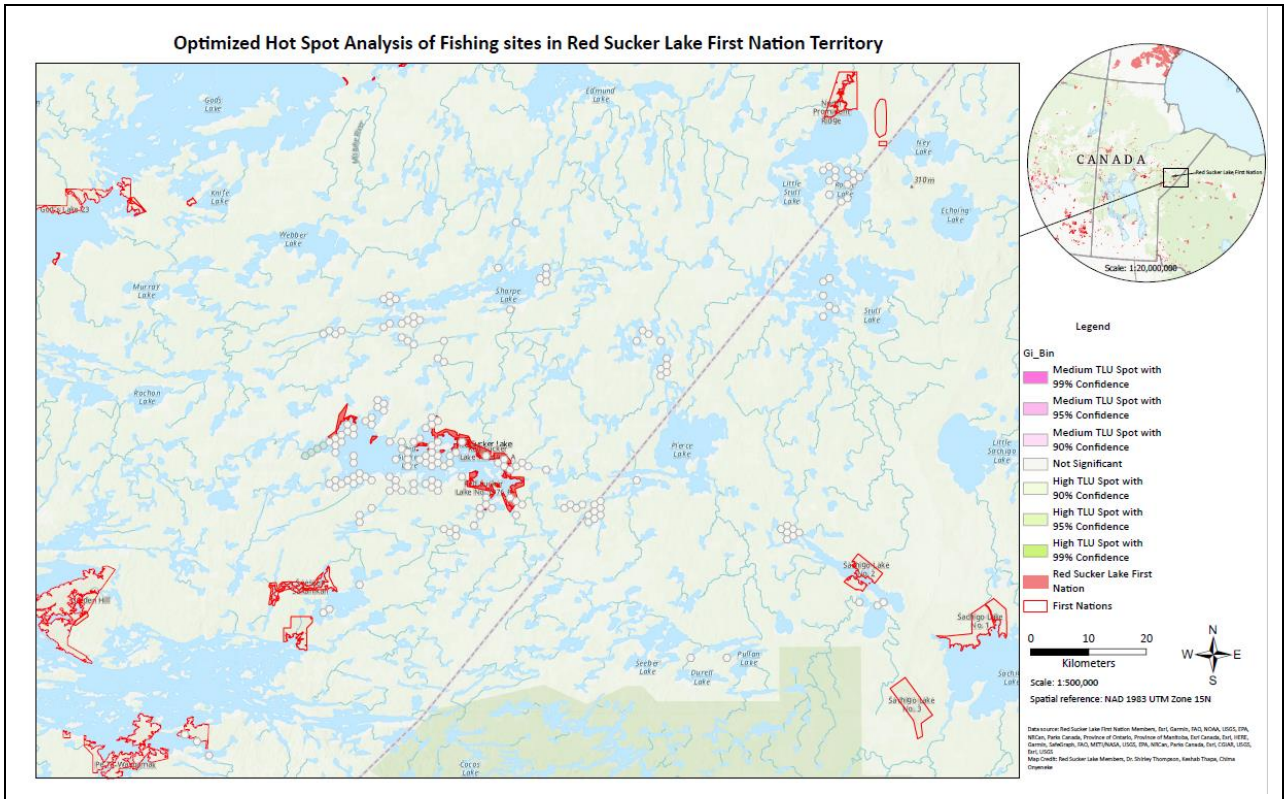


Figure 11c. Optimized hot spot map of the fishing sites of 21 Red Sucker Lake First Nation members.

4.1.4. Location, density, and hotspots of animal hunting sites.

Animals hunted for sustenance in the traditional territory of RSLFN include bear, beaver caribou, deer, goose, marten, moose, muskrat, rabbit, and other mammals (Figure 12). Hunting sites include in/near Red Sucker Lake, Sharpe Lake, Seeber Lake, Pullan Lake, Durell Lake, Sachigo Lake, Ponask Lake, Pierce Lake, Kistigan Lake, Little Stull Lake, Stull Lake, Rorke Lake, Shorty Island, and Namaypin Lake. Highly dense hunting activities are recorded in/around Red Sucker Lake, Pierce Lake, Ponask Lake, Pullan Lake, and Durell Lake. Moderately dense hunting sites include parts of Red Sucker, Rorke, Stull Lake, and Sharpe Lake (Figure 12b). Optimized hot spot analysis (Figure 12c) shows that 55 output features are statistically significant. High TLU spots with 90-99% confidence were observed in/around Red Sucker and Seeber Lakes.

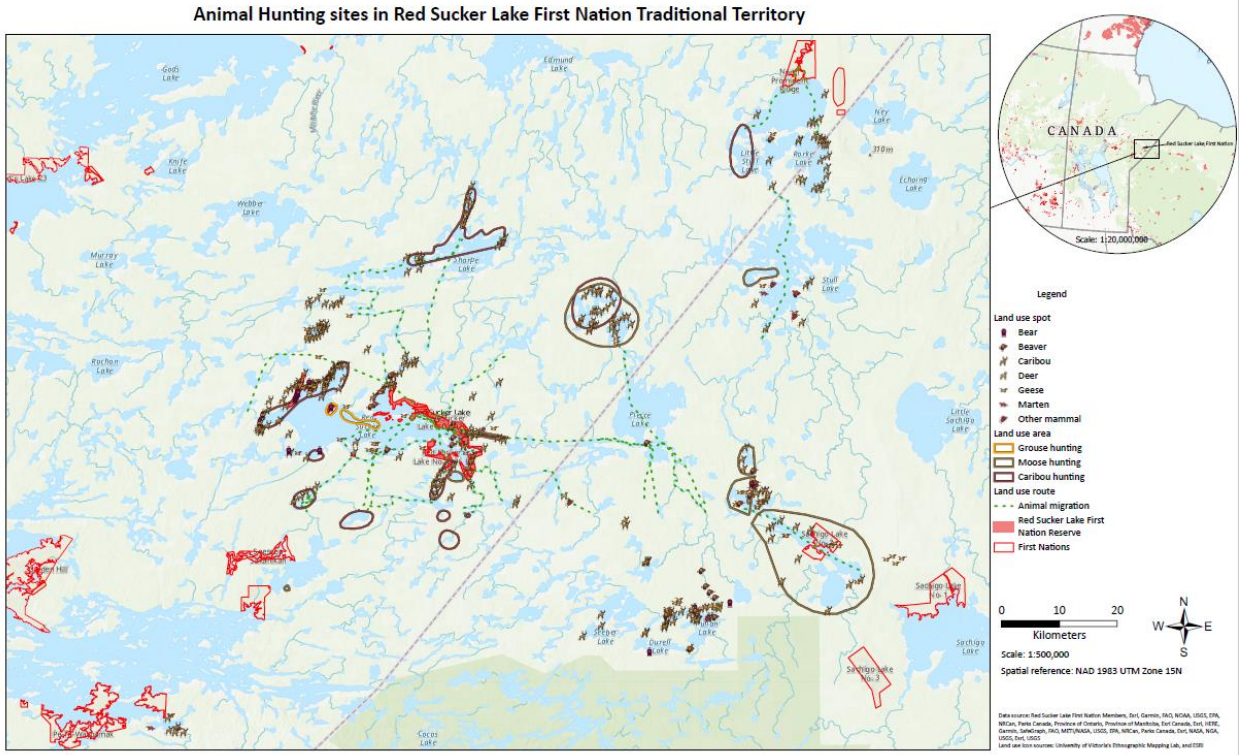


Figure 12. Animal hunting sites of 21 Red Sucker Lake First Nation members in their traditional territory.

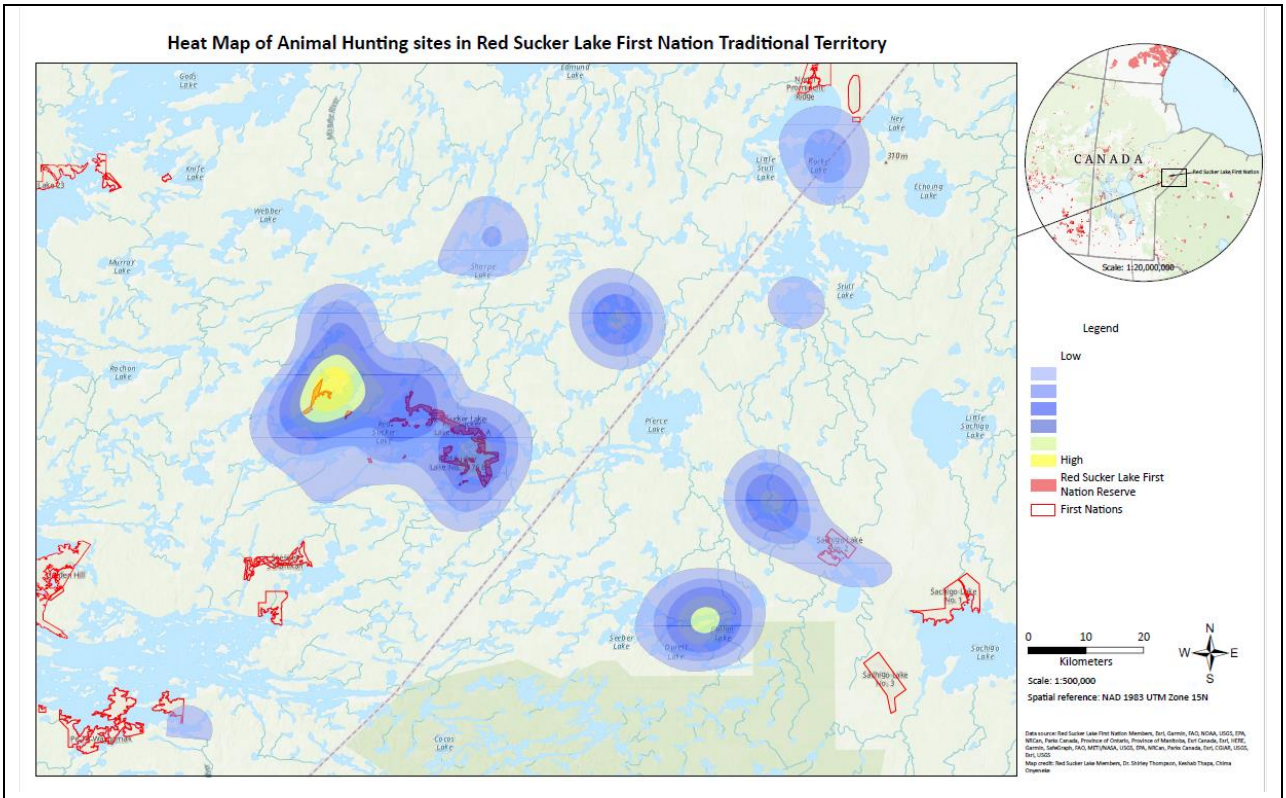


Figure 12b. Density map of 21 Red Sucker Lake First Nation members' hunting sites in their traditional territory

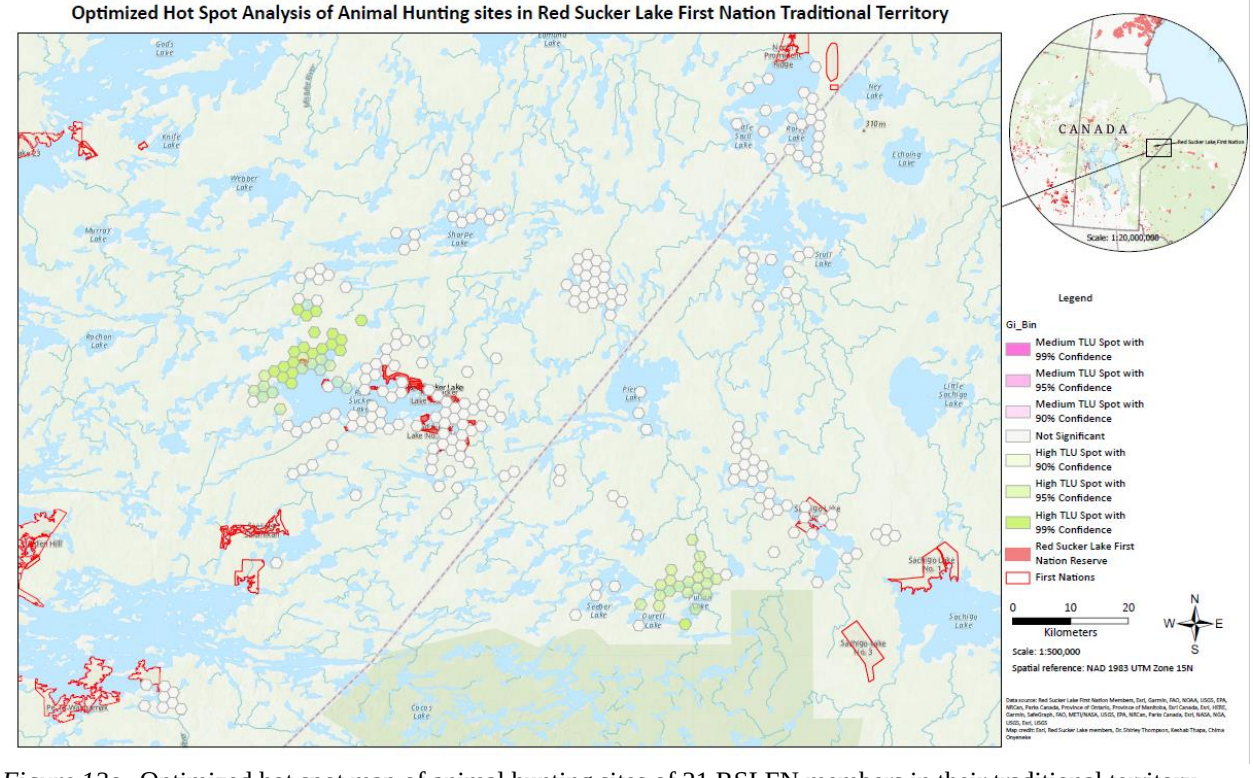


Figure 12c. Optimized hot spot map of animal hunting sites of 21 RSLFN members in their traditional territory.

4.1.5. Location, density, and hotspots of overnight stay sites.

Land-based activities including hunting and gathering for sustenance, cultural ceremonies, and knowledge-sharing meetings sometimes involve travelling and overnight stays. Figure 13 depicts the overnight stay sites of the 21 interviewees- typically log/plywood cabins, Lean-to, shack-tents, tarps, tents with/without a wood-burning stove, and under the stars. The density map (Figure 13b) indicates that overnight stays mostly occurred in/near Red Sucker, Pullan Lake, Durell Lake, Rorke Lake, Little Stull Lake, and Stull Lake. The optimized hotspot analysis map (Figure 13c) reveals zero statistically significant overnight stay sites.

