Restoring *Manomin* (Wild Rice): A Case Study with Wabaseemoong Independent Nations, Ontario

by

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Abstract

This thesis focuses on *manomin* (wild rice) ecocultural restoration by Wabaseemoong Independent Nations (WIN) in Northwestern Ontario. Ecocultural restoration includes the recovery of habitats and re-establishment of relationships between WIN and *manomin*. The objectives are to: 1) Describe the past and present state of rice-related practices in WIN and changes of the 20th century 2) Select and document a restoration site(s) 3) Identify the possibilities for the involvement of school students in the restoration process 4) Design a prototype for a wild rice camp that contributes to relationship re-establishment. The main pillars of the WIN restoration process - traditional ecological knowledge (TEK), site selection, involvement of children and young people, and transformative learning experienced by adult participants of a wild rice camp – are the main study components. The project is guided by a design-based methodology with data gathered through interviews, design workshops, participant observation, and biophysical methods.

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Acronyms

BCD: Biocultural Design

HCD: Human-Centered Design

IUCN: International Union for Conservation of Nature

IJC: International Joint Commission

IRLWWB: International Rainy-Lake of the Woods Watershed Board

JK: Junior Kindergarten

SER: Society for Ecological Restoration

TEK: Traditional Ecological Knowledge

WD: Wild Design

WIN: Wabaseemoong Independent Nations

WTLUA: Wabaseemoong Traditional Land Use Area

Glossary of Design-Related Words

Convergent thinking: The process of limiting the number of ideas and refining these ideas (Brown, 2009; Davidson-Hunt et al., 2012)

Creativity: The ability of people to make adjustments to their lives in order to meet their aspirations (Gatt & Ingold, 2013)

Design: Process and product of developing and planning the form and the structure of both material and non-material things

Design anthropology: "A field that seeks to understand how the processes and artifacts of design help to define what it means to be human" (Tunstall, 2013, p. 238)

Design brief: A short and precise document that establishes the aim and boundaries of a design project (Brown, 2009)

Design thinking: The ability to be intuitive and construct emotionally charged and functional ideas (Brown, 2009).

Design workshop: Workshops that contribute to the transition from research to design by bringing to light different agendas and understandings (Kjærsgaard, 2013)

Divergent thinking: Process of creating ideas and considering a full range of ideas (Brown, 2009; Davidson-Hunt et al., 2012)

Guiding coordinates: Very broad guiding principles, less strict and more flexible than guidelines that help those involved in a design process to make choices when specific outcomes are unknown (Davidson-Hunt et al., 2012)

Ideation: Space in design thinking that focuses on generating, developing, and testing ideas (Brown, 2009)

Implementation: Actions undertaken to move from a prototype to the wider acceptance of an innovation in a market or service delivery (Brown, 2009)

Innovation: Generation of change (Davidson-Hunt et al., 2012).

Inspiration: Activities undertaken early in a design process that facilitate the identification of a problem by participants and motivate them to search for solutions (Brown, 2009).

Prototype: Model that fulfills a certain purpose and which is desirable, feasible, and viable (Brown, 2009).

Glossary of Anishinaabe Words Related to Wild Rice (*Manomin*)

1. Manominikewin - Wild Rice Harvesting

Apwi – Paddle a Canoe

Bawa`am – Knock Wild Rice

Dagwaagan - Fall

Gaandakii`iganaak – Push Pole

Manominaatig/Manominaatigoons – Rice Stick/Little Rice Stick

Manominike – Harvest Wild Rice

Manominikewag – People Gathering Wild Rice

Niibi – Water

Tootooshaabo Manomin – Rice in the Milk Stage

Wiigwaaso Jiimanes – Birch Bark Canoe

Zaaga`igan – Lake

Ziibi – River

2. Kiishtoon Manomin – Finished Rice

Baasaan Manomin – Dry Wild Rice

Baawishkaam – Dance (on Wild Rice)

Kaakaapisigan – Roasting Tray

Kaakaapite – Roasted (Rice)

Kiizis – Sun

Mashkimot– Bag

Na`esitoon - Store (Wild Rice)

Nodin – Wind

Nooshkaachige – Winnow (Wild Rice)

Ogaapizaan – Parch (Wild Rice)

Ozoowaanowashk – Husks

Pagwaanike - Hole in the Ground

Wiigwaas – Birch Bark

Wiigwaaso Onaagan – Birch Bark Tray

3. Miichim – Food

Kiizhite Manomin - Cook Wild Rice

Manomin Naboob – Wild Rice Soup

4. Kiikwekoke`iinan - Teachings

Manaachitoon Manomin – Take Care of Wild Rice

Pizaan - Keep Quiet

Kwiishkosin Nodin Tabiitaanimon - Whistle and the Wind Will Come

5. Maamo – Miigwetchedam - Thanksgiving

Asema – Tobacco

Kizhe-Manito Kizhewaatiziwin - Gift of the Creator

Pagichigewinan - Offering

Wiigwas Onaagan – Birch Bark Offering Plate

Wiikonge – Feast

6. Gabeshiwinan - Campsite

Ishkode – Fire

Makizini Ataatiwinin – Moccasin Game

Pagwaanegamik – Tents

CHAPTER 1: INTRODUCTION

Chapter 1 aims to establish the context of this study and theoretical background prior to outlining the study's purpose and specific objectives. The next section briefly summarizes the study's methodology, which is described in detail in Chapter 3. The selection of a case study community is described after the methodology. Also, the chapter explains the significance of this study, both theoretical and practical. At the end, the structure of the thesis is presented.

1.1. Study Context and Theoretical Background

This study focuses on the ecocultural restoration of wild rice, an annual aquatic grass of *Zizania spp.*, by the Anishinaabe[1] community of Wabaseemoong Independent Nations (WIN) in Northwestern Ontario, Canada. The Anishinaabe name for wild rice is *manomin*[2], which is most often translated as "good berry" or "good seed", which testifies to the importance and positive role of this plant in Anishinaabe culture (Vennum, 1988).

Manomin has served as a dietary staple and a cultural keystone species of spiritual, symbolic, and economic significance for Aboriginal people of southern Québec, Ontario, and Manitoba, and eastern United States since before recorded time (Belcourt, 2000; Nabhan, Walker, & Moreno, 2010; Vennum, 1988). Before European contact, wild rice had been mostly harvested by Siouan and Algonquian peoples (Vennum, 1988). For the last three centuries, the principal harvesters have been the Anishinaabeg, who have been bound to *manomin* through stories, subsistence, and economic activities. According to Vennum (1988), they moved westward along the Great Lakes because of the rice fields that existed there.

[1] The Anishinaabeg/Anishinaabe people are also widely known as Ojibway, Ojibwa, Ojibwe, or Chippewa. This study uses the term *Anishinaabe/Anishinaabeg* (plural) which is preferred by the Anishinaabeg living in Ontario.
[2] Within this study, the Anishinaabe word *manomin* is used interchangeably with *wild rice* and preferred to the term *wild rice* in references to Anishinaabe culture.

Until the 1900s, Anishinaabe ricing[3] had remained mostly subsistence-based and relatively stable; however, the last century was a time of enormous changes at the international, national, and local levels (Drewes & Silbernagel, 2006; Vennum, 1988). Cultural changes, which were mostly reflected through the loss of cultural values and traditional practices, often resulted from economic and ecological changes. The introduction of wild rice paddies in the USA and mechanical equipment for wild rice harvesting and processing led to changes in wild rice harvesting economics, diminishing the economic importance of wild rice in some areas, and increased commercial exploitation of wild rice in other areas (Lee, 1986c; Vennum, 1988). For instance, in Canada, the natural ranges of *manomin* habitat in Northwestern Ontario and Manitoba have less wild rice at present than in Saskatchewan, where the crop was introduced in the 1930s (Archibold, 1995). Tourism development was also pernicious for wild rice because it resulted in the establishment of parks and protected areas in traditional ricing areas and increased boat traffic through wetland wild rice habitat (Vennum, 1988). Increased pollution caused by industrial development lowered the quality of wild rice (Vennum, 1988). Another threat described in Vennum (1988) was hydroelectric development, which changed water levels and flooded wild rice fields both in the USA and in Canada, including Northwestern Ontario.

WIN communities of Whitedog Lake[4], One Man Lake, and Swan Lake, located in the Wabaseemoong Traditional Land Use Area (WTLUA) north-west of Kenora, Ontario, also suffered from the hydroelectric developments on the Winnipeg and English Rivers in the 1950s. Due to the rise of One Man Lake's water level by three meters and flooding of 1600 hectares of land, which resulted in the disruption of traditional subsistence activities such as hunting, fishing,

[3] In accordance with Vennum (1988), ricing encompasses wild rice harvesting and all stages of finishing (processing).

[4] In this study, the Anishinaabe word *Wabaseemoong* or WIN is further used for the community, while *Whitedog* is used for the lake.

trapping, and wild rice harvesting, the people of One Man Lake had to move to Wabaseemoong (Smith, 1995). Inhabitants of Swan Lake were also gradually displaced and moved to the Wabaseemoong reserved lands which is the present day location of the community. At present, there are only four seasonal cottages on One Man Lake and two permanent houses on Swan Lake (Elder M. McDonald, personal communication, Apr. 10, 2014). Also, because most lakes and rivers in the WTLUA are topographically lower than the Winnipeg and English Rivers, the natural water fluctuation levels required for *manomin* were disrupted in many areas. Although hydroelectric development was not the only negative change, a WIN representative identified it as the main reason for the disruption of ricing practices in WTLUA (Appendix 1).

This study presents a holistic process of *manomin* restoration. As restoration implies revitalizing the natural composition, structure, and dynamics of an ecosystem, as well as relationships between humans and nature represented through language, cultural appreciation, and traditional activities (Palmer, Falk, & Zedler, 2006; Shebitz & Kimmerer, 2005; Uprety, Asselin, Bergeron, Doyon, & Boucher, 2012), this initiative is best identified as *ecocultural restoration*[5], which integrates ecological processes with cultural practices and requires a high level of community engagement (Kimmerer, 2011; Martinez, 2003, 2011, 2014). Also, ecocultural restoration implies that the well-being of an ecosystem is closely connected to the well-being of humans and involves projects guided by both material and spiritual responsibility.

This project identifies various elements that need to be restored and describes each of them in detail. This study is founded on both Western science-based knowledge and traditional ecological knowledge (TEK), because the integration of diverse worldviews creates unique opportunities for finding solutions at the intersection of nature and culture (Anderson, 1996;

[5] The choice of the term is explained in detail in Section 2.2.

Kimmerer, 2002, 2012). Also, both adult and young WIN members participate in the restoration process, which focuses on the intergenerational continuity of ricing practices. The re-establishment of the younger WIN members' relationships with *manomin* requires the involvement of the WIN Mizhakiiwetung Memorial School, while adult community member involvement must be reinstated through direct participation in ricing activities. Thus, this project is interdisciplinary, comprehensive, and practical, and aims to serve as a model for similar community-based restoration studies.

1.2. Research Purpose and Objectives

The research purpose and objectives presented below reflected the interests and intentions of WIN community members that were expressed in the design brief provided to the researcher by a community representative at the beginning of the project (Appendix 1) and throughout the project. The purpose of this study was to initiate, co-design, and study a community-based process that aimed to include both adults and young people in the ecocultural restoration of wild rice. The specific objectives were to:

1. Describe the past and present state of wild rice-related practices in WIN and changes that occurred in the 20th century.

Under this objective, TEK was documented. The juxtaposition of the past and present of ricing, as well as the description of changes that occurred in the 20th century, demonstrated the need for wild rice restoration processes and showed what exactly needed to be restored. The description of the present values and knowledge of both adults and young people indicated the disruption of intergenerational knowledge continuity. Overall, this objective clarified the need for ecocultural restoration of both habitats and relationships between WIN members and

manomin. Although ricing practices were documented as early as a century ago (Stickney, 1896), it is not clear how much knowledge is retained of these practices in the WIN community.

2. Select and document a site(s) for ecocultural restoration efforts.

Out of the sites where WIN members had harvested *manomin* historically, two sites were selected based on the criterion of accessibility, as well as diverse cultural and ecological criteria. Site-specific biophysical methods were used for each of the two sites.

3. Identify the possibilities for the involvement of school students in the restoration process.

This objective focused on the community school's actions for the direct and indirect involvement of students in the restoration process. Most of the actions prioritized were undertaken in 2014; thus, the thesis describes finished products.

4. Design a prototype for a wild rice camp that contributes to the re-establishment of relationships between adult WIN members and *manomin*.

The fourth objective introduced a prototype for a wild rice camp that was developed and tested during the project. It was hypothesized that a good prototype contributed to the relationship re-establishment through participants' instrumental, communicative, and transformative learning. Thus, camp participants' learning outcomes were documented.

1.3. Methodology and Methods

A pragmatic worldview, which focuses on solutions to problems and the use of methods that work, guided this research project (Creswell, 2014). A mixed methods research design allowed meeting both qualitative and quantitative objectives; however, the qualitative approach was prevalent and quantitative forms of data collection were embedded in a broader qualitative case study (Creswell, 2014; Yin, 2009). The ecocultural restoration design methodology used

within this study was influenced by biocultural (Davidson-Hunt et al., 2012), wild (Higgs, 2003; Higgs & Hobbs, 2010), and human-centered design paradigms (Brown, 2009), which are described in detail in Chapter 3.

The main qualitative research methods employed during my fieldwork in June-October 2014 were participant observation, semi-structured interviews (Stage A and Stage B), and design workshops. Participant observation mostly allowed for data triangulation and relationship building with research participants (Bernard, 2006). Stage A semi-structured interviews conducted with 29 Elders and adults[6], as well as nine young people aged 18-29 allowed me to obtain data pertaining to the first, second, and third objectives. Stage B semi-structured interviews conducted with 14 Elders, adult wild rice harvesters, teachers, and young people aged 18-29 who participated in the wild rice camp in September 2014 also provided some data related to the first objective, but mostly aimed at understanding the learning outcomes of the camp and identifying how the prototype should be improved for its future use, which corresponds to the forth objective. Data obtained through interviews were discussed, interpreted, and verified at design workshops, which included diverse facilitation techniques as described in Kjærsgaard (2013). Also, design workshops contributed to the development of the restoration process.

Quantitative biophysical methods, which corresponded to the second objective, varied for different sites. Depending on site characteristics, vegetation surveys, bathymetric mapping, water level fluctuation monitoring, water sampling, and wild rice transects were used.

Fieldwork was carried out in accordance with the Joint-Faculty Research Ethics Board at the University of Manitoba (Appendix 2). All research participants completed letters of informed consent and indicated if they wanted to be referred by name or recorded (Appendix 3).

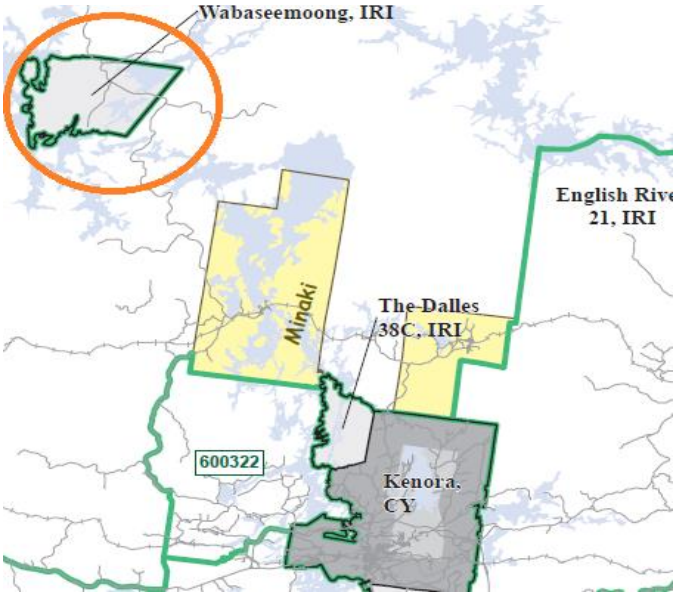
[6] Within this study, Elders were WIN individuals aged over 50 who identified themselves as Elders or were identified by others as Elders.

1.4. Selection of a Case Study Community

WIN expressed an interest in collaborative work with the University of Manitoba within the scope of the Social Science and Humanities Research Council (SSHRC)-supported grant "Partnering in the Development of a Biocultural Design Network". Discussions about a potential collaborative project lasted for about a year, during which potential research partnerships on WIN heritage, cultural landscape management, biodiversity-based community development, and Aboriginal innovation were explored. The wild rice ecocultural restoration project was supported by both the university and the community.

WIN is an Anishinaabe community formerly known as Islington Band # 29, located along the Winnipeg River 120 km north-west of Kenora, Ontario (Figure 1). Wabaseemoong Traditional Land Use Area (WTLUA), where the community is located, has a territory of 6,720 square kilometers ("Wabaseemoong Traditional Land Use Area", n.d.). The community is a part of Treaty # 3, which was signed in 1873 between Anishinaabe people of the Rainy River, Lake of the Woods, English River, Winnipeg River, and the Canadian Crown (Roberts, 2005).

Figure 1: Map of WIN Community (Source: Statistics Canada, Geography Division, 2011 Census of Population)



1.5. Significance of the Study

A critical shortcoming with many restoration projects is that their emphasis on either ecological or cultural restoration objectives prevails over the other. Also, many restoration projects rely heavily on external expertise. This community-based project is comprehensive because it is based on both qualitative and quantitative methods of data collection, focuses on different aspects of the restoration process, and also involves WIN members of different ages. Thus, it meets participants' aspirations to restore their cultural keystone species and relationships with it and serves as a model of ecocultural restoration for other projects and communities.

Also, this study contributes to the literature on ecocultural restoration and transformative learning. Additionally, it uses an ecocultural restoration design methodology, which differs considerably from common ecological restoration methodologies. The practical outcomes for WIN are a prototype for a wild rice camp, maps, and materials on *manomin* for the school. Moreover, the design process strengthens endogenous community development efforts and enhances individual and collective capacity building among participants.

1.6. Structure of the Thesis

This thesis consists of eight chapters. Following this chapter, Chapter 2 provides the theoretical context for this research, which is comprised of four main subject areas: wild rice, ecocultural restoration, involvement of young people, and transformative learning. Chapter 3 presents a detailed description of the methods employed in this research. The description of the worldview, research design, and methodology precedes the methods. The next four chapters address the study objectives separately. This form of presentation is chosen because in mixed methods research, data often need to be analyzed separately and concurrently in spite of their overall integration (Creswell, 2014). Chapter 8 includes a summary of the study and conclusions.

CHAPTER 2: LITERATURE REVIEW

"*Wild rice is intimately tied to the Anishinaabe's cultural identity, and they are willing to protect the rice at a considerable cost*" (Stiles, Altiok, & Bell, 2010)

This chapter summarizes findings from other studies related to wild rice, ecocultural restoration, the participation of children and young people in the restoration process, and transformative learning. It provides an overview of the main biological and cultural characteristics of wild rice, as well as recent research related to wild rice. It also explains the concept and the process of ecocultural restoration. In addition, this chapter outlines the main possibilities for the involvement of children and young people in the restoration process with a focus on restoration-based education and the incorporation of knowledge into school curriculum. The final section explains the process of transformative learning and the relevance of this theory.

2.1. Wild Rice

This section presents the main information about wild rice, including its importance, history, distribution areas, species native to North America, role in economics, and habitat requirements. It also reviews recent studies, project, and initiatives with a focus on habitat requirements and food sovereignty.

2.1.1. General Information about Wild Rice

Wild rice is a plant native to the Great Lakes region of North America (Archibold, 1995; Vennum, 1988). In Northwestern Ontario and Northeastern Manitoba in Canada, as well as Minnesota and Wisconsin in the USA, large stands of wild rice existed as long as 2500 years ago, and wild rice was already harvested for human consumption 1000 years ago (Lee, 1986c). Since then, the wild rice geographic range has extended through deliberate human introduction and reduced in some areas due to human-caused destruction of the plant's habitat (Archibold, 1995). While the amount of harvested rice has decreased in Northwestern Ontario, Saskatchewan

has become the main wild rice harvesting province in Canada (Archibold, 1995). The three species of wild rice native to North America are *Zizania palustris, Zizania aquatica*, and *Zizania texana* (Archibold, 1995). The rice species found within the WTLUA is *Zizania palustris* (Northern Ontario Plant Database Office, 2015).

Zizania spp. falls under the category of cultural keystone species, which "form the contextual underpinnings of cultures, as reflected in their fundamental roles in diet, as materials, or in medicine" (Garibaldi & Turner, 2004, p. 1). The plant is not only an important food source, it is also a gift of the Creator and, therefore, endowed with spiritual attributes and used for ceremonies (Vennum, 1988). Wild rice is also central to many Anishinaabe stories and traditional legends (Archibold, 1995; Vennum, 1988). Moreover, through their history of harvesting wild rice, the Anishinaabeg have evolved a variety of practices that not only regulate the gathering of wild rice, but also enhance its production (Vennum, 1988).

Besides being a plant of cultural significance, wild rice also plays an important economic role. As underlined by Wetzel, Duchesne, and Laporte (2006), wild rice is a bioproduct with a significant market impact and enormous potential both in Canada and the USA. In 2013, 290,032 kg of wild rice were produced in Canada, contributing around $2.5M to the national economy (Statistics Canada, 2015). The greatest exporter of wild rice in the country in 2013 was Saskatchewan, which produced and exported 120,493 kg. Wild rice harvesting is very successful in this province, due to the support of the Saskatchewan Indian Agriculture Program and the active involvement of Northern Saskatchewan entrepreneurs, although ricing was introduced there only in the 1930s and its commercial potential was realized to the full only in the 1970s (Archibold, 1995). Manitoba and Ontario, from which traditional rice harvesting originates, both have much smaller exports than Saskatchewan, at 77,710 and 74,484 kg of wild rice respectively.

The main countries which imported Canadian wild rice in 2013 were the USA (73,425 kg), Netherlands (62,181 kg), and Hong Kong (26,073 kg). Although the USA produces a lot of paddy-grown wild rice, there is still a demand for "Canadian lake rice".

The biological characteristics of *Zizania spp.*, an annual, wind-pollinated aquatic grass, give the species stringent habitat requirements shown in Table 1.

Table 1: Habitat Requirements for Wild Rice

Criteria	Habitat Requirements
Water depth	1 to 3 feet deep (Aiken, Lee, Punter, & Stewart, 1988; Moyle, 1944); 0.5 to 3 feet (Barton, 2012); 2 to 4 feet deep (Archibold, 1995; Rogosin, 1958); 0.5-3.5 feet (Steeves, 1952); not less than 10.4 cm (Weber & Simpson, 1967); not less than 8 cm (Thomas & Stewart, 1969)
Water level fluctuations	Stable water levels or gradually declining water (Archibold, 1985; Barton, 2012); sudden fluctuations in depth should not exceed 25 cm (Aiken et al., 1988) or 30 cm (Moyle, 1944); in spring or early summer water should not raise by more than 3 feet (Steeves, 1952)
Water circulation	Water circulation required (Archibold, 1995; Barton, 2012; Vennum, 1988); flow rates should not exceed 8-10 cubic feet per second (Meeker, 1996)
Water clarity/turbidity	Clear water free of algal scum and mud (Archibold, 1995)
Water quality (chemical properties)	pH equal to 6-8.5 (Archibold, 1995); alkalinity within the range 5-250 ppm (Vennum, 1988); sulphate content from 10 mg/L (Moyle, 1944) up to 200 mg/L (Rogalsky, Clark, & Stewart, 1971), below 4 mg/L (Minnesota Pollution Control Agency, 2014); no pollution with oils or detergents (Archibold, 1995)
Bottom soils	Muck, alluvial organic soils, preferably with some calcareous material such as snail shells (Aiken et al., 1988; Barton, 2012; Moyle, 1944); phosphorous. Nitrogen, and loss of ignition (Lee, 1986b)
Plant competition	Pickerelweed (*Pontederia spp.*), spike rush (*Eleocharis* spp.), bulrushes (*Scirpus spp.*), water horsetail (*Equisetum* spp.), stiff arrowhead (*Sagittaria rigida*), smartweed (*Polygonum spp.*), cattails (*Typha spp.*), loosestrife (*Lythrum salicaria*), waterlilies (*Nymphaea* spp. and *Nuphar* spp.), watershield (*Brasenia* spp.), duckweed (*Lemna minor*), bur reed (*Sparganium spp.*), coontail (*Ceratophyllum spp.*), pondweeds (*Potamogeton* spp.), bladderwort (*Utricularia spp.*), milfoil (*Myriophyllum spp.*), etc. (Aiken et al., 1988; Archibold, 1995; Roberts, 2005; Vennum, 1988)
Consumers	Waterfowl, muskrats, beavers, moose, deer, horses, domestic cattle, and carp (Aiken et al., 1988; Archibold, 1995; Moyle, 1944; Vennum, 1988)
Diseases and insects	Brown spot, leaf sheath, stem rot, anthracnose, leaf blotch, smut, ergot, minor fungal pathogens, and bacterial and viral diseases; riceworms, rice stalk borers, leafminers, braconid parasites, maggots, aphids, midges, pyralid moths, nematodes, and leaf beetles (Aiken et al., 1988; Vennum, 1988)

The most important environmental factors are water levels and fluctuations, especially during the floating leaf and aerial stages of rice growth. During the floating leaf stage, which is characterized by rice leaves floating on the water surface, roots are easily dislodged due to fluctuating water levels (Aiken et al., 1988; Vennum, 1988). The increase of water during the aerial leaf stage, during which the stem and leaves need to be above the surface, impedes photosynthesis and wind pollination (Aiken et al., 1988).

2.1.2. Recent Studies, Initiatives, and Projects: Contemporary Wild Rice Politics

While previous literature about wild rice focused primarily on habitat requirements or description of ricing practices, recent studies have a much greater diversity of interdisciplinary themes, including the integration of tradition and technology (Price, 2012), nutritional qualities (Qiu, Liu, & Beta, 2010), and wild rice archaeology (Yost & Blinnikov, 2011). Habitat requirements and cultural and economic politics of food are of special interest to this study.

2.1.2.1. Re-Evaluation of Habitat Requirements

Although wild rice habitat requirements were already described more than half a century ago (Moyle, 1944; Rogosin, 1958; Steeves, 1952), the topics of water levels and water chemistry are still central in present research initiatives. Many of these projects, for example, the projects undertaken by International Joint Commission Watershed Board and Minnesota Pollution Control Agency aim at the re-evaluation of standards related to habitat requirements.

The literature is quite conclusive about water levels and fluctuations required for wild rice (Aiken et al., 1988; Lee, 1986b; Moyle, 1944); however, the standards based on this literature are often outdated, not enforced by law, and require periodic re-evaluation (International Joint Commission (IJC), 2012; International Rainy-Lake of the Woods Watershed Board (IRLWWB), 2014; Minnesota Pollution Control Agency (MPCA), 2014). For example,

the IJC – an organization that focuses on the use and quality of waters located at the border between Canada and the USA - has recently started research targeted at the revision of the quantity of the water discharged from the Lake of the Woods into the Rainy River, which was stipulated in the Lake of the Woods Convention and Protocol between Canada and the United States in 1925 (IJC, 2012). The influence of water levels on rice fields located below the Lake of the Woods was the main concern that triggered the project. Two projects were funded that focus on the effects of water regimes on rice production and cattail invasion (IRLWWB, 2014). This research is very sensitive in nature because it may lead to strengthened requirements, which may not meet the interests of hydroelectric companies and other water consumers.