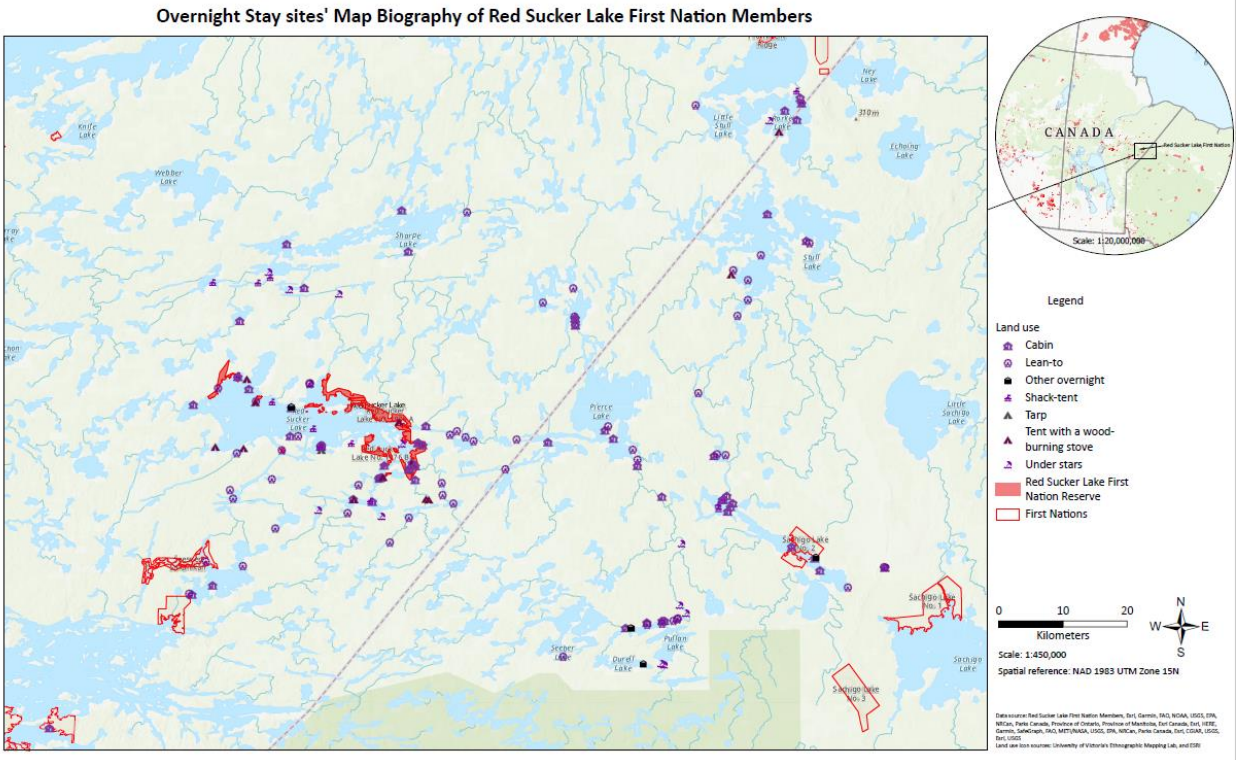


Figure 13. Overnight stay sites of 21 members of Red Sucker Lake First Nation in their traditional territory

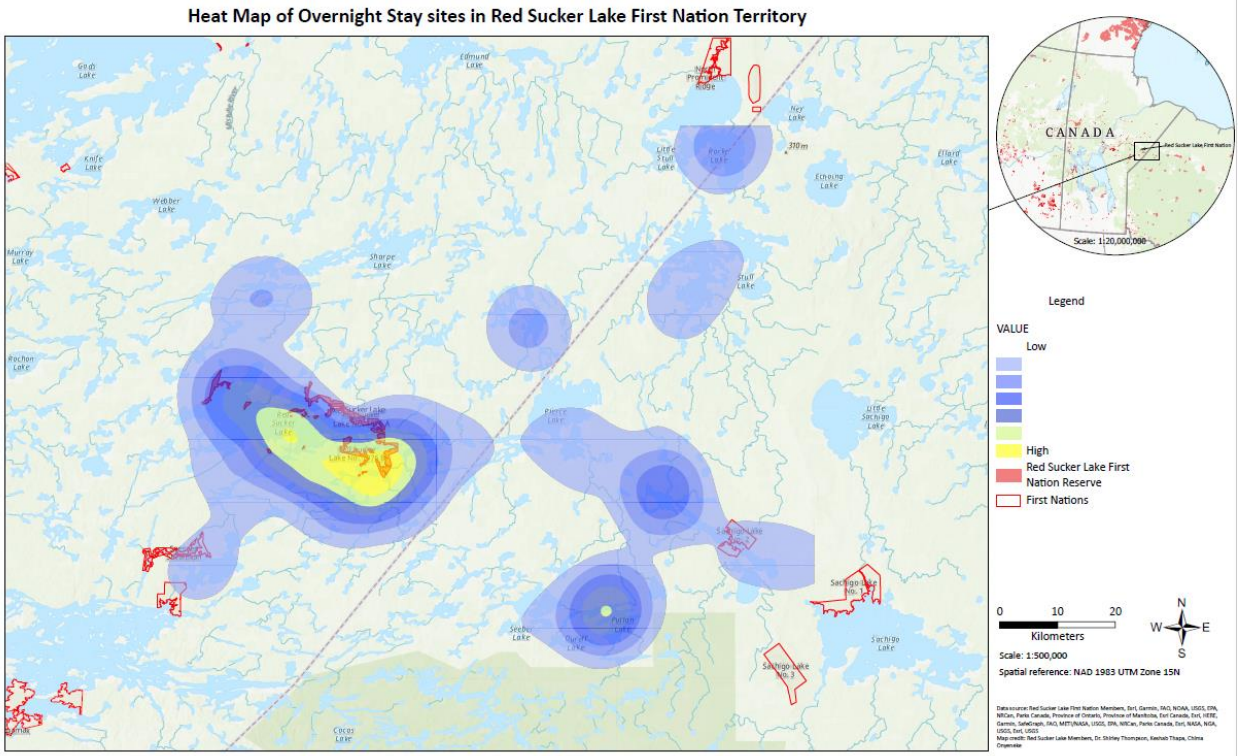


Figure 13b. Density map of overnight stay sites of 21 RSLFN members in their traditional territory.

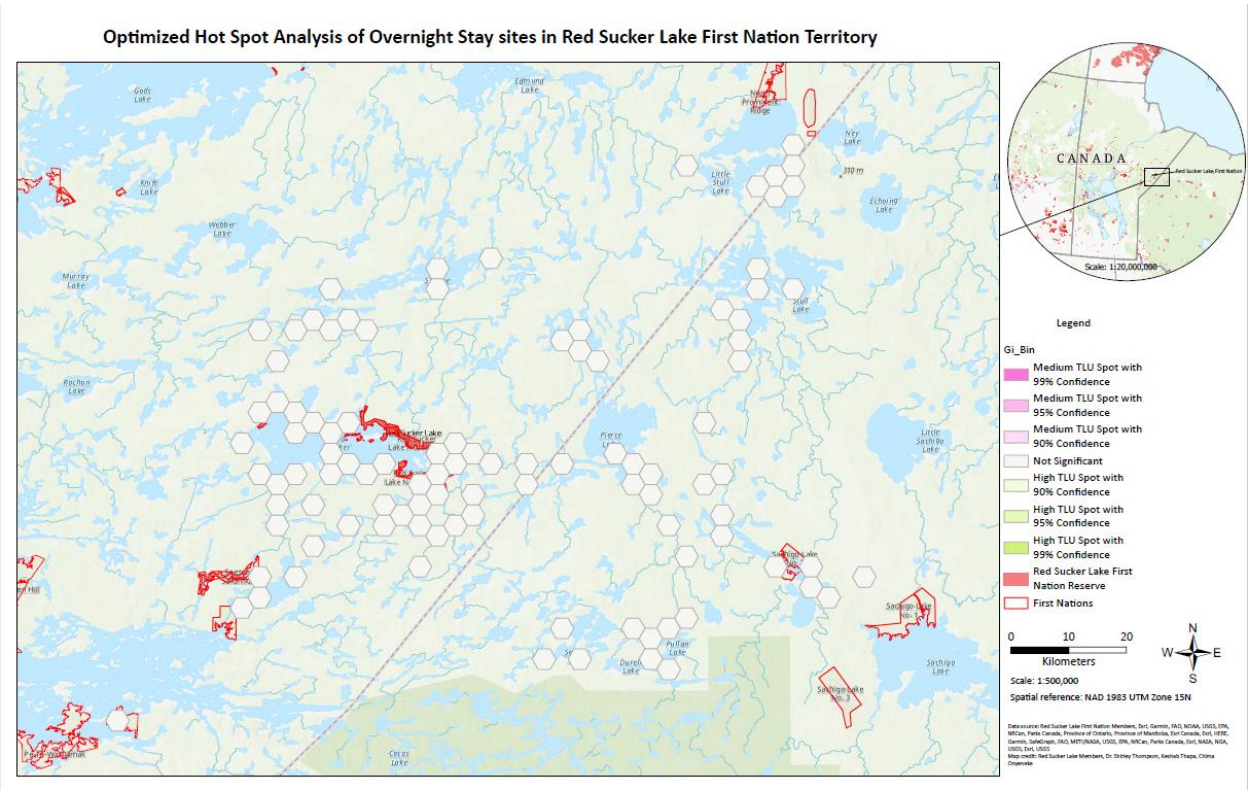


Figure 13c. Hot spot map of overnight stay sites of 21 Red Sucker Lake First Nation members.

4.1.6 Location, density, and hotspots of plants/wood/earth material harvesting sites.

Plants/wood/earth materials harvested by RSLFN members for their sustenance include berries, food plants, medicinal plants, other plants, construction wood, firewood, specialty wood, moss, peat, and soapstone (Figure 14). Harvesting occurred mostly in/near Red Sucker Lake, Rorke Lake, Ponask Lake, Sachigo Lake, and Richardson Lake (Figure 14b). Optimized hot spot analysis (Figure 14c) reveals 46 statistically significant output features. High TLU spots with 95-99% confidence occurred within RSL.

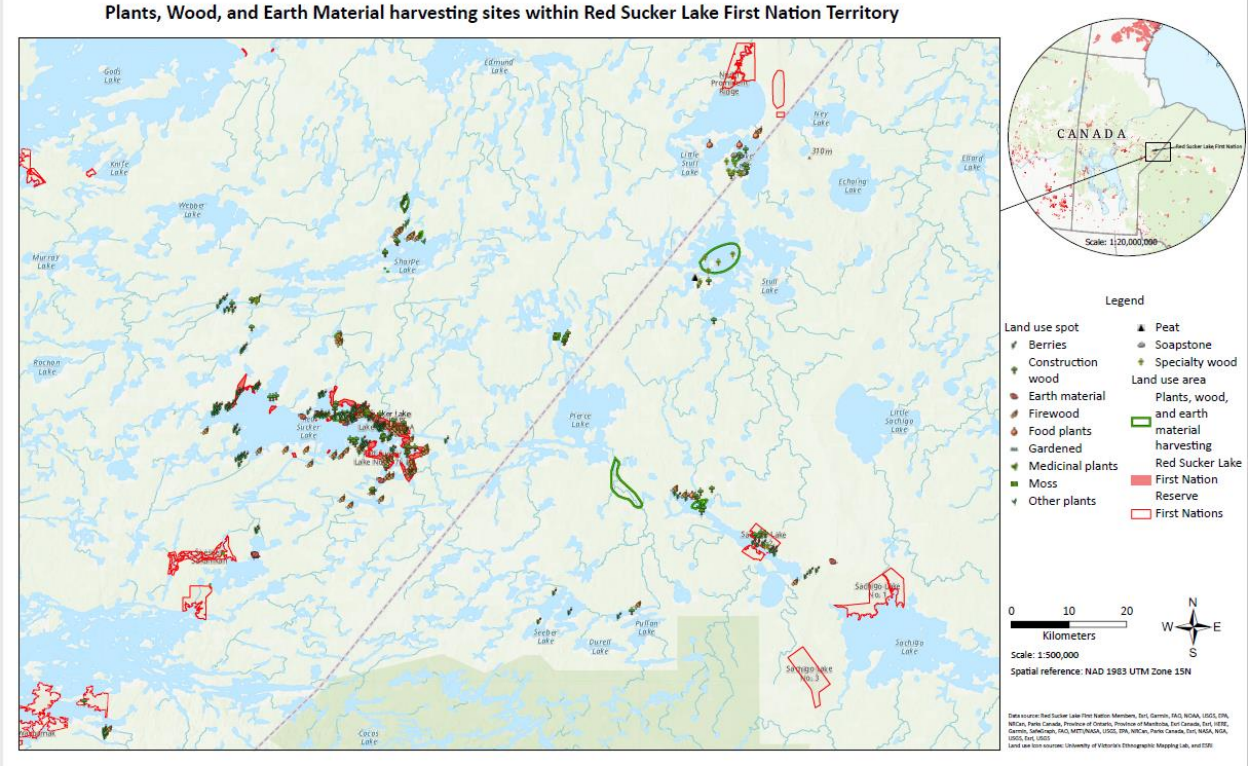


Figure 14. Plants, wood, and earth materials harvesting sites of 21 Red Sucker Lake First Nation members.

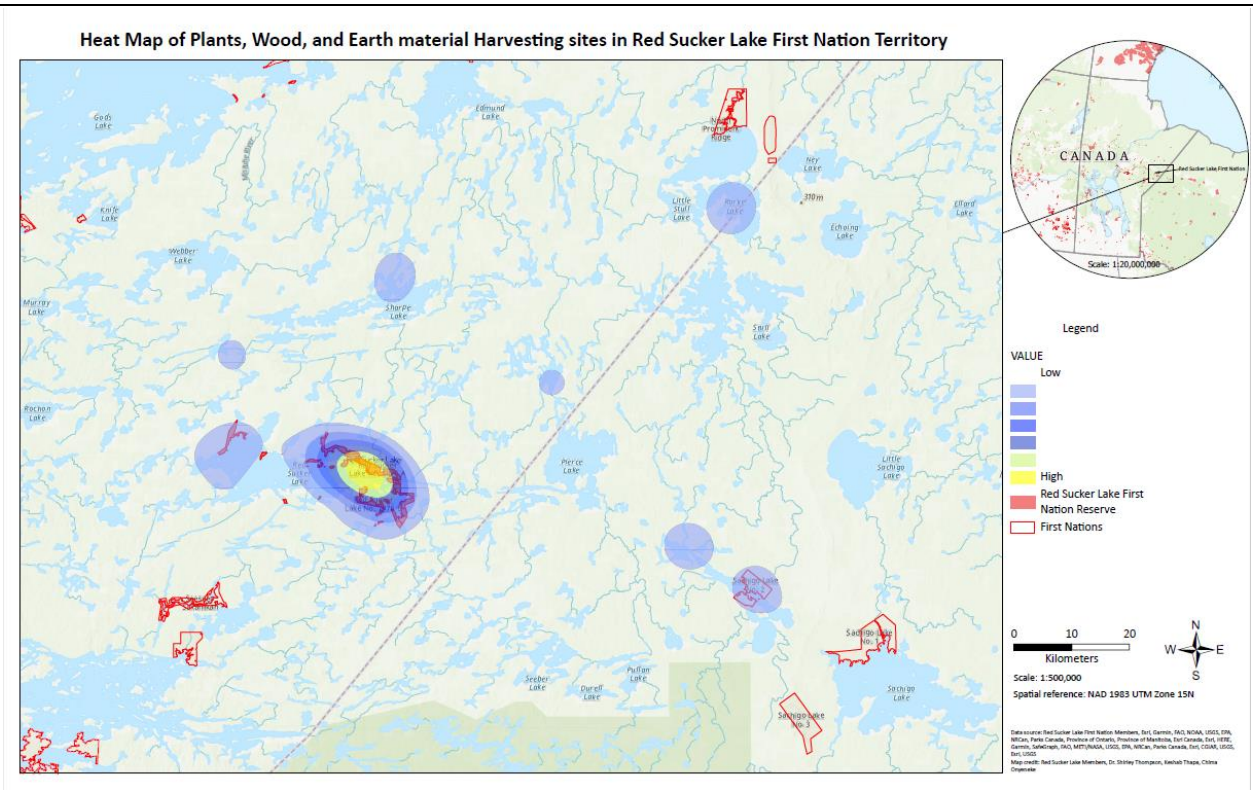


Figure 14b. Density map of plants, wood, and earth materials harvesting sites of 21 RSLFN members.

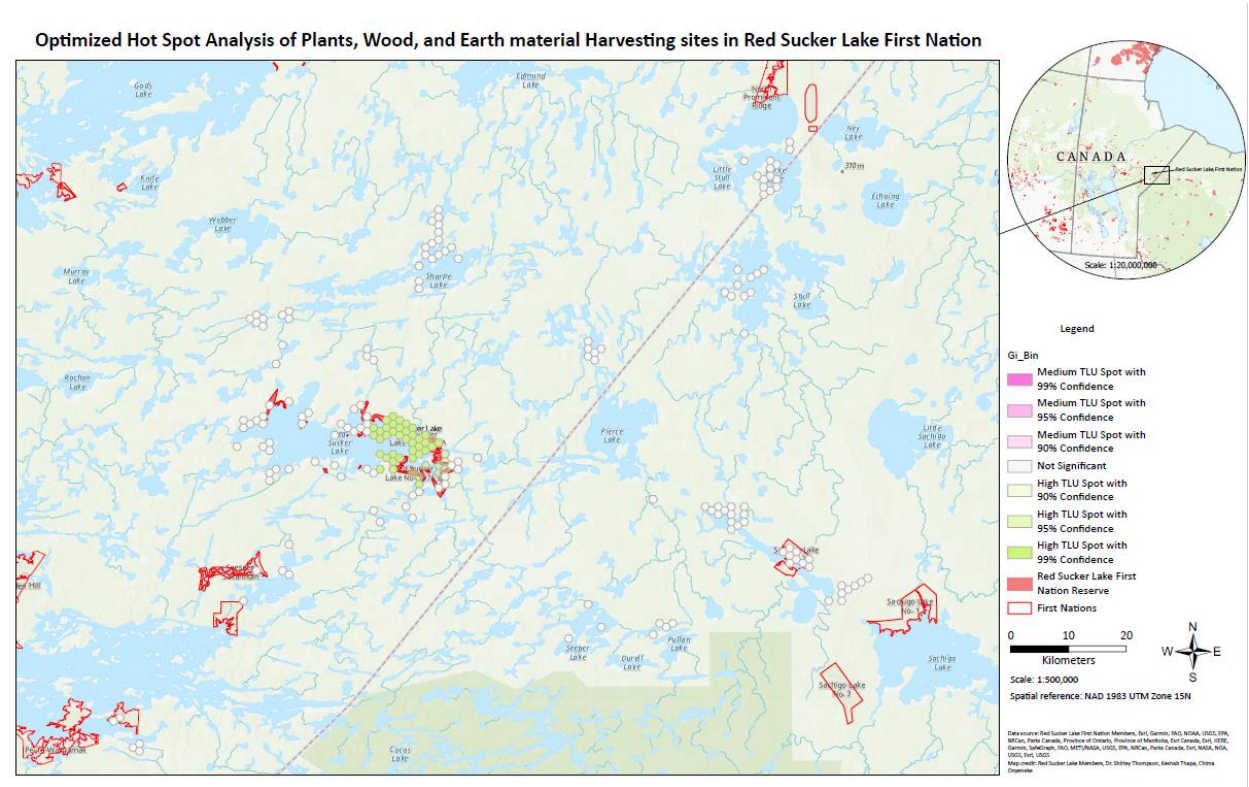


Figure 14c. Optimized hot spot analysis map of plants/wood/earth material harvesting sites.