Wild rice research related to water and soil chemistry, particularly sulphate content, has always been less conclusive than findings on water levels and fluctuations. Since Moyle (1944) expressed the idea that sulphate adversely affects wild rice and wild rice requires sulphate concentrations of no more than 10 mg/L, this standard has been constantly debated. For instance, according to Davis (1979), sulphate concentrations of 170 mg/L are normal for wild rice. Lee (2000) supports even higher minimum concentrations and suggests that any concentrations above 40 mg/L and below 1500 mg/L are suitable for wild rice. Fort et al. (2014) underline that sulphate concentrations below 5000 mg/L do not negatively influence early life stages.

Minnesota has been using Moyle's (1944) 10 mg/L sulphate concentration limit since 1973 (Minn. R. 7050.0224, subp. 2, 2011). In 2014, Minnesota Pollution Control Agency started a review of this standard. The preliminary result of the field and laboratory study is that sulphate is not directly toxic by itself but sulphate in the amount of 4-16 mg/L limits wild rice's ability to grow because it interacts with other chemicals present to form sulphide, which interferes with plant respiration and nutrient uptake (MPCA, 2014). Although many factors such as iron can

affect the rate at which sulphate is converted to sulphide, it is not possible to make site-specific conclusions for every site and this thesis considers the concentration of less than 4 mg/L suitable for wild rice growth. While in the USA the 10 mg/L standard is being debated, in Canada sulphate requirements are much less stringent. The *Guidelines for Canadian Drinking Water Quality* (Health Canada, 2012) set the sulphate standard of 500 mg/L as an aesthetic objective and do not consider the impact of sulphate on wild rice. As sulphate often originates from mines, wastewater treatment plants, and other industrial sources, sulphate pollution is a major issue because the interests of mining companies clash with the interests of rice harvesters.

2.1.2.2. From Commodification to Food Sovereignty

One of the most important changes in wild rice research, initiatives, and projects refers to the fundamental shift from the perception of wild rice as purely a commercial commodity to the discussion of the cultural and economic politics of food, food sovereignty, and relationship re-establishment. Past studies often considered traditional Aboriginal methods of production "primitive" (Steeves, 1952) and focused on the realization of the full commercial potential of wild rice (Lee, 1986c). Commercial wild rice development included the use of nutrients to combat the negative effects of increases in water depths, fertilizers to correct nutrient deficiencies, herbicides to eliminate competing aquatic plants, and wild rice genetic modification to enhance production (Lee, 1986a). Coupled with the destruction of wild rice habitats due to resource developments, commercialization of wild rice production resulted in the disruption of Aboriginal people's relationships with wild rice. Present research lays greater emphasis on maintaining Aboriginal people's rights and responsibilities to protect wild rice as their resource, the re-localization of Aboriginal economies, and the preservation of the status of wild rice as a

certified unique organic commodity that is different from cultivated paddy-grown rice (Grey & Patel, 2014; Stiles et al., 2010; Wetzel et al., 2006).

Kagiwiosa Manomin Inc. of Wabigoon First Nations and White Earth Anishinaabeg's initiative aimed at re-localizing their economy are excellent examples of initiatives that focus on the re-establishment of the relationships between people and wild rice, as well as wild rice development for the benefit of Aboriginal communities (Grey & Patel, 2014; Wetzel et al., 2006). Kagiwiosa Manomin Inc., a First Nations-owned worker cooperative located in Wabigoon (Northwestern Ontario), processes and packages certified organic wild rice (Wetzel et al., 2006). This cooperative has seven employees, buys green rice from 100-150 community members, makes an important contribution to the community economy, and provides a great example of Aboriginal entrepreneurial leadership. Another example of an initiative that focuses on food sovereignty, or the ability of groups of people to make decisions about their own food systems, is the White Earth Anishinaabeg living in northern Minnesota, who have attempted to re-localize their economy (Grey & Patel, 2014; Walker & Doerfler, 2009). This community is famous for winning the battle against genetically modified rice. The community also harvests wild rice and sells it to an Anishinaabeg-owned company, which purchases rice for a fair price because it processes and sells the product. Also, White Earth community members create their own local economy by trading wild rice within their community.

These inspiring initiatives may trigger further community-based wild rice restoration and economic development projects, which re-invigorate cultural identity and food sovereignty. However, because there is no strict model for community-based restoration projects, additional research is required on how to implement such projects so as to make them successful, contribute to community development, and meet community members' expectations.

2.2. Ecocultural Restoration

The term *ecocultural restoration* has its origins in the term *ecological restoration* proposed by the Society for Ecological Restoration (SER) (1990, 1995, 2004), but also emphasizes culturally important species, traditional landcare practices, community-building processes, and participation of local people (Higgs, 2003; Martinez, 2003, 2011, 2014). This section defines ecocultural restoration, explains the use of this particular term, and presents its characteristics.

This research departs from the earliest definition of restoration as a recovery of an indigenous, or historic, ecosystem (SER, 1990). Although this study recognizes the importance of understanding historical ranges of variability (Martinez, 2011, 2014), it defines restoration as a process of "assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed" onto a trajectory toward a healthier, more resilient, and self-sustaining state (Higgs, 2003; Kimmerer, 2011; Lake, 2013; Martinez, 2011, 2014; Palmer et al., 2004; SER, 2004, p. 3). This understanding of restoration shifts focus from historical fidelity, or loyalty to pre-disturbance reference conditions, to ecological integrity, which implies variability in biodiversity, ecological processes, context, and practices (Higgs, 2003). The main problem with historical fidelity is that historical reference conditions can hardly be defined due to the incompleteness of reference information, uncertainty, and rates of change, as well as the impossibility to understand the pre-contact condition of cultural landscapes (Higgs, 2003; Perry, 2009). Moreover, as a result of environmental, ecological, and cultural drivers, ecosystems are restored to a new state with a different dynamics (Higgs, 2012).

Very often, the term *reclamation* is used when ecosystems have been changed so drastically that a return to pre-disturbance conditions is impossible. This term is commonly used

in the context of mined lands, oil sands, coastal areas, and aquatic ecosystems (Guo, Gong, & Guo, 2015; Lee et al., 2014; Murray, Ma, & Fuller, 2015). However, because the term *reclamation* mostly focuses on the return to ecosystem conditions that ensure productive outputs for human use (Bradshaw, 2002; SER, 2004), *restoration* is preferred within this study as a more comprehensive and multi-faceted term. This term is also chosen over others from the literature, including *remediation*, *revegetation*, *rehabilitation*, and *regeneration* because some of them are not broad enough for implying both the idea of rescuing and the idea of re-establishment and some of them are not holistic enough (Higgs, 1997, 2003; SER, 2004; Uprety et al., 2012). The terms *restoration* and *recovery* are used interchangeably as *recovery* has a similar meaning and does not necessitate ecosystem's return to the previous state (Higgs, 2003).

While the study prefers the term restoration to other terms, the term *ecocultural restoration* (Higgs, 2003, 2012; Kimmerer, 2011; Martinez, 2003, 2011, 2014) is chosen over *ecological restoration* (e.g., SER, 2004) and *biocultural restoration* (Cairns & Heckman, 1996; Janzen, 1988; Nabhan et al., 2010). While ecological restoration overemphasizes the importance of ecosystem structure and dynamics and does not pay enough attention to cultural elements, community-building processes, and participation of local people, biocultural restoration often refers to top-down projects with the participation of human cultures (Kimmerer, 2011).

Meanwhile, the term *ecocultural restoration*, pioneered by D. Martinez, founder of Indigenous Peoples' Restoration Network, pertains to the restoration projects designed by Aboriginal communities and guided by the holistic goals and traditional ecological knowledge (TEK) of the inhabitants of a cultural landscape (Higgs, 2003; Kimmerer, 2011; Martinez, 2003, 2011, 2014). Thus, the restored landscape encompasses "cultural beliefs and practices along with ecological processes, structures, and patterns" (Higgs, 2003, p. 237).

Community-based ecocultural restoration projects are different from Western science-based restoration projects, which have a narrow, purely ecological perspective and mostly focus on habitat, species, and ecosystem recovery, do not take into consideration people's relationships with their land, rely extensively on external expertise, and prohibit sustainable harvest of resources from restored ecosystems (Nabhan et al., 2010). Community-based restoration represents a bottom-up approach that engages both professionals and volunteers from the local communities in environmental stewardship and sustainable development done in accordance with their perspectives and aspirations (Leigh, 2005). Thus, restoration becomes process-oriented with the emphasis shifting from recreating original conditions to taking the actions necessary to restore ecosystem functioning (Cairns & Heckmann, 1996; Higgs, 2003). In a community-based restoration process, TEK defined as "a cumulative body of knowledge, practice and belief evolving by adaptive processes and handed down through generations by cultural transmission" (Berkes, 2008, p. 7) provides information on pre-disturbance management practices and reference conditions, as well as encompasses values that inform and guide the restoration process (Kimmerer, 2000).

2.3. Involvement of Children and Young People[7]: Restoration and Education

Success of ecocultural restoration projects that focus on relationship re-establishment depends on the participation of children and young people, who will be responsible for the continuity of relationships in the future. Thus, ecocultural restoration projects need to consider children's and young people's knowledge, aspirations, and expectations. TEK may be included in the formal school curriculum, and young community members may participate in the

[7] In this study, individuals aged 0-18 are considered to be children and individuals aged 18-29 are considered to be young people.

restoration process through restoration-based education. This section defines the reasons for the involvement of children and young people in the restoration process, defines the concept of restoration-based education, speaks about how TEK can be incorporated into the school curricula, and presents wild rice camps as an example of restoration-based education.

Children and young people need to be stakeholders in environmental decision making (Hacking, Barratt, & Scott, 2007). However, in most cases, restoration projects are dominated by adult discourses, which reduce opportunities for children and young people to become empowered, learn about nature, and express their concerns at local and global scales (McCann, 2011). Although students are often involved in school gardening and projects initiated by school teachers (Hall & Bauer-Armstrong, 2010; McCann, 2011), in most cases, they have little opportunity in terms of making decisions, identifying problems, and envisioning how projects will unfold (McCann, 2011). Although children and young people are often marginalized, their concerns about the present and future state of the environment are legitimate and they make considerable contributions to restoration projects by bringing fresh ideas and energy (Hacking et al., 2007). Young participants also benefit from restoration projects, which make them more ecologically literate and help them gain competence, a sense of ownership, sense of place, and connection to their community (McCann, 2011). Thus, children and young people need to be perceived not only as learners, but also as citizen-scientists actively investigating and restoring ecological functions and relationships (Hall & Bauer-Armstrong, 2010).

As restoration and education are interlinked and one of the purposes of restoration is the recovery of relationships with the land and cultural restoration, an important part of the restoration process is the incorporation of western science-based and TEK into the formal school curriculum. Existing Western science-based knowledge on wild rice is extensive (see Section

2.1). However, TEK is as important as scientific knowledge, especially for education in Aboriginal communities, which is highly influenced by the Western culture with its "one size fits all" instructional approach (Quigley, 2009). As described in Aikenhead and Elliott (2010), the problem with such instructional approaches is that the worldviews of the indigenous and Western science-based knowledge systems are incompatible in spite of some common values and features. The differences do not imply that indigenous education is the only alternative for indigenous people. Indeed, scientists call for bicultural education with two co-existing instructional realities and underline the importance of both Western science-based knowledge and TEK in such education (Aikenhead & Mitchell, 2011; Aikenhead & Ogawa, 2007).

Most research on the incorporation of TEK into formal curriculum refers to science classes. Kimmerer (2012) points out that the key elements of the integration of TEK and scientific knowledge include clear analysis, experiential learning, holistic engagement of multiple elements, recognition of the linkage between knowledge and responsibility in indigenous understanding of the world, and of the unity between matter and spirit. Aikenhead and Mitchell (2011) list the resources teachers can use in science education such as Elder involvement, community context, role models, critically selective materials and resources, appropriate classroom environment, flexible instructional approaches and assessment methods, and the use of Indigenous languages. Although there is much research on science curriculum, there is a lack of empirical studies on native language classrooms, although native languages are critically related to TEK (Quigley, 2009).

A wide array of programs and lesson plans is available to teachers who want to incorporate knowledge about wild rice into school curricula. Appendix 4 presents an annotated bibliography of various wild rice-related resources, which can be used from Junior Kindergarten

(JK) up to high school. Besides programs and lesson plans, there are many other resources, which can be used in the process of education, for instance, activity books and books of recipes.

Overall, while using all these programs and resources, it is necessary to understand that a formal classroom is not the only environment for restoration efforts and for TEK knowledge incorporation (Kimmerer, 2012). Authentic experiences require learning, which implies developing skills and knowledge through direct participation (Kimmerer, 2012). Thus, McCann (2011) suggests the use of restoration-based education, which is a part of environmental education, and defines it as "restoration efforts that are intentionally designed to include an educational purpose" (p. 318). Restoration-based education helps students to understand ecological concepts and learn the natural and cultural history of a place important and relevant to them; thus, it includes both social and ecological aspects and contributes to both habitat restoration and relationship re-establishment (McCann, 2011).

Within the context of wild rice restoration, wild rice camps provide an excellent opportunity for restoration-based education. Such camps are a common practice in the USA (for example, at Lake Vieux Desert, Tubbs Lake, and Gunn Lake Rice Camps in Michigan), but not in Canada. They take place during rice harvesting time, which is of great religious and social significance for Anishinaabe people. Present wild rice camps, as well as those that occurred centuries ago, create a place for social interaction, unite families, give attendees a chance to learn about the methods of harvesting and processing and important traditional equipment, such as knocking sticks, pushing poles and winnowing baskets, which attendees make themselves (Vennum, 1988). Children and young people also often participate in seeding, which takes place at the same time as harvesting. Thus, wild rice camps provide educational raw materials for habitat restoration and relationship re-establishment (Whitney, 2011).

The important success factors of wild rice camps and other restoration-based education initiatives are team work, partnerships with other organizations and agencies, ongoing support of teacher teams, availability of funding, student centered learning, and cultural diversity (Hall & Bauer-Armstrong, 2010). Many scientists point out the importance of school or educational programs as mediators between restoration practitioners, children, and young people (Hall & Bauer-Armstrong, 2010; McCann, 2011, Whitney, 2011). Hall and Bauer-Armstrong (2010) emphasize the importance of links among students, their families, schools, and communities.

Overall, restoration creates a context for education and benefits from education as well; thus, restoration-based education connects these processes and provides a positive, proactive, dynamic, and experience-based context for both (Whitney, 2011). However, as restoration-based education is a relatively new concept, there is often no curricula guidance for teachers and there is limited research regarding educational efficacy of restoration-based education (McCann, 2011). Thus, new possibilities need to be researched and described, which should bring life-changing and enlightening experience, build self-confidence, and contribute to knowledge acquisition (Hall & Bauer-Armstrong, 2010).

2.4. Transformative Learning

While school education is an important part of the restoration efforts targeted at the re-establishment of relationships between students and *manomin*, it is not as relevant to adults who already have established perceptions, cognitions, and feelings related to wild rice, or frames of reference as defined in transformative learning theory (Mezirow, 1978, 1981, 1991, 1994, 1997, 2000, 2008, 2012). With respect to adults, relationship re-establishment may occur through transformative learning first described in Mezirow (1978), which is a purely adult learning theory because younger learners cannot be critically reflective of their own assumptions

(Mezirow, 2000). New information is only a resource for adults in the learning process, which is based on the understanding of frames of reference and critical reflection (Mezirow, 1997). Thus, this section explains the concept of transformative learning, describes its phases, identifies ideal learning conditions, explains the types of learning which create a platform for transformative learning, and provides examples of learning in an informal context.

Transformative learning refers to a process with individual and social dimensions where people gradually change their views on the world and themselves (Mezirow, 1978, 1981, 1991, 1994, 1997, 2000, 2008, 2012). Specifically, transformative learning theory explains how people interpret life through a process of critically reflecting on their beliefs and assumptions, exploring new ways of being, and making decisions based on their new insights (Mezirow, 1994). An individual's worldview is influenced by frames of reference, which are structures of culture and language that limit and shape individuals' perceptions, cognitions, feelings, and actions (Mezirow, 2000). As stated in Mezirow (1994), two-dimensional frames of reference comprise meaning perspectives and meaning schemes. Meaning perspectives comprise assumptions and expectations which people use for filtering their impressions (Mezirow, 2012). Meaning schemes are manifestations of meaning perspectives, which shape particular interpretations (Mezirow, 1994). According to Mezirow (2000), frames of reference include meaning perspectives composed of habits of mind and points of view. Habits of mind, which are "habitual ways of thinking, feeling, and acting", are articulated as points of view, particular complexes of feelings, judgments, and attitudes (Mezirow, 1997, p. 5). Transformative learning triggers the transformation of frames of reference "to make them more inclusive, discriminating, emotionally capable of change, and reflective" (Mezirow, 2000, p. 7).

Mezirow (1978) identifies ten main phases of transformative learning starting from disorienting dilemma and concluding with becoming more confident in new roles and re-integrating based on new perspectives. The intermediate phases included the processes of self-examination, critical assessment, exploration, trying, and learning. Mezirow (1991) adds one more phase to the transformational learning process – changing relationships and starting new relationships. Often, throughout these phases and a process of dialogue and critical reflection, a learner undergoes perspective transformation, or a shift in worldview (Mezirow, 1994, 2000).

The ideal learning conditions, or conditions for free, full, and successful participation in the discourse, were first identified in Habermas (1971) and then elaborated in Mezirow (1981). These conditions include the ability to have accurate information; absence of coercion, self-deception and anxiety; openness to alternative points of view; ability to understand, to weigh evidence, and assess arguments; ability to become aware of the context of ideas and critically reflect on assumptions; equal opportunity to participate in discourse; presence of a test of validity until new perspectives, evidence, or arguments are encountered and validated. These conditions serve as a pre-requisite for transformative learning and need to be created by the facilitators of transformative learning.

Also, three main types of learning described in Habermas (1971) and incorporated into transformative learning theory by Mezirow (1981, 1991, 1994) are interconnected and instrumental and communicative learning have the potential to create transformative learning (Sinclair, Collins, & Spaling, 2011). Task-oriented and skills-based instrumental learning mostly refers to the ability to complete a certain task and control or manipulate the environment, while communicative learning involves a discourse between individuals and negotiation of values, purposes, feelings, and meanings targeted at finding common ground (Mezirow, 2000).

However, it is rare for purely instrumental or communicative learning to occur, since learning often involves components of both domains (Mezirow, 2000).

While most research related to transformative learning has traditionally focused on higher education contexts (e.g., Cranton, 2001; Kitchenham, 2008; Taylor, 2003, 2007), there has been a recent increase in research on transformative learning and its role in the environmental impact assessment process (Sinclair & Diduck, 2001; Walker, Sinclair, & Spaling, 2014), community conservation and natural resource protection initiatives (Moyer, Sinclair, & Diduck, 2014; Sims & Sinclair, 2008; Sinclair et al., 2011), or other non-formal education settings such as farmer field schools in Kenya (Duveskog, Friis-Hansen, & Taylor, 2011; Najjar, Spaling, & Sinclair, 2012; Taylor, Duveskog, & Friis-Hansen, 2012). Most of the research mentioned above focuses on long-term transformations, while epochal, or immediate, transformative learning described in Mezirow (2008) is much less researched.

Overall, although the main critique is that research on transformative learning theory is overabundant and reiterative (Taylor, 2007), this study uses transformative learning as a lens for analyzing potential changes in adult research participants that contribute to the re-establishment of relationships between WIN members and *manomin*. Thus, similarly to Sinclair et al. (2011), this study uses transformative learning as one of the measures of the success of a community-based restoration project that leads to a transformation in participants' perspectives.

2.5. Summary

This chapter presented the theoretical and conceptual foundations of this study. It began with the presentation of socio-cultural, economic, and biological information about wild rice, as well as recent trends in wild rice research. Afterwards, the concept and process of ecocultural restoration were explained. The third section of this chapter addressed education,

both formal and informal, in the context of restoration, specifically about restoration-based education and the incorporation of knowledge about wild rice into school curriculum, as well as the flaws of the restoration projects with the participation of children and young people. Finally, the chapter elaborated on the context, types, and phases, of transformative learning, as well as conditions for initiating it from the literature, through which relationships between adult community members and wild rice can be re-established.

CHAPTER 3: METHODOLOGY

"*Ideally, design will amplify and not diminish our commitment to flourishing ecosystems" (Higgs, 2003, p. 14)*

This chapter discusses the study's philosophical worldview, research design, research strategy, and methods. Both qualitative and quantitative methods, as well as data analysis procedures and sampling techniques, are interpreted. Also, this chapter explains how the validity of data was assured and how results were disseminated. Finally, this chapter presents a diagram of the research process.

3.1. Philosophical Worldview

A pragmatic worldview guided this community-driven restoration process, in which methods, techniques, and procedures could not be completely fixed and the main focus was on the outcomes of the research – the actions, situations, and consequences of the inquiry (Creswell, 2007). The pragmatic worldview was valuable because it allowed for the use of information obtained through research and any methods that worked in order to implement feasible solutions to a real world problem (Creswell, 2014). Also, pragmatism was a suitable paradigm because it has strong associations with mixed methods research (Cameron, 2011; Creswell, 2014).

3.2. Research Design

This study used a mixed method research design to match the need for both qualitative and quantitative findings on the research questions (Creswell, 2014). However, the methodology relied predominantly on qualitative research, which can be defined as "any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification" (Strauss & Corbin, 1990, p.17). This study chose a primarily qualitative research design due to its goal of providing an in-depth descriptive analysis of a single case with rich

contextual findings. Quantitative methods were used only in the process of site documentation, which could not be done without surveying the sites for relevant biophysical site parameters.

Qualitative and quantitative methods were mixed throughout the study. For instance, one of the sites chosen for restoration efforts was also chosen as the venue for the wild rice camp. Site selection was also based on both the ecological characteristics of the sites and their cultural importance. Given that there is integration of data across the stages of the study, this project is not quasi-mixed research, which Teddlie and Tashakkori (2009) criticize as inappropriate.

The research design was also of an interactive adaptive nature, which means that the research responded to the complexity of the problem and changed in accordance with the changing context (Nelson, 1991). This approach helped to address the uncertainties and complexities of multifaceted research. Such a research design is especially useful for studies in turbulent environments which have a continuously changing research context.

3.3. Strategy of Inquiry

This study embeds quantitative survey research in a larger qualitative case study, which corresponds to the embedded mixed methods case study with concurrent qualitative and quantitative data collection (Creswell, 2014; Scholz & Tietje, 2002). The case study explores a system bounded by time and activity (Creswell, 2007, 2014; Stake, 2005). As underlined in Yin (2009), case study research is appropriate when investigators cover contextual conditions as well as specific phenomena and rely on different sources of evidence. This particular case study focuses on the process of the ecocultural restoration of wild rice at WIN. This project is also bounded by time and place, given that fieldwork took place in the WIN community during a field season of less than four months. As underlined in Yin (2009), confinement to a single case study forces the researcher to deploy an integrated mode of analysis.

3.4. Selection of a Case Study Community

The WIN community was an ideal location to explore possibilities for undertaking a bounded case study as there was on-going collaboration between researchers and WIN staff through a research project. My research interest to find a project focusing on heritage, cultural landscape management, biodiversity-based community development, and Aboriginal innovation matched the community's interests. In November 2013, TLUA Resources Information Officer Elder M. McDonald initially proposed and described the idea of *manomin* ecocultural restoration in a design brief, which was a two-page document describing the context and the research objectives (Appendix 1). In February 2014, the initial ideas from this design brief were discussed and agreed upon at a preliminary workshop with the participation of Elder M. McDonald, the WIN school principal, Anishinaabe language teacher, and his assistant, who were the first project design team members.

The WIN community has identified a need for community development projects, which have a potential to contribute to intergenerational knowledge transfer, education improvement, income generation, and economic development. Like most Aboriginal communities in Canada, WIN experiences lower socio-economic conditions than the general provincial or national population and has specific challenges that place it at a disadvantaged position with respect to many social and economic indicators. According to the latest data obtained through Census/National Household Surveys in 2011 (Table 2), life expectancy in the WIN community is lower than average in Ontario, which testifies to the idea of a small number of Elders, who are traditional knowledge holders, and the necessity of intergenerational knowledge transfer. Also, students' success and education rates among the WIN community are very low; alluding to a need for more culturally appropriate education and the inclusion of cultural knowledge into

school curriculum. Additionally, WIN households are more crowded and in a worse physical condition than the households of average Ontario residents. The economic situation in the community is also characterized by a higher unemployment and lower average total income than the provincial average, highlighting the need for greater economic opportunities.

Table 2: WIN Community Profile

Description	WIN	Ontario	Source
Total population	865	12,651,795	Aboriginal Affairs and Northern Development Canada, 2015d
Population aged 65 and over (% of total population)	2.3%	13.9%	Aboriginal Affairs and Northern Development Canada, 2015d
Population 15 years and over with no degree, certificate or diploma (%)	75.4%	18.7%	Aboriginal Affairs and Northern Development Canada, 2015a
Number of households	225	4,886,655	Aboriginal Affairs and Northern Development Canada, 2015b
People per household	3.8	2.6	Aboriginal Affairs and Northern Development Canada, 2015b
Dwellings requiring major repairs (% of all dwellings)	57.8%	6.6%	Aboriginal Affairs and Northern Development Canada, 2015b
Employment rate	38.3%	60.1%	Aboriginal Affairs and Northern Development Canada, 2015e
Unemployment rate	35.30%	8.3%	Aboriginal Affairs and Northern Development Canada, 2015e
Average total income	$17,778	$42,264	Aboriginal Affairs and Northern Development Canada, 2015c

The principal sources of WIN employment are the government (Wabaseemoong band, provincial, and federal) and the Mizhakiiwetung Memorial School (Smith, 1995). The lack of jobs, which is the primary cause of the community's low average incomes and high unemployment rate, became a major issue in the second half of the 20th century mostly due to the construction of hydroelectric dams in the 1920s-1950s and mercury contamination in 1962-1970. The hydroelectric developments on the Winnipeg and English Rivers disrupted natural water fluctuations and wild rice habitats, while mercury contamination impeded the operation of tourist lodges and commercial fishing, which were the main sources of revenue for WIN members.

3.5. Methodology

Cultural landscapes are unique and, therefore, require unique methodologies for successful restoration (Roberts, 2005). Thus, after the analysis of several existing methodologies, a specific ecocultural restoration design methodology was developed drawing upon the principles of biocultural design (BCD) (Davidson-Hunt et al., 2012), wild design (WD) (Higgs, 2003; Higgs & Hobbs, 2010), and human-centered design (HCD) (Brown, 2009).

Numerous existing restoration guidelines that focus primarily on the ecological dimensions of the restoration process were evaluated for use in this study, but were not compatible with the aspirations of community members and relied too heavily on external expertise. Table 3 provides two examples of these methodologies. As underlined in Roberts (2005), the guidelines of the Society of Ecological Restoration are very narrow and fail to meet cultural objectives (SER, 2004). Conversely, the guidelines of the International Union for Conservation of Nature (IUCN) are more flexible and sophisticated on matters of cultural relevance, but focus on protected areas, which is different from community-based projects.