4.1.7 Location, density, and hotspots of trapping sites.

Animal trapping sites, as seen in Figure 15, extend far beyond the reserve land of RSLFN. It stretched as far as Kistigan Lake to the north, Bankisian River to the south, Mista Lake to the west, and Sachigo Lake eastwardly. The heat [or density] map (Figure 15b) shows that trapping activities mostly occurred in the Red Sucker region (yellow patches on the heat map). Moderately dense trapping activities happened in/around Richardson Lake, Lenover Lake, McHenry Lake, Robson Lake, Okas Lake, Sekak Lake, Mista Lake, Makeekat Lake, Wallace McKay Island, MacDonald Island, Baskerville Island, West Kakenokamak Lake, and Bankisian River. Optimized hot spot analysis of the trapping sites (Figure 15c) indicated no statistically significant output features at a 90-99% confidence level.

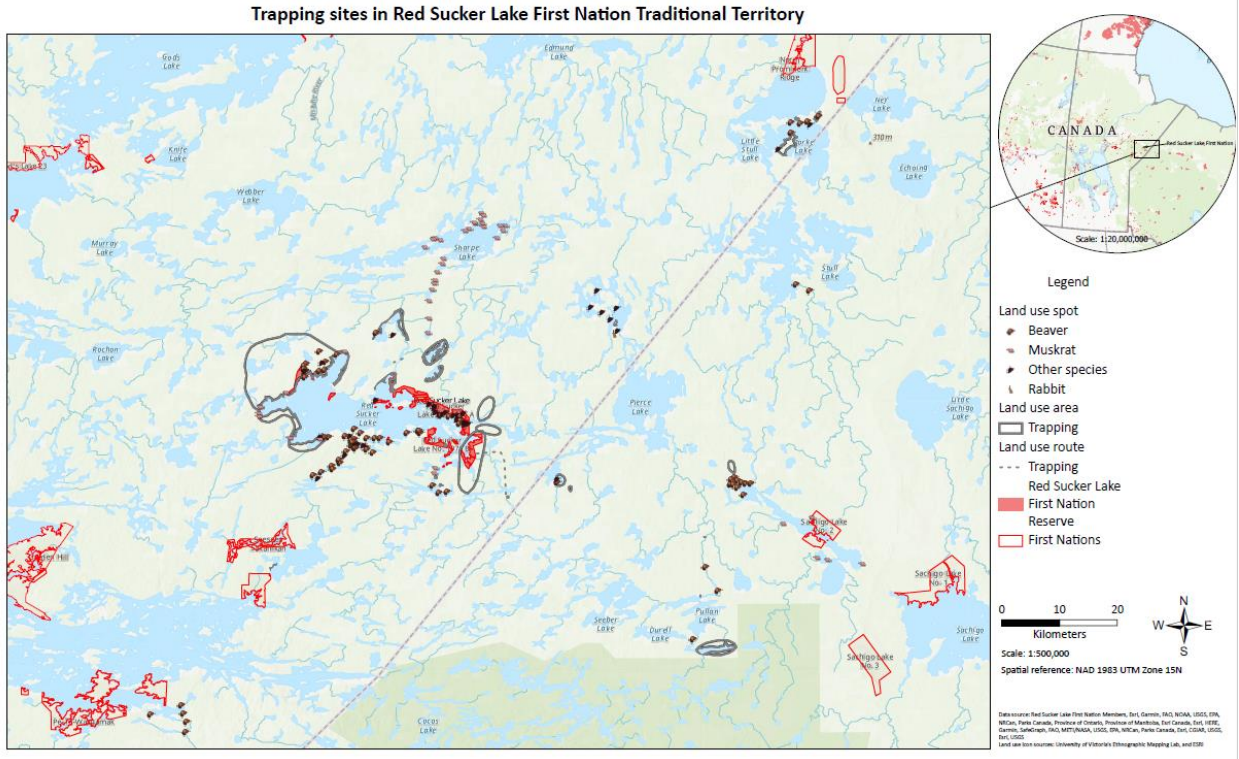


Figure 15. Trapping sites of 21 Red Sucker Lake First Nation members in their traditional territory.

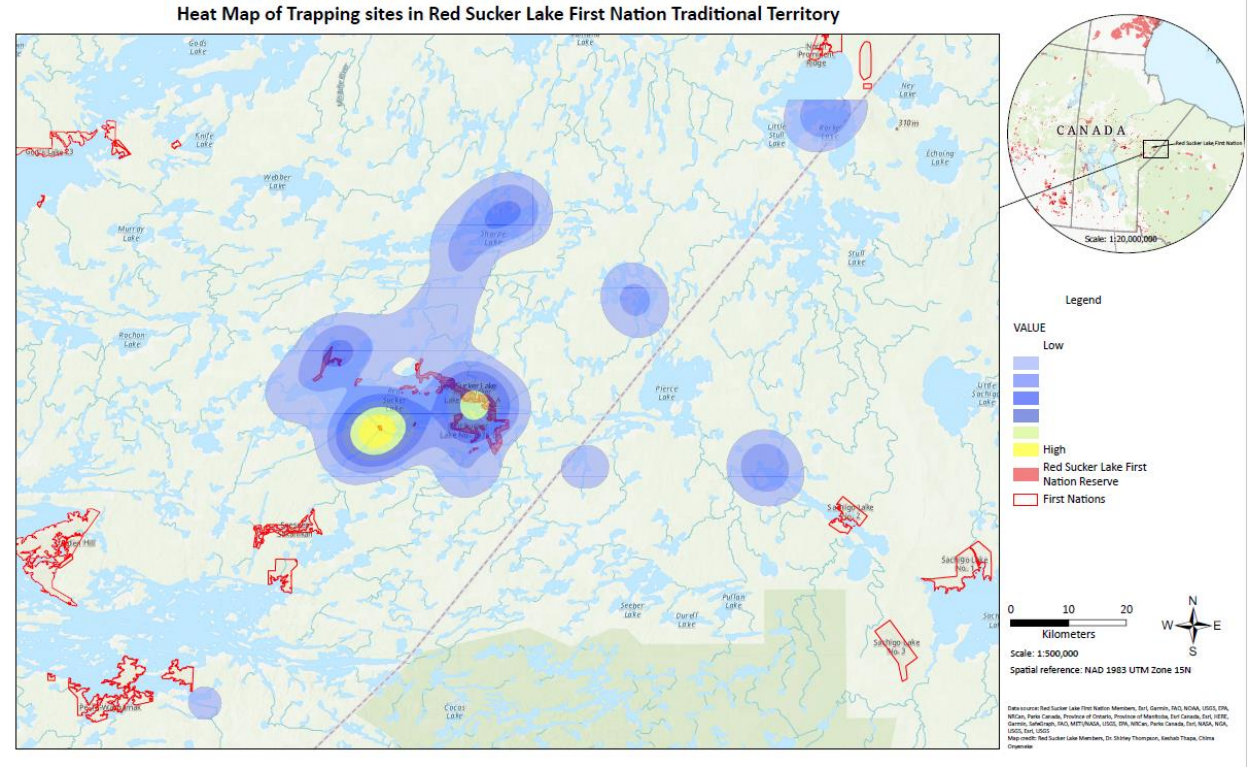


Figure 15b. Heat map showing density pattern of the trapping sites of 21 RSLFN members in their territory.

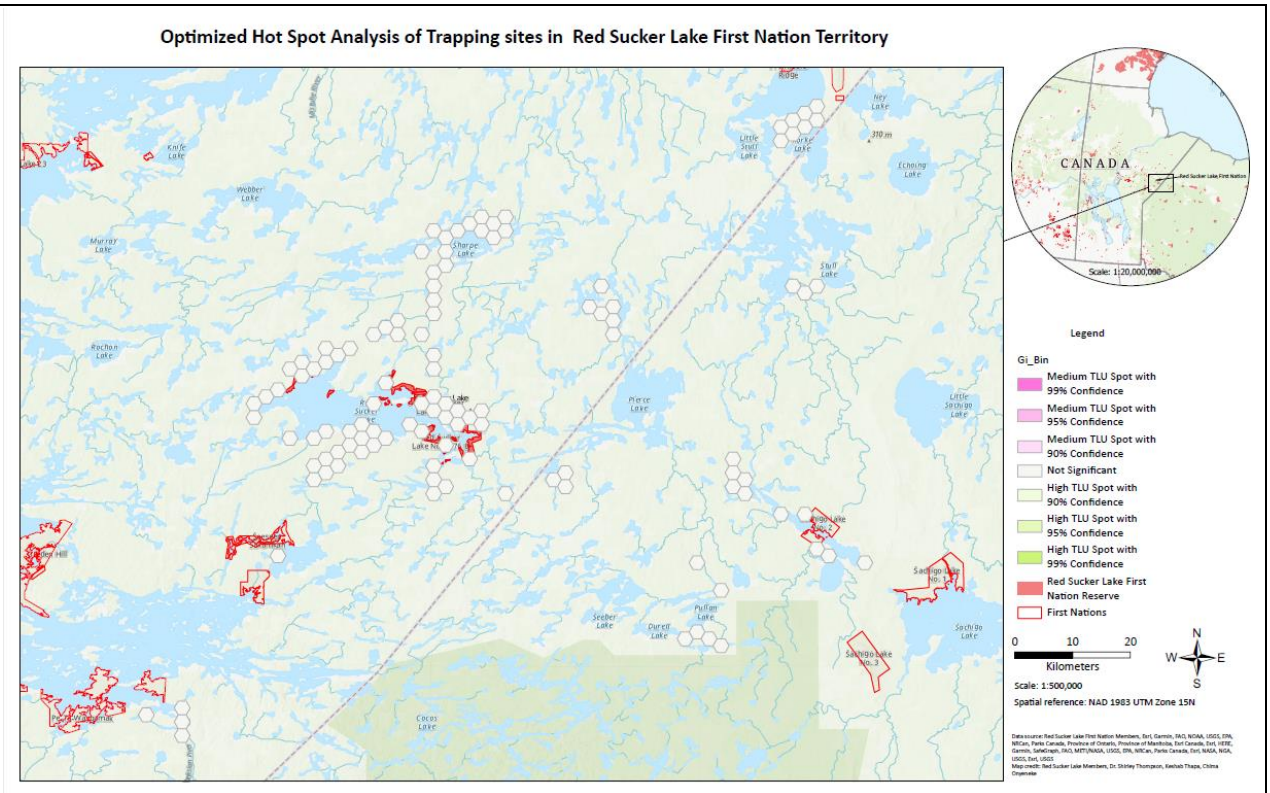


Figure 15c. Optimized hot spot analysis of the trapping sites of 21 RSLFN members in their traditional territory.

4.2 Summary discussions on land use of Red Sucker Lake First Nation

4.2.1. Land use maps

The land uses of the 21 Red Sucker Lake First Nation members, according to the mapping data, are concentrated around lakes and rivers. This dependence on water signals the importance of water to the sustenance of the RSLFN people. Also evident from the maps (especially Figure 6) is the long distances travelled by the different community members from their reserve land for livelihood and cultural activities. Thus, considering extended areas in land use/planning consultations with First Nations is required across provincial borders.

The ability of community members to traverse these territories in the absence of access roads is also an indication of the deep connections they have established with the land over the years (Natcher, 2001; Thapa, 2018). The lack of access roads makes these traditional land use journeys lengthy. One of the interviewees narrated how several days of canoeing was done from Red Sucker, through Pierce Lake, to Ponask Lake [both in Ontario] and back home with their canoe heavy-laden with harvests:

> *"I remember when we took the boat to Rorke Lake. Oh, from Red Sucker Lake to Pierce Lake to Richardson, Twin Lakes, then to Stall Lake…there's Kistigan River, then to Rorke Lake. That portage is about… I think 6 miles. We took a boat, gasoline, food, guns, and our clothing. It took us all day, and by the time we were done, the sun went down. It took three days to get to our destination."* -PIN 310

These long trips often require overnight stays in cabins, tents, other camping structures, and under the stars. An indication of how one traditional land use is connected to the other. As many as the land use sites indicated on the maps seem, the locations are a fraction of the entire community's land use sites. These maps show the land use of 21 out of the 725 community members (Statistics Canada, 2022). Therefore, the land use of the entire community is expected to

produce bigger high TLU spots and possibly cover a wider region, as more traplines will be involved.

The previous land use study conducted in RSLFN involved 14 community members different than those selected for my research work's TLU study. While both studies recorded some TLU areas in common, each study also recorded distinct TLU areas as community members' traplines differ. Traditional land use areas peculiar to the 2018 study include Namapanis Lake, Moose Lake, Mistune Lake, Sakwasi Lake, Robson Lake, Errin Lake, York River, Mukataysip Lake, and Jeffers Lake (Appendix 1). Some of the TLU areas common to both the 2018 and 2022 studies, are: Kistigan Lake, Pierce Lake, Seeber Lake, Rorke Lake, Sharp Lake, Richardson Lake, Stull Lake, and Lenover Lake (Thompson & Thapa, 2018). A combination of these land use sites will produce maps with much more TLU areas and statistically significant areas.

4.2.2 Density and hot spot maps

Density [or heat] maps indicated land use concentration areas of the 21 RSLFN members, whereas optimized hot spot maps identified statistically significant land use locations. Significance levels with 90%, 95%, and 99% confidence, whether high TLU or medium TLU spots, imply that the clustering of land use features is not random. Again, it is noteworthy that this analysis is a product of only a small sample size of the community's population; hence, the result of my analysis does not represent the entire community. Also, areas not shown as land use locations on the map may well have cultural/sacred significance to the community. Community members, for fear of colonization threats, may withhold information on certain landscapes/land use (Joly et al., 2018 in Thapa, 2018). Documenting the land uses of more community members would have produced higher land use densities and much more statistically significant output clusters, as evidenced by the 2018 TLU study.

4.3. Impacts of mining and exploration on the traditional land use of Red Sucker Lake First Nation members

Thematic and summary maps prepared from community members' map biographies showed locations of specific land use concentrations and an overall view of the land use by RSLFN members. These land uses are within greenstone belts (Figure 16). Mining has affected the practice of traditional knowledge in RSLFN. Noise from mining-related activities has affected moose hunting and thus the availability of traditional food (Appendix 7). The frequent noises of mining helicopters and planes at the RSLFN airport is disrupting wildlife behaviour and traditional land uses.

One of the elders interviewed narrated how he made his first moose kill at age 17, whereas his son only killed his first moose at age 35. He attributed this wide berth in the 'first moose kill age' to a decrease in wildlife abundance due to industrial developments. In his exact words, he said:

> "*So much disturbing in the land. Like this mining thing, I think one company that is working at...Yamana. When they had choppers going from here to Lingman, Twin Lake. I remember that winter, all the moose were coming from the north side, they were heading south. That trail to Pierce Lake, there was a track of moose… they were heading south...away from the sound. I remember last year when they were flying from here to Lingman, this lake I don't think they killed nothing there when they went moose hunting. Then at Pierce Lake, Irene's camp, I don't think. There's been a lot of disturbance from the choppers hauling their equipment for the mining*."

Also, the transfer of Indigenous knowledge from elders and knowledge keepers to younger generations, for nature conservation, is impaired. The proximity of mining claims to traditional land use locations can be as little as 4km, some mining claims overlap on land use sites (Figure 16). Thereby depriving community members of traditional practices in such overlapping areas, and thus limiting the transfer of traditional knowledge to younger ones. Therefore, the results of

this research will provide RSLFN with evidence-based protection against mining developments on their traditional land. In the future, a large print of the greenstone belts vs traditional land use and occupancy sites will be sent to RSLFN for placement in the community. This map will be a reference point for the significance of greenstone belts to the sustenance of livelihood in the community.