Given that no compatible guidelines for community-based ecocultural restoration were found in the literature, a specific ecocultural restoration design methodology was developed for this study drawing upon the principles of BCD (Davidson-Hunt et al., 2012), WD (Higgs, 2003; Higgs & Hobbs, 2010), and HCD (Brown, 2009). Table 4 present a review of the main characteristics of these design frameworks and their applicability. Due to the fact that restoration is "fundamentally a design practice" (Higgs, 2003, p. 274) and is mostly an exertion of humans' will targeted at certain species and ecosystems (Higgs & Hobbs, 2010), design informs and guides restoration projects.

Table 3: Restoration Methodologies

Type	General description	Advantages	Disadvantages	Source
SER	51 procedures for ecological restoration corresponding to the norms of the discipline. The main phases of project work are conceptual planning, preliminary tasks, implementation planning, project implementation, post-implementation tasks, and evaluation and publicity	● Very detailed step-by-step procedures with clearly defined stages of the restoration process allow for the highest project quality and decrease errors of omission ● The guidelines are applicable to the restoration of both terrestrial and aquatic ecosystems	● These guidelines are more suitable for larger-scale technical restoration projects with ecological goals prevailing over cultural goals ● Some guidelines are not applicable to this restoration project; for instance, there are no laws that regulate restoration in the areas of traditional resource use, such as WTLUA ● This community-based restoration project is incompatible with efficiency-based restoration, which is a term applicable to the restoration processes guided by SER guidelines (Higgs, 2003)	SER (2004)
IUCN	Three principles and 14 guidelines for protected areas. The main phases include defining the problem and engaging stakeholders, assessing the problem, developing goals, developing objectives, designing ecological restoration approach, implementing ecological restoration approach, and implementing adaptive management	● IUCN provides both principles and guidelines, which allow for the flexibility of the restoration process ● These guidelines are more sophisticated on matters of cultural relevance than SER guidelines. ● IUCN recognizes the necessity of minimal ecological intervention ● A part of the first phase is the engagement of stakeholders	● These guidelines focus on restoration processes in protected areas; therefore, much attention is paid to visitor experience and other aspects which are not relevant to the WIN restoration project ● There is too much focus on climate change, which is also not particularly relevant to small community-based projects, such as the WIN project	IUCN (2012)

Table 4: Design-Based Methodologies

Type	General Description	Advantages	Disadvantages	Source
Human-centered design (HCD)	HCD with three main phases: inspiration (insights are gathered from every possible source), ideation (insights are translated into ideas), and implementation (best ideas are developed into concrete plans of action)	● This design methodology enriches the restoration process by showing how ideas can be conceived and implemented ● This methodology provides guidelines for the restoration process facilitation	● This methodology focuses on the design process with no reference to restoration projects ● This design methodology is very market- and profit-centered, while restoration is not only about economic opportunities	Brown, 2009; IDEO, n.d.; IDEO & River dale, n.d.
Wild design (WD)	WD refers to intentions and plans that support free-flowing ecological processes. Seven principles of WD are clarity, fidelity, resilience, restraint, respect, responsibility, and engagement	● WD combines ecological and ethical principles ● WD sets certain boundaries for intervention, in comparison with most contemporary guidelines ● WD recognized the importance of TEK in the restoration process ● WD creates possibilities for genuine human engagement	● This methodology is used with reference to the restoration of protected areas ● It is questionable if it can support free-flowing ecological processes	Higgs, 2003; Higgs & Hobbs, 2010
Biocultural design (BCD)	BD presents an "intentional, collective and collaborative process by which individuals with a diversity of knowledge and skill sets engage in a creative process of designing products and/or services" (p. 39)	● BD links economic opportunities with cultural practices and associated skills; so that it contributes to both cultural restoration and endogenous development ● BD focuses on the expansion of participants' capabilities ● BD supports design as a decolonizing practice	● BD focuses on the production of goods and services, not on ecocultural restoration, and overemphasizes the importance of the functional outcome with its material value at the expense of the processes of creativity, relationship restoration, and healing	Davidson-Hunt et al., 2012

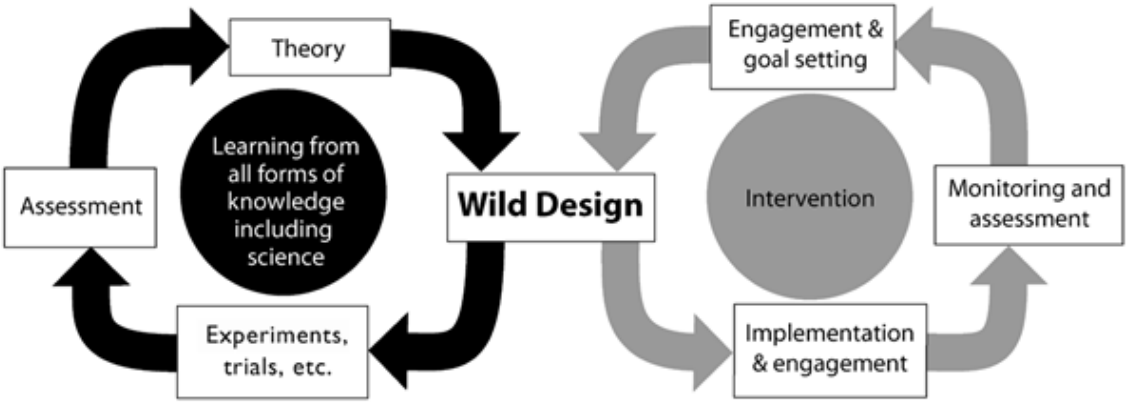
The present study perceives design as both a process and product of developing and planning the form and the structure of both material and non-material things and views design through the lens of design anthropology, which is "a field that seeks to understand how the processes and artifacts of design help to define what it means to be human" as defined in Tunstall (2013, p. 238). Design anthropology shifts from hegemonic colonialist value systems to an epistemology which caters to the well-being of marginalized peoples with the help of design processes and practices and makes design a decolonizing practice (Otto & Smith, 2013). The main characteristics of design, highlighted in Otto and Smith (2013) - materiality, temporality, and relationality – contribute to the ecocultural restoration process. Material practices of visualization, prototyping, and performance inform the materiality of restoration projects. Temporality, which is related to the future orientation of design, shifts the ecocultural restoration focus from the recovery of historical reference conditions to the re-establishment of new resilient socio-ecological systems with renovated human-environment interactions. Relationality, which implies that design anthropologists work with different groups of people including designers, researchers from other fields, and users, is especially fruitful for community-based projects.

The HCD framework described in Brown (2009), IDEO (n.d.), and IDEO and Riverdale (n.d.), which explains the main stages of the design process, emphasizes the importance of prototyping and points out important characteristics of design, all of which were very important for the restoration process. Firstly, this design framework clearly describes the stages of the design thinking process – inspiration, ideation, and implementation – which can guide the whole wild rice restoration project and its components. Secondly, HCD explains how to develop a prototype that is desirable, technologically feasible, and economically viable. Thirdly, key characteristics of the design process such as the use of a design brief as a starting point, working

in teams, divergence of opinions at the beginning, human-centered approach, fast prototyping, sharing ideas, and building upon previous ideas, also provided guidance for the project.

WD, which is the only design framework developed specifically for restoration projects, is important for this study because it combines ecological intervention with ecological learning as shown in Figure 2 (Higgs, 2003; Higgs & Hobbs, 2010). By emphasizing ethical intervention and using the principles of fidelity to ecosystem, restraint of intervention, respect to ecosystems, and responsibility for failure during intervention, this methodology limits interventions and creates a balance between human and ecological considerations. The principle of the engagement of humans with all forms of knowledge, including TEK with its strong reciprocal ties with ecosystems, adds an additional important element to restoration.

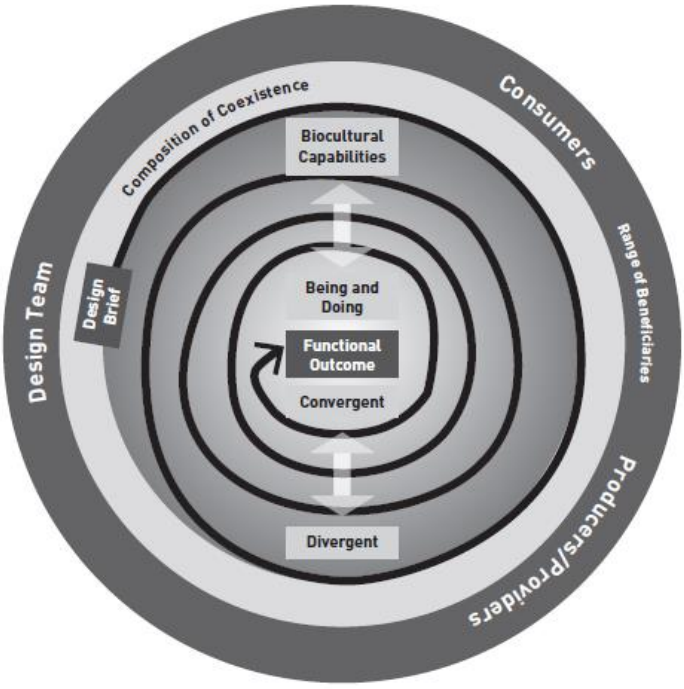
Figure 2: Wild Design Framework. Source: Higgs & Hobbs, 2010. Used with permission



Most of the conceptual basis and process characteristics of the ecocultural restoration design methodology employed by this study are drawn from BCD presented in Figure 3, which respects the intimate relationships people have with their lands and supports communities in developing their own plans, products, and services (Davidson-Hunt et al., 2012). BCD is based on the concept of biocultural heritage, which includes both biodiversity and landscapes with spiritual values and customary laws; it also links knowledge and practices of local communities to biological diversity (Apgar, Ataria, & Allen, 2011; Swiderska, 2006). The idea of biocultural

heritage is applicable to the restoration of cultural landscapes within this study, which have been formed through the interaction of humans and nature. BCD also offers a capability-sensitive approach with a focus on capabilities, or opportunities that allow people to live their lives in a manner which they perceive as valuable, as an alternative to the traditional perceptions of design as design for development or the market (Oosterlaken, 2009; Sen, 1999). Besides expanding participants' capabilities, BCD allows for endogenous community development, or engagement with the world in a way that enables the well-being of both people and nature (Apgar et al., 2011; Davidson-Hunt et al., 2012; Pretty et al., 2008). In process, the BCD framework establishes the steps of the design process. According to Davidson-Hunt et al. (2012), the biocultural design process starts with a design brief, the establishment of a team and sub-teams of people with diverse knowledge and skills, and their engagement with different components of the projects. As well as Brown (2009), Davidson-Hunt et al. (2012) underline an important role of transfer from divergent thinking, or creating choices, to convergent thinking, or making choices.

Figure 3: Biocultural Design Process. Source: Davidson-Hunt et al., 2012



The following guiding coordinates for ecocultural restoration design were developed on the basis of the above-described frameworks and incorporated in this project (Figure 7):

- A design process, as well as its component, goes through the stages of inspiration, ideation, and implementation (Brown, 2009)
- Prototyping of event(s)/activity(ies)/process(es) that target ecocultural restoration is an essential part of a design process (Brown, 2009; IDEO, n.d; IDEO & Riverdale, n.d.)
- A special environment to facilitate innovation needs to be created, possibly through design workshops (IDEO, n.d.; IDEO & Riverdale, n.d.; Kjærsgaard, 2013)
- The integration of TEK and Western science-based knowledge broadens and deepens ecocultural restoration (Higgs, 2003; Higgs & Hobbs, 2010; Kimmerer, 2012)
- Ecological intervention should be done intelligently and ethically; restraint and less intervention are better than too much intervention (Higgs, 2003; Higgs & Hobbs, 2010)
- Various forms of engagement are required for the physical and emotional connection of people with their ecosystems (Higgs, 2003; Higgs & Hobbs, 2010)
- Most of the design work is done in teams, which include participants with diverse skill sets, knowledge, and experience (Brown, 2009; Davidson-Hunt et al., 2012)
- If a design process is organized correctly, participants move from divergent to convergent thinking (Brown, 2009; Davidson-Hunt et al., 2012)
- One of the focuses is on the expansion of participants' capabilities through ecocultural restoration process (Davidson-Hunt et al., 2012).

3.6. Data Collection Methods, Sampling Techniques, and Data Analysis

This section presents both qualitative and quantitative methods of data collection and analysis. Table 5 gives an overview of how different methods met different objectives.

Table 5: Methods Used to Achieve Research Objectives

	Data collection method						
Objectives	Participant observation	Stage A interviews	Design workshop 1	Design workshop 2	Biophysical methods	Stage B interviews	Design workshop 3
Objective 1: Describe the past and present state of rice-related practices in WIN and changes that occurred in the 20th century							
Documentation of past and present knowledge and practices	×	×	×			×	
Definition of historical ricing areas	×	×					
Documentation of changes in 20th century	×	×	×			×	
Documentation of adults and young people's knowledge	×	×	×			×	
Documentation of wild rice values	×	×	×			×	
Objective 2: Select and document a site(s) for ecocultural restoration efforts							
Field assessment of current status of rice in historical ricing areas					×		
Documentation of two sites	×	×	×		×	×	
Identification of needed ecological interventions					×		
Objective 3: Identify the possibilities for the involvement of school students in the restoration process							
Identification of possibilities	×	×	×	×			
Identification of priorities				×			
Objective 4: Design a prototype for a camp that contributes to the re-establishment of relationships between WIN adults and wild rice							
Development of a wild rice camp prototype	×	×	×	×	×		
Gathering of wild rice camp participants' feedback						×	×
Assessment of participants' learning outcomes						×	×

3.6.1. Qualitative Methods

Qualitative methods included participant observation, interviews, and design workshops. Participant observation was used for establishing rapport, as well as facilitating involvement in community activities. Semi-structured interviews conducted in two stages provided the main data related to the objectives of the study. Design workshops guided the project and allowed for the design process to occur.

3.6.1.1. Participant Observation

This method is based on gaining data through participation with, direct experience of, and writing field notes about research participants (Bernard, 2006). According to Bernard (2006) and Kawulich (2005), participant observation allows for the collection of an extensive variety of data within cultural research and enables to ask more sensible questions. This method is appropriate for the present research because the Anishinaabeg believe that the participation in traditional land-based activities is essential for acquiring knowledge (Davidson-Hunt & Berkes, 2003). The most significant benefit at the beginning of this study was that participant observation helped to establish rapport, identify participants of the project, gather preliminary data, and establish emergent themes. Participant observation also contributed to higher validity of qualitative research through triangulation when combined with other forms of data collection.

Participant observation took place in different public settings, including the band office, the school, the wild rice camp, and design workshops. Trips to ricing sites for biophysical surveys and measurements also provided extensive opportunities for participant observation. My role was that of a participant observer, or an active participant, not a complete observer following people with little interaction (Bernard, 2006; Gatt & Ingold, 2013). Overall, my observations focused on the existing relationships between WIN members and manomin, as well

as ricing processes, ricing areas, and responses towards the project within the community. Observation of participants' involvement and responses to different components of the design process at design workshops helped me to understand participants' needs, interests, and motivations for involvement. During the wild rice camp and the finishing event, observation was mostly targeted at the overall atmosphere, participants' emotions related to their involvement, the memories that participants brought to the experience, possibilities for intergenerational knowledge transfer, adult learning, and interaction between participants.

Field notes were taken daily and typed in most cases. Often, jottings, or short scratch notes (Bernard, 2006), taken throughout the day helped not to forget what was observed. Field notes were repeatedly consulted during the data analysis phase.

3.6.1.2. Semi-Structured Interviews

Interviewing is an important method of qualitative data collection for several reasons described in Barriball and While (1994) and Dunn (2008). First, it allows for the understanding of beliefs, complex behaviours, and motivations, as well as collection of a diversity of meaning, opinion, and experiences. In addition, interviewing helps respondents to reflect upon their experiences. It also ensures that all the needed respondents answer all the required questions. Overall, this method allows for more focus and, therefore, the accomplishment of interview goals within a shorter period of time than participant observation.

The study used semi-structured interviews, which strike a balance between pre-determined order and flexibility (Dunn, 2008). Resulting from the open-ended nature of questions asked, semi-structured interviews allow for a more in-depth discussion of interviewees' personal experiences while helping to maintain a degree of control over the direction of the interviews. The choice of semi-structured interviewing helps to avoid the

common pitfalls of both highly structured and unstructured interviews. Highly structured interviews, which replicate the exact question order from one interviewee to the next, are not as appropriate because they restrict the freedom of responses and the freedom of designing a restoration process (Creswell, 2014; Rowley, 2012). On the other hand, unstructured interviews make it difficult for the researcher to maintain focus on the topic(s) of interest.

Interviews for the project were conducted in two stages: Stage A and Stage B. Stage A interviews, which were exploratory by nature, were conducted at the beginning of the project with young people aged 18-29 and adults aged over 40 (Figure 4). These interviews allowed for the documentation of TEK on historical locations, abundance, and use of wild rice and stimulated a discussion of community member' perspectives and ideas about wild rice restoration. Appendix 5 presents a list of questions and probes for these interviews. Walking probes were used for several interviews, which implied visiting sites that have meaning to participants, in order to elicit relevant data (De Leon & Cohen, 2005). Appendix 6 presents the interview guide for Stage B interviews, which took place after the wild rice camp, aimed at gathering participants' feedback on the new prototype for a wild rice camp and understanding the learning outcomes. The interviews took place 32-34 days after the completion of the camp so as to give the participants time for contemplation. The Stage B interviewees were asked to think about what they liked about the camp, what they learned, and how the camp could be improved.

Participants of both Stage A and Stage B interviews were selected using snowball sampling and key informant sampling, two types of judgment sampling which implies active selection of the most productive sample (Marshall, 1996; Tongco, 2007). According to Tongco (2007), this non-random sampling method does not require a certain number of research participants. The researcher decides what kind of information needs to be collected and searches

for people who want to provide the information. Snowball sampling used for Stage A interviews was based on referrals made among people who knew that others had certain qualifications related to the research question (Marshall, 1996; Shafie, n.d.). As described in Shafie (n.d.), the research team identified a few WIN members and asked them to identify other members of the population who could participate. Snowball sampling contributed to the diversity of informants and decreased bias associated with the choice of the most qualified interviewees by the researcher. Stage B interviews used key informant sampling associated with the choice of the most knowledgeable individuals (Tongco, 2007). All the camp participants aged 18 and over were asked to participate.

The information obtained through semi-structured interviews was transcribed on a daily basis with the help of the research assistant M. Scott. The data were also manually coded and analyzed for emergent themes and patterned regularities. Data analysis focused on a relatively small number of themes that reflected the objectives of the study, as well as the themes in the literature pertaining to ricing, involvement of young people, and transformative learning.

Figure 4: Interviewing and Elder and a Young Person from the WIN Community

3.6.1.3. Design Workshops

Three design workshops in the community, which were organized by the researcher with the help of Elder M. McDonald and M. Scott, were the main method guiding the project and the

link between other methods. These workshops were used for understanding key goals, discussing main findings, developing common understanding, and identifying next steps (Figure 5). Design workshops described in Kjærsgaard (2013) contribute to the transition from research to design by bringing to light different agendas and understandings. When knowledge pieces are juxtaposed and put together, reflection, creativity, and ideas emerge from the frictions.

Figure 5: Design workshops No. 2 and 3

Although Kjærsgaard (2013) does not provide an explanation of how exactly design workshops should be held, several techniques were used to trigger the design process. First, multi-aged WIN residents, including Elders, adults, and young people, with diverse educational and occupational backgrounds were invited to participate. This diversity of backgrounds allowed for unexpected discussions (IDEO, n.d.). Second, each workshop had all of the three design thinking: inspiration, ideation, and implementation (Brown, 2009). After the researcher's insights were shared with the workshop participants through a presentation, various exercises allowed for the translation of these insights into ideas and concrete plans of action.

Although there is no strict design kit with exercises for design workshops, several toolkits, for instance, the handbooks developed by IDEO (n.d.) and the Education Program of the Public Service Alliance of Canada (EPPSAC) (2007), provide techniques and tips, which guided the workshop participants through the process of creating and implementing solutions (Table 6).

Table 6: Use of Design Techniques at Design Workshops

Technique	Definition	Goals at WIN workshops
Visioning	Visioning allows participants to envision the future they want and make plans for achieving this future (Green, Haines & Halebsky, 2000)	- To set goals and plan actions for the restoration process
Asset mapping	Asset mapping identifies assets, or attributes and advantages of the community (Fuller, Guy, & Pletsch, 2002). These attributes and advantages include physical objects (natural and built assets), as well as jobs and businesses (economic assets), values and culture (social assets), and medical and educational services (public assets) (Falls Brook Centre, n.d.).	- To make a map of assets that exist in the community and could be useful in the wild rice project
Brainstorming	This technique is used for focused generation of ideas related to a certain theme or question, which gives permission to think expansively and without any organizational, operational, or technological constraints (EPPSAC, 2007; IDEO, n.d.; IDEO & Riverdale, n.d.)	- To identify possibilities for the involvement of children and young people - To define goals - To define what the community needs for achieving project goals
Dotmocracy	Dotmocracy is a method for a group to quickly establish priorities when faced with a long list of items (EPPSAC, 2007). Participants receive sticky dots and allocate them next to the items on the list which they consider the most important	- To define first and second priority restoration-related activities.

Due to the large number of participants and the necessity to create a knowledge-sharing environment, workshop participants worked in focus groups that consisted of 6-10 people in accordance with Hancock (1998). Elders and young people were usually grouped together. Teachers and other adults participated in the capacity of focus group facilitators. Each focus group received multi-colour stickers and pens for recording key discussion points and had a representative/s who presented the results after the discussion. Stickers were grouped on flip charts in accordance with the participants' identified themes. Notes about the workshop were compiled on the same day when workshops were held and were continuously consulted during data analysis.

3.6.2. Quantitative Methods

Numerous quantitative biophysical methods were used, such as bathymetric mapping, water level monitoring, vegetation surveys, water sampling for sulphate and pH, and transects (Figure 6). All these methods were targeted at measuring the factors which are important for wild rice habitats. Field surveys were done with the help of Elder M. McDonald and Monica Scott.

Figure 6: Bathymetric Mapping; a Secchi Disk and a Frame Used for Transects

3.6.2.1. Bathymetric Mapping

Bathymetric mapping is often required to evaluate overall habitat suitability for wild rice and the percentage of water body area in a given lake or river where wild rice could grow. A bathymetric map shows the shapes and depths of a bottom of a water body.

Within this study, bathymetric data were recorded using Lowrance LMS-520C sonar/GPS chartplotter combination device and analyzed through ArcGIS 10.2. Detailed procedures of data collection and analysis are described in *Insight Genesis User Guide* (n.d.) and Levec & Skinner (2004). Briefly, Lowrance LMS-520C was installed on a 12-foot Lund boat with a 3.5-horsepower Mercury motor. The boat was driven with a speed of no more than 10 km/h in a crisscross pattern with one transect looping the near shore area. The distance between passes was around 50m. Bathymetric data collection was done within the shortest possible period of time so as to avoid data inaccuracies due to water level fluctuations within a longer timeframe.

3.6.2.2. Water Level Fluctuations

Given that wild rice cannot tolerate sudden changes in water levels, water level fluctuations need to be monitored in ricing areas. In areas where water level indicators are missing, depth can be measured by installing baseline poles and observing water level changes after regular periods of time throughout extended periods. Throughout this study, water level fluctuations were monitored by installing a baseline pole and measuring changes in water levels.

3.6.2.3. Vegetation Survey

As many aquatic plant species compete with wild rice (see Chapter 2), submerged, floating-leaf, and emerging plant species found in ricing areas were recorded. No rakes were used to survey submerged plants because water depth was shallow enough.

3.6.2.4. Water Sampling for pH and Sulphates

Water samples were collected and analyzed for pH and sulphate concentrations. Water samples were taken at a distance from each other and away from other sources of water so as to secure samples that are representative of the selected water bodies. They were taken from the front part of the canoe/boat. Bottles were rinsed three times with lake/river water and submerged at arm's length below the water level. The samples were not refrigerated. pH analysis was done using a pH meter at the University of Manitoba. Sulphate analysis was done by ALS Global Lab.

3.6.2.5. Biophysical Documentation Using Transects

Biophysical documentation methodology using transects was adapted from Roberts (2005) without any considerable modifications and based on the development of transect lines through wild rice to the extent of its boundaries and conducting measurements of water depth, water turbidity, and vegetation cover by wild rice and other aquatic plant species. This

methodology helps to show any correlation between diverse habitat factors and wild rice growth and establishes baseline data for further monitoring the site and wild rice production over time.

In summer 2014, the extent of wild rice presence or absence was measured along 23 transect lines (A-W) across the Scot River by using a canoe to navigate the lake. The distance between transects fluctuated: transect start points were located where the researcher could see clear changes in wild rice density. Although Roberts (2005) used ground truthing for identifying these changes, ground truthing was not feasible in this study due to inaccessible shoreline and wetlands in the riparian zone. Thus, changes in wild rice density were estimated from the canoe.

Each transect had a different number of sampling plots and measurements due to the variation in the width of the river. Sampling intervals along each transect depended on the changes in the presence and/or absence of wild rice. For example, if wild rice was present for two consecutive sampling locations without any interruption in between them and any considerable change in density (e.g., 10m and 20m), sampling intervals would be increased by 10m. Also, at both the start and finish for each transect line, a shoreline buffer of 10m was applied to eliminate the shoreline edge effect. Distances were measured using a Garmin eTrex GPS device, as well as all the other locations with the help of UTM and 15E coordinates.

Water depth, water turbidity, rice proportion, extraneous aquatic vegetation proportion, and other aquatic vegetation species presence were recorded at each sampling plot. Both water turbidity and water depth were measured from the centre of the right hand side of the canoe using a 20 cm Secchi Disc with a rope marked with 0.5 m increments (Figure 6). The Secchi Disc is usually used to measure how deep sunlight penetrates the water column, and the depths of disappearance of the disc correspond to turbidity measurements; however, similarly to Roberts' (2005) study, this study used the Secchi Disc for measuring depth.

The proportion of wild rice cover and the proportion of other vegetation were also recorded at all 175 sampling plots. To evaluate the percentage of wild rice and other vegetation cover, the research team constructed a 1×1m wooden frame (Figure 6). For each measurement, the square was held over the water on the right-hand side of the canoe, which allowed for the evaluation of the percentage of wild rice and other vegetation, as well as identification of the species found inside this square. Also, there were two vegetative 2×2m shoreline plots located 10 m from the shoreline, where other vegetation was documented.

As stated, this methodology corresponds to the methodology described in Roberts (2005) with some minor changes, which were necessary due to the characteristics of the landscape and flora. This study had many more transects than Roberts' (2005) as study transects were located on a small river instead of a lake. Also, due to inaccessibility of the shore, many transects could not be marked with tags on the trees. In addition, while the transects described in Roberts (2005) ran 360º due North, transects within this study were not parallel due to river curvatures.

Obtained data were analyzed using an analysis of variance (ANOVA) with the proportion of wild rice as a dependent variable and depth, transparency, and proportion of other aquatic plants as independent variables to see if these factors influence wild rice density. Analysis of covariance (ANCOVA) was also done with rice density as a dependent variable, plant species presence or absence as a fixed factor, and water depth as a covariate to identify how the presence or absence of certain plant species influences wild rice density.

3.7. Validity and Reliability of the Study

With respect to qualitative data, triangulation of data, verification workshops, and member checking helped to address concerns over validity and reliability (Lee, Mishna & Brennenstuhl, 2010). Triangulation mostly occurred through the incorporation of three distinct

qualitative data collection methods described above: design workshops, interviews, and participant observation. (Lee et. al., 2010; Stake, 1995; Yin 2009). Validity increases with the use of several sources of data collection (Yin, 2009). In addition, design workshops served as verification workshops. Moreover, constant member checking increased the validity of the data.

3.8. Dissemination of Results

Collected information was shared with research participants at design workshops. Before the wild rice camp and wild rice finishing event, annotated bibliography, lesson plans, and posters printed in 48''× 36'' format were provided to the teachers. With the completion of the research, hard copies of the thesis, as well as a video of the wild rice camp and finishing day, all project photos, interviews and their transcripts, and tables with quantitative data will be submitted to the WIN band office and the school. Also, the research results have been presented at 38th Annual Conference of the Society of Ethnobiology, the 2015 Annual Conference of the Environmental Studies Association of Canada, and *Connecting Peoples and Grounds* conference in Kenora. At two of these conferences, results were co-presented together with WIN Elders.

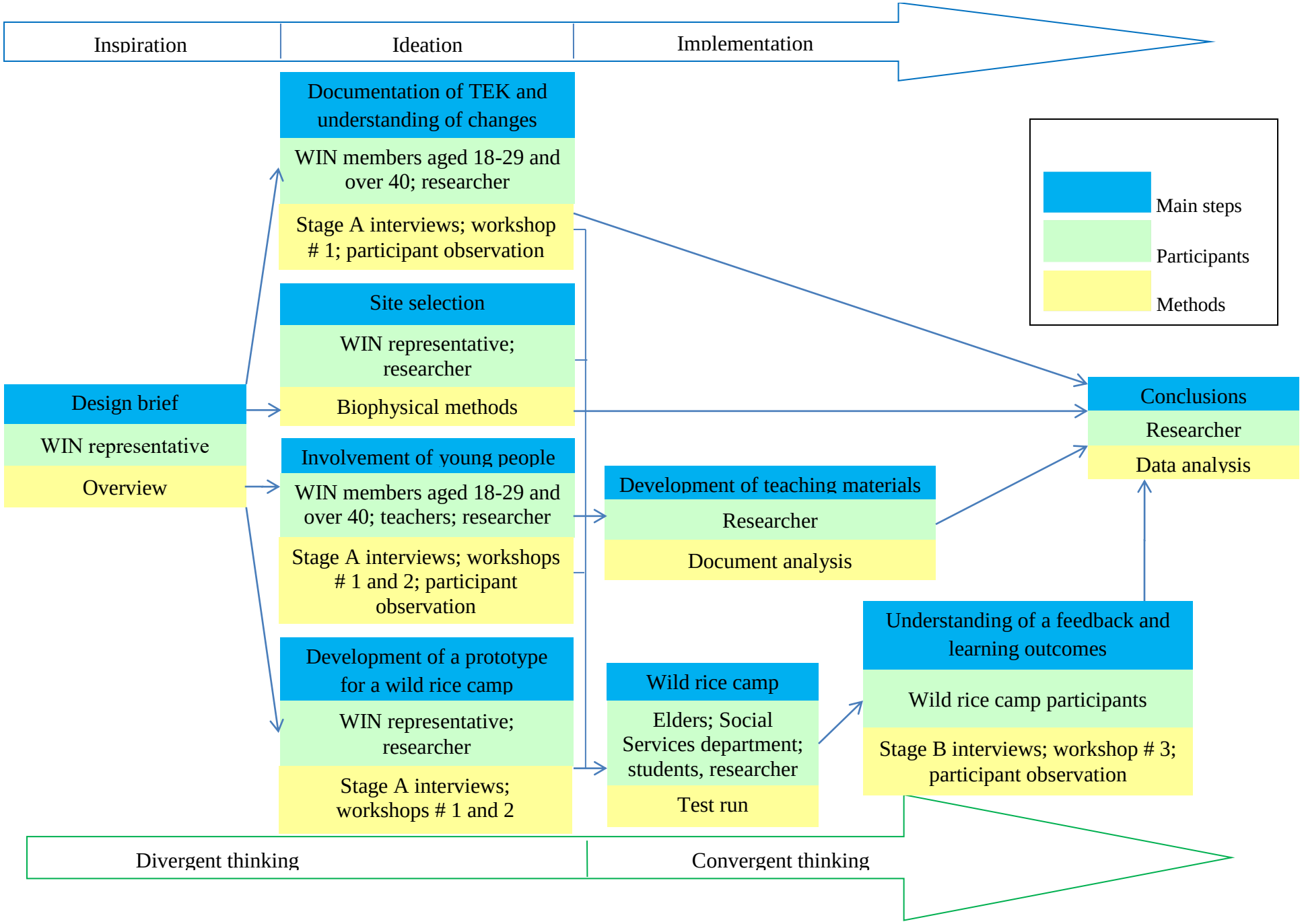
3.9. Research Process

Figure 7 presents the main stages, participants, and methods of the research process.

3.10. Summary

In this chapter, the research worldview, design, strategy, and methodology were described in detail. This pragmatic mixed methods case study drew upon principles of BCD (Davidson-Hunt et al.), WD (Higgs & Hobbs, 2010), and HCD (Brown, 2009). Qualitative data were collected through participant observations, semi-structured, and design workshops. The study also used numerous quantitative biophysical survey methods.

Figure 7: Research Process



CHAPTER 4: PAST AND PRESENT STATE OF WILD RICE-RELATED PRACTICES

> *"We need that rice. The Indians were given Indian rice, while Chinese and Japanese people were given white rice. We are all given different things. Our wild rice was given to share. Now, we don't have Indian rice to share anymore"* (Elder I. Muckle, interview, Aug. 7, 2014).

In the past, the WIN members had numerous wild rice–related practices including harvesting (*manominike***)**, finishing (*kiishtoon***)**, storage (*na`esitoon*), cooking (*kiizhite*), planting, and controlling water levels. However, major socio-cultural, economic, and ecological changes in the second half of the 20th century undermined these practices. As a result, practically a half of adult research participants aged over 40 have not harvested wild rice for more than 30 years and rice can be found in fewer areas in the WTLUA than before. The data presented in this chapter are collected through 24 Stage A and Stage B interviews with adults aged over 40, 12 Stage A and Stage B interviews with young people aged 18-29, first and second workshops, and personal communication with research participants. Throughout the chapter, these data are compared and combined with the information found in *Wild Rice and the Ojibway People* (Vennum, 1988)[8].

4.1. Ricing and Other Wild Rice-Related Practices in the Past

This section describes the past state of rice-related activities, which include harvesting, finishing, and cooking, as well as presents harvesting areas and teachings relevant to wild rice camps. All this is juxtaposed to the contemporary state of ricing in the next section.

4.1.1 Involvement in Wild Rice Harvesting

Most of the adults interviewed (91.7%) harvested wild rice in the past. Of those who did not participate directly, G. Scott used to take care of her younger siblings in a camp while her parents were ricing and never harvested rice herself (interview, Aug. 22, 2014). C. Morrison-

[8] Vennum (1988) mostly uses data collected in Minnesota and Wisconsin, where wild rice-related practices could be significantly different from the practices in Central Canada. Also, Vennum has a Western science-based perspective as a non-Anishinaabe researcher. Nevertheless, as the major historical text about wild rice it is utilized to show changes that have occurred, including changes in TEK.

Mandamin, who is originally from Rat Portage reserve in Northwestern Ontario, did not have a chance to be involved because she spent most of her childhood in a residential school (interview, Aug. 26, 2014). However, her family took her to rice fields when she was around five or six. She expresses her sadness related to missed chances to harvest rice:

> "*I never got the enjoyment of learning this process… I was looking forward to when it was going to be my turn to be able to do what my sisters were already doing and learning how to harvest that rice"* (interview, Aug. 26, 2014).

4.1.2. Wild Rice Harvesting Methods and Equipment

All interviewees (100%) touch upon traditional ways of harvesting (*manominike*) wild rice from a canoe or by walking. The latter way, which is not described in Vennum (1988), was used in lakes (*zaaga`igan*) and rivers (*ziibi*) which naturally dried up throughout the summer and, therefore, were not suitable for canoeing. However, harvesting from a canoe was the most common method due to its convenience and sufficient depth of most water bodies.

The main traditional equipment used while harvesting rice from a canoe were push poles (*gaandakii`iganaak*) and ricing sticks (*manominaatig*). Push poles were often respectfully called push masters (C. Cameron, interview, Jul. 30, 2014). As indicated by A. Quewezance (interview, Jul. 29, 2014), straight push poles were about six to eight feet long with triangular plywood pieces attached at the end. Interviewees do not recollect what was used before plywood was invented. According to Vennum (1988), traditional push poles had wooden forks at the end. With respect to the material of push poles, interviewees mention spruce (Elder C. Fisher, interview, Aug. 1, 2014) and driftwood (G. Scott, interview, Aug. 22, 2014).

Ricing sticks were another essential piece of rice harvesting equipment. These sticks were mostly made of spruce, which is a perfect light material that becomes lighter with time due to drying out (Elder M. McDonald, interview, Jul. 28, 2014). Eastern white cedar, which is very resistant to rot due to natural oils it contains, is even better, but it was rarely used in WTLA

because of its scarcity (Elder C. Fisher, interview, Aug. 1, 2014). Hardwood was also used for making rice sticks, although more rarely. For example, as described by G. Michaud (interview, Oct. 23, 2014), some sticks were made out of poplar, which is a heavier but more durable hardwood. According to Elder C. Fisher (interview, Aug. 1, 2014), some community residents made sticks out of ash over the winter, dried them, and put them in boiled water in order to avoid cracking. Such sticks lasted a lifetime. The size of sticks is also very important. As pointed out by Elder R.R. McDonald (interview, Aug. 11, 2014), arm-long sticks are the easiest in operation. With regard to the shape, many families used to make sticks about 2-4 inches thick at the base, narrowing to a point because they were more functional (Elder I. Muckle, interview, Aug. 7, 2014). Also, sticks often had decorative handles (Elder M. McDonald, interview, Jul. 28, 2014). The following statement reflects the importance of sticks to their owners:

> *"My Dad brought some little sticks… That's what he used to tell us: "I don't want you guys to play around with these sticks. These are for wild rice picking. If you play around with them, you will get them dirty". So, we never touched them. They were always on the wall, on the tree in a camp, or, mostly, in the canoe"* (Elder T. Tikanye, interview, Jul. 28, 2014).

While using a canoe and traditional ricing equipment, one of the participants paddled (*apwi*) or pushed a pole into the lake or river bottom in order to move the canoe forward, while the second participant, the picker, used rice sticks for knocking (*bawa`am*) rice down into the canoe. Push poles were very useful for harvesting in rice beds, where water was often very shallow. Polers pushed into the mud very carefully so as not to disturb the root system (Elder J. Hunter, personal communication, Sep. 16, 2014). While pushing was a physically demanding job, rice knocking required certain skills, specifically, hand-eye coordination (Elder T. Tikanye, interview, Jul. 28, 2014). The basic technique explained by interviewees corresponds to the description provided in Vennum (1988, p. 99): "the ricer holds one stick in each hand and as the

poler moves the boat forward, the harvester reaches to the right with the stick and pulls as many stalks as she (or he) can… She/he then knocks the stalk with the stick in her/his left hand in a glancing stroke aimed at the bottom of the canoe". Correct knocking was done from the side, not from the top (Elder M. McDonald, personal communication, Sep. 16, 2014).

In the canoe, harvesters (*manominikewag*) might sit in three different ways. When the water was not deep and push poles were being used, pickers sat at the back facing the front of the canoe and polers stood behind them at the stern (Elder M. McDonald, interview, Jul. 28, 2014). This description directly corresponds to the information provided in Vennum (1988) with respect to contemporary wild rice harvesting. When it was possible to use paddles, paddlers sat at the front and pickers harvested rice at the back (Elder C. Fisher, interview, Aug. 1, 2014), which corresponds to mid-19th century practices described in Vennum (1988). This harvesting method was very common, but some community members modified it. For example, G. Michaud has always harvested rice with his regular harvesting partner J. Carpenter in a reverse way (interview, Oct. 23, 2014). J. Carpenter paddled at the back, while G. Michaud knocked rice at the front facing the paddler. According to G. Michaud, this way it is possible to "embrace more rice". Although interviewees acknowledge that wild rice harvesting was a two-person job, Elder P. Michaud has harvested rice alone all his life and managed to match the harvesting rate of two-person teams (interview, July 29, 2014). He was successful because he worked in the middle of the lake where rice density was low, but there was less competition.

Several research participants mention gender-based distinctions between harvesters' roles. As stated by Elder M. McDonald (interview, Jul. 28, 2014), women were usually responsible for harvesting rice and men performed poling duties because it was a more physically demanding job. Polers and paddlers were usually the fittest people out of the two ricing partners (Elder A.

Henry, interview, Jul. 31, 2014). As pointed out by Elder A. Fraser (interview, August 7, 2014), handling 80-100 pound bags of rice was the most difficult task for her and her female partner.

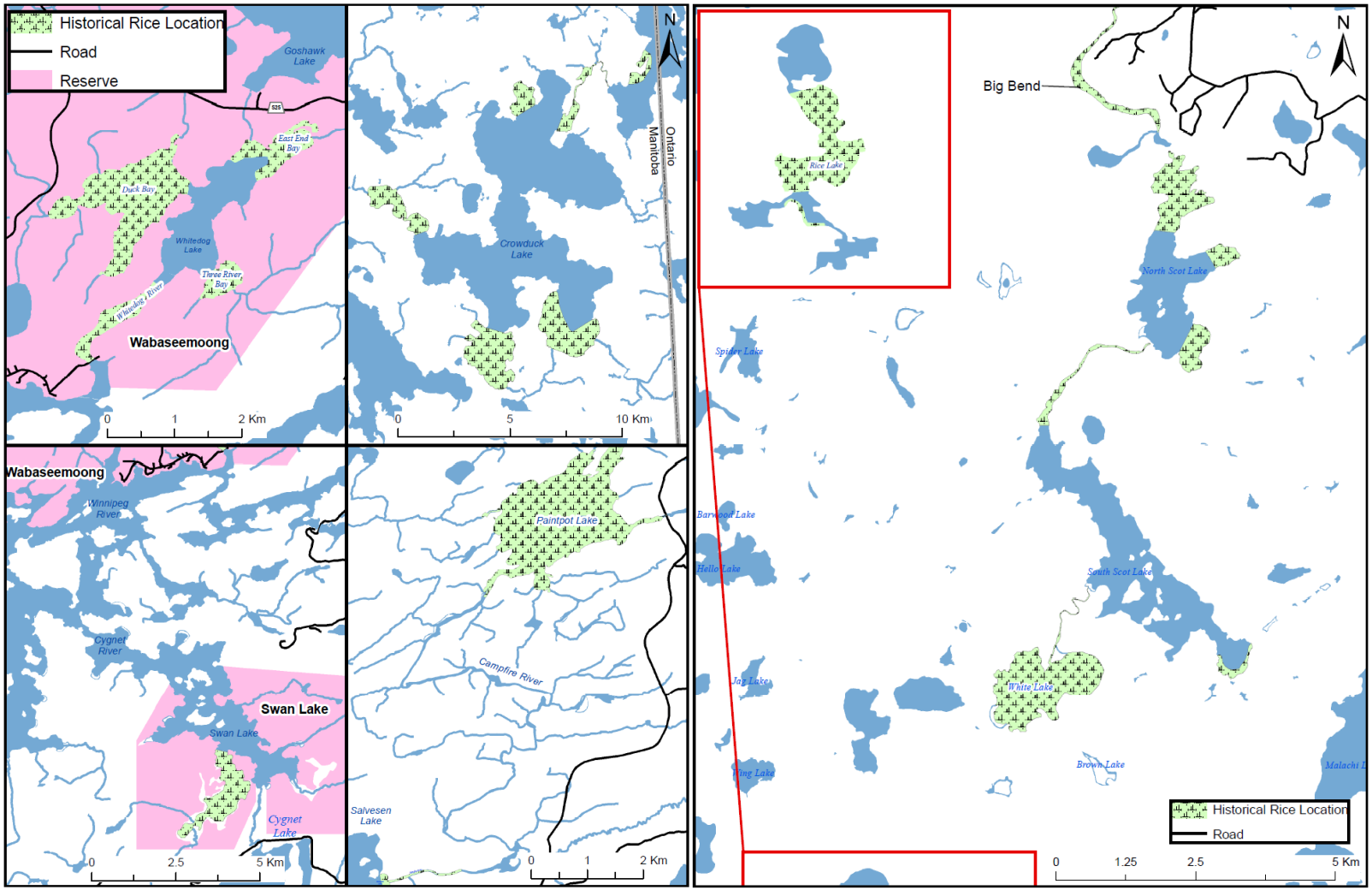
When lakes and rivers dried out, community residents hand-picked wild rice while walking. This practice is not described in Vennum (1988). It often happened on the Whitedog River, which dried up by August-September and forced community residents to walk on dried mud (Elder M. McDonald, interview, Jul. 28, 2014). To prevent sinking in the mud, harvesters tied cardboard or plywood to their shoes with strings to increase the contact surface and caught rice in tarps or canvas (Elder C. McDonald, interview, Aug. 5, 2014). Two people at the front were harnessed into sheets of canvas, while a person at the back knocked rice into the canvas. Children often walked and harvested rice in packsacks (Elder C. McDonald, interview, Aug. 5, 2014). Overall, community members were very resourceful in finding ways to harvest *manomin*.

4.1.3. Wild Rice Harvesting Areas

Figure 8 presents a map of the most important historical ricing areas identified through interviews with community members. Most ricing sites were located within WTLUA; however, sometimes WIN members harvested rice outside of WTLUA. Although Whitedog Lake was the main ricing area due to its proximity to the WIN community, WIN members often travelled for a very long distance. As underlined by Elder M. Quewezance (interview, Aug. 28, 2014) and A. Quewezance (interview, Jul. 29, 2014), community residents used to have a nomadic way of life.

In some cases, WIN members harvested rice on water bodies located close to their trapline areas. For instance, as underlined by Elder M. McDonald (interview, Jul. 28, 2014) and Elder M. Smith (interview, Aug. 12, 2014), Paintpot Lake was the Fishers' trapline area. Although the property was not legally defined, no other families harvested wild rice in that area.

Figure 8: Maps of Historical Wild Rice Distribution Areas[9]



[9] These maps, as well as other maps in this thesis, do not show the exact locations of the ricing areas and are not accompanied by context maps in order to respect the wishes of WIN in masking exact locations of wild rice fields.

The main means of transportation used by community members for traveling to remote rice fields were by boat, plane, or train. Canoeing and crossing portages was physically demanding. Elder C. Fisher mentions that sometimes they spent seven to eight hours in a canoe to get to the rice field (interview, Aug. 1, 2014). Elder I. Muckle also recollects that several families used to share one boat, which carried several canoes behind it and traveled no faster than 5 km per hour (interview, Aug. 7, 2014). Alternatively, some of the ricing areas, such as Salvesen and Paintpot Lakes, were accessible only by air before the construction of the road to Ear Falls by Ontario Ministry of Natural Resources (G. Scott, interview, Aug. 22, 2014).

4.1.4. Wild Rice Camps

During the rice harvesting season, WIN members often camped at ricing sites to avoid commuting between remote sites and their settlements. Families lived in large canvas tents (*pagwaanegamik*) and shared the same carefully chosen campsites (*gabeshiwinan*) with other families year after year (H. Kent, interview, Aug. 2, 2014; G. Scott, interview, Aug. 22, 2014). When the campsite was selected, many factors were taken into consideration such as site openness, closeness to water, absence of waves, remoteness from mosquito infestation areas, and access to wood and clean water (Elder R.R. McDonald, interview, Aug. 11, 2014).

As described by Elder R.R. McDonald (interview, Aug. 11, 2014) and J. Fisher (interview, Aug. 5, 2014), camps served as a space for collaboration and reciprocity. People shared responsibilities such as the securing and management of communal resources like firewood and water. Community members also shared meals together (Elder C. McDonald, interview, Aug. 5, 2014), as well as exchanged small food items with one another such as small bags of rice, meat, and fish (Elder R.P. McDonald, interview, Aug. 26, 2014). This ethic of sharing was a significant part of camp life; for example, if somebody killed a moose, they

typically shared the meat (Elder J. Hunter, interview, Aug , 2014). However, most families did not hunt any large game so as not to distract themselves from the rice harvest. Fishing was the only activity which did not interfere with ricing.

There was a job for everyone at the camps, from the youngest to the oldest participants. Elder T. Tikanye (interview, Jul. 28, 2014) and G. Scott (interview, Aug. 22, 2014), both the oldest children in their families, mostly undertook child care for their brothers, sisters, and cousins. One of their responsibilities was the protection of their younger siblings from wild animals (G. Scott, interview, August 22, 2014). Older people at the camps also cared for children, cooked meals, or cleaned fish (Elder M. Quewezance, interview, Aug. 28, 2014).

Wild rice camps were used not only for labour, but also as a place for important leisure activities that contributed to family and community cohesion. Games were an important part of the leisure experience. The main games mentioned by the interview participants included throwing a pocket knife (Elder C. McDonald, interview, Aug. 5, 2014), twelve sticks (Elder T. Tikanye, interview, Jul. 28, 2014), and the moccasin game (Elder R.P. McDonald, interview, Aug., 26, 2014). As a girl, Elder M. Quewezance (interview, Aug. 28, 2014) was never allowed to play the moccasin game (*makizini ataatiwinin*), but she remembers that some of the players would hide a marble under leather pelts at the sound of the drum and their opponents would try to guess where it was hidden by stepping on the pelts with moccasins on.

Overall, community members have positive memories of wild rice camps. According to Elder R.P. McDonald (interview, Aug. 26, 2014), camping was a very "happy, quiet, and free time with much openness and freedom". Elder I. Muckle also expresses her positive sentiments:

> *"Everybody had fun, lots of fun in there. People used to tease each other. They didn't compete against each other. There wasn't any greediness. They helped each other to pack rice. It was like a big family. That's the way it was. That's the way it is supposed to be"* (interview, Aug. 7, 2014).

4.1.5. Wild Rice Finishing

Although only ten adult research interviewees (41.7%) participated in wild rice finishing and all of them (100%) sold it green or non-finished, all Elder informants (100%) have either seen or participated in the wild rice finishing (*kiishtoon*) process. WIN members usually finished rice for subsistence purposes. Some families sold finished rice for additional income, due to its price of $4 per pound as opposed to green rice which sold at around 50 cents (Elder P. Michaud, interview, July 29, 2014).

The wild rice finishing process described by WIN Elders was practically the same as described in Vennum (1988); however, there were some subtle differences. The main stages included drying (*baasaan*), parching (*ogaapizaan*), hulling (*baawishkaam*), and winnowing (*nooshkaachige*). According to Elder P. Michaud (interview, Jul. 29, 2014), before parching, rice needed to be stored in bags for around four days. Vennum (1988) states the opposite: fresh rice from the lake was dried (*baasaan*) almost immediately. Elder M. Quewezance's grandparents dried rice by spreading it on a canvas tarp (interview, Aug. 28, 2014). No research participants spoke about rice smoke drying, which is described in Vennum (1988).

For parching (*ogaapizaan*), rice was usually put in large rectangular pans (*kaakaapisigan*) over a low fire and pushed back and forth by two people with the help of a pole with a triangular piece of plywood at the end, which was similar to a push pole. Elder R.P. McDonald's parents used a round rice pan and a paddle (Elder R.P. McDonald, interview, Aug. 26, 2014). C. Morrison-Mandamin (interview, Aug. 26, 2014), who was raised at Rat Portage, also recollects "big steel drums". The fuel of choice for parching was usually dry poplar, which was burned at low temperatures to avoid burning rice kernels (Elder P. Michaud, personal communication, Sep.

20, 2014). Traditional parching, in comparison with modern machine parching, brought a distinct roasted flavour to wild rice (Elder A. Henry, interview, Jul. 31, 2014).

Traditional hulling was done by placing the rice in bags within a hole in the ground (*pagwaanike*) and stepping on them. This so-called "dancing on the rice" (*baawishkaam*) was done to remove the close-fitting chaff (*ozoowaanowashk*) from the kernel. This process is also called treading (Vennum, 1988, p. 130). According to Elder M. Quewezance (interview, Aug. 28, 2014), holes were always dug to have very smooth walls. Alternatively, WIN members used to remove chaff by putting rice in bags and rubbing the bags (Elder I. Muckle, interview, Aug. 7, 2014). Finally, rice was winnowed (*nooshkaachige*) by putting it on birch bark trays (*wiigwaaso onaagan*), tossing it into the air, and catching it, allowing the loose chaff to blow away in the wind (Elder R.P. McDonald, interview, Aug. 26, 2014).

WIN members made parching, hulling, and winnowing equipment by hand, constructing tools such as parching pans or troughs out of aluminum or galvanized steel (Elder M. McDonald, interview, Jul. 28, 2014; Elder C. Fisher, interview, Aug. 1, 2014). The metal was often burnt before the pans were used (Elder T. Tikanye, interview, Jul. 28, 2014). Traditional hulling did not require special equipment, but Elder P. Michaud's family, which sold finished rice, mechanized the hulling process using a machine, which he still stores in his backyard (Elder P. Michaud, interview, Jul. 29, 2014). The machine consists of a rotating drum with an axis and a series of sticks that are fixed inside at different angles. Trays for winnowing were usually made out of birch bark. Elder M. Quewezance describes the birch bark pre-harvesting and harvesting process (interview, Aug. 28, 2014). Before harvesting, trees were marked and offerings were given to those trees which were to be hurt. After harvesting, bark was cleaned and refrigerated.

4.1.6. Teachings and Customary Laws

There are numerous teachings (*kiikwekoke`iinan*) and beliefs related to the wild rice harvesting and finishing processes. Wild rice camps were an excellent learning environment which allowed grandparents and parents to share their knowledge with the youth. Table 7 contains the main teachings identified by the research participants. The overarching themes are respect to wild rice and nature, patience, discipline, responsibility, and knowledge transfer.

Table 7: Wild Rice-Related Teachings and Beliefs in the WIN Community

Teachings	Description
Avoid any damage of wild rice plants and their roots	It is necessary to use a push pole carefully so as not to damage wild rice plants and their roots (Elder C. Cameron, interview, Jul. 30, 2014); no zigzagging is allowed as rice pickers need to move in straight parallel lines (Elder P. Michaud, interview, Jul. 29, 2014)
Give gifts to nature	Harvesters need to put tobacco in the bush and in the water to express gratitude for the rice (J. Fisher, interview, Aug. 5, 2014); it is important to feast rice and other gifts that come from water (Elder M. Quewezance; interview, Aug. 28, 2014)
Be patient and do not rush	Harvesting needs to be done slowly and patiently, without any rush (Elder C. Cameron, interview, Jul. 30, 2014); rice pickers need to have a rest on the shoreline from time to time (Elder J. Hunter, personal communication, Sep. 17, 2014); young rice pickers need to learn the ricing process patiently (G. Michaud, interview, October 23, 2014)
Put everything to where it belongs	Chaff from wild rice finishing needs to be thrown back into the water (Elder M. Quewezance, interview, Aug. 28, 2014)
Keep wild rice camps clean	Garbage needs to be destroyed by burying it in a hole in the ground and covering the hole with rocks (A. Quewezance, interview, Jul. 29, 2014); no food can be left at the campground, even fish and fish bones are to be thrown away into the water (Elder C. Cameron, interview, Jul. 30, 2014)
Do not drink at wild rice camps	Excessive consumption of alcohol should be avoided; "you gonna spoil the apple if you bring alcohol" (Elder I. Muckle, interview, Aug. 7, 2014)
Teach the next generations	Share what you know with the next generations (J. Fisher, interview, Aug. 5, 2014)

Several customary laws existed which were related to *manomin* harvesting and helped to organize the ricing process. Rice fields needed periods of rest; therefore, after three days to a week of harvesting, on one water body, community members moved to other areas and then came back (Elder A. Henry, interview, Jul. 31, 2014). Elder C. Fisher calls this practice, which is

also described in Vennum (1988), “lake rotation” (interview, July 31, 2014). Every camp had a knowledgeable Elder who announced to others the appropriate time to begin harvesting or move to a new area (Elder R.R. McDonald, interview, August 11, 2014). Vennum (1988) calls this leader a “rice chief” (p. 178). The participants of the first workshop referred to this person as a “rice keeper” and expressed their dissatisfaction with the term “chief”, which overemphasizes the direct management role of this individual and does not reflect the importance of stewardship.