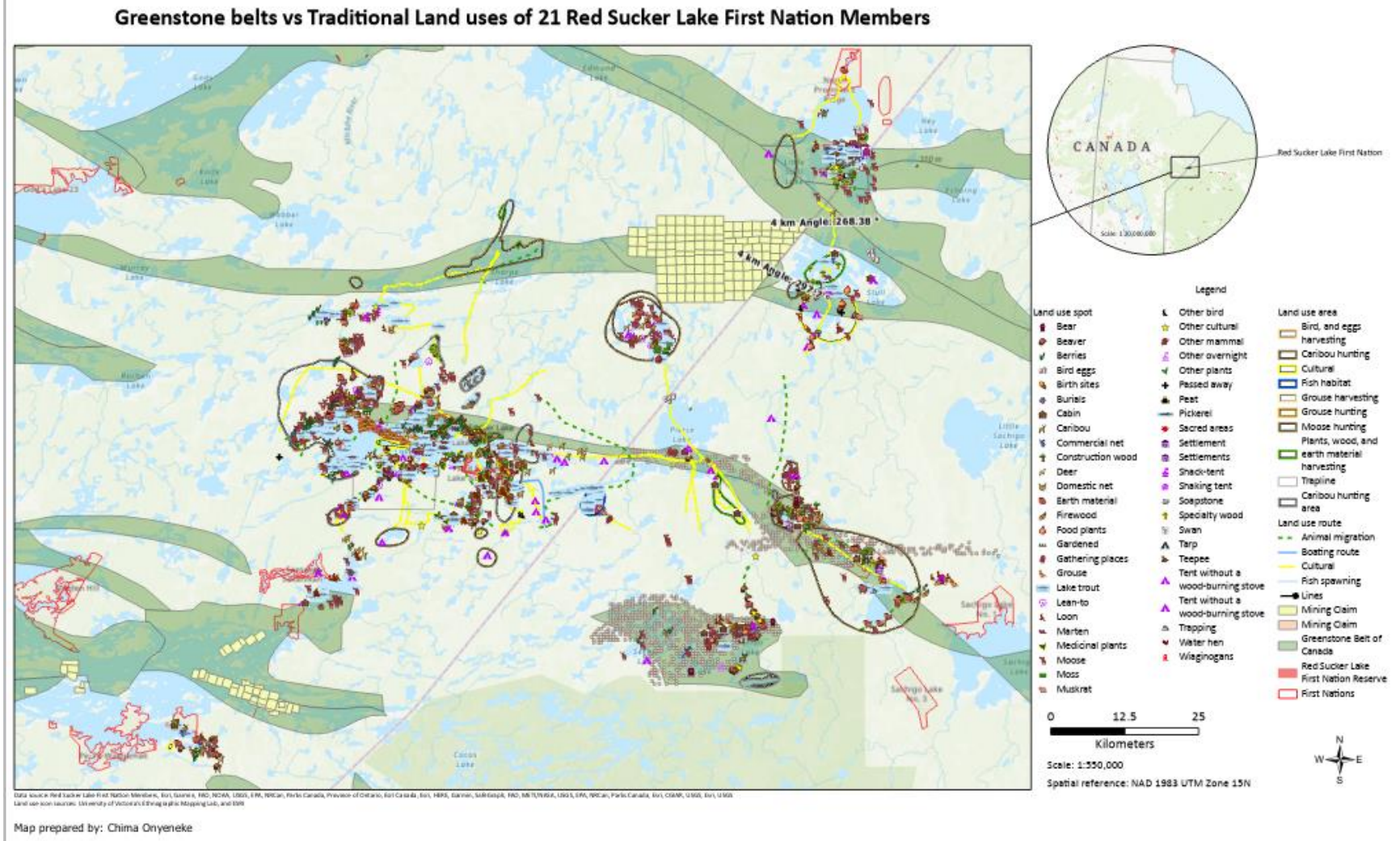


Figure 16. Greenstone belts vs traditional land use of 21 Red Sucker Lake First Nation members

4.3.1. Community members' perspectives of mining impacts

Twenty-one Red Sucker community members were questioned about their land use activities and how mining developments impact them. The views shared by these interviewees were processed in NVIVO, using the word frequency tool, to generate a word cloud (Figure 17). The keywords frequently used by community members include land, area, right, lake, moose, hunting, river, people, traditional, fish, cabins, family, and trapping indicating what is impacted by mining.



Figure 17. Word cloud from the interview of 21 Red Sucker Lake First Nation members

The perspectives of 18 of the interviewees towards mining impacts varied from person to person (Figure 18), especially between age groups. The Elders unanimously expressed concerns about the adverse impacts (negative) of mining, whereas the youths were less aware or had mixed

views. The Elders' views regarding mining impacts are indicative of their relationship with the land over the years, unlike the youths who are increasingly becoming distant from land-based activities. The Matrix-coding Query (Yearworth & White, 2013) result (Figure 18) depicts that the impacts of mining on RSLFN, as opined by interviewees, is largely negative. The coding reference count of interviewees who had 'neutral' and 'mixed' opinions on mining impact was 1, whereas that of 'negative' opinions ranged from 1 to 5. None of the respondents had a 'positive' opinion on mining's impact on their community.

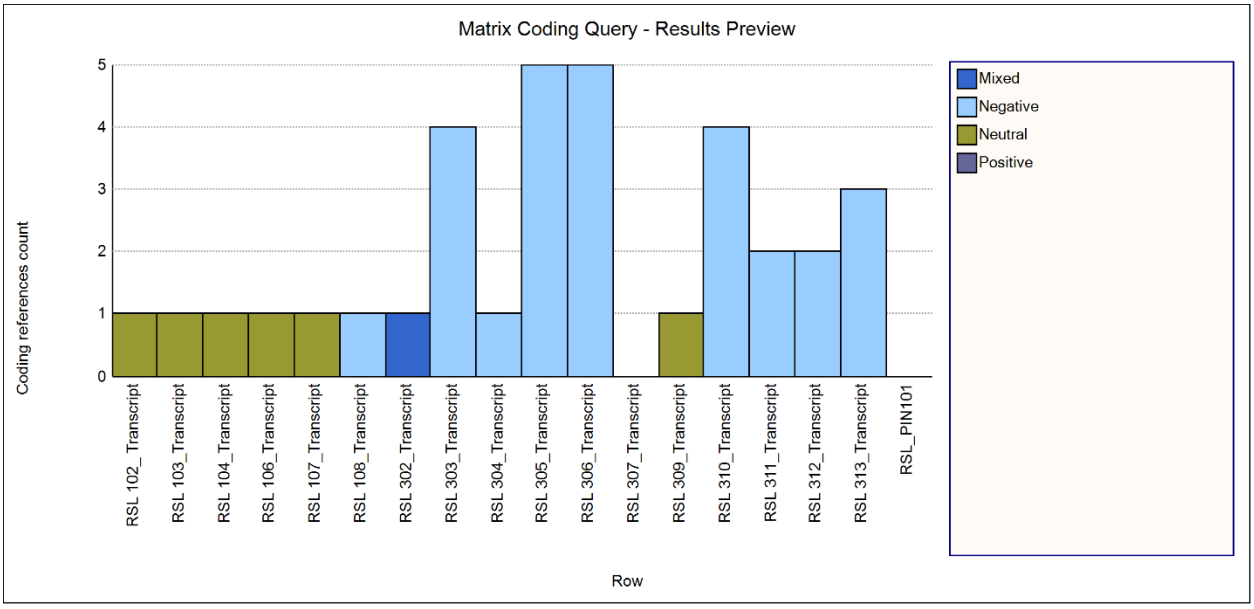


Figure 18. Result of matrix coding query of the interview data

Themes, sub-themes, and codes emerged from the cleaned interview transcripts. The themes generated were land protection, significance of land, land protection priorities, and mining impacts. The gender/age group comparison (Figure 19) chart is a fair representation of the overall disparity in respondents' views. The outcome of the analysis suggested that age and gender influenced the interviewees' opinions concerning mining impact. The views of a female youth (neutral) when compared to those of a male elder (negative) could be indicative of the importance

of traditional knowledge (Dixit, 2011). The male elder (PIN 313), when asked about the impacts of mining in his community, said:

> *"So, all that scares away the animals- moose. So, there's not much. There used to be a lot of moose there before. That's why I'm marking all those areas where I killed a moose but now I can't. But it's not only...it's the birds too- ducks and geese, and beavers die there on the water, we pull them out of the water because they'll damage the river."*

Another respondent opined:

> *"Well, like if this mine starts up, I don't know, I know for a fact that we going to lose the whole area. People are going to come in and destroy...So, it'll be flights in and out. It will be oil, gas. It'll be maybe hydro development."*-PIN 305

Referring to the impact of mining on hunting, a community member (PIN 306) said:

> "*There was a lot of prospecting, and they would fly materials there. There is a lot of it I've seen, even in the deep-water areas, and the problem is when they're heated. And then explode, they make a loud noise, and that would scare the animals away and it's just all over."*

Talking about the environmental pollution impact of mining on the community, PIN 306 said:

> "*Yes, and you don't know where they left maybe gas or other materials and it's leaking out into the land...animals take that up. You don't know. There they go, draw away from that. Yes, I remember we were there hunting...and we checked and there were barrels there. Rechecked next day, and there's bills there..., clean up*."

Another member responded:

> "*I used to work for a mine. Twin Lake. I do not want any kind of mining or development in this area, because I've seen it how they do things. They bring in these big bladders. They fly in these big bladders and sometimes those bladders are on the ice...these little barriers....it wouldn't contain the spill. It will just contaminate the whole area. One of those bladders ruptured. No, I don't want anything like that around here."*-PIN 303.

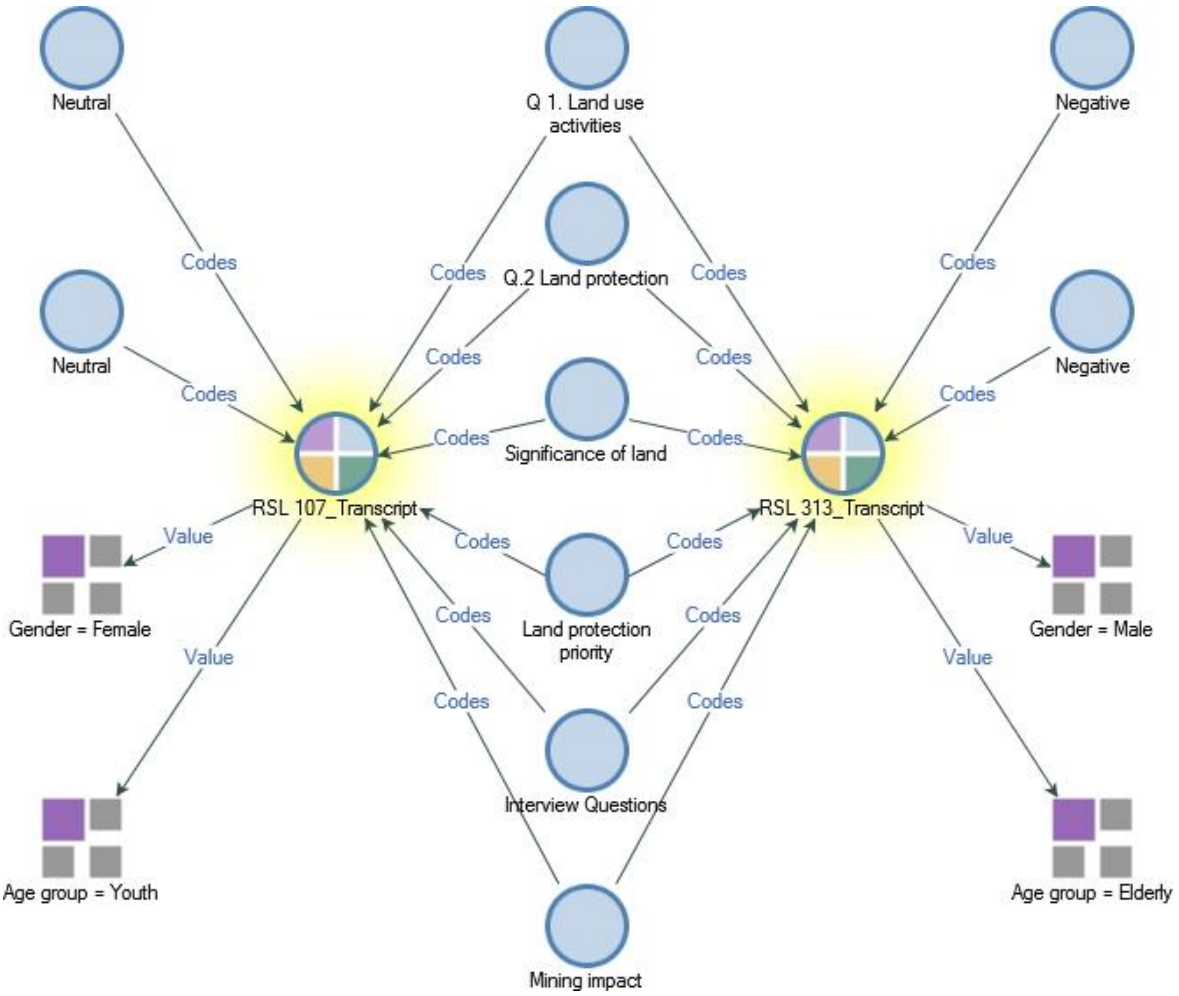


Figure 19. Comparing 2 community members' views on mining impacts, based on age group and gender.

Identifying the land protection priorities of the traditional owners of lands and resources is an important step in the Indigenous planning process (Matunga, 2013). The interviewees' perspectives concerning land protection priorities were unanimous. All 21 community members wished that their entire traditional lands be protected from all forms of industrial development. Some of their exact comments are:

> *"I know I cannot protect every area. That's our traditional area, I guess, but I'm not going to be around for a long time. In future, where my grandchildren, I would like to see a protection of all this- all around Red Sucker. All this territory."*- PIN 313

One of the interviewees simply said- "everywhere." –PIN 311

Another interviewee said:

> *"I don't think anybody wants their traditional lands to be disturbed, you know, to be destroyed, or altered in any way."* –PIN 306.

The significance of land to the Indigenous peoples of Red Sucker Lake, as indicated by the interviewees, seems connected to their views concerning land protection/priorities and mining impacts. The land is important to the 21 RSLFN members in diverse ways. Some of their responses, when asked why land is important to them, are:

> *"It's a way of providing sustenance, food. And all this way to live off the land. There are no organic materials that are better than the animals that are here."*-PIN 102.

> *"Because it's my hunting ground. I wouldn't want anything to happen to it."* -PIN 104.

> "*Because it was given to me...it was given to my family. Man did not give it to us- God gave it to us. That's why it's important to me. And it's a gift, we can't put price on it...we can't put value on it in terms of money thinking. It's the same thing as you getting a gift. If you get a new baby from your wife, can you sell him- your baby? Can you imagine making a baby so that I can sell it. It's the same thing- it's given to us, not to sell. We have to take care of it. And all the animals. the trees, is not given to us but we are entrusted as caretakers. No man gave it to me, God gave to me- my land, my language, my heritage."* -PIN 108.

> *"It provides sustenance. The traditional teachings...work smart, not hard. My grandfather and uncles used to teach us how to do things, how to set snares, how to trap, how to hunt moose. I mean you don't just go to the bush and make some noise to scare everything away. The teachings are in the land."*- PIN 303.

> "*Like right now, I don't really buy any meat from the Northern store because I mostly use wild food. That's the number one important thing."*-PIN 305.

> "*Aside from traditional food, berries medicine. Being out on the land there's healing from the problems that we face because of Western or European influence. Being out in the wild brings healing. Healing of the mind, tranquility, if we're getting problems and you recoup, you can build yourself up. Having peaceful scenery."*- PIN 306.

Other reasons stated include for shelter, fun, and for upcoming generations to grow up in. Land-based activities, including education, are an integral part of the Indigenous way of life, and thus their relationships with the land and health (Lines & Jardin, 2019; Wildcat et al., 2014). This dependence on land by the Indigenous peoples necessitates the protection of their ancestral territory to ensure the sustainability of their age-long traditions.

Responding to interview questions concerning mining impacts, the interviewees also revealed that the duty to consult has not been expressly respected by the proponents and colonial

government. In the respondents' opinion, and rightly so according to UNDRIP (UN General Assembly, 2008), RSLFN community members have the right to free, prior, and informed consent [FPIC] to developmental activities. Due consultations can mitigate land use conflicts, thereby averting the escalation of litigations and continued discord (Natcher, 2001). Concerning the transboundary nature of mining impacts, in relation to the duty to consult, one of the respondents said:

> *"Just to let the surrounding people know what they are up to. Pretty much Kistigan Lake and Rorke Lake and Stall Lake, and Richardson because the whole lakes are connected."* -PIN 312.

An elder also commented on the unapproved existence of prospectors' camps in the territory, saying:

> *"Now, right along this river we have seen camps in there and these are the geologists that are there...it's a really high hill there all along both sides."* -PIN 313.

And when asked if the community was consulted prior to such prospecting activities, he answered:

> *"No, they don't but we see those camps. There's supposed to be like consultation if they want to, but they don't do that."* -PIN 313.

Another respondent commented on the unwanted way prospecting happens in the community:

> *"Just invasive prospecting we don't like. It's not appreciated. It's like walking into somebody's house and sit on... turns on the TV without their permission. All this trapline...Nobody should be there at all when we are not there unless they ask. They get permission first."* -PIN 303.