4.1.7. Wild Rice Storage

Wild rice was mostly stored (*na`esitoon*) in sacks or large glass jars (Elder C. McDonald, interview, Aug. 5, 2014). WIN research participants do not mention traditional cedar bark containers described in Vennum (1988). Elder M. Quewezance’s grandparents used to store rice in a root cellar in the middle of the house alongside with berry jams, vegetables, dried berries, and sturgeon oil used for frying bannock (interview, Aug. 28, 2014). The straw matting on the cellar floor was changed every year. Similarly, Elder I. Muckle’s family had an outdoor root cellar for storing rice and other consumables (Elder I. Muckle, interview, Aug. 7, 2014).

4.1.8. Other Attempts to Manage Wild Rice

Besides harvesting and finishing, there have been other attempts to manage wild rice, with mixed results. Community members also planted wild rice and controlled water levels, which was unsuccessful in most cases. For example, Elder T. Tikanye’s grandfather once planted rice in a small bay near the present-day WIN daycare facility, but it never took hold (interview, Jul. 28, 2014). The main reason perceived by Elder T. Tikanye was that rice does not grow in noisy areas. However, when wild rice was seeded on a small pond near the Trout Lake Road, it grew there and yielded a harvest in 2014 (Elder T. Tikanye, personal communication, Jul. 31, 2014). With respect to water level control, Elder P. Michaud’s father successfully installed dams

made of rocks on the rapids at Cygnet Lake (interview, Jul. 29, 2014). Research participants recollect no other management practices described in Roberts (2005) or Vennum (1988). The reasons may be the loss of knowledge or the absence of these practices in the WIN community.

4.1.9. Cooking Wild Rice

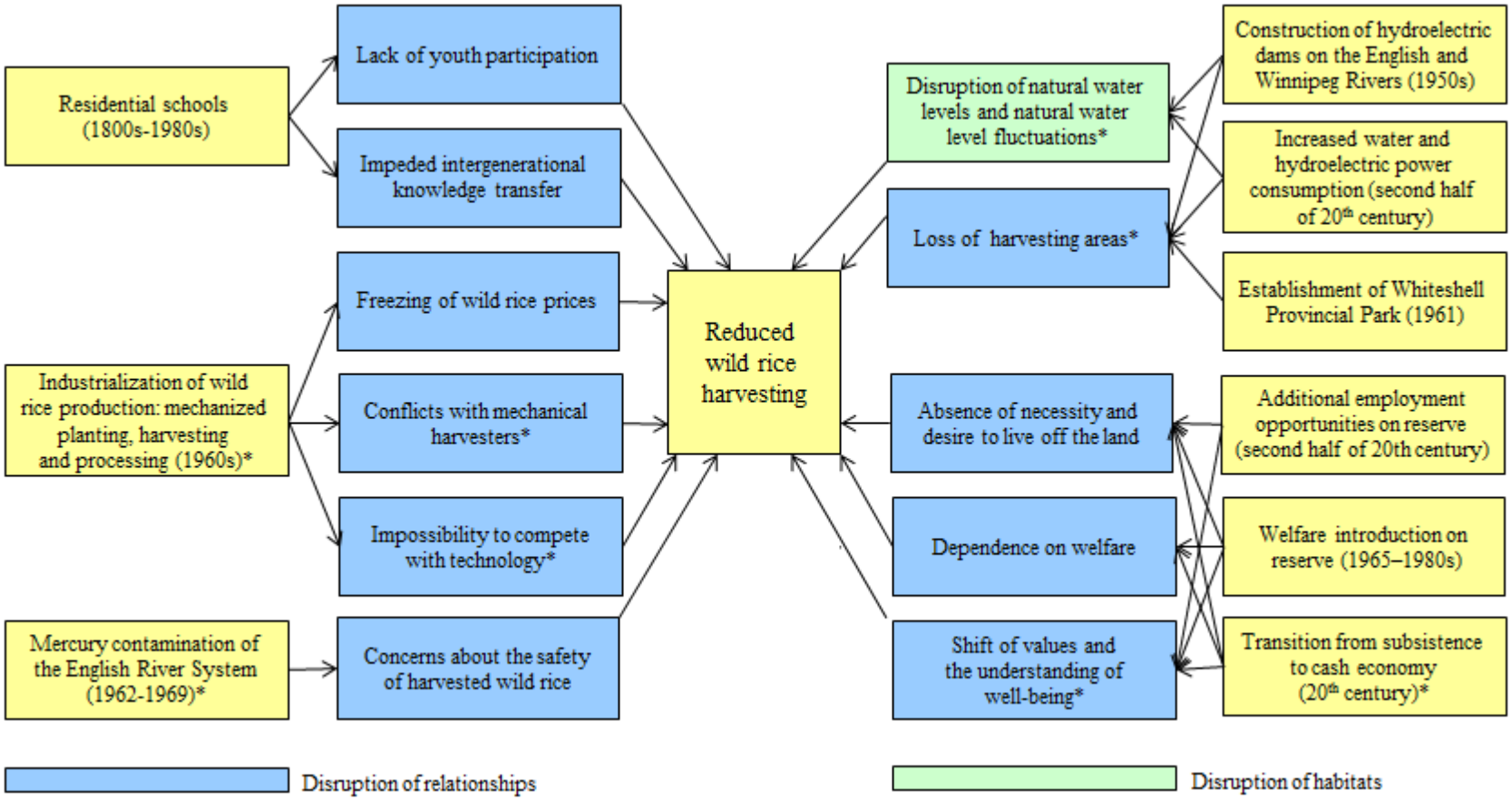
Stage A interviewees also describe different ways of cooking (*kiizhite*) wild rice. The dish preferred by Elder R.R. McDonald is wild rice soup, which he believes is best when prepared with moose meat (interview, August 11, 2014). Wild rice meat loaf is another delicacy mentioned by interview participants (Elder C. McDonald, interview, Aug. 5, 2014. Some community residents mention deserts such as wild rice puddings with blueberries (Elder I. Muckle, interview, Aug. 7, 2014) and raisins (Elder A. Fraser, interview, Aug. 7, 2014).

One more dish mentioned in the interviews is popped wild rice. Elder R.R. McDonald (interview, Aug. 11, 2014) explains that popping rice is the same as popping corn. Rice is put on a lightly greased frying pan and stirred non-stop until it pops. It is a delicious meal similar to puffed cereal. Elder M. Quewezance remembers that rice was often popped over an open fire (interview, Aug. 28, 2014).

4.2. Changes in the 20th Century

The 20th century brought many changes that negatively influenced the ricing practices. These changes led to both disrupted wild rice habitats and disrupted relationships with *manomin*. Figure 9 presents the socio-cultural, economic, and ecological factors that contributed to the demise of wild rice harvesting. The factors marked with an asterix are described in Vennum (1988). The other factors are identified by the informants.

Figure 9: Factors that Contributed to the Demise of Wild Rice Harvesting



4.2.1. Disrupted Relationships

Residential schools influenced wild rice harvesting directly and indirectly. C. Morrison-Mandamin never harvested wild rice because she spent all her childhood in residential schools (interview, Aug. 26, 2014). Several other community members mention the same direct impact of residential schools. In addition, schools impeded the dissemination of knowledge and contributed to the disappearance of the Anishinaabe language, which had an indirect negative influence on community members' relationships with their cultural landscapes. As stated by Elder R.P. McDonald (interview, Aug. 26, 2014), present-day native language teacher at Mizhakiiwetung School, he forgot the language while in a residential school, but managed to recover it once he returned home.

The industrialization of wild rice production through wild rice paddy cultivation and mechanical harvesting and processing had several negative impacts on traditional wild rice harvesting. Firstly, industrialization resulted in "frozen" prices for wild rice. In spite of inflation, wild rice prices have not increased since the beginning of the 1980s (Kuzivanova field notes, September 23, 2014). The average purchase value per pound of wild rice in the 1980s was 50 cents; in 2014, wild rice harvested by the participants of the WIN wild rice camp was sold for 62 cents per pound. As stated by Elder C. Cameron (interview, Jul. 30, 2014), community members stopped harvesting because these prices were no longer worth the time and resources required to harvest wild rice. Secondly, according to several participants, the introduction of mechanical harvesting resulted in conflicts between traditional and mechanical harvesters, who are often mistrusted by traditional harvesters. Elder P. Michaud is the only research participant who expressed a positive attitude towards airboats used for harvesting, because they can be used for rice harvesting after rice is hand-picked (interview, Jul. 29, 2014). J. Fisher recollects with

displeasure that in the past airboats knocked all the rice down before canoeists could get to the rice fields (interview, Aug. 5, 2014). Elder R.R. McDonald also recollects that harvesting by airboats was done by WIN members themselves (interview, Aug. 11, 2014). Elder T. Tikanye also expresses her disliking of mechanical rice knocking; however, she holds the impression that machines were mostly operated by outsiders (interview, Jul. 28, 2014). Thirdly, industrialization of the wild rice production process made it impossible for traditional harvesters to compete with the scale and speed of harvest that the efficient machinery made possible.

One more factor was the establishment of Whiteshell Provincial Park in 1961. WIN people were gradually pushed out of Crowduck Lake area, which was not a part of WTLUA anymore (Elder C. McDonald, interview, Aug 5, 2014). Mercury contamination of the English River in 1962-1969 was one more factor that resulted in decreased wild rice harvesting. As underlined by H. Fisher (workshop, Jul. 23, 2014), she is concerned about the concentrations of mercury in wild rice harvested in the WTLUA.

The introduction of welfare is another reason for the declining involvement in ricing identified by community members. With the introduction of welfare, rice harvesting was no longer necessary for survival (Elder H. Fisher, interview, Aug. 19, 2014). As stated by Elder M. McDonald (interview, Jul. 28, 2014), the 1965 Indian Welfare Agreement "contributed to the downfall of the Anishinaabe culture", although the negative effects of welfare introduction became obvious only in the 1980s because it took WIN members more than ten years to start trusting the welfare system. Another factor that decreased the necessity of rice harvesting was the onset of employment opportunities on reserve. Elder C. McDonald recollects that his parents stopped going out "to the bush", when they became employed (interview, Aug. 5, 2014).

Both welfare introduction and additional employment opportunities also resulted in a shift of values and understanding of well-being. This shift coincided with the larger transition from a subsistence to a cash-based economy by many Aboriginal peoples during the 20th century. In the 1950s-1960s, wild rice harvesting became a source of livelihoods, alongside with fishing and blueberry picking. As stated by Elder M. Quewezance (interview, Aug, 28, 2014), when she started picking rice after the residential school in the late 1950s and early 1960s, no one harvested rice for subsistence anymore. The harvesting period was very intense and people often harvested rice without taking any breaks (Elder C. Cameron, interview, Jul. 30, 2014). Harvest quantities ranged from one bag of rice a day as described by Elder R.R. McDonald (interview, Aug. 11, 2014) up to six bags a day as mentioned by Elder T. Tikanye (interview, Jul. 28, 2014). Each bag contained 60 to 100 pounds of rice. As underlined by Elder A. Henry (interview, Jul. 31, 2014), many community residents ceased rice finishing because they wanted the immediate payment without waiting a month to complete the finishing process. Therefore, rice was sold "green" (Elder C. Cameron, interview, Jul. 30, 2014). According to Elder C. McDonald (interview, Aug. 5, 2014), rice prices fluctuated from 50 cents to $1.35.

Commodification of wild rice negatively influenced the spiritual relationship that Anishinaabe people had with *manomin* (Elder I. Muckle, interview, August 7, 2014). For Elder A. Henry (interview, Jul. 31, 2014), in the present day wild rice has no meaning besides the opportunity to make money. For J. Fisher (interview, Aug. 5, 2014), wild rice is first and foremost the way that he feeds his family. Elder R.P. McDonald expresses his concern about the overemphasis of the material value of wild rice and underlines that the practice of wild rice harvesting is related to many other cultural activities such as feasts (*wiikonge*), offerings (*pagichigewinan*), and land stewardship (interview, Aug. 26, 2014). Those who harvest rice for

money forgot that it is a gift of the Creator (*Kizhe-Manito kizhewaatiziwin*). Elder C. Fisher also expresses his dissatisfaction with the loss of the cultural value:

> "*I know what in the old days Elders used to do. Before a harvest season starts, they used to have a ceremony with tobacco offering and offerings like clothes, foods, blankets, pots, and cooking… Then they had a big feast. After that, they started picking rice and nothing ever happened. There were no storms or anything like that. They were listened to. Today, it's totally different. At that time what I was talking about, it (rice) was for food. It wasn't to make money out of it. It was not for sale… Today it's different. They will say next week we will start picking rice. No ceremony, nothing. They will pick it for two-three days, and it's gone already. It's not taken care of or managed…*" (interview, Aug. 1, 2014).

4.2.2. Disrupted Habitats

The main reasons for disrupted wild rice habitats are hydroelectric developments on the Winnipeg River and its principal tributary, the English River, and increased hydroelectric power consumption. Large-scale hydroelectric generating stations built in the 1890s-1950s (Table 8) altered hydrological cycles of the lakes and rivers in the WTLUA. The peak water levels on the Winnipeg and English Rivers are now observed in June-July during the most critical floating-leaf stage of wild rice growth, which differs from natural spring flooding substantially. The low-lying water bodies in the WTLUA that are connected to the Winnipeg and English Rivers follow the flooding pattern of the main rivers. The only watershed located at higher elevation and, thus, not influenced by the Winnipeg River includes Rice Lake, White Lake, South Scot Lake, North Scot Lake, and the Scot River. These rivers and lakes function as a cascade.

Table 8: Generating Stations that Influence the Hydrology of WTLUA

Name	River	Owner	Built	No. of Units	Capacity
Norman	Winnipeg	H2O Power LP	1898	5	10 MW
Whitedog Falls	Winnipeg	Ontario Power Generation	1958	3	68 MW
Pointe Du Bois	Winnipeg	Manitoba Hydro	1926	16	75 MW
Caribou Falls	English	Ontario Power Generation	1958	3	91 MW

The levels on the Winnipeg River, flooding, and discharges from the Lake of the Woods have been controlled by the Lake of the Woods Control Board since 1919 (Lake of the Woods

Control Board, 2015b). However, wild rice has never been a priority while setting water limits. Elder H. Fisher underlines that one more reason for the disruption of habitats is the increase in hydropower and water demand (interview, August 19, 2014).

However, although most research participants express their discontent with hydroelectric developments, Elder P. Michaud underlines that the main reason for reduced wild rice production is the disruption of relationships with the wild rice plant:

> "*They (community members) do not do it anymore. That's why the rice is disappearing. We get punished because nobody wants to go out. Nobody has been to Scot Lake for at least twenty years. Wild rice is still there. That's why the water comes up. Mother Nature, not the Hydro*" (interview, Jul. 29, 2014).

4.3. Contemporary Wild Rice Harvesting and Finishing

As a result of the changes described in the previous section, the rice harvesting and finishing practices have eroded in WTLUA and have become a "lost art" (H. Kent, interview, Aug. 2, 2014). The disappearance of practices resulted in diminishing knowledge and a shift of values, especially the knowledge and values of the younger generation.

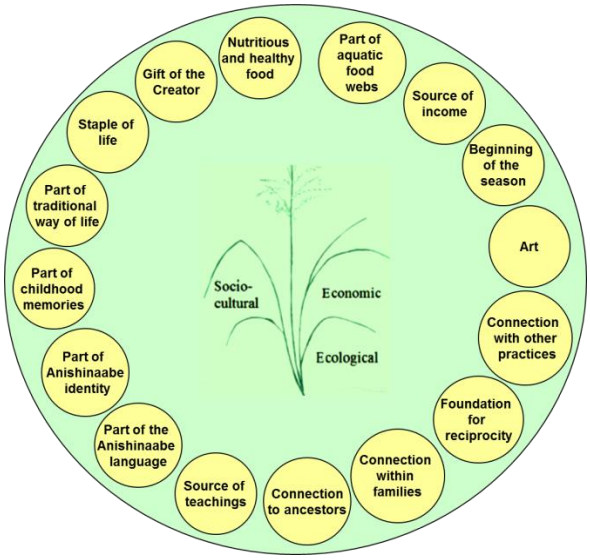
Eleven of the WIN adult research participants who have rice harvesting experience (45.8%) have not harvested rice for 30-40 years. The last WIN research participants harvested wild rice around 5-6 years ago. According to Elder A. Henry (interview, Jul. 31, 2014), those who still harvest rice do it for "old time's sake" and subsistence purposes. Subsistence harvesting does not require large volumes of wild rice; therefore, the harvesting period is mostly limited to one day. According to Elder A. Henry (interview, Jul. 31, 2014), wild rice harvesting was already eroding when he was a child. With respect to wild rice consumption, adult research participants eat store-bought pre-cooked wild rice (Kuzivanova field notes, September 22, 2014).

While most adults still possess the knowledge of ricing practices, 100% of young research participants have never harvested wild rice and do not know much about *manomin*.

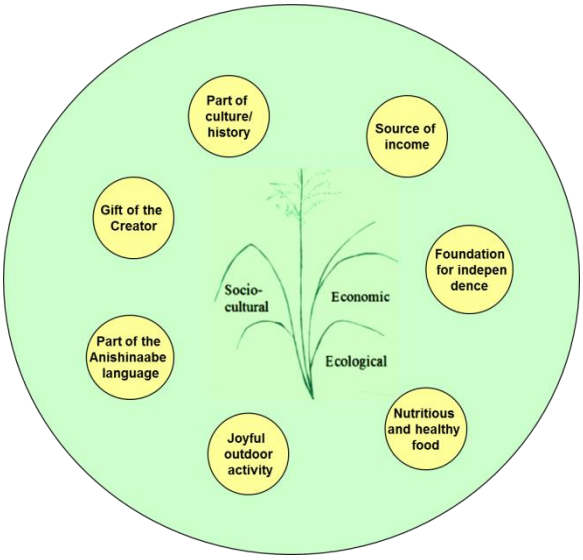
Besides possessing no experience in wild rice harvesting, young people also do not consume rice very often. Some of them eat wild rice at home (e.g., M. Mandamin, interview, Aug. 13, 2014), while others consume it only at community feasts, ceremonies, and funerals (e.g., I. Land, interview, Jul. 30, 2014). Therefore, R. Muckle calls wild rice food eaten "on occasions" (interview, Aug. 7, 2014). The main reason for eroding practices named by seven young research participants (58.3%) is limited sharing of TEK within families and at school. N. Scott mentions that her Anishinaabe language teacher never talked about *manomin* (interview, Aug. 19, 2014).

In spite of disappearing practices and reduced consumption, WIN members still recognize numerous values of *manomin* summarized in Figure 10[10].

Figure 10: Wild Rice Values Perceived by Adults and Young People



Source: interviews with adult community members aged over 40



Source: interviews with young community members aged 18-29

While both adult (75%) and young (66.7%) interviewees recognize socio-cultural values of wild rice, the values identified by the young people are much less diverse. Overall, young

[10] The data collected through Stage B interviews are not included in this diagram so as to be able to objectively see the values remaining in the community prior to any restoration efforts, because the restoration efforts could change those values and perceptions. Thus, this diagram is based only on the information provided by Stage A interview participants (twenty adults and nine young people).

research participants (66.7%), who have never been involved in ricing practices, mostly speak about *manomin* as a traditional, tasty, and healthy food. Also, four young interviewees (44.4%) express their dissatisfaction with the lack of physical activity, as well as overabundance of modern technology, and point out that ricing, alongside with other traditional off-land activities, can be an enjoyable physical activity. Adult interviewees do not use this angle for analyzing the social values of *manomin,* because they had to gather rice for subsistence and sale.

With regards to economic opportunities related to wild rice, there is also a slight difference between the 55% of adult interviewees and 44.4% of young interviewees who mentioned these values. While adults mostly speak about their past rice-selling experiences, young people also mention the potential for *manomin* to support community independence from welfare and grocery shopping in the closest town of Kenora (R. Mandamin, interview, Jul. 31, 2015; T. McDonald, interview, Jul. 31, 2015). Young people's focus on community development and economic well-being reflects their concerns related to the lack of access to grocery stores in the community, dependence on travelling to town, and the lack of jobs on reserve, which were not as acute in the past when people used to live off the land.

Thus, young people recognize fewer socio-cultural values of *manomin* than adult research participants, but they also point out some new benefits of ricing more related to contemporary WIN challenges, such as deteriorating physical health and poor economic development opportunities in the community. The understanding of these values and the shift of values allows constructing a meaningful restoration process, setting goals, and understanding the future possibilities for the involvement of adults and young people.

4.4. Summary and Conclusions

This chapter presents an overview of wild rice-related practices, as well as changes that occurred in the 20th century. Most WIN adults (91.7%) harvested wild rice in the past; however, only 10 adults (41.7%) participated in wild rice finishing. The past harvesting, finishing, storage, and other practices in the WTLUA are very similar to what is described in Vennum (1988), although because the book was issued almost 30 years ago, most practices recalled by the research participants refer to the stage of ricing that is deemed contemporary by Vennum.

This chapter also elaborates on diverse factors that led to diminished wild rice harvesting. The drivers of negative change were social, economic, and ecological, as well as international, national, regional, and community-based. As a result of these changes, ricing is a lost art, as well as a missing cornerstone of Anishinaabe culture, a missing source of income, and a missing part of the ecosystems of WTLUA water bodies lying below the Winnipeg River and English River levels. It has been 5-6 years since any WIN adult research participants have harvested wild rice, but a half of the interviewees have not riced for 30-40 years and none of the young people have ever harvested *manomin*.

Thus, this chapter demonstrates the need for restoration of both habitats and relationships with the cultural landscapes, which encompass practices, traditional diets, sustainable economies, values, teachings, customary laws, language, and culture in general. It also sets cultural and ecological historical reference conditions for the restoration process, which are revealed through adult WIN members' TEK on ricing practices and areas of wild rice distribution. As traditional knowledge still exists and *manomin* is still perceived as a valuable plant, there is hope that wild rice can be restored if WIN members can choose among the different uses of *manomin* which they consider valuable.

CHAPTER 5: SELECTION AND DOCUMENTATION OF SITES

"*Despite the vastness of its natural stands, wild rice is a relatively delicate plant*"
(Vennum, 1988, p. 20)

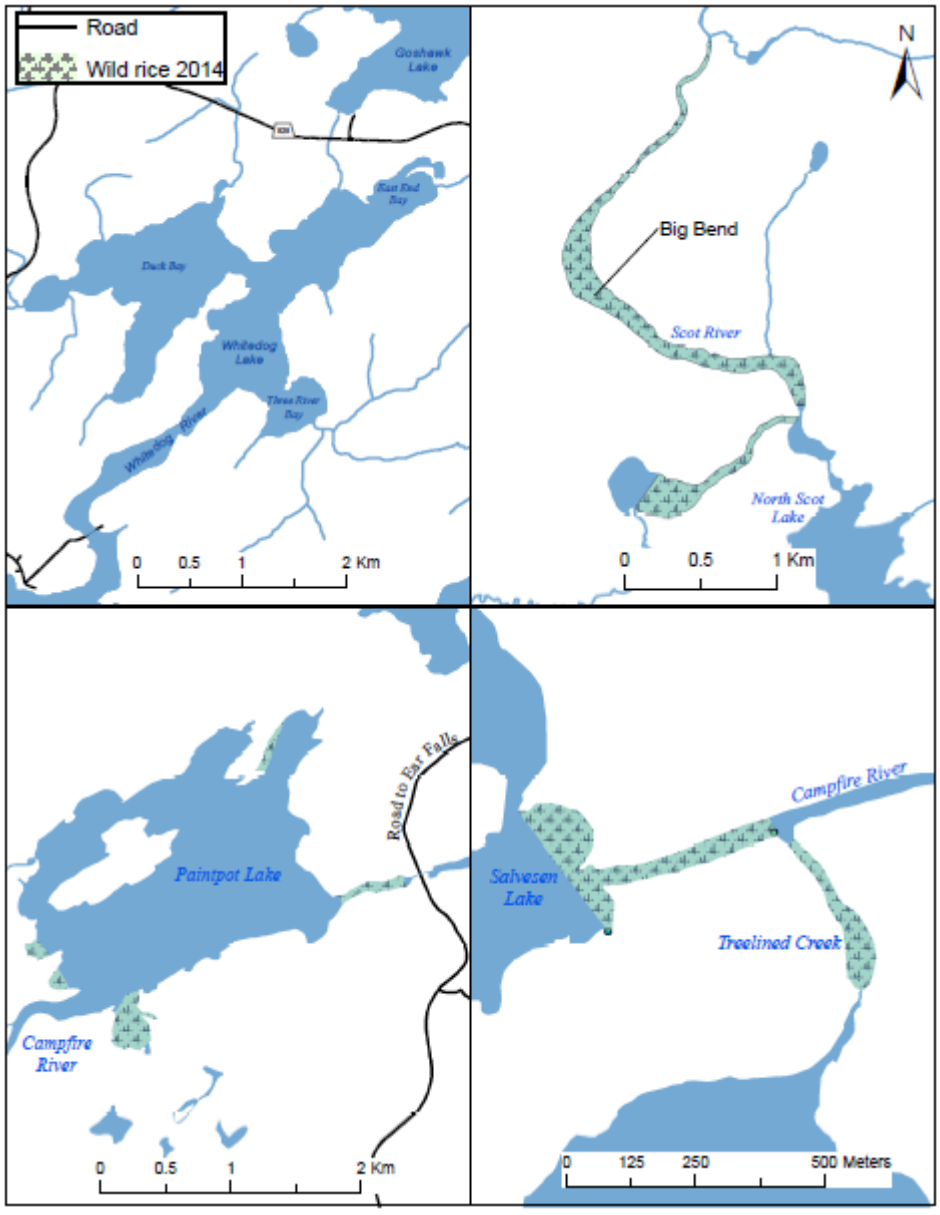
This chapter explains the initial choice of two sites for restoration efforts, presents the documentation of two sites, and provides conclusions with respect to the final site selection. Initially, four sites were selected based on the criterion of accessibility and proximity to the WIN community. After these sites were checked for the presence of rice in summer 2014, the Scot River and Whitedog Lake were chosen for further documentation. Because wild rice fields are cultural landscapes and their restoration involves both ecological and cultural processes, documentation included general site description, historical context, and biophysical features. Historical information about the sites was collected through Stage A and B semi-structured interviews, as well as participant observation. The methods used for the biophysical documentation of sites included vegetation surveys, bathymetric mapping, water level fluctuation monitoring, water sampling for pH and sulphate, and wild rice transects. Documentation allowed for choosing the main site for restoration effort. Biophysical features at the time of observation, such as wild rice distribution, wetlands, roads, beaver dams, beaver lodges, falls, rapids, and transects, as well as cultural features including a falls, a cabin, portages, camping sites, and the historical names of bays were included in maps created in ArcGIS 10.2 (Figures 12 and 13).