4.3.2. Outcome of the systematized review of archival reports on mining impacts

A detailed illustration of the mining developments' impacts is presented in Table 3. A summary of the impacts (Table 4), considering the construction/operation/decommissioning project phases, are like those envisaged or currently experienced by RSLFN members. These include impacts on water quality/quantity/disturbance regime, air quality, and habitat fragmentation and/or loss. Also, the emergence of disease(s) or an escalation of existing health

issues, noise, and light pollution scaring wildlife away and thus loss of country food, reduced opportunities for local knowledge sharing and community interactions. Further, impact on land use due to sensory disturbances and restricted access to mine areas, thus limiting hunting/gathering/cultural activities (Canadian Impact Assessment Registry, 2023).

Table 3 enlists the possible adverse impacts of selected gold and rare earth metal mines in northern Canada. The mining projects' activities descriptions show the types and scales of the mining operations, and the respective outputs responsible for the environmental, socio-economic, health, and land use impacts identified. Table 4 summarizes the adverse impacts according to the project phases- construction, operation, and decommissioning.

Table 3

Adverse Impacts of Selected Gold and Rare Earth Metals Mines in Canada's North

Project Title	Description	Assessment Link	Province	Ecozone/ Landscape	Possible Adverse Impacts				Notes
					Environmental	Socio-economic	Health	Land use	
Valentine Gold Project	Construction, operation, decommissioning, rehabilitation, and closure (after 13 years) of two open pit gold mines covering a total area of about 128 hectares (10,960 tonnes daily capacity) near Valentine Lake, approximately 55 kilometers southwest of Miller town. The geographical coordinates are 490055 m Easting and 5358023 m Northing, 113 km from the Miawpukek First Nation reserve at Conne River.	https://iaac-aeic.gc.ca/050/evaluations/document/143895	Newfoundland (NL)	The island of NL within the boreal forest ecoregion is characterized by rolling hills, thick to thin glacial material, bedrock outcrop, and wetlands (bogs and fens) in lower areas and basins.	A combined ore and waste material estimated at 453 million tonnes will contain only 41 million tonnes of ore, thereby leaving a burden of approximately 91% cyanide-laden waste on the environment. Potential increase in particulate matter concentration from access road upgrade/construction, blasting, mining, general earthworks, and GHGs from combustion processes. Possible surface and groundwater contamination by heavy metals and acid rock drainage from mine effluents and tailings.	Locals and their businesses may not be equitably represented employment and contracts wise. Fish and fish habitat may be impacted by pond/dam constructions. Impairment of outfitting operations.	Changes in the quality of water bodies result in aquatic animals' contamination (especially from mercury and cyanide). The potential effect of air and noise pollution on human health.	Potential loss of historical/cultural sites. Interference with recreational fishing activities. Changes in water flow. The potential effect of noise and light pollution on wildlife. Changing attributes of cultural and spiritual landscapes and altering Indigenous peoples' experience.	Species at risk include bats (especially Northern Myotis), American marten, Atlantic salmon, and **caribou**. Also, there is a risk of possible alteration or loss of lands or resources for traditional use.

					Loss of flora from site preparation. Noise from machinery and equipment operation.				
Whabouchi Mining Project	Nemaska Lithium Inc. proposed the construction, operation, restoration, and decommissioning of an open-pit and underground spodumene mine, 3,000 tonnes per day capacity for 26 years, 30 km east of Nemaska Cree Nation and 280 km from Chibougamau. The geographical coordinates are $75^0$51'49.7''W and $51^0$40'42.0''N.	https://iaac-aeic.gc.ca/050/evaluations/document/120496	Quebec (QC)	The ecozone is a boreal forest within the Rupert River watershed characterized by a mosaic of peat bogs and conifer and hardwood stands. The landscape consists of igneous and metamorphic rocks, with 50 to 75 meters in elevation.	The potential risk of spills of contaminated water in case of sedimentation pond dike damage. Noise impacts of waste rock and tailings pile on Cree camps around Nemiscau River and Bible camp. Effect of particulate matter and gaseous emissions (SO_2, NO_2, CO_2) from site preparation, vehicles, and mining operations. Potential decrease in the volume of watersheds during site preparation and mine development. Water pumping for mine dewatering can cause	Increased pressure on available amenities and services due to project-related increase in population. Landscape deterioration limiting social activities. Visual and auditory impacts of mine operation can disrupt social activities at the Bible Camp.	Human health concerns about consumption of fish and waterfowl from contaminated water. Possible presence of contaminants in other traditional foods from hunting and gathering. Effect of radioactive metals such as Uranium if discharged into waterbodies. Health concerns about changes in air quality.	Loss of breeding habitats and hence impact on the abundance of culturally adapted species. Changes in terrestrial and wetland environments can alter landscape elements, such as views from hunting camps.	Potential encroachment into trapline R20, thereby impacting fishing/ice fishing for sturgeon, furbearer trapping, big game and goose hunting, berry picking, and wood and medicinal plants harvesting. Potential impact on snowmobile trails, valued sites, portage trails, and navigable streams all within trapline R20. Species at risk include short-eared owls, northern myotis,and wolverine. Impacts on Indigenous

					groundwater drawdown and impact nearby wetlands. Possible erosion results in increased suspended solids and water quality alteration. Possible changes in water quality from sediment loading, acid mine drainage, and metal leaching.				rights include loss of hunting and gathering lands that fall within mine infrastructure and safety zone. And a reduction in wildlife populations and the quality of meat.
Brucejack Gold Mine Project	The proposed 2700 tonnes per day underground gold and silver mine (long-hole open stoping) location is adjacent to Brucejack Lake approximately 65 km north of Stewart Town with the regional district of Kitimat-Stikine. The mine, with a minimum 22-year mine life, will be approximately 160 km northwest of the	https://iaac-aeic.gc.ca/050/evaluations/document/101082	British Columbia (BC)	Terrestrial ecozone. Humid maritime and highlands. The biophysical landscape of this remote region is characterized by mountainous topography and glaciers.	Possible emissions of SO_2, NO_2, CO_2, dust, and particulates. Potential increase in metal concentrations and suspended solids from tailings and acid mine drainage.	Reduced local food availability due to land use and land cover changes from mining-related constructions, including expansion/upgrade of the existing 73 km access road, transfer station, and separate 60km transmission line corridor. The potential effect of fish habitat contamination on the fish population in the Unuk River watershed.	Exposure to mining-related accidents and health risks, thereby increasing the vulnerability of health and social infrastructure. Increased pressure on the water and sewage system of the host communities, thereby potentially weighing in on the health of the people. Generally, potential effects of changes to	Reduced access to culturally important resources and sites. Reduced chances of participating in culturally important activities and ceremonies. Possible disengagement from the local language.	Increased pressure on available housing due to population growth, thereby dovetailing into land use. The transmission line that will feed the mine will traverse past the Nass wildlife area, hence potentially reducing wildlife accessibility. Species at risk include bats (little brown myotis and northern

	nearest Nisga'a village. The geographical coordinates are 56.56348 and -130.23112.					Possible effect on hunting and trapping activities, thereby reducing opportunities for local knowledge sharing and community interactions, and people may need to purchase food from stores to compensate for the loss of country foods.	noise, air quality, water quality, and contamination of country foods will affect the health of Indigenous peoples.		myotis), birds (northern goshawk, common nighthawk, olive-sided flycatcher), western toad, grizzly bear, and wolverine. Potential interference with Indigenous rights on fishing, hunting, trapping, and gathering. The cumulative effect of previous mining operations in the region.
Akasaba West Copper-Gold Mine Project	Proposed construction, operation, and decommissioning of an open-pit gold and copper mine sited approximately 15 km east of Val-d-Or (within the traditional territories of Nation Anishnabe de Lac Simon and the Nation Anicinapek de	https://iaac-aeic.gc.ca/050/evaluations/document/124383	Quebec (QC)	The boreal forest is characterized by jack pines and black spruce, and relatively small hills formed by rocky outcrops and interspersed with wetlands.	Potential loss of fish habitat due to encroachment, reduction in water quantity, and degradation of water quality (from metal, metalloids, and organic contaminants) in watercourses, especially those affected by the ore transport road. Possible drawdown and	Reduction in fish population due to surface water quality degradation from metals and suspended solids, and quantity decrease. Impact of vegetation clearance on crop abundance, thereby impacting country food availability.	Health threats of noise and air pollution/dust propagation, and water contamination. Contamination of traditional fishing, hunting, and harvesting resources.	Loss of aquatic habitat due to encroachment. Also, 'potential on trapping of terrestrial wildlife. Cultural and spiritual implications of the Caribou population	Birds at risk include the Common Nighthawk, the Olive-sided Flycatcher, Canada Warbler, Rusty Blackbird, and Short-eared Owl. Other species at risk are woodland caribou, northern myotis, and snapping turtles. Too intense or

	Kitcisakik), with geographical coordinates: -77.580744^{0}W and 48.043099^{0}N. The project, which constitutes an open pit and containment and storage area for overburden and waste rock, is scheduled to extract 5.1 million tonnes of ore over a four-year period.				contamination of groundwater. Potential disturbance from noise, vibration, and lighting. Transboundary effects of GHG emissions.				persistent noise may scare away birds and other wildlife. Also, tree felling may impact birds' nesting and population. Transboundary environmental effects like GHG emissions. Impact on use of land (about 93 hectares that will be under restriction) and resources for traditional purposes, and interference with Indigenous rights to hunting.

Note. Canadian Impact Assessment Registry, 2023

Table 4

Summary of Adverse Impacts of Mining Projects

Project Phase	Impact Type			
	Environmental	**Health**	**Socio-economic**	**Land use**
Construction	Effect on the surface and groundwater quantity due to change in hydrologic flow regime. Particulate matter and emissions from combustion engines/trucks. Possible change in vegetation species from invasive species or direct habitat loss. Change in wetland functions due to disturbance regime.	Potential changes in community well-being and physical health conditions due to project-related changes in population, income, noise, and emissions.	Changes in fish habitat levels due to dewatering or infilling from the construction of mine infrastructure, thereby affecting the fish passage and population. Noise and light pollution can scare wildlife and affect outfitting operations. Potential pressure on local amenities and services. Possible effect on hunting and trapping activities, thereby reducing opportunities for local knowledge sharing and community interactions, and people may need to purchase food from stores to compensate for the loss of country foods.	Changes in avifauna and other wildlife abundance due to habitat fragmentation from vegetation clearing and infrastructure installation. Changes to caribou movement and mortality due to site preparation activities and vehicular collision. Changes to land use due to sensory disturbances and restricted access to mine areas. Thereby limiting hunting, gathering, and recreational activities. Changing attributes of cultural and spiritual landscapes and altering Indigenous peoples' experience. Effect of dam infrastructure on water stability and the resultant impact on water transportation.
Operation	Effect on the surface and groundwater quality from activities that result in a change of physical and chemical properties of water resources. GHG emissions from combustion processes. Possible spillage of diesel or hazardous substances.	Potential changes in community well-being and physical health conditions due to project-related changes in population, income, access to local foods, and emissions. Generally, potential effects of changes to noise, air quality, water quality, and	Changes in fish habitat quality due to contamination from process water flows, thereby affecting the fish population. Blasting near fish habitats and increased fishing pressure can potentially affect fish health/survival and abundance.	Changes in avifauna abundance due to occurrences such as vehicular collisions, increased predation, and harvest pressure. Changes in caribou abundance due to sensory disturbance.

	Possible changes in water quality from sediment loading, acid mine drainage, and metal leaching.	contamination of country foods will affect the health of Indigenous peoples.	Emissions, noise, and light pollution can affect wildlife abundance. Increased pressure on existing local infrastructure and services due to project-related population growth. Possible effect on hunting and trapping activities, thereby reducing opportunities for local knowledge sharing and community interactions, and people may need to purchase food from stores to compensate for the loss of country foods.	Changes to land use due to sensory disturbances and restricted access to mine areas. Thereby limiting hunting, gathering, and recreational activities. Changing attributes of cultural and spiritual landscapes/sites and altering Indigenous peoples' experience. Impacts on Indigenous rights include loss of hunting and gathering lands that fall within mine infrastructure and safety zone.
Decommissioning	Particulates and solid wastes from demolition activities.	Health concerns of particulate matter concentrations from demolition activities.	The discomforts associated with adapting to life after the mine.	The discomforts associated with re-adjusting to physical and cultural attributes post-decommissioning of mine. Coping with permanent loss of land use, in the absence of alternatives.

Note. Canadian Impact Assessment Registry, 2023

The only environmental audit document accessed was that of Victoria Gold Corp's Eagle Gold Mine. However, the audit, as disclaimed by the consulting company (Stantec Consulting Ltd.), is completely based on desktop assessment without any site verification or data validation. Thus, conclusions and recommendations drawn from this audit document may not be suitable for the purpose of this research and hence excluded from this review.

The summary of actual and potential adverse environmental, health, socio-economic, and land use impacts of mining activities (Table 4) obtained from the systematized review corroborates the findings from the mapping and interview analysis methods. Expectedly, the community-specific impacts revealed by the mapping and interview methods are but a subset of the findings from the archival study, which covers a wider range of territories. Therefore, the triangulation of these research findings with this systematized review has strengthened the credibility of these findings as regards mining impacts.

4.4. Policy Implications

The importance of the entire traditional territory of RSLFN, which extends beyond their reserves and across the provincial boundary, is depicted in the land use, density, and hot spot maps. Most of the land uses, as revealed by the greenstone belt map (Figure 16), are on or within greenstone belts indicative of the significance of these regions to the sustenance of livelihood. The Manitoba provincial laws favour the designation of these greenstone belts for mining purposes above other land uses (Thompson et al., 2019).

Red Sucker people's wish is that their ancestral land be void of industrial developments, including mining. They intend to fulfill their sacred role of maintaining the pristine nature of the forests. Mining claims at Monument Bay and Lingman Lake, as designated by the provinces of Manitoba and Ontario (Ministry of Northern Development and Mines, 2023; IMAQS, 2022), are

either overlapping on land use hot spots or in proximity thereby clashing with the traditional activities and livelihood of RSLFN people. Manitoba government should prioritize the protection of Indigenous land and water against industrial development (Manitoba Indigenous, and Northern Relations in Thapa, 2018). However, RSLFN reaches over two provinces with different regulators. Therefore, the policy implication of my research should extend to both provinces and to the federal level of the Canadian government. The same fate of mining impacts await [or already befall] other First Nations endowed with greenstone belts as revealed by the systematized review result.

The Canadian government has joined the global recognition of the important role that Indigenous peoples can play in climate change mitigation through the conservation of forests using an Indigenous-led approach. The Federal government, through the Indigenous-led Area-based Conservation (ILABC) funding program initiative, empowers Indigenous governments to protect and conserve lands and waters in their traditional territories. However, the ILABC program does not fund any areas nearby to greenstone belts (Environment and Natural Resources Canada, 2022). This explains the unsuccessful outcome of the expression of interest (EOI) in the ILABC funding submitted by Island Lake Tribal Council, called Anishininew Okimawin, in 2022.

The relationships between traditional land use and greenstone belts revealed by my research, if considered and incorporated into provincial policymaking for land designation, could be instrumental in the national reconciliation pursuit. Recognizing the pertinence of Indigenous-led land protection to the Indigenous people of Red Sucker and accommodating this wish in policymaking processes, could be crucial in redressing the damages of the past (Youdelis et al., 2021). The Red Sucker people wish to determine land uses on their territory.

Further, the federal and provincial governments' reconsideration of land use purposes for greenstone belts. By considering greenstone belts as IPCAs, achieving Canada's Target 1 for

biodiversity would be advanced (Zurba et al., 2019). Including greenstone belts in Indigenous Protected and Conserved Areas (IPCAs) will increase the span of conserved forests, and thus foster greater biodiversity, carbon sequestration, and better climate action (Wardle et al., 2012). An increase in biodiversity will amount to an abundance of wild food and promote ecosystem balance (Zakharchenko et al., 2018; Catovsky et al., 2002).

Chapter Five: Conclusion and Recommendations

This research aimed to analyze and document the issues and impacts of mining exploration and related activities at Monument Bay and other proximal mines on the traditional land use areas of Red Sucker Lake First Nation. Based on a quantitative and qualitative analysis of semi-structured interviews and archival impact assessment data, industrial mining interferes with traditional land use practices of the Red Sucker Lake First Nation people and inhibits Indigenous-led nature conservation. The 21 base map biographies depicting traditional land use and occupancy of the interviewees in RSLFN, however, represent a small fraction of the community's population.

The results show that greenstone belts are on/within traditional land use sites for animal hunting, bird/eggs harvesting, cultural activities, fishing, and plants/wood/earth materials harvesting, which are the bane of sustenance for this remote fly-in community. Also, the results indicate that noise from mining-related activities has affected moose hunting and other practices in this territory, and thus the availability of traditional food. Mining supplies fly in and out of the RSLFN in helicopters and planes creating frequent noise and disruption without any no-fly zones or times to protect wildlife. Spills made and property damaged by contractors and explorers who cover up these issues, and are only discovered when the community flags it. Amidst these adverse impacts of mining activities on the community, RSLFN members have continually been denied adequate consultation. A cumulative result is the impairment of Indigenous knowledge transfer from elders and knowledge holders to younger generations, thereby disrupting nature conservation.

The methods employed in this mapping research with RSLFN for interviews, maps, and archival study were expectedly effective in addressing my research questions and advancing progress in the quest for the protection of these richly biodiverse spots, self-determination, and *Mino Bimaadiziwin* for the Indigenous peoples. This research clearly illustrates the importance of

Indigenous-led land protection [greenstone belts and buffers inclusive], but it also uncovers the need for determining community-specific strategies toward land protection. Red Sucker is peculiarly a fly-in community; hence, their strategy for land protection could be unique. Further research to determine the specific strategy that the Red Sucker people wish to adopt for their land protection is needed, due to the limitations of this study. The outcome of this further research could be important in formulating a template for Indigenous-led land protection strategy for other fly-in First Nation communities.

The findings of my research could help protect the lives and livelihood of RSLFN people from the impacts of mining. Evidence of clashes between mining claims and traditional land use sites should inform provincial decision-making in favour of land protection for the sustenance and well-being of the Indigenous peoples of RSLFN. This land protection will, by extension, benefit the entire Island Lake region. Gaps in knowledge indicated by the literature, regarding documenting the spatial relationship between actual land use sites of RSLFN people and mining claims/greenstone belts, have been addressed by this study. Also, other community-specific impacts of mining developments have been uncovered.

The results of this study challenge existing federal and provincial regulations on the use of greenstone belts and buffers. The Province having laws stating that mining is the best and only "sustainable" use of greenstone belts counteracts Canada's stance as a global leader in the green economy campaign (Thompson et al., 2020; Hayden, 2014; Kuyek, 2005). This use of the term sustainable is counter to the quest for an inclusive, low-carbon, and biodiverse Canada (MacArthur et al., 2020). This is also contradictory to Indigenous protected and conservation areas, where Indigenous people decide what pristine lands in their territory to protect for biodiversity and conservation. My research findings have shown that these pristine forests, designated greenstone

belts, fall within the traditional territory of the RSLFN people. These greenstone belts are high traditional land use spots, and the people's desire is to keep them intact and void of industrial development.

In brief, my research revealed that:

- Red Sucker Lake First Nation's traditional land use area is more expansive than the RSLFN reserve or trap lines;
- Industrial mining interferes with the traditional land use practices of affected Indigenous peoples and inhibits Indigenous-led nature conservation, with spills, contractors, explorers and frequent noise from mining needing better mechanisms for resolution and Indigenous governance;
- Red Sucker Lake First Nation community members desire Indigenous-led land protection and conservation, and have been part of requests for funding IPCAs;
- There are lapses in the execution of the duty to consult. Hence, RSLFN members are not duly consulted prior to industrial development bids on their traditional territory;
- Current resource extraction policies are inconsiderate of First Nations' wishes for land use on their territories and thus do not favour Indigenous-led protection of greenstone belts/buffers and the actualization of *mino bimaadiziwin* (the good life).

Therefore, to address resource extraction issues through a combination of Western science and Indigenous approach, my recommendations are:

1. Land protection for the sustenance and well-being of the Indigenous peoples of RSLFN should come before mining or other provincial interests.

2. A change of governments' policies, requiring the designation of greenstone belts for mining purposes solely inconsiderate of RSLFN's and other First Nations' wishes for land use, is needed.
3. Red Sucker Lake First Nation should be legislatively allowed to determine land uses on their territory.
4. Requests for land protection and nature conservation should be funded, and not rejected as was done with the Island Lake ILABC.

Clearly, this participatory indigenous research has identified the interference of mining-related activities with traditional land use/ecological knowledge protection and shown the significance of greenstone belts to the sustainability of RSLFN's livelihood. Thus, this research has uncovered the need for provincial and federal governments to recognize greenstone belts/buffers as IPCAs when RSLFN and other First Nations are calling for their Indigenous-led protection and conservation.

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Appendix 1

Geoscientific map showing mining claims at the Monument Bay

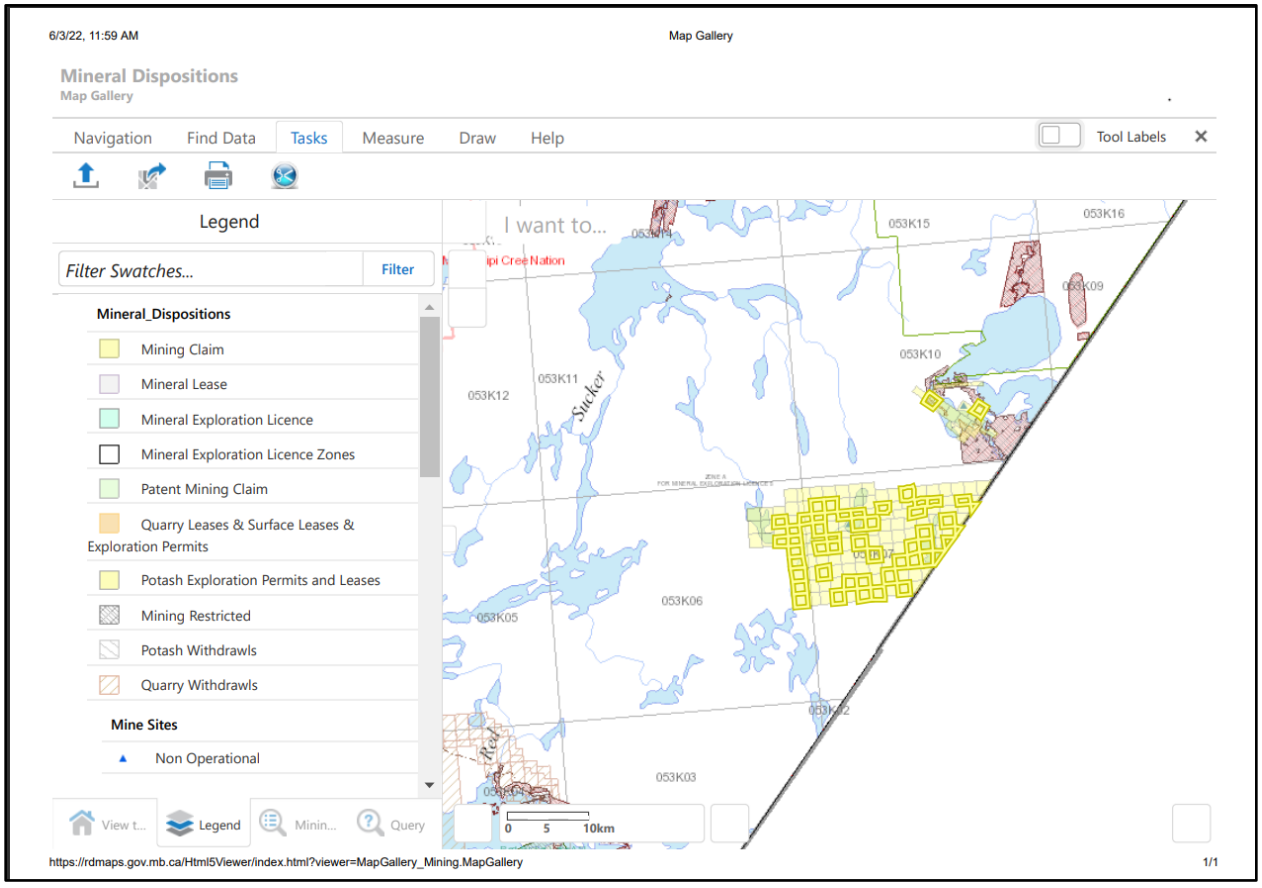


Figure 1. Geoscientific map showing mining claims at the Monument Bay
Source: Manitoba Map Gallery

Geoscientific map showing mining claims in Island Lake Territory

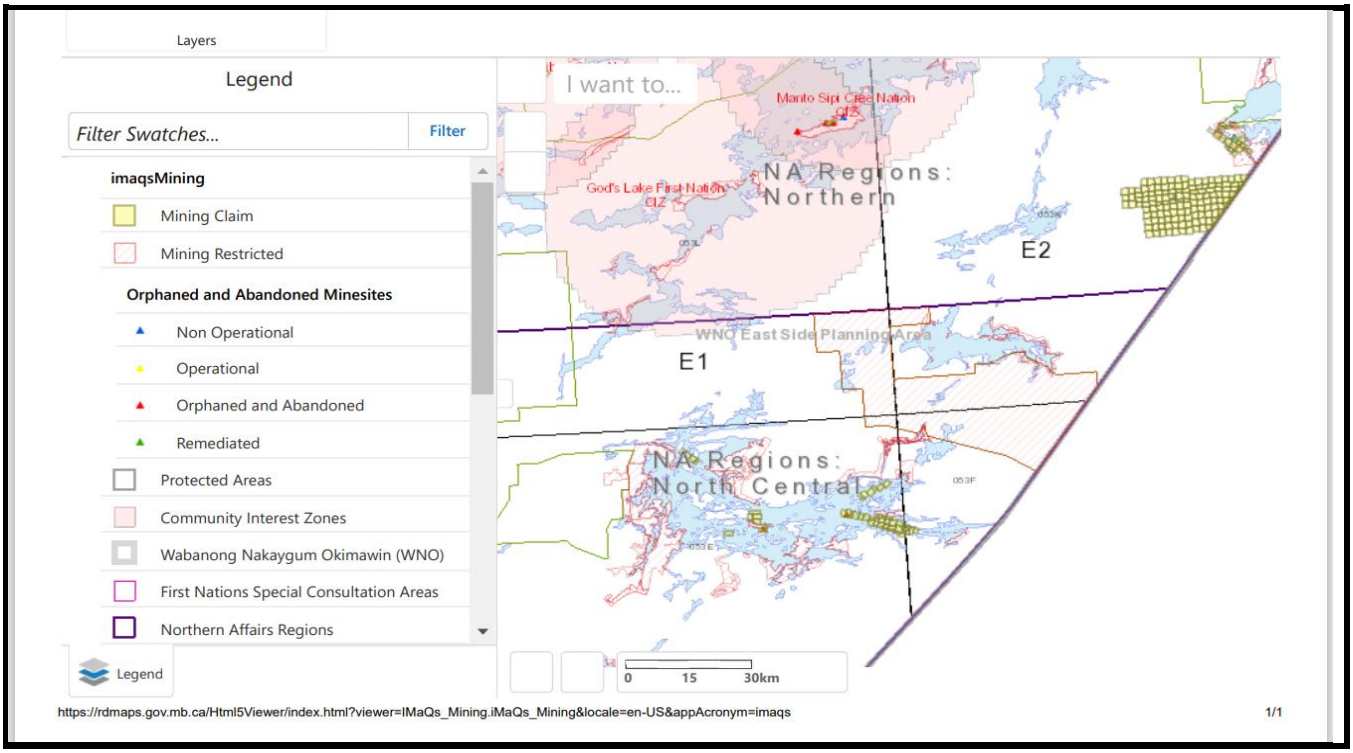


Figure 2. Geoscientific map showing mining claims in Island Lake Region
Source: Integrated Mining and Quarrying System, Manitoba

Proposed resource management area for the Island Lake Region by the Island Lake Tribal Council

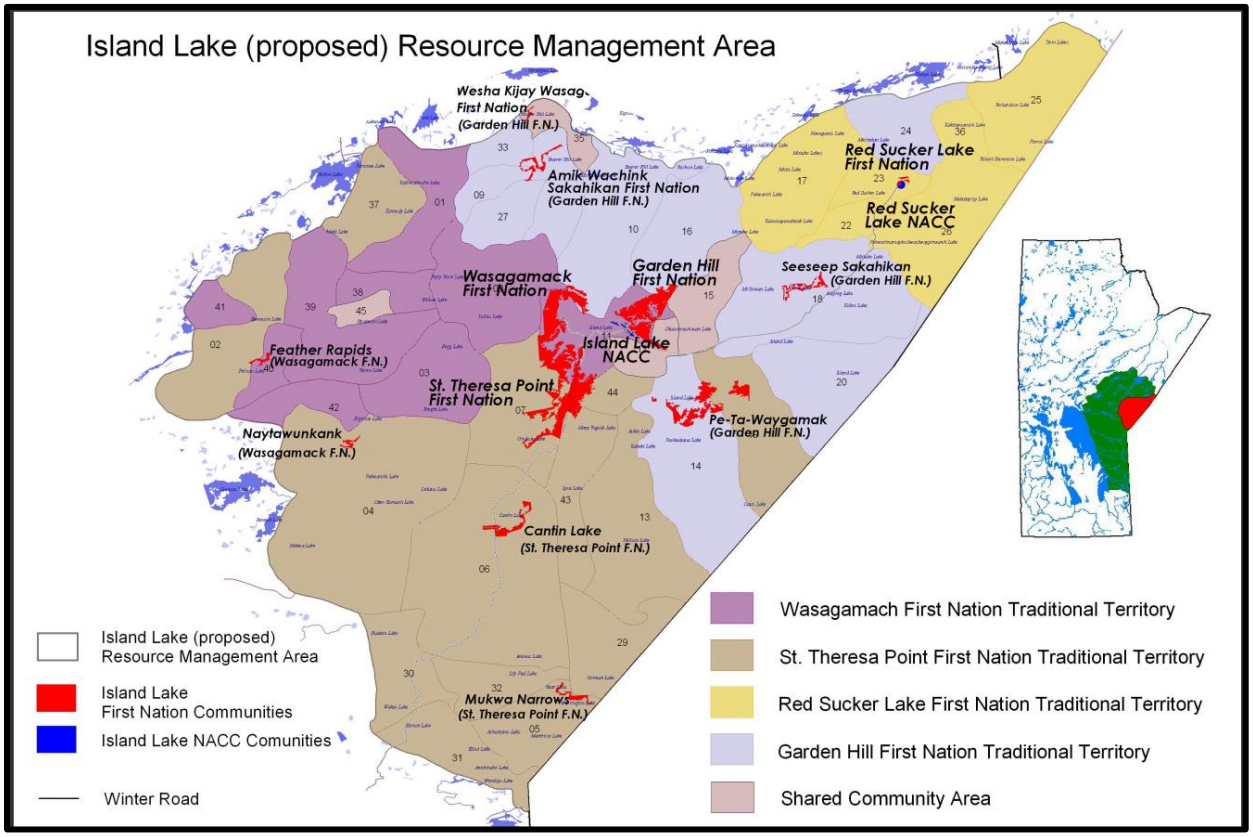


Figure 3. The proposed resource management area for the Island Lake Region by the Anishininew Okimawin Grand Council.
Source: Manitoba Map Gallery

Mining claims and Exploration Licences in Manitoba

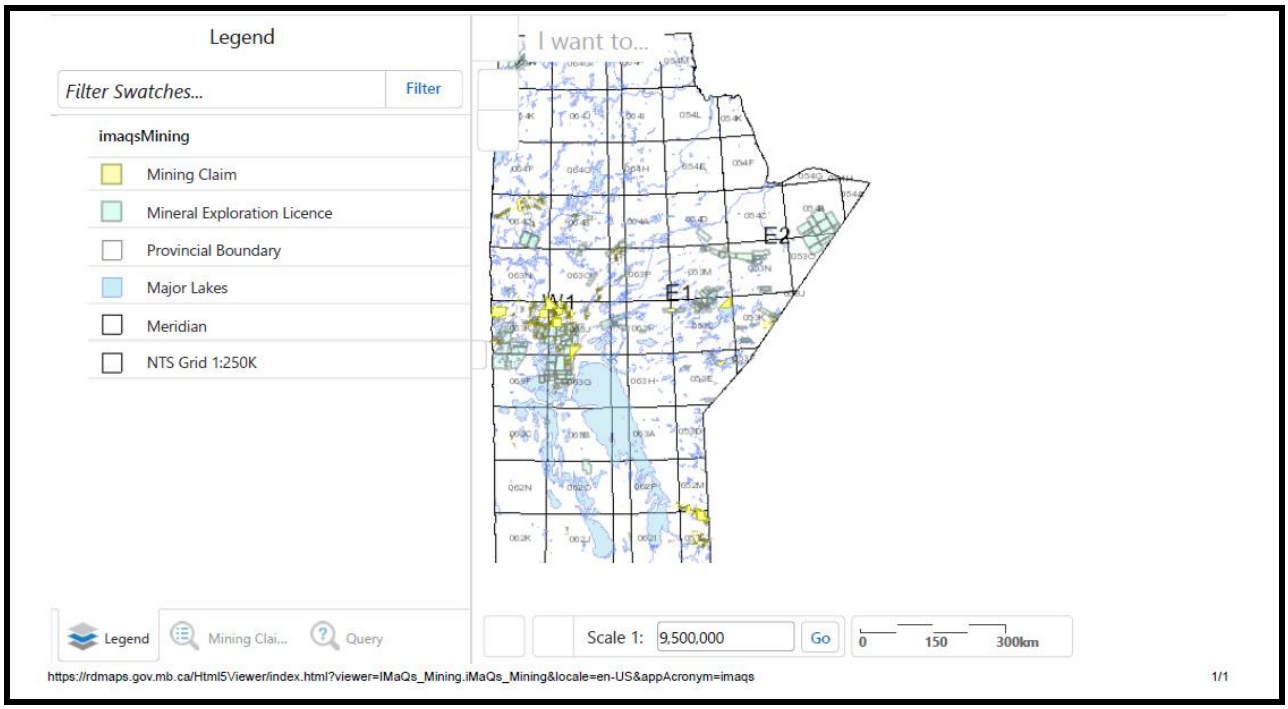


Figure 4. Map showing mining claims and mineral exploration licences in the province of Manitoba
Source: Integrated Mining and Quarrying System, Manitoba