5.1. Initial Site Selection

Out of the sites where wild rice was distributed historically, which were identified through the Stage A interviews, four of the closest and most accessible sites were selected. At all the selected sites - Whitedog Lake, Scot River, Salvesen Lake, and Paintpot Lake - wild rice distribution in 2014 was documented (Figure 11). Whitedog Lake had no wild rice in 2014. Paintpot Lake had small low-density (0.5-8.0%) wild rice stands in several bays. Salvesen Lake

had only one small low-density (2-10%) wild rice field located at the confluence of the Campfire River into Salvesen Lake. The Scot River had the highest-density (up to 70%) rice, which occurred in larger stands than at other sites.

Figure 11: Wild Rice Distribution in 2014



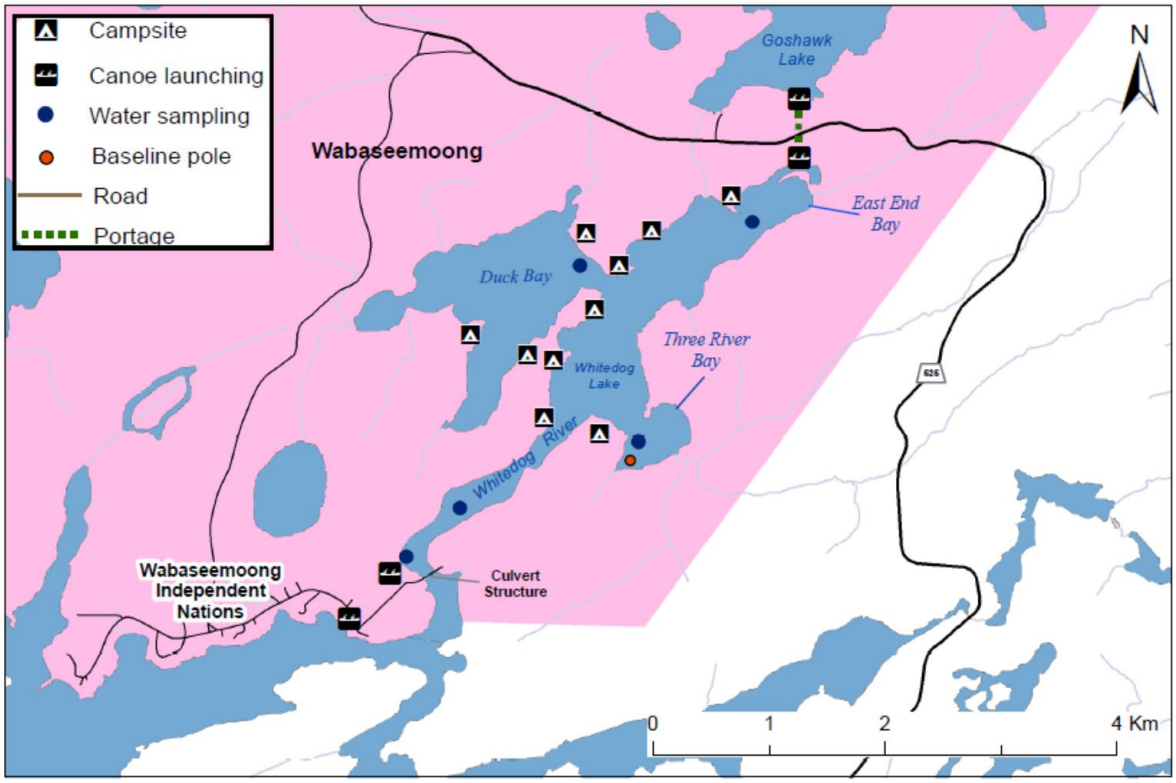
Out of these four sites, the Scot River and Whitedog Lake were selected for documentation. Whitedog Lake was selected for further analysis because of its proximity to the community and its importance underlined by the Stage A interviewees. Although the lake is

influenced by Winnipeg River level, there have already been attempts to control water levels and mimic natural water level fluctuations there. The Scot River, which had the largest wild rice stands when observed, is not influenced by the dams on the Winnipeg and English Rivers due to its topography. The area reaching from Rice Lake to Scot Bay is higher in elevation than the Winnipeg River and is characterized by a chain of falls and rapids.

5.2. Documentation of Whitedog Lake

5.2.1. General Description

Figure 12: Whitedog Lake with Cultural and Biophysical Features in 2014



Wild rice restoration on Whitedog Lake was identified as the main focus of the project in the initial design brief (Appendix 1). Whitedog Lake was identified as either the primary or one of the main harvesting areas by 10 Stage A and B interview participants (41.7%). The lake is located on WIN reserve in the closest proximity to the WIN community. The western side of the Whitedog River borders the WIN community. Whitedog Lake can be easily accessed from the

north via Highway 525, which leads to the community, and from the south via the Whitedog River, a tributary of the Winnipeg River, from the eastern end of the WIN community.

At the entrance of the Whitedog River, there is a mud dam with a culvert structure. This dam is still operational and provides access to the WIN graveyard located across the Whitedog River from the community. However, in the present day, the culverts are corroded, the gates are not functioning anymore, the observation platform is damaged, and there is no level gauge next to the dam. Despite the opened culvert gates, in June-July 2014, the water level in the Winnipeg River was so high that it was possible to boat over the mud dam. Besides the Whitedog River, Whitedog Lake has no other feeding and drainage channels at present.

5.2.2. Historical Context

WIN members used to gather wild rice on the Whitedog River and in all of the lake's bays, which had their own names mentioned by Elder J. Hunter (interview, Aug. 6, 2014) and marked on the map in Figure 12. The central part of the lake was too deep for wild rice to grow. Research participants still remember the location of numerous campsites at the lake; however, due to the lake's proximity to the community, many community members made daytrips there (Elder I. Muckle, interview, Aug. 7, 2014). The last informants who harvested rice on Whitedog Lake were G. Michaud (interview, Oct. 23, 2014), J. Carpenter (interview, Oct. 20, 2014), and I. Fisher (interview, Oct. 20, 2014), all of whom carried out their last harvest five to ten years ago. Since then, no records of the presence of wild rice on the lake have been found.

According to interview participants, the lake used to be much shallower. As stated by Elder C. McDonald (interview, Aug. 5, 2014), harvesters used to pick rice on the Whitedog River by walking (see Chapter 4). Also, during a visit to the lake, Elder M. McDonald (personal communication, June 30, 2014), pointed out several areas on the lake where rocks that are

currently submerged used to be above water. The main reason for increased water levels is the construction of the Pointe Du Bois, Whitedog, and Caribou Falls Generating Stations on the Winnipeg and English Rivers from the 1920s to the 1950s.

The construction of a mud dam and culverts at the entrance of the Whitedog River was an attempt to mitigate high water level and water level fluctuations. The mud dam and the culverts were designed in 1976 by the Surveys and Engineering Branch of the Ontario Ministry of Natural Resources. The initial culvert structure consisted of riveted carbon steel pipes with 48" diameter and slide gates, and the mud dam had a design elevation of 303.89 m. According to Elder M. Smith (interview, August 12, 2014), 30-40 years ago there used to be an appointed community member who controlled the culverts and put the gates down during critical periods in the wild rice life cycle. Elder R.R. McDonald (interview, August 11, 2014) remembers that the structure was operational only for the first four to eight years. The main reasons for the breakage of the culverts were ice, vandalism, and rust (Elder M. McDonald interview, Jul. 28, 2014).

Two other options that the WIN community explored to prevent high water levels were addressing Ontario Hydro with a demand not to increase water levels during the critical stages of rice growth and pumping water out of the lake. Elder T. Tikanye (interview, Jul. 28, 2014) mentions that community Elders had to address Ontario Hydro with a request not to flood lakes in the WTLUA. Another attempt to control water levels was pumping water out of Whitedog Lake. One year, pumps were installed on the Whitedog River side of the dam for two to three months to achieve that objective (Elder C. Fisher, interview, Aug. 1, 2014. However, the water level did not decrease. Elder H. Fisher (interview, August 19, 2014) is sure that the pumps were effective, but they fell into a state of disrepair soon because of the lack of maintenance.

5.2.3. Biophysical Documentation

Appendix 7 presents detailed biophysical documentation of Whitedog Lake. Due to its general elevation of 298 m, the lake is influenced by the operation of the hydro generating stations on the Winnipeg and English Rivers. Thus, bathymetric mapping and water level fluctuation monitoring were the main methods applied. High water levels and water level fluctuations seemed to be the main factors that resulted in the absence of wild rice on Whitedog Lake in 2014. Water analysis and vegetation surveys showed that pH and sulphate, as well as aquatic vegetation, did not exceed the norm for wild rice habitats and, thus, could hardly lead to the absence of wild rice. According to visual observation, aquatic weeds, besides the most abundant water smartweed (*Polygonum amphibium* L.), do not present significant competition to wild rice.

Although the results of the study are limited to 2014, when flooding was more intense than in the previous years, the main site management recommendations for Whitedog Lake pertain to water control. A possible solution is the repair of the culvert structure at the entrance to the Whitedog River. The bathymetric data collected can be used for redesigning the structure. The gauge # 05PF051 on the Winnipeg River, which reflects water level fluctuations on Whitedog Lake, can be used for further monitoring of the lake's water level. In the redesigning and renovation of the dam, the main challenge is a lack of financial resources. Given that WIN members voted to ratify a Settlement Agreement on August 1, 2011, WIN can no longer maintain any claims with respect to flooding against the provincial government and Ontario Power Generation. There are no other factors that require any active intervention at present. However, further monitoring of water smartweed (*Polygonum amphibium* L.) and algal scum is required in the event of further efforts.

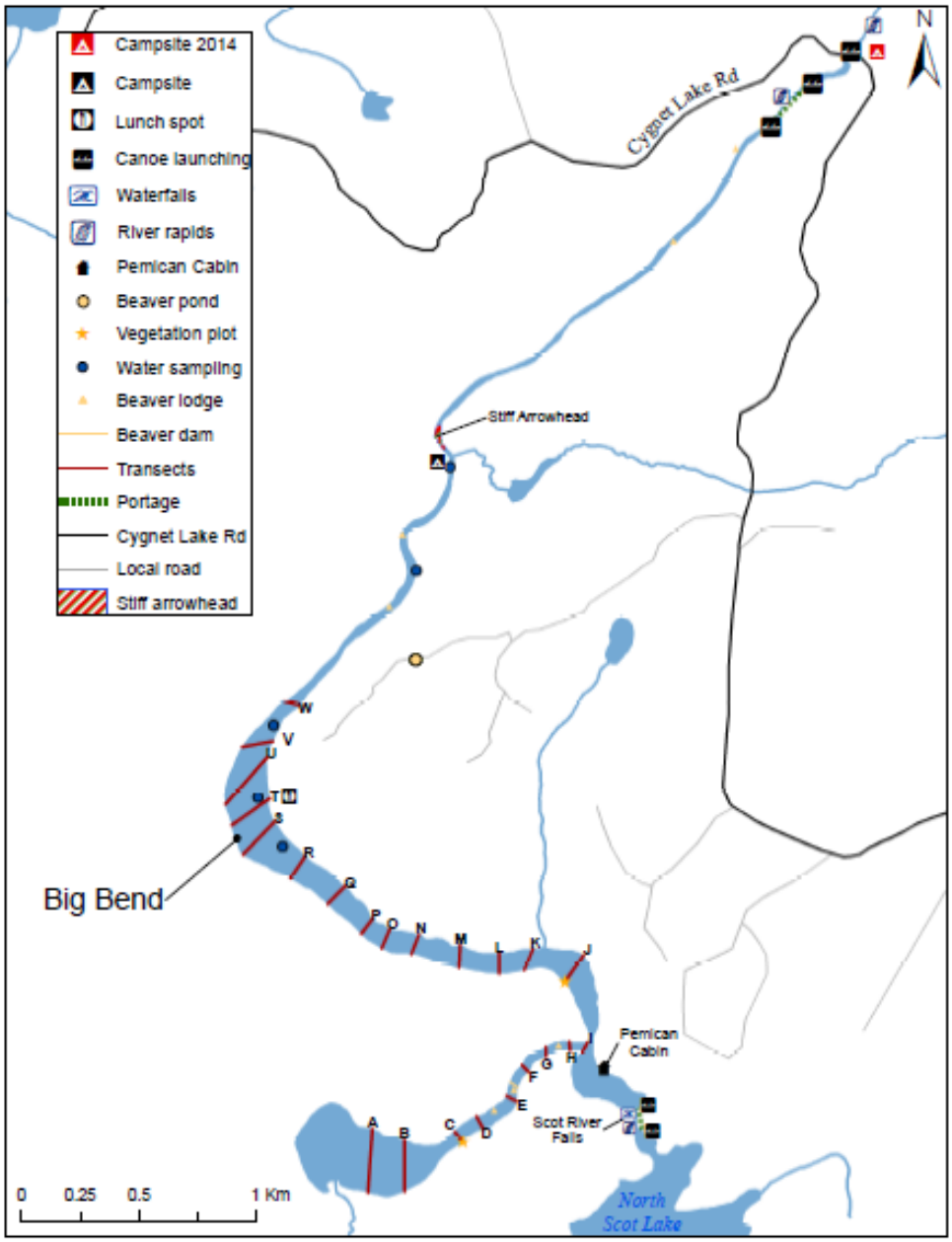
5.3. Documentation of the Scot River

5.3.1. General Description

The Scot River (Figure 13), as well as North Scot and South Scot Lakes, was mentioned by 41.7% of interviewees aged 40 and over, as many as Whitedog Lake. It is the only accessible body of water in WTLUA at a high elevation. The easiest point of access is located next to the bridge on the 26th km of Cygnet Lake Road, which intersects with Highway 525. However, due to the presence of rapids on the river, canoes must be portaged from the bridge across 150-m of land. There are two other trails leading from Cygnet Lake Road to the Scot River that are much less accessible. One of the trails, which was previously used by logging trucks and wild rice harvesting airboats 7 years ago, is completely blocked by a beaver pond.

The main portion of the river investigated in the observation period is located between the Scot River Bridge on the Cygnet Lake Road and the Scot River Falls. The so-called historical Big Bend area had the most abundant and dense wild rice stands, which coincides with the memories of research participants. The portage leading from the Scot River Falls to North Scot Lake was not crossed due to the poor condition of the path caused by beaver activity. Thus, North Scot Lake, South Scot Lake, White Lake, and Rice Lake were not included in this study, although these areas could have wild rice.

Figure 13: The Scot River with Cultural and Biophysical Features in 2014



The Scot River, with an elevation of approximately 320 m, is not influenced by the nearby hydro activity. Among the factors that influence the water level on the Scot River is the activity of beavers, whose lodges and dams are prominent along the river. The shores in close proximity to the Scot River Bridge are rocky and high, but become flatter farther away from the Scot River Bridge. This area provides a good habitat for moose, deer, and wolves, which are

common to the area. Also, the presence of wild rice attracts an abundance of geese, ducks, and mallards. Thus, the area around the Scot River is one of the most mentioned WIN hunting areas. Elder F. Henry (interview, Oct. 20, 2014) points out that the Scot River was his favourite rice harvesting area because of the hunting grounds.

5.3.2. Historical Context

The Scot River used to be one of the most important travelling routes from the WIN communities to South Scot Lake, where there was an old saw mill (Elder J. Hunter, interview, Oct. 22, 2014). The river also gave access to the town of Malachi, where there were many job opportunities for community members (I. Fisher, personal communication, Sep. 17, 2014), as well as other rice harvesting areas. Most wild rice harvesting on the Scot River took place around the Big Bend area, where wild rice was always abundant. Around this area, there were several campsites and a famous lunch spot on the Big Bend rock. One of the most mentioned cultural sites on the Scot River is the Scot River Falls.

5.3.3. Biophysical Documentation

On the Scot River, which was full of wild rice in 2014 and is not influenced by water level fluctuations, biophysical documentation was done through transects and water analysis for sulphate and pH. Vegetation surveys were a part of transects. Detailed results of these biophysical methods are presented in Appendix 8.

Biophysical data reveal that the Scot River has the following necessary characteristics for producing wild rice: shallow and clear water and suitable water chemistry. However, an analysis of variance (ANOVA) showed that increased cover of other aquatic plants decreases the proportion of wild rice present in plots. Also, the abundance of broadleaf cattail (T*ypha*

latifolia), which expands very fast and prefers habitats with minimal water level fluctuations such as the Scot River, is a concern.

Thus, as there is a statistically significant correlation between the proportions of wild rice and other aquatic plants shown by ANOVA, further site monitoring is required and aquatic weed management may be required in the future. Additional site monitoring will reveal if the amount of wild rice will reduce in case the proportion of other vegetation cover increases. Additional measurements are required for understanding the correlation between the wild rice cover and the cover of each other species. Moreover, cattail management may be required if its stands expand.

5.4. Summary and Conclusions

Two sites were selected for restoration efforts. The documentation of Whitedog Lake and the Scot River included general and biophysical site characteristics, as well as the historical and cultural context. The restoration of wild rice cultural landscapes requires the understanding of land management practices that have shaped them, areas of wild rice harvesting, cultural landmarks, and the overall importance of these sites. Biophysical documentation, which was done in accordance with the needs for each site because different limiting factors were identified for Whitedog Lake and the Scot River, is essential for understanding how the sites need to be ecologically managed. Although Whitedog Lake is more accessible than the Scot River, it is questionable whether the repairs on the culvert will result in a restored habitat or it will be a different ecosystem with a distinct structure and dynamics. Active management of the Scot River requires fewer efforts. Vegetation monitoring is recommended, but not required. Thus, based on the principle of minimal ecological intervention included in the wild design framework (Higgs, 2003; Higgs & Hobbs, 2010), the Scot River was selected as a site for organizing a wild rice camp in September 2014 and is recommended for further wild rice harvesting.

CHAPTER 6: DANCING WILD RICE ANEW: CHILDREN AND YOUNG PEOPLE

"I think it creates a lot of wonderment in the younger people to know that they are able to participate in something that our ancestors did a long time ago… It would feel very magical I think if the kids would at least experience some of that lifestyle because I know we're losing our culture at a rapid pace. If they were exposed to that kind of life like being out and utilizing the land, I think their wonderment and their imagination and everything would sky rocket" (C. Morrison-Mandamin, interview, Aug. 26, 2014).

As described in Chapter 4, the disappearance of the ricing practices and the lack of knowledge sharing both within families and at school resulted in the disruption of intergenerational knowledge continuity. The Stage A and Stage B interview participants aged between 18 and 29 had never harvested wild rice before the wild rice camp and have very limited knowledge of ricing practices and their importance for the WIN community. Younger community members are likely to have even less knowledge. According to the school principal, Elder R.R. McDonald (interview, Aug. 11, 2014), the school should be the main platform for the involvement of students and the re-introduction of students to the knowledge on *manomin*. Similarly, C. Morrison-Mandamin underlines the importance of the school and teachers in "bridging the past and the present for the cultural identity of the youth" (interview, Aug. 26, 2014). At the workshop on August 26, 2014, the school principal, teachers, and supply teachers announced that wild rice ecocultural restoration would be a significant school priority in 2014-2015 academic year and identified the main actions to be taken by the school. This chapter describes the school's actions for involving students in the restoration process.

6.1. Results of the Second Workshop

The workshop participants expanded the list of potential activities that was presented to them by including more students, particularly younger students from grades JK to 8, as well as assigning a more active role to students. They also ranked the activities in accordance with the degree of their priority (Table 9).

Table 9: Priority School Activities Identified by the School Workshop Participants

#	Activities	Number of people who chose this activity as first priority	Number of people who chose this activity as second priority
1	Wild rice camp	22	4
2	Native language classes	11	11
3	Teaching starting from 6-7-8 grades	5	4
4	Culture Day (Fall Harvest)	4	17
5	Wild rice dictionary	3	12
6	Elder-youth workshop	3	8
7	Repetition of vocabulary	3	5
8	Students' presentations	3	4
9	Practicing on grass (for younger children)	2	17
10	Science classes	2	6
11	Building up knowledge	1	3
12	Wild rice movie	1	2
13	Book of recipes	-	17
14	Wild rice cooking contest	-	8
15	Posters about wild rice	-	6
16	Elementary school curriculum	-	4
17	Home economics classes	-	4
18	Disc with interviews	-	4

6.2. Description of Activities

This section analyzes the activities of the highest priority from the table above.

6.2.1. Wild Rice Camp

All 22 workshop attendees (100%) labeled wild rice camps as the first priority activity. This corresponds to the findings of Stage A interviews, which show that both adults and young people support the idea of wild rice camps and realize the "eye-opening" educational potential of the camps (Elder C. McDonald, interview, Aug. 5, 2014). For instance, T. McDonald underlines the potential of the camps to transfer teachings and involve students:

> *"Wild rice camps are a good idea. It can get the kids doing something and it would be educational for them. It would be teaching them something that out grandpas and grandmas did when they were young. It would teach them history. It would also give them something to do, not just hanging around on the reserve"* (interview, Jul. 31, 2014).

Other informants underlined both the hands-on informal nature of the camp and its relevance to different formal classes, such as native language, native studies, and science.

At the workshop on August 26, 2014, it was unanimously decided that elementary school students were too young to go and they needed to practice wild rice harvesting moves on the grass next to the school using traditional ricing sticks. Therefore, high school students enrolled in native language and peer leadership classes took part in the 2014 camp. In accordance with the results of Stage B interviews, direct involvement in novel activities boosted students' interest in ricing and made them reflect on the economic and cultural values of *manomin* (R. Fisher, interview, Oct. 21, 2014). Also, the young participants continued discussing the camp after they came back to the community and sounded much more confident than their peers while conversing about the future of wild rice in the WIN community during the third workshop. Chapter 7 presents further discussion of the camp. As in 2014, funding for the participation of the school in the 2015 wild rice camp was secured from Bimose Tribal Council.

6.2.2. Wild Rice Finishing Event

The so-called Culture Day, or Fall Harvest, mentioned by the workshop participants is usually organized by the Mizhakiiwetung Memorial School; however, in 2013 it was not held due to lack of funding. On this day, instead of classes, Elders and teachers show students different traditional activities including hide finishing, jam making, fish gutting, and game skinning. Wild rice finishing has only recently been included in this list of activities.

In 2014, after wild rice was brought to the community, a wild rice finishing event was organized on a regular school day (Figure 14). Students from JK to high school were invited to the finishing site. Each grade level had around 20 minutes to participate. Native language class students helped with event organization. Elders P. Michaud and J. Hunter showed the students

the whole finishing process from parching to winnowing. Two variations of hulling were shown, including “dancing” on rice and mechanical hulling with the help of a rotating drum. The students actively participated in finishing activities and also packed rice in small pouches for presenting it to Elders in accordance with the recommendation of R. Creedon (workshop, August 26, 2014), who emphasized the importance of gift giving as a part of Anishinaabe wild rice feasting. The participants also ate cooked wild rice, many of them for the first time.

Figure 14: Wild Rice Finishing Event Activities

The school intends to organize similar wild rice finishing events in the future. Ideally, the comprehensive event needs to include wild rice finishing and consumption, as well as the involvement of Elders, teachers, and students. This event can be also expanded providing funding is secured. J. Kakepetum describes a modified version of the Fall Harvest (interview, Oct. 21, 2014). In his community of Deer Lake (Northern Ontario), there is a longer event called Culture Week, when there are no classes and whole families participate in traditional activities.

6.2.3. Incorporation of Knowledge on Wild Rice into the Formal School Curriculum

While the wild rice camp and the finishing event present excellent examples of informal education, formal education was also marked as a priority by most research participants and Stage A interview informants. As underlined by Elder A. Henry (interview, Jul. 31, 2014), C. Henry (interview, Jul. 31, 20140, and M. Diez-Lopez (interview, Sep. 10, 2014), even JK

students can be taught some formal knowledge about wild rice in a classroom setting. The participants of the workshop on August 26, 2014 also underlined the importance of "building up" formal knowledge starting from JK and increasing the participation of 6th-8th graders.

Both Western science-based knowledge and TEK can be included in the curriculum. Research participants of Stage A interviews and the workshop mentioned a number of classes where knowledge on wild rice needs to be incorporated: science/science and technology, social studies, native language, the arts, home economics, and native studies. Table 10 presents the subjects from the Ontario curriculum in which knowledge can be easily incorporated in.

Table 10: Subjects and Strands Relevant to Knowledge about Wild Rice

Subject	Strand	Grades
The arts	Visual arts	1-8
Health and physical education	Active living	1-8
	Movement competence	1-8
	Healthy living	1-8
Social studies	Heritage and identity	1-6
	People and environments	1-6
	Canada, 1800–1850: Conflict and Challenges	7-8
	Creating Canada, 1850–1890	7-8
	Canada, 1890–1914: A Changing Society	7-8
The arts	Visual arts	9-12
Business studies	Entrepreneurship	9-12
Geography	Interactions in physical environment	9-12
	Managing Canada's resources	9-12
History	Canada, 1914–1929	10
	Canada, 1929–1945	10
	Canada, 1945–1982	10
	Canada, 1982 to the present	10
Health and physical education	Healthy active living education	9-12
	Recreation and healthy active living leadership	9-12
	Health for life	9-12
Native studies	Expressing Aboriginal cultures	9
	Aboriginal peoples in Canada	10
	Current Aboriginal issues in Canada	11
	Aboriginal beliefs, values, and aspirations	11
	Issues of Indigenous peoples in a global context	12
Social sciences and humanities	Equity, diversity, and social justice	11
	Equity and social justice: from theory to practice	12

6.2.3.1. Native Language Classes

Native language classes were prioritized by 11 workshop participants (50%). This strong support is not surprising because language is the main means by which culture is maintained, and the way knowledge, attitudes, and values are shared and transferred (Ontario Ministry of Education, 2001a, 2001b, 2001c). Deep knowledge and understanding of a culture require learning a language (Ontario Ministry of Education, 2001a, 2001b, 2001c).

Knowledge of wild rice, as well as wild rice-related vocabulary, can be easily incorporated into the native language curriculum from JK to high school (Appendix 9). While the youngest elementary grades mostly focus on oral communication, more intensive reading and writing are required in the higher grades. Throughout the grades, the skills and the knowledge base are developed from basic comprehension of spoken language to the analysis of texts (oral, audio, video, and written), summarizing, demonstrating knowledge and understanding in writing. In Grade 6, for the first time, the comprehension and summarizing of short stories is included, which creates a platform for personal *manomin* and legends. In Grade 7, students already have to demonstrate a variety of independent research skills, which allows them to search for the information on wild rice on their own. The expectations in grades 9-12 are even higher, and there is more focus on Native philosophy, spirituality, and values. During these grades, concepts, such as relationships with the land (Mother Earth) and more specialized language to describe traditional and community activities are introduced comprehensively. These concepts are very important to the process of wild rice ecocultural restoration, which requires the understanding of the Native philosophy. Thus, the acquisition of traditional ricing knowledge occurs through all grades, starting from the use of basic vocabulary and spoken language and continuing to the expression of sensitivity to cultural issues and higher-level critical thinking.

The school's main challenges with respect to native language classes are the absence of classroom technology and the lack of materials about wild rice in Anishinaabe. For instance, the absence of a smart board and a projector impedes the learning process because media communication skills are an important expectation in the native language curriculum and students need to be able to create presentations about Native topics. Also, the community itself needs to prepare materials in Anishinaabe pertaining to wild rice, both oral and written. Although numerous videos on YouTube show the whole ricing process and parts of it, as well as other Anishinaabe communities' restoration efforts, the videos are all made in English with the exception of several specialized words. Moreover, although there are numerous teaching aids that show how wild rice knowledge can be incorporated into the curriculum (Appendix 4), all these aids are exclusively in English with the exception of a limited number of words studied.

6.2.3.2. Science and Technology/Science Classes

Although fewer workshop participants indicated science and technology/science classes, this curriculum has also been analyzed in detail because of the availability of diverse Western-science based knowledge on wild rice biology that can be included in the curriculum (Appendix 10). Both classroom learning and field trips (wild rice camps) can be an important part of science classes, which aim at ensuring scientific literacy through "an intellectual pursuit but also as an activity-based enterprise within a social context" (Ontario Ministry of Education, 2008, p. 10). Thus, wild rice ecocultural restoration has a potential to fulfill all these requirements of science classes. Wild rice camps could take the participants of the educational process from a familiar to an unfamiliar environment, which creates an authentic learning experience with a real-world scientific challenge embedded in a specific cultural context. Within science classes, as well as within native language classes, the same concepts, skills, and knowledge are taught from year to

year drawing upon prior knowledge so as to develop critical and independent thinking, as well as higher levels of scientific investigation skills.

6.2.3.3. Environmental Education

Although not mentioned by workshop participants, environmental education, which needs to be a part of the curriculum for every class, also provides possibilities for including knowledge on wild rice (Ontario Ministry of Education, 2009). Environmental education is applicable to ecocultural restoration because it has a local focus and "builds capacity for community-based decision making and environmental stewardship" (Ontario Ministry of Education, 2009, p. 4). Students not only acquire knowledge about the resources of the Earth, ecosystems, and the dependence of humans on ecosystems, they also develop critical thinking, problem-solving skills, and an ability to use available resources in addressing environmental issues. Moreover, students develop appreciation for nature and other positive attitudes. All this has a potential to make students the agents and decision makers in the wild rice restoration process, not just passive receivers of information.

6.2.4. Wild Rice Dictionary and Other Posters

As emphasized by Elder R.R. McDonald, not only the activity of traditional rice harvesting is to be restored, but also the Anishinaabe words pertaining to ricing (interview, Aug, 11, 2014). R. Mandamin underlines that the native language teacher, for instance, needs to introduce both vocabulary and related practices at the same time (interview, Jul. 31, 2014). For instance, s/he can bring a moose and ask students to butcher it while explaining the Anishinaabe terms related to this activity. Elder R.P. McDonald underlines that Anishinaabe words pertaining to rice need to be reiterated and taught in different grades and during different subjects (workshop, Aug. 26, 2014), which is also emphasized in the Ontario native language curriculum

because the vocabulary introduced in one grade is expanded in the next years (Ontario Ministry of Education, 2001a, 2001b, 2001c). Moreover, all the teachers need to be aware of the vocabulary. Thus, a poster with a glossary related to wild rice divided into thematic groups was prepared for the school in collaboration with the native language teacher R.P. McDonald (Appendix 11, Poster 1).

Although the idea of posters received fewer dotmocracy votes, some other posters were prepared as teaching aids for other classes at teachers' requests (Appendix 11). Poster 2 contains community Elders' and other adults' memories and teachings documented through Stage A interviews and related to wild rice. This poster can be used for developing the understanding of the culture and culture sensitivity, mostly for the native language and native studies classes from Grade 1 to high school. Poster 3 describes suitable wild rice habitat requirements including water depth, water circulation, water quality, water clarity, plant competition, bottom soils, diseases and insects, and animal consumers. It was prepared as a teaching aid for the Grade 8 science/technology class topic *Water Systems*. Poster 4 developed for the Grade 9 science class, presents an aquatic food web that starts with wild rice as a primary producer.

6.2.5. Elder-Youth Workshops

Elder-youth workshops can be a form of informal and formal education. Two of the workshops held on July 23, 2014 and September 23, 2014 took place with the participation of young people and Elders. For focus groups, young people were partnered with Elders for exercises such as visioning the future, asset mapping, and planning future restoration efforts. While Elders and students brainstormed ideas together, young people were responsible for recording the ideas and presenting them afterwards. Students developed their presentation and media skills, which is an important requirement of the educational process as stated by the

teachers at the workshop on August 26, 2014, and described in the Ontario formal school curriculum for all the classes.

6.2.6. Wild Rice Videos and Films

Besides numerous videos of the ricing process found on YouTube, other videos and films may also be used as a part of the formal and informal school curriculum. Two examples include Michelle Derosier's documentary film *Return to Manomin* and my video documentary *Bringing Back Manomin* that was developed primarily for educational purposes.

Return to Manomin, produced by Thunderstone Pictures, is an example of a comprehensive documentary about the connection between the Anishinaabeg and wild rice. This film is touching and very personal because it was developed as "a love letter to a family and a culture" (Thunderstone Pictures, n.d.). Also, some parts of this film are in the Anishinaabe language with English subtitles, which makes it more educational and authentic. *Return to Manomin* was also produced in Northwestern Ontario, which makes it culturally relevant to the context of the WIN community. The film is not very suitable for formal lesson settings because it is 72 minutes long; however, it can be easily used for extracurricular activities.

My video documentary starts with a short description of the community and the present ricing situation and includes some of the Elders' stories, important episodes of the wild rice camp including harvesting, ricing, stick making, and visiting cultural sites, as well as the wild rice finishing event. The advantages of this video are that it can be incorporated in every school lesson because its length is only 10 minutes and students can relate to the events shown in the video because it is based on personal experiences of themselves, their family members, friends, acquaintances, and other community members whom they know. This video can be obtained through contacting the Mizhakiiwetung Memorial School or Elder M. McDonald.

6.3. Summary and Conclusions

There is presently little to no relationship between *manomin* and young WIN members who do not possess knowledge and skills of the traditional ricing practices. Even eating wild rice is often a new experience for them. Thus, a part of the WIN restoration process needs to be the re-establishment of relationships and creation of conditions for producing new environmental knowledge and establishing new relationships.

The school was chosen as the main platform for achieving restoration goals related to children and young people. The Stage A interviews and the workshop with school teachers on August 26, 2014 allowed for the identification of potential solutions appropriate and possible within the WIN context. Research participants pointed out different options including Culture Day, the incorporation of knowledge into the school curriculum, workshops with the participation of students and Elders, as well as the preparation of additional materials such videos, a dictionary, and posters. Most informants supported the idea of the wild rice camp, a form of restoration-based education, which includes restoration efforts that are intentionally designed for educational purposes (McCann, 2011). Many of the alternatives identified were successfully implemented in 2014 and are planned for 2015.

This chapter and its appendices describe several of the identified formal and informal educational possibilities, which serve as guidelines for the restoration process or examples of the restoration efforts that can be taken by the school. This chapter also presents a list of resources to be used by teachers and potential solutions to the following problems: lack of funding, textbooks and materials (audiovisual aids), and availability of experts with Aboriginal knowledge. Recommendations provided do not have to be implemented in the full scope in order to trigger positive change.

An overall important conclusion is that even if wild rice habitats are restored and adult community members get involved in ricing again, the future of ricing will still not be secured if young community members do not have any desire to "dance the rice anew", which means to re-establish old relationships and establish new ones. Given that profit was the main incentive reported by young research participants for participating in the ricing process as underlines in Chapter 4, wild rice purchasing costs are very low, and the majority of older WIN members are against increasing profit by using airboats to harvest rice, it is doubtful that the younger generation will be participating as actively as their predecessors. However, both informal and formal knowledge sharing, which provide a clear picture of the wild rice history, as well as hands-on experience, allow young people to expand the list of their motivations and see possibilities for their future involvement.

CHAPTER 7: TRANSFORMATION THROUGH CAMPING: A PROTOTYPE THAT HELPS TO RE-ESTABLISH RELATIONSHIPS

> *"When we came back (from the wild rice camp), we had a very different perspective on things. We appreciated things….We established friendship because of everything we shared… This is the way our people lived long time ago"* (Elder R.P. McDonald, interview, Oct. 21, 2014).

As shown in Chapter 4, WIN members' relationships with *manomin* were disrupted in the 20th century and the future of ricing depends not only on habitat restoration, but also on the re-establishment of relationships between WIN members and wild rice. Based on the data collected through participant observation, Stage A interviews, and the first two workshops, a prototype for a wild rice camp was developed. Chapter 6 describes this prototype from the educational point of view, which is usually the main emphasis of wild rice camps in the USA. This chapter describes the prototype, as well as the feedback provided by participants, and uses a different approach for analyzing this prototype. It considers the wild rice camp as a platform for relationship re-establishment and relies on the assumption that, in order to renew these relationships, there must be a transformation within the participants. Thus, transformative learning theory serves as a lens for analyzing the potential of wild rice camps for relationship re-establishment. Participants' feedback and learning outcomes are documented through Stage B semi-structured interviews, the third workshop, and participant observation throughout the camp. As transformative learning theory focuses only on adult learners, the camp participants aged under 18 were not interviewed.

7.1. Prototype Description

The initial prototype for a wild rice camp shown in Figure 15 was developed in August 2014. The design of this prototype was informed by several factors. First, this prototype extensively relied on community residents' TEK described in Chapter 4. The camp was organized with as many traditional elements as possible, including manual rice harvesting, living in tents, and other camp activities. Second, it was planned that the camp would take place at the

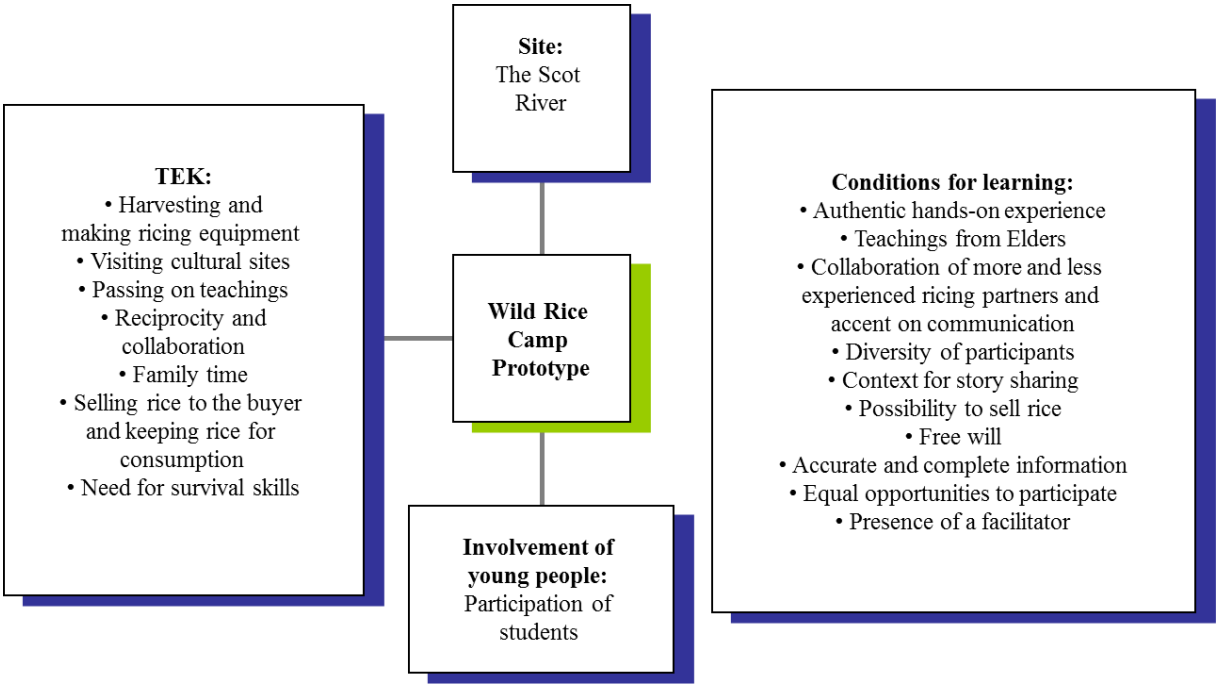
selected site – the Scot River – with rice finishing also to be conducted there. However, this rice finishing was later relocated to the WIN community because of the difficulty of transporting wild rice parching/hulling equipment and the possibility of involving more people in an event in the community. Also, the prototype allowed for the participation of high school students.

Moreover, as shown in Figure 15, the wild rice camp created conditions for instrumental, communicative, and transformative learning. In order to allow for the acquisition of information and development of skills or the occurrence of instrumental learning, participants were involved in a hands-on, authentic wild rice harvesting experience. Expert knowledge holders (Elders and teachers) were available and more experienced participants were coupled with less experienced ones. To allow participants to explore and understand one another's values, normative concepts, and points of view, the prototype emphasized communication in different settings such as at the camp, on the river, and in the canoe. The diversity of participants allowed for a range of insights to be shared through the communication process. Visiting cultural sites, portaging, canoeing, tobacco offering, and other traditional activities allowed for the creation of a context for story sharing. The possibility to sell rice, as well as to finish it and keep it for consumption, helped participants to understand wild rice values and potential uses.

Some of the factors described above correspond to the ideal learning conditions pointed out in Chapter 2. Overall, the wild rice camp was chosen as a platform for adult learning because of its hands-on character, the direct involvement of participants, and active nature involving thoughts and feelings, which differs from information presentation in an ordinary educational context (Mezirow, 1997). The presence and cooperation of multi-aged participants, both Anishinaabe and non-Anishinaabe, with different worldviews, led to the existence of alternative views. The intergenerational and intercultural context required from the participants to listen to

each other, understand each other, and critically reflect on each other's assumptions. The exposure of young and non-Anishinaabe participants to old ways of life and the involvement of experienced participants in the present context also contributed to camp critical appraisal. The camp was also open to both forms of knowledge, TEK and Western science-based knowledge, which made it comprehensive.

Figure 15: Prototype Characteristics



Moreover, in accordance with Mezirow (1981, 1997, 2000), camp participants had accurate and complete information about the camp and had equal opportunity to participate at free will without any coercion or deception. Participation in the wild rice camp was open to all interested community members, and the camp was thoroughly advertised in the community. To provide free and open participation, a poster was distributed in the community a week before the beginning of the camp. This poster provided complete information on the location of the camp, dates, requirements, and other relevant information. It also informed about the possibility to sell rice to a buyer. Participants signed up for the camp voluntarily. High school students were

invited by their teachers, but were not required to participate and went on their own volition. Due to the high level of unemployment in the community, not all community residents possess vehicles, camping equipment, and possibility to buy food for a four-day stay in the forest. Therefore, rides to the camp, food, tents, canoes, paddles, push poles, ricing sticks, and rice bags were provided. Also, all participants had a choice of staying at the camp or coming for a day to accommodate WIN members who could not take time from work for the entire experience.

7.2. Prototype Testing: Wild Rice Camp

The wild rice camp took place on September 15-18, 2014 (Figure 16). The site chosen for camping was located next to the Scot River Bridge. The rice field at the Big Bend was a 1-1.5 hour paddle away.

Figure 16: Wild Rice Camp Experiences, 2014

The organizers of the camp were the WTLUA Resources Information Officer, Wabaseemoong Social Services Department, Mizhakiiwetung School, and myself. The funding was provided by Wabaseemoong Social Services, University of Manitoba, and Bimose Tribal

Council, located in Kenora, Ontario, which supports members of nine Anishinaabe communities with advisory and professional services and program delivery in the fields of economic development, education, administration, housing, and other community affairs. The group of participants possessed a very diverse range of ages, skills, and occupations. Two Elders, three clients of the Wabaseemoong Social Services Department, two teachers, and the TLUA Resources Information Officer - all aged 50 and over - knew how to harvest rice. Three teachers/supply teachers from outside of the community, two non-Anishinaabe and one Anishinaabe, as well as six high school students, another University of Manitoba student, and myself had never harvested wild rice before the camp. Also, two of the high school students mentioned above were daughters of the school native language teacher and attended as family members. Out of the 19 participants, 14 were interviewed after the camp. The only participants who were not interviewed were minors, myself, and the other University of Manitoba student.

Camp organizers provided participants with most of the necessary equipment. Seven push poles were made before the camp. Adult harvesters brought their own ricing sticks, which were either antiques from the old harvesting times or made just before the camp. Ricing sticks for students and teachers were made on the day of their arrival for demonstration purposes.

On the first day, September 15, 2014, camp participants set up tents and organized the camp. Elders and Social Services Department clients harvested rice on September 16-18, 2014. Participants varied greatly in their harvesting speed; for example, it took I. Fisher and myself five hours to collect one bag, while G. Michaud and J. Carpenter, who have been harvesting rice together for many years, harvested the same amount within two hours. On September 18, 2014, high school students came to the site along with their teachers. In addition to harvesting and bagging harvested rice, the students went to see old cultural sites, including the Scot River Falls,

the old portages, and Pemican cabin. When the students came back, all the participants returned to the community. The main participants sold their rice to the buyer, who was a Shoal Lake Wild Rice agent, while the rice harvested by students was taken to the community for finishing.

7.3. Prototype Feedback

The overall prototype feedback documented through 14 Stage B interviews with all the participants aged 18 and over and the third workshop was positive. The main indicator of success was that all the participants (100%) expressed their desire to participate in wild rice camps in the future. However, all the interviewees also made recommendations for improvement (Table 11).

Table 11: Wild Rice Camp Participants' Feedback

Positive Aspects	Suggestions for Improvement
− Communal experience and shared activities (71.4%) − Hands-on experience (64.3%) − Availability of rice and familiarity with the site (28.6%) − Diversity of participants: Elders, clients of the Social Services Department, teachers, and students (14.3%) − Provision of food/sharing of meals and responsibilities (14.3%) − Visiting cultural sites (14.3%) − Invitation of a buyer and ability to sell rice (7.1%)	− Find and organize a better campsite (57.1%) − Provide better access to the camp (50%) − Extend the duration of the camp (35.7%) − - − Provide higher participation rate (adults and students) (35.7%) − Find future camp leaders and Elders who can participate (28.6%) − Sell rice within the WIN community (28.6%) − Make wild rice camps a regular practice to reinstitute the practice in the long term and to "keep the momentum" (28.6%) − Pre-instruct students before the camp (28.6%) − Add additional activities for students (21.4%) − Search for other potential ricing sites (21.4%) − Provide higher purchasing prices (14.3%) − Provide warmer bedding (14.3%) − Include the wild rice camp in the community calendar of events (14.3%) − Combine rice harvesting with other traditional activities (14.3%) − Consider different modes of transportation to the camp (14.3%) − Fix the road to the camp (14.3%) − Secure funding (7.1%) − Lay emphasis on the participation of families (7.1%) − Provide a possibility to sell rice to everyone, including students (7.1%) − Provide the participation of a buyer at every camp (7.1%) − Involve middle-aged people in teaching students (7.1%) − Provide better and more modern equipment (7.1%) − Provide safety from wild animals (7.1%)

According to Table 11, the most significant factors of the camp success were communal atmosphere and hands-on experience. The participants enjoyed harvesting rice together, laughing, taking breaks, sharing jokes, and sitting by the fireplace, as well as field experience that "makes memories" and cannot be replaced by classroom learning. The main improvements were related to venue and logistics. Suggestions included the search for more accessible trails and a better campsite, use of a boat instead of trucks for reaching the Scot River, relocation of the camp closer to Big Bend, and construction of a permanent structure at the campsite. Other improvements referred to camp duration, participation rate, profit-making, regular character of the camps, students' pre-instruction, inclusion of other activities, and better equipment.

The most controversial factor of success was profit increase. According to M. Gowing (interview, Oct. 22, 2014), a top priority in future camps would be the direct presence of a buyer at the site to allow every participant, including students, to see the financial benefits of the camp's activities. Given that in 2014, students and teachers' rice was brought to the community for the finishing event, C. Carpenter (interview, Nov. 11, 2014), a high-school student, expresses his dissatisfaction with the inability to sell the rice he harvested. Two Social Services Department clients (14.3% of interviewees) also express dissatisfaction with the apparent lack of increased sale values for their rice, which sold at 62 cents per pound, or the same price that was received in the 1980s. In light of these issues, four participants (28.6%) offer several alternatives to selling rice to the buyer. Elder M. McDonald (interview, Oct. 20, 2014) suggests selling rice to the local people because there is a high demand within the WIN community and several community members asked him to sell them rice after the camp. Also, he expressed a desire to keep some of his harvest for himself for subsistence purposes and finish it in the traditional way. Elder F. Henry (interview, Oct. 20, 2014) and G. Michaud (interview, Oct. 23, 2014) share Elder

M. McDonald's sentiment and underline that the band should buy rice from the harvesters because "rice should stay in the community for people to enjoy". R. Fisher (interview, Oct. 21, 2014) suggests that the rice procured by the band can be used for feasts and ceremonies and a wild rice business operation can be opened in the community. M. Gowing (interview, Oct. 22, 2014) mentions the need for more upgraded equipment in order to increase production. However, as underlined in Chapter 4, most WIN research participants argue against airboats.

Overall, the above-described improvement suggestions need to be considered in the development of the improved version of the prototype, while positive characteristics identified by Stage B interview participants need to be preserved. Although not all the improvement suggestions are feasible and many of them depend on the availability of future funding for the camp, any future iterations of the camp prototype should take them into consideration.

7.4. Learning Outcomes of the Camp

7.4.1. Learning Overview

Initially, it was hypothesized that the participants of the wild rice camp aged over 18 may experience instrumental, communicative, and transformative learning, which can contribute to the re-establishment of relationships between community members and *manomin*. The disorienting dilemma, which is described in detail in Sections 4.2 and 4.3, is characterized by a disconnect between wild rice and WIN members, as well the attempts to reignite these socio-cultural and economic relationships.

Although the camp lasted for only 4 days, the findings of Stage B interviews show that participants experienced instrumental, communicative, and transformative learning, although instrumental learning was the most extensive (Table 12).

Table 12: Instrumental, Communicative, and Transformative Learning Outcomes of the Wild Rice Camp

Primary Categories	Secondary categories	Grounded themes
Instrumental learning	Obtaining skills and information Adapting to new circumstances Improving efficiency	<u>Information about wild rice and wild rice management practices</u>: - Suitable wild rice habitat - Stages of wild rice growth - Physical appearance of ripe rice plants - Origin of wild rice - Ways of harvesting rice - Competing plant species - Water chemistry <u>Skills related to wild rice harvesting</u>: - Identifying rice - Harvesting rice - Employing new strategies that enable teamwork - Improving efficiency in harvesting wild rice - Paddling and navigating in shallow water bodies with a mucky bottom - Performing different finishing tasks - Making ricing equipment
Communicative learning	Understanding others' values and points of view	- Importance of wild rice in Anishinaabe tradition - Potential of wild rice harvesting to create jobs for young people - Importance of teamwork and mutual help - Respect for nature
Transformative learning	Change in meaning scheme (pertains to wild rice harvesting)	- Transferring from thoughts to actions - Feeling more optimistic about the future of rice - Feeling increased interest in wild rice harvesting - Having an awakened desire to find other ricing areas and to make ricing equipment - Having a change in consumption behavior - Protecting wild rice harvesting areas
	Change in meaning perspective (pertains to general worldview)	- Appreciating the natural resources in WTLUA - Feeling empowered - Healing oneself

7.4.2. Instrumental Learning

As per Chapter 2, instrumental learning includes understanding the reality and how something works, as well as learning to do something (Moyer et al., 2014). The main subthemes of instrumental learning experienced by the camp participants were obtaining skills and information, adapting to new circumstances, and improving efficiency. Adapting to new

circumstances and improving efficiency can be considered a part of the task-oriented problem solving subcategory defined in Mezirow (1995).

As predicted before the camp, more than half of participants (57.1%) identify several instrumental learning outcomes of their involvement, especially with respect to the acquisition of information on wild rice, harvesting skills, and other relevant skills. The degree of instrumental learning varies for different groups of people from very high for those participants who have never harvested wild rice before to low and no learning for other more experienced participants. Experienced participants had to adapt to new circumstances and improve their efficiency instead of learning new information and skills.

One of the observed instrumental learning outcomes was the acquisition of information related to wild rice and ricing practices. For young community members and teachers from outside of the community, most information about wild rice was new. For example, J. Kakepetum can now identify suitable wild rice habitat while on the lake or on the river (interview, Oct. 21, 2014). R. Fisher and C. Carpenter learnt which water levels are required for wild rice to grow (interview, Oct. 21, 2014; interview, Nov. 11, 2014). M. Gowing and H. Land noticed from experience that darker plants are riper and, therefore, easier for knocking rice kernels for harvesting (interview, Oct. 22, 2014; interview, Oct. 21, 2014). M. Gowing and G. Matheson, who are a high school teacher and substitute teacher from outside of the community, claim that all the information they now know about wild rice was received at the wild rice camp (interview, Oct. 22, 2014). For M. Gowing, one of the revelations was that wild rice is native to North America (interview, Oct. 22, 2014). Also, M. Gowing learnt about different stages of rice growth and different ways of rice harvesting, such as manual and mechanized harvesting. Moreover, several research participants learnt that there was so much rice in WTLUA and that

rice can be harvested very close to the community (R. Fisher, interview, Oct. 21, 2014; G. Matheson, interview, Oct. 22, 2014; C. Carpenter, interview, Nov. 11, 2014).

75% of participants who had already harvested wild rice in past did not learn any technical information. However, Elder M. McDonald, who had a much longer learning period than other participants because he provided help, learnt about different aquatic plant species, especially those which compete with wild rice, and water chemistry required for wild rice to grow (interview, Oct. 20, 2014). Information did not always contribute to the future restoration efforts. Elder F. Henry participated in the wild rice camp in the hope to obtain profit, but now realizes that manual wild rice harvesting is not profitable given the current wild rice price of 62 cents per pound (interview, Oct. 20, 2014). Also, Elder F. Henry saw a general lack of interest towards wild rice harvesting among young people during the camp.

With respect to harvesting skills, the six interviewees who had never harvested wild rice before (43%) acquired many new skills. Rice identification, a key skill associated with harvesting, was pointed out by J. Kakepetum, R. Fisher, and G. Matheson, who would have paddled by the plants before their participation in the camp (interview, Oct. 21, 2014; interview, Oct. 21, 2014; interview, Oct. 22, 2014). Also, the inexperienced participants learnt how to do their job more efficiently. G. Matheson allowed M. Gowing to knock rice, while she was paddling, because she was aware of the shortage of time and recognized her picking partner's efficiency (interview, Oct. 22, 2014). M. Gowing, in turn, put effort into finding the most efficient ways of knocking rice with a stick in order to get the maximum amount of rice kernels. The experienced wild rice camp participants already possessed wild rice harvesting skills. However, team work with new partners challenged some of the pickers and made them explore new ways of rice harvesting. For example, because I. Fisher was a very fast paddler, Elder M.

McDonald had to try a new way of harvesting (interview, Oct. 20, 2014). He was hitting plants with a stick without reaching for them and then leaning them towards the bottom of the canoe.