Spatial Locations of RSLFN and Monument Bay

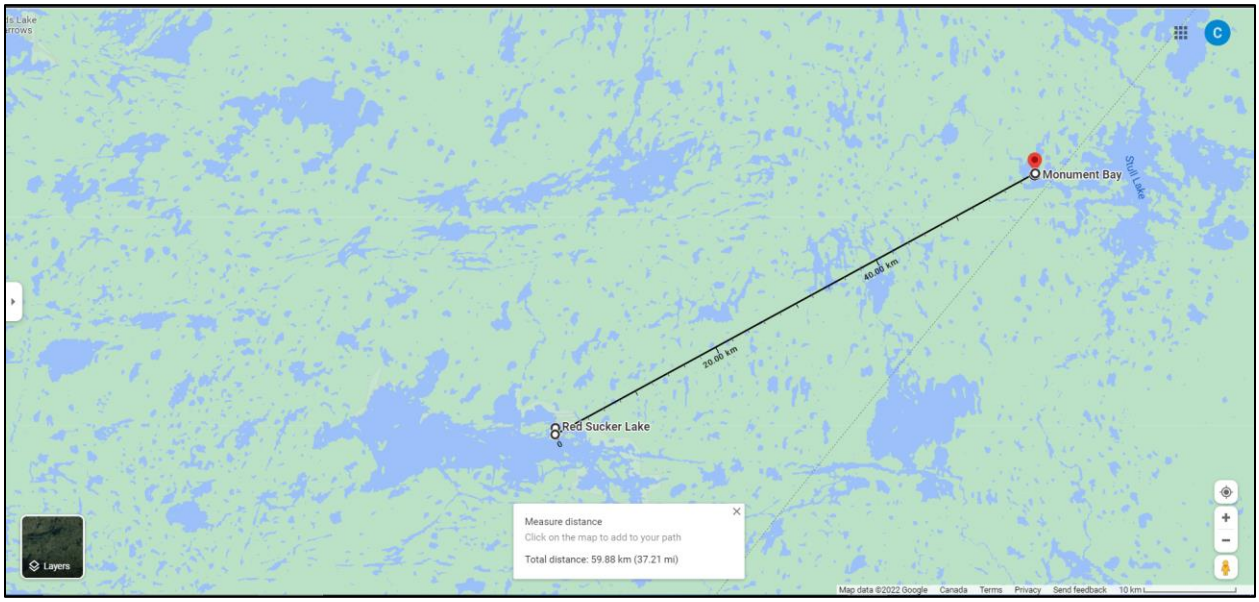


Figure 5. Map showing the distance between Red Sucker Lake First Nation community and the gold exploration site at Monument Bay
Source: Google Earth

The proximity of RSL to mineral exploration and mining sites



Figure 6. Map showing proximity of Red Sucker Lake First Nation community to the gold exploration site at Monument Bay (60km away) and the mine at Lingman Lake (66km away)
Source: Google Earth Pro

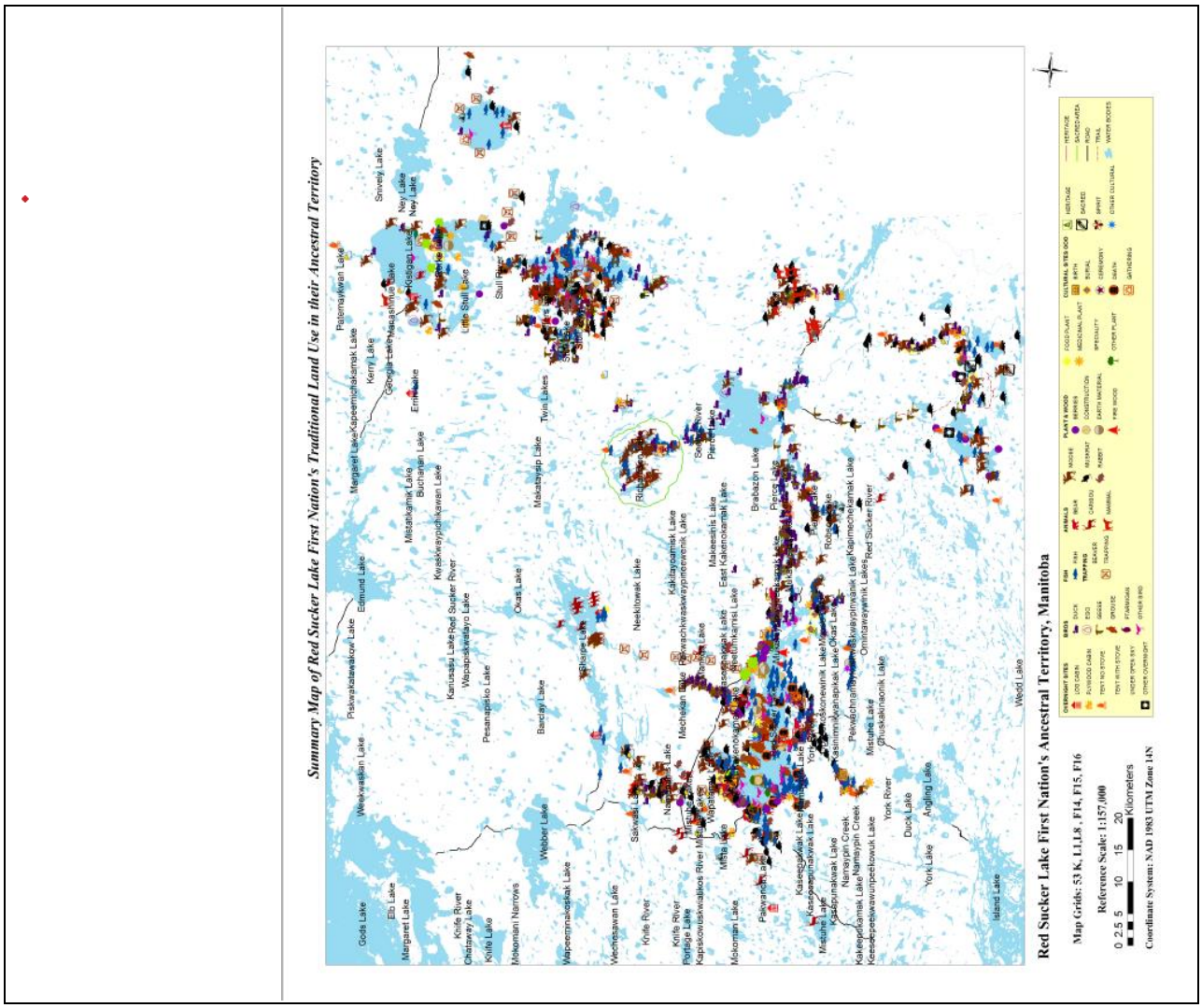


Figure 7**.** Summary Map of traditional land use sites of 14 RSLFN members as of 2018

Source: Dr. Thompson's laboratory

Appendix 2

United Nations Declaration on the Rights of Indigenous Peoples

Article 3

Indigenous peoples have the right to self-determination. By virtue of that right they freely determine their political status and freely pursue their economic, social and cultural development.

Article 8

1. Indigenous peoples and individuals have the right not to be subjected to forced assimilation or destruction of their culture.

2. States shall provide effective mechanisms for prevention of, and redress for:

(a) Any action which has the aim or effect of depriving them of their integrity as distinct peoples, or of their cultural values or ethnic identities;

(b) Any action which has the aim or effect of dispossessing them of their lands, territories or resources;

(c) Any form of forced population transfer which has the aim or effect of violating or undermining any of their rights;

(d) Any form of forced assimilation or integration;

(e) Any form of propaganda designed to promote or incite racial or ethnic discrimination directed against them.

Article 10

Indigenous peoples shall not be forcibly removed from their lands or territories. No relocation shall take place without the free, prior and informed consent of the indigenous peoples concerned and after agreement on just and fair compensation and, where possible, with the option of return.

Article 11

1. Indigenous peoples have the right to practice and revitalize their cultural traditions and customs. This includes the right to maintain, protect and develop the past, present and future manifestations of their cultures, such as archaeological and historical sites, artifacts, designs, ceremonies, technologies and visual and performing arts and literature.

2. States shall provide redress through effective mechanisms, which may include restitution, developed in conjunction with indigenous peoples, with respect to their cultural, intellectual, religious and spiritual property taken without their free, prior and informed consent or in violation of their laws, traditions and customs.

Article 12

1. Indigenous peoples have the right to manifest, practice, develop and teach their spiritual and religious traditions, customs and ceremonies; the right to maintain, protect, and have access in privacy to their religious and cultural sites; the right to the use and control of their ceremonial objects; and the right to the repatriation of their human remains.

2. States shall seek to enable the access and/or repatriation of ceremonial objects and human remains in their possession through fair, transparent and effective mechanisms developed in conjunction with indigenous peoples concerned.

Article 13

1. Indigenous peoples have the right to revitalize, use, develop and transmit to future generations their histories, languages, oral traditions, philosophies, writing systems and literatures, and to designate and retain their own names for communities, places and persons.

2. States shall take effective measures to ensure that this right is protected and also to ensure that indigenous peoples can understand and be understood in political, legal and administrative proceedings, where necessary through the provision of interpretation or by other appropriate means.

Article 18

Indigenous peoples have the right to participate in decision-making in matters which would affect their rights, through representatives chosen by themselves in accordance with their own procedures, as well as to maintain and develop their own indigenous decision-making institutions.

(b) Any action which has the aim or effect of dispossessing them of their lands, territories or resources;

(c) Any form of forced population transfer which has the aim or effect of violating or undermining any of their rights; (d) Any form of forced assimilation or integration; (e) Any form of propaganda designed to promote or incite racial or ethnic discrimination directed against them.

Article 23

Indigenous peoples have the right to determine and develop priorities and strategies for exercising their right to development. In particular, indigenous peoples have the right to be actively involved in developing and determining health, housing and other economic and social programmes affecting them and, as far as possible, to administer such programmes through their own institutions.

Article 26

1. Indigenous peoples have the right to the lands, territories and resources which they have traditionally owned, occupied or otherwise used or acquired.

2. Indigenous peoples have the right to own, use, develop and control the lands, territories and resources that they possess by reason of traditional ownership or other traditional occupation or use, as well as those which they have otherwise acquired.

3. States shall give legal recognition and protection to these lands, territories and resources. Such recognition shall be conducted with due respect to the customs, traditions and land tenure systems of the indigenous peoples concerned.

Article 27

States shall establish and implement, in conjunction with indigenous peoples concerned, a fair, independent, impartial, open and transparent process, giving due recognition to indigenous peoples' laws, traditions, customs and land tenure systems, to recognize and adjudicate the rights of indigenous peoples pertaining to their lands, territories and resources, including those which were traditionally owned or otherwise occupied or used. Indigenous peoples shall have the right to participate in this process.

Article 29

1. Indigenous peoples have the right to the conservation and protection of the environment and the productive capacity of their lands or territories and resources. States shall establish and implement assistance programmes for indigenous peoples for such conservation and protection, without discrimination.

2. States shall take effective measures to ensure that no storage or disposal of hazardous materials shall take place in the lands or territories of indigenous peoples without their free, prior and informed consent.

3. States shall also take effective measures to ensure, as needed, that programmes for monitoring, maintaining and restoring the health of indigenous peoples, as developed and implemented by the peoples affected by such materials, are duly implemented.

Article 31

1. Indigenous peoples have the right to maintain, control, protect and develop their cultural heritage, traditional knowledge and traditional cultural expressions, as well as the manifestations of their sciences, technologies and cultures, including human and genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs, sports and traditional games and visual and performing arts. They also have the right to maintain, control, protect and develop their intellectual property over such cultural heritage, traditional knowledge, and traditional cultural expressions.

2. In conjunction with indigenous peoples, States shall take effective measures to recognize and protect the exercise of these rights.

Article 32

1. Indigenous peoples have the right to determine and develop priorities and strategies for the development or use of their lands or territories and other resources.

2. States shall consult and cooperate in good faith with the indigenous peoples concerned through their own representative institutions in order to obtain their free and informed consent prior to the

approval of any project affecting their lands or territories and other resources, particularly in connection with the development, utilization or exploitation of mineral, water or other resources.

3. States shall provide effective mechanisms for just and fair redress for any such activities, and appropriate measures shall be taken to mitigate adverse environmental, economic, social, cultural or spiritual impact.

Article 37

1. Indigenous peoples have the right to the recognition, observance and enforcement of treaties, agreements and other constructive arrangements concluded with States or their successors and to have States honour and respect such treaties, agreements and other constructive arrangements.

2. Nothing in this Declaration may be interpreted as diminishing or eliminating the rights of indigenous peoples contained in treaties, agreements and other constructive arrangements.

Article 38

States in consultation and cooperation with indigenous peoples, shall take the appropriate measures, including legislative measures, to achieve the ends of this Declaration.

Article 39

Indigenous peoples have the right to have access to financial and technical assistance from States and through international cooperation, for the enjoyment of the rights contained in this Declaration.

Article 40

Indigenous peoples have the right to access to and prompt decision through just and fair procedures for the resolution of conflicts and disputes with States or other parties, as well as to effective remedies for all infringements of their individual and collective rights. Such a decision shall give due consideration to the customs, traditions, rules and legal systems of the indigenous peoples concerned and international human rights.

Article 41

The organs and specialized agencies of the United Nations system and other intergovernmental organizations shall contribute to the full realization of the provisions of this Declaration through the mobilization, inter alia, of financial cooperation and technical assistance. Ways and means of ensuring participation of indigenous peoples on issues affecting them shall be established.

Article 42

The United Nations, its bodies, including the Permanent Forum on Indigenous Issues, and specialized agencies, including at the country level, and States shall promote respect for and full application of the provisions of this Declaration and follow up the effectiveness of this Declaration.

Article 43

The rights recognized herein constitute the minimum standards for the survival, dignity and well-being of the indigenous peoples of the world.

Appendix 3

Overview of Canada's Impact Assessment Act 2019

Purposes of the Impact Assessment Act

• To foster sustainability, ensure respect of Government's commitments with respect to the rights of Indigenous peoples

• To include environmental, social, health and economic factors within the scope of assessments

• To establish a fair, predictable and efficient impact assessment process that enhances Canada's competitiveness and promotes innovation

• To consider positive and adverse effects

• To include early, inclusive and meaningful public engagement

• To promote nation-to-nation, Inuit-Crown, and government-to-government partnerships with Indigenous peoples

• To ensure decisions are based on science, Indigenous knowledge and other sources of evidence

• To assess cumulative effects within a region

The Impact Assessment Act:

• Lays out the impact assessment process and timelines

• Identifies factors that must be taken into account during the impact assessment and decision-making

• Provides tools to support cooperation and coordination with other jurisdictions

• Enables the Agency to support participant engagement through funding programs

• Requires transparency through information made publicly available on the Registry

• Provides tools and authorities to ensure compliance

Subsection 22(1)

(a) Changes to the environment or to health, social or economic conditions (including malfunctions, accidents and cumulative effects)

(b) Mitigation measures

(c) Impacts on any Indigenous group and on the rights of Indigenous peoples

(d) The purpose and need for the project

(e) Alternative means of carrying out the project

(f) Alternatives to the designated project

(g) Indigenous knowledge provided with respect to the designated project

(h) The extent to which the designated project contributes to sustainability

(i) The extent to which the effects of the designated project hinder or contribute to the Government of Canada's ability to meet its environmental obligations and its commitments in respect of climate change

(j) Any change to the designated project that may be caused by the environment

(k) The requirements of the follow-up program in respect of the designated project

(l) Considerations related to Indigenous cultures raised with respect to the designated project

(m) Community knowledge provided with respect to the designated project

(n) Comments received from the public

(o) Comments from a jurisdiction that are received in the course of consultations conducted under section 21

(p) Any relevant assessment referred to in section 92, 93 or 95

(q) Any assessment conducted by or on behalf of an Indigenous governing body

(r) Any study or plan that is conducted or prepared by a jurisdiction — or an Indigenous governing body — that is in respect of a region related to the designated project

(s) The intersection of sex and gender with other identity factors

(t) Any other matter relevant to the impact assessment that the Agency or the Minister requires to be taken into account.

Planning phase

Purpose

• To introduce proposed projects into the impact assessment process

• To engage with Indigenous peoples and the public to identify issues and concerns, including potential impacts to Indigenous rights, related to proposed projects

• To produce a Detailed Project Description and to respond to identified issues and concerns

• Proponents may alter the project description to respond to issues and concerns or to alter project design

• This early planning opportunity can help avoid key issues coming up later in the assessment process

• To determine whether an impact assessment is required

To identify opportunities and plan for collaboration/cooperation with other jurisdictions

• Impact Assessment Cooperation Plan

• To provide clarity and certainty around meaningful participation and consultation throughout the impact assessment process

• Public Partnership Plan

• Indigenous Engagement and Partnership Plan

• To provide clarity to proponents on anticipated regulatory needs for the project to proceed

• Permitting Plan

• To tailor guidelines that will clearly identify studies and information requirements for the Impact Statement developed by the proponent

• Tailored Impact Statement Guidelines

Impact Statement Process Phase

Purpose To outline and evaluate impacts of a project (Proponent)

• Proponent prepares its Impact Statement based on the Tailored Impact Statement Guidelines

• These guidelines are the result of scoping that took place in the Planning Phase

• They describe the necessary information and studies that are required in the proponent's Impact Statement

• Proponent gathers information through studies and by engaging with Indigenous groups and the public to inform the Impact Statement

• Proponent seeks advice from the Agency and federal authorities, as necessary, to better reflect the guideline requirements in the Impact Statement

Impact Assessment Process Phase

Purpose To outline and evaluate impacts of a project (Agency), including

• Analysis of the Proponent's Impact Statement

• Technical review of the Impact Statement

• Preparation of a draft Impact Assessment Report and draft potential conditions

• Engagement with public and Indigenous groups to seek their views

• Consultation with Indigenous groups

• Potentially, co-development of parts of Impact Assessment Report and potential conditions with Indigenous groups

• Finalized Impact Assessment Report and potential conditions that are sent to the Minister to inform the public interest decision

Decision-making Phase

Purpose Determination by the Minister, or by Governor in Council (Cabinet) on whether the adverse effects, and adverse direct or incidental effects, are in the public interest par. 60(1)a s.62 Public interest determination is be based on the Impact Assessment Report and a consideration of the following factors:

• Project's contribution to sustainability

• Extent to which adverse effects within federal jurisdiction and the adverse direct or incidental effects are significant

• Associated mitigation measures

• Impacts on Indigenous groups and adverse impacts on rights

• Extent that project's effects hinder or contribute to Canada's environmental obligations and climate change commitments

Post-decision phase

Purpose

• To verify the accuracy of predictions laid out in the Impact Assessment Report

• To verify the effectiveness of the mitigation measures

• To provide opportunities for Indigenous peoples and the public to participate in monitoring

• To encourage continuous improvements to impact assessments

Appendix 4

Survey Questions

Part 1

1. What is your date of birth? Where were you born? Your parents' names? Mother's maiden name? A brief sharing of who you are?

Part 2

Google Earth Map will be projected and shared through the zoom or printed maps will be employed, and the interviewee will be asked to mark areas.

In this part I am going to ask questions about places you or other _____FN people have stayed overnight while trapping, hunting, fishing, gathering, traveling, or working in the bush.

(Note: all overnight sites are going to be mapped as points).

I'm now going to ask questions about places you or other _____ First Nation people have stayed overnight while trapping, hunting, fishing, gathering, traveling, or working in the bush.

2. Did you ever build or help build a cabin? If yes indicate the spots. Who owns (or owned) that cabin? Are the cabin walls made of logs or plywood? Did you ever sleep overnight in that cabin? Do people still stay overnight in that cabin or is it abandoned?

3. Did your brother or other relatives build a cabin? If yes indicate the spots. Who owns (or owned) that cabin? Are the cabin walls made of logs or plywood? Did you ever sleep overnight in that cabin? Do people still stay overnight in that cabin or is it abandoned?

4. Did you ever build a shack-tent? If yes indicate the spots. Who owns (or owned) that cabin? Are the cabin walls made of logs or plywood? Did you ever sleep overnight in that cabin? Do people still stay overnight in that cabin or is it abandoned?

5. Did your brother or other relatives ever build a shack-tent? If yes indicate the spots. Who owns (or owned) that cabin? Are the cabin walls made of logs or plywood? Did you ever sleep overnight in that cabin? Do people still stay overnight in that cabin or is it abandoned?

6. Are there any places you have slept overnight in a tent with a wood-burning stove. If yes indicate some spots. Whose tent was it?

7. Are there any places where you stayed out overnight in a tent that didn't have a wood-burning stove in it? If yes, indicate some spots.

8. Are there any places that you stayed out overnight under a Lean-to or under a tarp? If yes, indicate some spots.

9. Are there any places where you stayed out overnight under the stars? If yes, indicate some spots.

10. Are there any places you stayed overnight in any kind of other overnight structure? Examples might be a forestry company building, a tourist camp or in a vehicle or boat. If "yes" indicate some spots. What did you sleep in at each spot?

Part 3

We're now going to talk about trapping.

11. Have you ever done trapping anywhere on these maps? By trapping, we mean the setting of any kind of trap or snare for any kind of furbearers, but not including rabbits or bears. If 'yes' please indicate the areas.

12. Have you ever trapped and killed a beaver? If yes indicate some spots.

13. Have you ever trapped and killed a muskrat? If yes indicate some spots.

14. Have you ever trapped and killed other species including mink, marten, rabbits or bears for use for clothing or food?

Part 4

I'm now going to ask questions about where you killed different kinds of animals – fish, birds, and mammals. For this part of the interview, we want to map only places where you killed animals to feed your family or community. 1) we only want to map spots you killed animals and took some home for eating purposes. 2) we don't want to mark a spot where you killed animals for commercial or peddling purposes unless you also took some home to eat. 3) we don't want to mark spots where you killed animals for tourists while you were guiding unless you took some of the meat to eat. 4) we don't want to mark spots where you shot an animal but couldn't find it to take home. 5) we don't want to mark spots where you killed animals that were used only for dog food or trapping bait. Only places where you killed animals to eat.

NOTE: all animal-kill sites are to be mapped only as points, not lines or polygons.

15. Are there any places where you killed Lake trout or sturgeon and took some home to feed your family? If yes, indicate some spots.

16. Are there any places that you helped check a domestic net, where you killed fish and took some home to feed your family? If yes, indicate some spots.

17. Are there any places that you helped check a commercial net, where you killed fish and took some home to feed your family? If yes, indicate some spots?

18. Are there any places that you used a rod and reel or any kind of hook and line gear, where you killed fish and took some home to feed your family? If yes, indicate some spots.

19. Are there any places where you used any kind of different gear, where you killed fish and took some home to feed your family?

20. Are there any places you killed ducks (including scoter) or geese or swans to feed your family? If yes indicate some spots.

21. Are there any places you killed waterhen (coots) or Loon or merganser or sandhill crane to feed your family? If yes indicate some spots.

22. Are there any places you harvested grouse (partridge/prairie chicken) or ptarmigan to feed your family? If yes indicate some spots.

23. Are there any places where you harvested any kind of other bird to feed your family? Examples might be grebe, owl, eagle, seagull, or even small birds like blackbirds. If 'yes' indicate some spots.

(Indicate the code, and the kind of bird for all OB sites, in the IRF or on your scribble pad.

24. Are there any places you collected bird eggs to feed your family? If yes indicate some spots. What kind of eggs did you collect at each spot?

25. Are there any places you harvested moose or bear to feed your family? We are not interested in marking places you killed these animals for tourists unless you took some meat home to feed your family. If yes indicate some spots.

26. Are there any places you harvested caribou or deer to feed your family? If yes indicate some spots.

27. Are there any places you harvested rabbit or porcupine to feed your family? If yes indicate some spots.

28. Are there any places you shot (not trapped) and killed beaver or shot and killed muskrat to feed your family? If yes indicate some spots.

29. Are there any places you harvested any kind of other mammals that your family ate? Examples might be lynx, squirrel, and groundhog. If yes, indicate some spots.

<u>Part 5</u>

I'm now going to ask questions about where you collected different kinds of plants and wood for direct family use. We don't want to mark spots where you collected plants or wood for commercial or peddling purposes.

Plant, wood, and earth-material collecting sites are to be mapped as points, lines, or polygons, depending on the extent of the area the respondent actually collected the plant or material. Remember

we are mapping harvesting sites. We are not mapping habitat. We are not mapping the presence or absence of the resource.

30. Are there any places you collected berries to feed your family? We don't want to mark spots where you collected berries for commercial sale unless you took some for your family to eat. If yes indicate some spots. What kind of berry did you collect?

31. Are there any places you collected/harvested food plants to feed your family including wild rice? If 'yes' indicate some spots. What kind of food plant did you collect at each spot?

32. Are there any places you collected medicine plants? If yes, indicate some spots. What kind of medicine plants did you collect at each spot?

33. Are there any places you collected Moss for things like chinking cabin logs, insulating ice houses, and use for baby diapers? If yes indicate some spots? What did you use the moss for?

34. Are there any places you collected peat for gardening or other purposes? If yes indicate some spots? What did you use the peat for?

35. Are there any places you gardened? If yes indicate the areas?

36. Are there any places you collected specialty wood? These are wood collected specifically for making tools or utensils, like birch for snowshoe frames or tamarack for toboggans. If 'yes' indicate some spots. What kind of wood did you collect at each spot, and what was made with it?

37. Are there any places you collected construction wood? Examples might be logs for building a cabin or poles for making a dock or smokehouse. If 'yes' indicate some spots. What was built?

38. Are there any places you collected firewood for heating a building, cabin, or shack tent? If yes, indicate some spots. We don't want to mark spots where you cut wood for commercial sale unless you used some for your own family's heating needs.

NOTE: do not mark sites that were used only for cooking fire or at a temporary overnight site like a tent or lean-to.

39. Are there any places you collected OTHER plants or wood for direct family use? An example might be a plant or wood used for doing rituals or ceremonies or for tanning hides or for making a dye to color things or for making smoking tobacco. If yes indicate some spots. What kind of plant or wood did you collect at each spot and what was it used for?

40. Are there any places you collected soapstone? If yes indicate some spots. What kind of plant or wood did you collect at each spot and what was it used for?

41. Are there any places you collected any EARTH MATERIAL for direct family use? These are soils, sand, clay, and rocks that are used for things like building dock cribs, cabin foundations, fireplaces, and gravel for making cement. If yes, indicate some spots. What kind of material did you collect at each spot and what was it used for?

Part 6.

I'm now going to ask questions about other kinds of cultural sites. For all the questions about animals and plants up until now, we've only been interested in places where you personally harvested things, anytime in your lifetime. For the rest of the questions, we're interested in marking sites you know about, even if you did not personally use them.

We want to mark sites, even if they were before your time, insofar you know for sure that the site was used by your First Nation people in your lifetime, or in the lifetimes of your parents or grandparents. If a site was only used farther back in time than that, then we won't mark it.

42. Do you know of any settlements? These are places where different families had cabins and lived together for a period of years, more or less on a year-round basis. If yes indicate the sites.

43. Do you know of any gathering places? Are there places where different families came together at a particular time of year and camped together in tents for a period of days for purposes of harvesting a particular resource or for a special social event? If yes, please indicate the sites.

44. Do you know of any waginogans or wigwams sites (WG) or Teepee or Tipis (TP) sites?

45. Do you know of any shaking tent (SH) sites?

46. Do you know of any heritage cabin sites? A heritage cabin is an abandoned cabin that was built by your parents or grandparents or any other old people of their generation - -and whether it was built either before you were born or when you were a child. It doesn't matter, whether the cabin is still standing or has rotted away. If yes, please indicate the spots. Who owned the cabin?

47. Do you know of any burials out on the land - -places where a First Nation person was buried? If yes, indicate the sites. Who is buried there?

48. Do you know of any birth sites out on the land – places where your First Nation person was born? If yes, indicate the sites. Who was born there?

49. Do you know of any death sites out on the land – places where a person from your First Nation passed away? If yes, indicate the sties? Who died there?

50. Do you know of any legend or spirit sites out on the land? These are places or landforms that people associate with a particular legend or spirit. If yes, indicate the sites. What do you know about the place?

51. Do you know of any sacred areas out on the land? These are places that are sacred to your family or community and they can be sacred for any reason. If yes, indicate the sites. What is sacred about that place?

52. Do you know of any other cultural sites that we should map? Examples might be trading posts, rock paintings or ceremony sites. If 'yes" indicate the sites. What kind of site is it?

Part 7

53. Where are the places you visited where ecological knowledge of habitats and sites is critical to the survival of important animal populations; for instance, caribou migration corridors, islands where moose calve, waterfowl breeding grounds and staging areas, and spawning beds.

54. Would you share any traditional protocol or practices or knowledge or stories related to the use and

protection of animals, plants, water, land, and air by your ancestors, Elders, and community members?

55. What are the Travel and trade routes that you have traveled on your land and are important?

56. Why is land important to you, your family, and community? Could you share your special events and memories that you had on your land?

57. What are the names of key areas on your land in your language? What are the key words/sentences in your language that you think or feel or talk while you are out on your land ?

58. What areas should be protected where no development should occur? Are there any areas that would be acceptable to develop for industrial or commercial uses or tourism?

59. Are there eskers, artisan well, water springs, special land formation that should be protected?

60. Are you aware of any impacts of the industrial developments such as mine, hydro, lumber, etc.? Could you show on the map and describe the impacts of such development?

61. How would you want your ancestral land to be governed, and why do you think this model/way of land governance is important to you?

62. What are your thoughts on the term reconciliation? How comfortable are you with the term "reconciliation" regarding the governance of your land?

63. How would reconciliation look like for your land and community/nation? The Truth and Reconciliation Commission of Canada's final report highlights "reconciling with land/nature" is another important part of reconciliation, besides reconciling relationships between settlers and Indigenous peoples in Canada. What does this mean to you? How can this be achieved?

64. Would you like to share anything that we did not cover in this interview? Or do you have any question to us?

With this we come to the end of this interview. Thank you for participating in this interview. Recording will be stopped, and the interview will end.

Appendix 5
Research Budget

In real-world impact evaluations, researchers have limited control over project implementation amidst other contextual factors. These uncertainties make it rather difficult to draw up a flexible budget. In this study, the remoteness of the study area will also influence the personnel cost including transportation, lodging, feeding, etc. Barring unforeseen eventualities, the budget for the proposed study has been summarised in Table 5. It is noteworthy that I have received stipend and funding to date, but the budget ends in December 2022, while the UMGF scholarship continues till September 2023.

Table 5
Cost of the Research Work

	Unit	Cost/unit (CAD)	No. of units	Total cost (CAD)
Travel & subsistence				
Airfare	Round trip	500	1	1000
Accommodation	Nights	200	3	600
Total				**1600**
MITACS support x 4 = 40,000 CAD				
Grand total = 41, 600 CAD				

Note. Field trip to Red Sucker Lake FN for land use study, 2022 and research internship stipend

Appendix 6

Project Schedule of Major Activities and Deliverables Timeline

Timelines have been projected for the successful execution of the proposed project as shown in Table 6.

Table 6

Proposed Schedule of Major Activities and Deliverables Timeline

Stages	Major Activities and Deliverables		Date								
			June 2022	August 2022	September 2022	Oct. 2022	Nov. 2022	Dec. 2022	Mar-Jun. 2023	Jul-Aug. 2023	Sep. 2023
Preliminary	Needs assessments for impact monitoring										
	Community plan visions and revisions										
	Ethics processing										
	Draft research proposal feedback from the supervisor						Nov. 4th				
	Submit a research proposal to John for approval for the 2-week review						Nov. 14th				
	Submit a thesis proposal to the thesis committee for 2-week review						Jan. 14th				
	Thesis advisory committee meeting						Jan. 30th				
	Proposal defense						Jan.30th				
Data Collection& Processing	Visit to RSLFN for interviews and mapping, pictures, and video recordings				Sep. 21st-Sep. 24th						
	Secondary data										
	Data preparation, cleaning, and analysis	Map scanning					Completed				
		Map digitization					Completed				
		Interviews transcription						Jan. 30th – Feb. 28th			
	Report to the community and Anishininew Okimawin Grand Council								Mar. 20th		
Reporting & Presentation	Thesis submission (First draft) to supervisor								Apr.10th		
	First draft committee meeting								Apr. 24th		
	Preparation of the final thesis and submission to the supervisor								May. 24th		
	Send the final draft to John for approval								Jun. 1st		
	Review and send to the thesis committee								Jun.15th		
	Thesis defense									Jul. 30th	
	Revision and submission to M-space									Aug. 10th	
	Research journals, community-led guides, and reports										Sep. 10th

*Note***.** Thesis Process manual and RSL Land Guardianship program outline

Appendix 7

A Red Sucker Lake First Nation member and his son with his first moose kill



L-R: A RSLFN member and his son exercising their traditional knowledge. Son shot and killed his first Moose at the age of 35, while his father had his first kill at age 17. A young man's first moose kill has cultural significance in RSLFN and is considered a right of passage.