Wild rice harvesting skills were not the only skills acquired for both experienced and inexperienced harvesters. For H. Land, one of the students, not only rice harvesting, but also paddling and being in the canoe was a first-time experience (interview, Oct. 21, 2014). More experienced paddlers also learnt how to better navigate in shallow water bodies with a mucky bottom (M. Gowing, interview, Oct. 22, 2014). From time to time, M. Gowing had to use his paddle for pushing the canoe instead of traditional paddling. Several participants also mention that they learnt to make ricing equipment. Elder M. McDonald, who made seven push poles for the wild rice camp with my help, has now "mastered the art of making push poles" (personal communication, Sept. 16, 2014). Also, camp participants had a chance to learn what material ricing sticks are made of and which instruments are needed for making them through the demonstration provided by Elder J. Hunter. Even Elder F. Henry admits that he learnt a lot, although he had made sticks many times in his young adulthood (interview, Oct. 20, 2014).

Most instrumental learning outcomes identified in this section were collective in nature, or experienced by several participants, which corresponds to findings in other literature on transformative learning (e.g., Najjar et al., 2012). The similarity of outcomes can be explained by the similarity of experiences throughout the camp. Most of the instrumental learning was experiential in nature and pertained to the very specific wild rice harvesting context. As for instrumental learning, the ability to accomplish a certain task is the main measure of success (Sinclair et al., 2011), the wild rice camp succeeded, although experienced participants did not report many instrumental learning outcomes.

7.4.3. Communicative Learning

While instrumental learning outcomes prevailed, participation in the wild rice camp also led to communicative learning outcomes for five participants (35.7%), which refer to understanding, questioning, and negotiating values and points of view. The main values and points of view learnt were the importance of *manomin* and the ecological importance of the area. Communicative learning occurred not only through communication, but also through practical application and observation. However, communication during the camp was supported, encouraged, and facilitated. As stated by Elder F. Henry, he enjoyed numerous possibilities for communication, which is "the best policy at every camp" (interview, Oct. 20, 2014).

Inexperienced harvesters, who had heard little about the values of wild rice before the camp, mostly learnt about the cultural and economic importance of wild rice. G. Matheson, a non-Anishinaabe teacher, now understands the importance of wild rice for Anishinaabe people:

> *"I didn't know that it was such a big part of the culture here that people would have grown up doing this. We heard a couple of people talking about their fun memories of the time with their relatives, friends, and tipping each other out of the canoes. Really, it was obvious that it was a part of a really positive memory for people*" (interview, Oct. 22, 2014).

As she now understands the importance of wild rice harvesting, G. Matheson feels privileged to have participated and to have been "a part of something unique" (interview, Oct. 22, 2014). M. Gowing, who works as a teacher at Mizhakiiwetung School, and always thinks about everything from the point of view of how it will affect his students, now sees the potential of wild rice harvesting to create jobs for school graduates (interview, Sep. 22, 2014).

Teamwork in canoes also created a context for communicative learning, especially due to the fact that teachers and Elders were coupled with students and people from outside of the community shared canoes with community members. Several wild rice camp participants underline the importance of teamwork and mutual help while harvesting wild rice (Elder R.P.

McDonald, interview, Oct. 21, 2014; Elder J. Hunter, interview, October 22, 2014). Elder R.P. McDonald thinks that while harvesting rice, students learned from Elders and their teachers to respect "the land, the water, and the way their ancestors lived", as well as to respect one another (interview, Oct. 21, 2014). Also, J. Kakepetum, who was harvesting rice for the first time with a native language teacher R.P. McDonald, listened to his numerous stories and understood how valuable past experience was for his harvesting partner (interview, Oct. 21, 2014).

Thus, the main values learnt include the importance of wild rice harvesting for Anishinaabe people and mutual help. Inexperienced camp participants learned from those who had harvested rice before, while experienced participants reflected upon what they observed. The fact that more participants did not have communicative learning outcomes was consistent with the findings of other researchers with respect to resource and environmental management (e.g., Sinclair et al., 2011; Najjar et al., 2012). The prevalence of instrumental learning can be explained by the main goals of the wild rice camp, which was purely experiential in nature. Communication was limited to communication with a harvesting partner in a canoe and communication at the camp while setting tents, cooking, and being involved in other activities.

7.4.4. Transformative Learning

Several learning outcomes pertain to transformative learning, which occurs within higher level meaning structures and generates a change that affects the whole person (Moyer et al., 2014). Both experienced and inexperienced wild rice camp participants, as well as other non-participating community members, had transformative learning outcomes. Transformation of meaning schemes related to wild rice harvesting was extensive, while transformation of meaning perspectives which refer to people's worldviews in general was very limited (Najjar et al., 2012).

Most likely, limited transformation in a meaning perspective resulted from the fact that the camp was a short-term experience with a narrow restoration focus.

Transformation in meaning schemes, or immediate beliefs and expectations (Baumgartner, 2002), was reflected through a change in how the participants perceive the future of wild rice and the community involvement. Also, the camp contributed to the desire to protect wild rice fields and influenced participants' consumption behaviour with respect to wild rice. The camp itself was a transfer from thoughts to actions and the first step forward in the restoration process**.** Elder M. McDonald emphasizes that before 2014 he had thought about wild rice picking for a very long time, but never took action (Kuzivanova field notes, Sep. 15, 2014).

With respect to the future of wild rice, several informants indicate that they felt much more optimistic about community participation and saw increased interest in wild rice harvesting in the WIN community after the camp. For instance, Elder M. McDonald notes that the wild rice camp triggered a lot of discussions in the community and many people expressed their desire to participate in similar camps in the future (interview, Oct. 20, 2014). Elder R.P. McDonald describes that after the students had returned to the community, they talked repeatedly about the wild rice camp and their ricing experience (interview, Oct. 21, 2014). As mentioned by Elder F. Henry, many WIN members asked him if he enjoyed being on the Scot River and why (interview, Oct. 20, 2014). According to J. Kakepetum (interview, Oct. 21, 2014), after the camp, several adults continued harvesting rice for themselves. Although M. Gowing cannot say for sure if wild rice camps will keep happening because "the desire to participate has not necessarily translated to the next generation yet", but he feels that the wild rice camp of 2014 was an important first step and more experiences can happen in the future (interview, Oct. 22, 2014).

Also, Elder J. Hunter now expresses his desire to expand ricing areas, explore other historical wild rice fields in WTLUA in the near future, and go across the Scot River falls to North Scot Lake, South Scot Lake, and other ricing lakes (interview, Oct. 22, 2014). During the third workshop, Elders J. Hunter and R.P. McDonald spoke about exploring harvesting rice on Crowduck Lake, which used to be a part of the WTLUA. J. Carpenter expresses his awakened desire to make ricing equipment (interview, Oct. 20, 2014).

Additionally, participants started speaking about the protection of ricing areas. One of the students agreed to make a presentation on behalf of the Mizhakiiwetung School for the Chief and Council and higher-level authorities to establish a provincial protected wildlife management area at the Scot River. Elder R.P. McDonald expressed his hopes in the following statements:

> *"Hopefully, in the future, students can go not just rice picking, but also participate in other activities and preserve wildlife because it involves everything: the water, the plants, the trees, all that is right there… That's why we need to keep moving and protect this area … It's actually coming back, this field. It was empty before. There was absolutely nothing, just like Whitedog Lake, just deserted. Now it's coming back. Let's protect the area"* (interview, Oct. 21, 2014)**.**

R. Fisher, one of the students, mentioned that further steps need to be the proper use of the TLUA, prohibition of any machinery, and non-Anishinaabe loggers (interview, Oct. 21, 2014). Also, during the last workshop, while identifying further restoration steps, all three focus groups mentioned prohibiting machines and log cutting, sampling water, and protecting the ecosystem. This learning outcome is unique because it turns away from mere restoration of wild rice for its use by humans to conservation of the whole area and its long-term sustainability.

The wild rice camp also has a potential to increase wild rice consumption. M. Gowing speaks about a change in his consumption behavior:

> "*That's a part of my value system: eating locally, trying as much as possible. So, the fact wild rice is from Canada and grows relatively close by would certainly change the way I purchase"* (interview, Oct. 22, 2014).

While the camp participants report numerous changes in meaning scheme, as stated earlier, only one interviewee describes a meaning perspective change. According to Elder R.P. McDonald (interview, Oct. 21, 2014), the participants acquired a different perception of the world and appreciation of things, experienced empowerment and healing, As stated by Elder R.P. McDonald, considerable changes occurred in the participants' worldview:

> *"When we came back, we had a very different perspective on things. We appreciated things….We established friendship because of everything we shared… This is the way our people lived long time ago"* (interview, Oct. 21, 2014).

Also, Elder R.P. McDonald feels empowered after having lived through the memories of his childhood again and having re-established connection with his ancestors:

> *"We talked to each other… It's like we lived in the past. We were kids again. We pictured our parents. I can visualize all the relatives from the community. I can see them and feel the connection. You feel it as you are paddling along. How empowering it is. It is really something"* (interview, Oct. 21, 2014).

He was also empowered by the fact that non-Anishinaabe teachers joined community members in the wild rice harvesting process. This outcome is very special and important for intercultural communication as wild rice harvesting has always been a typically Anishinaabe occupation.

Healing was also an essential part of Elder R.P. McDonald's re-establishment of an inter-relationship with wild rice and his meaning perspective transformation (interview, Oct. 21, 2014). Elder R.P. McDonald speaks with enthusiasm about nature and its potential to heal the camp participants:

> *"It's something very special. It's something that happens like healing. When you sit in the bush by yourself, you could feel everything. That's the healing part because there is trees and water that heal you"* (interview, Oct. 21, 2014).

The transformation of the meaning scheme towards more optimistic perception of the wild rice future was expressed collectively. However, now, it is impossible to say how enduring this transformation will be and if this transformation will result in behaviour change and collective

action. Transformative learning results from communicative and instrumental learning and coincides with one, or the other, or both domains, which corresponds to the findings in Moyer et al. (2014). For instance, the comprehension that there is wild rice in the WTLUA and it is feasible to harvest rice, which is an instrumental learning outcome, resulted in a desire to explore other ricing sites and check for the presence of wild rice in other areas, which is already a transformative learning outcome. The understanding of the value of rice in the Anishinaabe tradition led to a desire to further harvest rice and consume more locally-grown rice. Thus, in most cases, it is difficult to separate transformative learning outcomes from instrumental and communicative learning.

7.5. Summary and Conclusions

The wild rice camp prototype described in this chapter drew on existing TEK, which mirrors the community's rich and diverse biocultural heritage, and allowed for the involvement of both Elders and young people. This prototype was tested in September 15-18, 2014, on the Scot River, which was selected as one of the main restoration sites. After the camp, the participants shared their reflections about the camp, which revealed both positive and negative characteristics of the camp and provided guidelines for its improvement. Also, a transformative learning framework was chosen because of the presence of a disorienting dilemma and a need for a deep-rooted change resulting in the re-establishment of relationships between people and wild rice. Special conditions that could trigger instrumental, communicative learning and ideal learning conditions in keeping with the theory of transformative learning were created.

The majority of learning in this study was instrumental by nature; however, some learning was also found in the communicative and transformative domains. Such an outcome could be expected because most of the learning was experience-based, and the focus of the camp

was on transmitting rice harvesting skills and information related to wild rice. The degree of instrumental learning and the diversity of outcomes were higher for young people and teachers from outside of the community, which can be explained by the absolute absence of knowledge about the activity among these participants and the novelty of experiences. Both experienced and inexperienced participants had communicative learning outcomes; however, the values learned differed for different groups of participants.

Overall, both experienced and non-experienced wild rice camp participants report the occurrence of transformative learning. The Stage B interview results show that participants mostly experienced transformations in meaning schemes (Najjar et al., 2012), which was reflected through changes in how participants perceive wild rice and its use in the community, as well as the future of wild rice harvesting in WTLUA and wild rice consumption. There was no significant change in participants' worldviews and life in general, or transformative learning in a meaning perspective as described in Najjar et al. (2012). Elder R.P. McDonald was the only participant who reported a change similar to the transformation of meaning perspective.

Although transformation of life trajectories, or complete change of livelihood did not happen, transformation of participants' minds was important in the process of ecocultural restoration and re-establishment of wild rice for those participants that have harvested rice before and acquisition of new values for those who are new to wild rice harvesting. Experienced wild rice harvesters acquired more hope about the future of wild rice, and intensified their interest in wild rice harvesting; while first-time participants acquired an interest in wild rice harvesting and understood the importance of wild rice harvesting for the Anishinaabeg.

CHAPTER 8: CONCLUSIONS AND RECOMMENDATIONS

Going back and ricing brought tears into the eyes of those who already have experience and memories… I would like to say that it's something that is gonna keep happening, because I feel that it hasn't necessarily translated to the next generation yet. They don't have this bank of memories and experiences to draw from … But I feel that this was an important first step… I hope that this can snowball so that more experiences could happen. Then, as this happens over years, you start to reclaim those experiences into the culture. So, yes, I am optimistic about what happened… That's good and that's momentum. The thing is just carrying forward this momentum to next year" (M. Gowing, Oct. 22, 2014).

This chapter summarizes and discusses the main findings of this study and its theoretical and practical implications. Future restoration steps are described in a table, which outlines the goals, objectives, tasks, functions of the participants, equipment, and funding needed for the transfer of knowledge about wild rice and active wild rice management. In addition, the chapter suggests areas for future research and reflects on the appropriateness of the methodology.

8.1. Main Findings and Discussion

8.1.1. Past and Present State of Rice-Related Practices

The findings pertaining to the first objective include TEK about wild rice and ricing practices as a knowledge-practice-belief complex that links WIN members with wild rice (Berkes, 2008), as well as changes that occurred in the 20th century. *Manomin* used to be an important cultural plant for WIN members, a part of ecosystems in WTLUA, and a significant source of income in the 1960s-1980s. Complex changes at different levels - local, regional, national, and international – in the 20th century resulted in the disruption of habitats and practices, knowledge loss, and impeded intergenerational knowledge continuity. Many of these changes are irreversible and correspond to the global shift of values, industrialization, and resource development in the 20th century. However, the fact that 100% of research participants think that rice needs to be restored and see values of *manomin* brings up hopes and reasons for

the community involvement, although the younger generation perceives much fewer socio-cultural values of wild rice.

These findings re-iterate some of the descriptions from Vennum (1988); however, the need for documenting knowledge still exists because TEK is dynamic, place-based, and constantly adapting to external circumstances (Agrawal, 1995; Berkes, 2008). Thus, it cannot be conceived of as static and universal for all Anishinaabe communities.

Overall, the use of TEK is an empowering act that allows WIN members to reclaim their biocultural heritage and increases the social acceptability, economic feasibility, and ecological viability of the project (Kimmerer, 2012; Uprety et al., 2012). Also, because TEK incorporates memory that is dissonant with the contemporary context, it allows for the emergence of creativity while preserving the linkages between the past and the future (Davidson-Hunt, 2003). Thus, TEK is a good foundation for designing a restoration project by the WIN community.

8.1.2. Selection and Documentation of Sites

In summer 2014, the project team visited four accessible water bodies. Wild rice was found in abundance on the Scot River and in small amounts on Salvesen and Paintpot Lakes. Two sites - Whitedog Lake and the Scot River - were chosen for historical and biophysical documentation and potential restoration efforts based on their accessibility and importance to the community. The Scot River does not require any ecological interventions besides aquatic vegetation monitoring, while Whitedog Lake requires intensive intervention because of the unsuitability of water levels. Based on the principle of restraint, or minimal ecological intervention, included in the wild design framework (Higgs, 2003; Higgs & Hobbs, 2010), the Scot River was selected as a site for organizing a wild rice camp in September 2014 and can be

used for rice harvesting in 2015. Whitedog Lake is more damaged and requires repair works on the culvert structure for mimicking natural water fluctuations.

The choice and documentation of the sites was done based on both historical and biophysical data, as well as site accessibility. Site accessibility is a big issue because many WIN members have no vehicles or boats. Historical and cultural importance of the sites is essential because it provides for community engagement and, thus, the long-term success of the project. Also, history contributes to the understanding of ecosystem restoration projects done respectfully and with a long-term perspective (Higgs, 2012). Biophysical characteristics show how much intervention is required for restoring wild rice habitats. The maps of the sites created as a part of the site documentation process also include the site accessibility, cultural, and biophysical features. This consideration of cultural aspects and attention to multiple site characteristics are more appropriate for the ecocultural restoration of cultural landscapes.

8.1.3. Dancing *Manomin* Anew: Young People and Children

The school was identified as the main partner and education as the main medium for the involvement of young people and children in ecocultural restoration. A workshop with school teachers allowed the identification and prioritization of the main options for incorporating knowledge about wild rice into the school program. These were both formal (links of wild rice knowledge to the school curriculum) and informal (a wild rice finishing event), as well as purely theoretical (posters) and hands-on (a wild rice camp), time consuming (a wild rice camp) and fast in execution (short wild rice video). Because TEK is place-based and school curricula differ, these suggestions are specifically aimed at the WIN community; however, Chapter 6 also provides ideas for similar projects in other areas.

All the possibilities described in Chapter 6 are much more than just forms of passing on knowledge about wild rice and ricing practices to the younger generation in order to establish young people's relationships with wild rice. Culturally-inappropriate education systems with the prevalence of the industrialised models and negligence of the minority languages have negatively influenced Aboriginal societies for a long time (Pretty et al., 2008). The preservation of knowledge about wild rice as culturally relevant knowledge decolonizes education by making it more place-based and culturally responsive (Aikenhead & Elliott, 2010; Faires, 2004; Pretty et al., 2008; Smith, 1995). Aboriginal school curricula need to incorporate the holistic perspective of the world to prepare students for successful lives (Faires, 2004). Also, hands–on experience in the form of a wild rice camp as time spent directly interacting with nature improves psychological and physical health (Ontario Ministry of Education, 2009).

8.1.4. Transformation through Camping

The approach chosen for re-establishing adults' relationships with *manomin* did not focus on education because adults have already had experience and need to transform their existing frames of reference related to wild rice through critical reflection on their assumptions in accordance with Mezirow (1978, 1994, 1997, 2000, 2008, 2012). Thus, a prototype for a wild rice camp was developed in 2014 based on the findings related to the previous objectives and ideal learning conditions described in Mezirow. The overall camp participants' feedback was positive with communal and hands-on experience as the main factors of success; however, the participants disliked some of the issues including, primarily, hardships with logistics issues, short duration of the camp, and low participation.

2014 camp participants also experienced learning, which contributed to relationship re-establishment. If relationship is understood as connection resulting from physical and emotional

engagement, instrumental learning outcomes that included acquisition of knowledge about wild rice and diverse ricing skills were important for relationship re-establishment. Communicative learning outcomes related to understanding values and perceiving the importance of wild rice and wild rice camps also contributed to emotional connection with wild rice. Transformative learning outcomes, mostly including the transformation of meaning schemes, were essential for transferring from thoughts to actions and taking practical steps targeted at further relationship re-establishment. Although only one camp participant spoke about appreciating resources, feeling empowered, and healing after the camp, these changes in meaning perspective are ultimate goals of the camps after centuries of colonization and suppression of traditional practices. The healing of Mother Earth, as well as oneself and one's community, is an essential part of indigenous people's identity (Jones, Baker, & Schuman, 2000).

Because the wild rice camp in 2014 generated very positive feedback, the event was held again in 2015 with certain improvements based on the suggestions of the participants. For instance, in 2015, the camp was longer than in the previous year, it was located closer to the ricing site, there were more participants, canoes were transported to the site by water, and better tents were purchased for the event to make it more organized. Thus, the amount of rice harvested in 2015, which was 1800 pounds, was much higher than in 2014. However, the camp in 2015 still followed the main prototype principles described in Figure 15 and retained all the positive aspects of the camp in 2014, which were identified by the 2014 camp participants.

Overall, with certain changes, this prototype may be applied to other community initiatives targeted at strengthening TEK and cultural well-being through the awareness of the value of traditional foods. Hopefully, this prototype will lead to further prototypes within and

outside of the wild rice project because, in accordance with Brown (2009), prototyping inspires new ideas.

8.2. Theoretical Research Implications

This research contributes to the literature on ecocultural restoration and adult learning. This study presents a holistic approach to restoration, which incorporates ecological processes and cultural practices (Higgs, 2003; Kimmerer, 2011; Martinez, 2003, 2011, 2014; Pukonen, 2001). Wild rice cultural landscapes were created by Anishinaabe people through their engagement with the land and traditional land management (Davidson-Hunt, 2003). Thus, the ecocultural approach is more applicable to the restoration of wild rice than a purely ecological approach, which excludes humans from ecosystems and focuses on the recovery of ecosystem structure and dynamics as defined in Palmer et al. (2004) and Palmer et al. (2006). Ecocultural restoration includes not only biophysical surveys and development of recommendations for each selected restoration site, but also the engagement of community members for the re-establishment of socio-cultural and/or economic relationships with *manomin* which, according to the literature, are essential for the longevity and sustainability of any ecosystem (Kimmerer, 2011; Martinez, Salmon, & Nelson, 2008). This study provides a model for the development of a holistic ecocultural restoration project that uses Western science-based knowledge and TEK as complimentary knowledge systems. Ecocultural restoration serves as a decolonizing practice because it involves project participants in decision-making, recognizes their knowledge, extends their capabilities, allows them to determine their own futures through controlling their own resources, and does not require external expertise.

Besides providing insights on how to develop an ecocultural restoration project, this study also suggests the use of transformative learning theory as a criterion of effectiveness of

relationship re-establishment between people and land. Thus, this project contributes to the literature on adult learning in informal settings by defining learning conditions at the wild rice camp and exploring the potential of the camp to trigger instrumental, communicative, and transformative learning. Overall, literature on informal community-based conservation and restoration does not often use transformative learning theory with a few exceptions, such as Najjar et al. (2012) and Sinclair et al. (2011). This study's main finding relevant to transformative learning was that most learning occurred in the instrumental domain, with very little communicative or transformative learning occurring, which corresponds to the findings of other studies in the field of natural resources management (e.g., Najjar et al., 2012; Sims & Sinclair, 2008; Sinclair et al., 2011). However, this study shows that wild rice camps have a potential to trigger epochal transformations, or sudden re-orientations in people's habits of mind (Mezirow, 2008), although other researchers consider that transformation cannot result from a single intervention or experience (Feinstein, 2004). Moreover, this study acknowledges that instrumental, communicative, and transformative learning may result from lived experiences and not from rational discourse through dialogue, which is overemphasized in the transformative learning literature, according to Sims (2008).

8.3. Reflections on Methodology

This study was guided by a design methodology drawing upon biocultural design, wild design, and human-centered design frameworks (Brown, 2009; Davidson-Hunt et al., 2012; Higgs, 2003; Higgs & Hobbs, 2010). Thus, one of the main contributions of this research is the use of a design methodology in a restoration project, which is rarely discussed and done with the exception of Higgs (2003) and Higgs and Hobbs (2010). This multi-faceted methodology may serve as a model for diversifying restoration projects. While Section 3.5 discusses the main

characteristics and guiding coordinates, this section reflects on the benefits and the main challenges of using the ecocultural restoration design methodology.

8.3.1. Benefits of Using a Design Methodology

The main benefits of design include the researcher as a co-designer, multiple forms of engagement, team work, prototyping, and the inclusion of diverse knowledge systems. The awareness of the researcher of his/her role as a co-designer and not a project a leader helps to avoid making unilateral decisions, reduce personal bias, and prevent an unbiased power relationship. At the same time, the researcher is not treated as a mere facilitator and an observer without his/her own points of view, opinions, ideas, and expertise. Co-design allows for the inspiration, conception, and implementation of ideas, which correspond to community's and researcher's needs and interests. Within the project, WIN research participants generated ideas and identified the next steps of the restoration process together with the researcher by having facilitated discussions.

In addition, team work involving people with diverse knowledge, skills, and experience leads to better results than researcher-only work and increases the possibility of more successful outcomes. Ecocultural restoration, which is a very complex process, requires different types of knowledge including the knowledge of biology, TEK, educational process, forms of adult involvement, and economics of wild rice production. Throughout the project, participants with diverse expertise played different roles: teachers developed ways for the school involvement; wild rice camp participants tested and provided a feedback on the prototype; adults, Elders, and young people shared their knowledge and perspectives. Most research participants contributed to the project through their involvement in the interviews, workshops, wild rice finishing event,

and/or the camp. The most active participants, Elder M. McDonald and M. Scott also assisted with interview transcription, workshop preparation, and biophysical surveys.

The principle of human engagement characteristic of design methodologies is also beneficial for ecocultural restoration projects, which require hands-on experience for the re-establishment of relationships people have with their land as underlined by Stage B interview participants. All WIN residents had a chance to engage culturally and economically with *manomin* through learning, passing on knowledge, ricing, and selling wild rice. Their intercultural, intergenerational, and interdisciplinary, as well as formal and informal, classroom-based and hands-on, collective and individual engagement were essential to the project's success.

Prototyping is another important contribution of the design process to ecocultural restoration projects. The recognition that every idea generated is a potential prototype diversifies restoration projects and helps to avoid a rigid technocratic process developed in accordance with strict guidelines, which is criticized in Higgs (2003). The wild rice camp was the strongest and most detailed prototype developed throughout this project; however, numerous other smaller prototypes were generated and implemented as well. For instance, the second workshop resulted in numerous educational materials, which were developed immediately.

The responsiveness of design to different knowledge systems is beneficial as well. Within this project, all the design stages integrated TEK and Western science-based knowledge, which enriched each other. For instance, the identification of historical areas of wild rice distribution helped to identify the water bodies in the WTLUA with potentially suitable habitats and select sites for restoration efforts, the description of past practices allowed for the understanding of the type of relationships that needed to be restored, the explanation of the past uses of wild rice created alternatives for its future uses, and the description of past wild rice camps contributed to

the creation of a prototype for a wild rice. Biophysical documentation of ricing sites facilitated site selection for the wild rice camp in 2014. Thus, the principle of non-dismissal of any knowledge systems contributes to the wholeness of restoration efforts and completeness of data.

Overall, in accordance with Higgs (2003) and Higgs and Hobbs (2010), it is important to recognize that restoration is essentially a design practice driven by human interests. This recognition results in more ethical ecological intervention and adds the values of land stewardship, responsibility for the land, and respect to the land to the restoration process.

8.3.2. Challenges of Using a Design Methodology and Possible Solutions

The main challenges of incorporating a design methodology in a restoration project include the creation of the inspiration space, facilitation of divergent and convergent modes of thinking, human engagement, turbulence of projects that incorporate design, and overemphasis of design on the material value of the final product. This section provides different solutions for these challenges, which were used within the wild rice project.

Brown (2009) and Brown and Wyatt (2010) give a clear definition of inspiration, which is a space that allows participants to identify the main problem and get motivation to search for solutions, and suggest going into the world to observe clients' experiences and define their needs as the main inspirational activity. However, this solution is not truly applicable to community-based projects with participants who are very familiar with the community context as designers. Although the main problem and the project goal had already been defined through the discussions with WIN representatives and the design brief before the fieldwork, the facilitation of the inspiration space was one of the project challenges. The main solution to this challenge was the focus on community assets, achievements and other communities' best practices through positive workshop presentations, as well as visioning and asset-mapping facilitation techniques.

Also, one of the inspiration spaces was visits to historical ricing sites or walking probes at these ricing sites. Moreover, as a contribution to inspiration, workshops included important cultural elements such as, for instance, a traditional Anishinaabe opening ceremony with tobacco and prayers. There was no huge divide between the inspiration and ideation spaces: Stage A interviews and the first two workshops helped both to collect background information and to generate ideas for the next steps of the restoration process.

Both the biocultural design (Davidson-Hunt et al., 2012) and human-centered design frameworks (Brown, 2009; IDEO, n.d., IDEO & Riverdale, n.d.) imply that if the design process and teams are well-composed, participants move from divergent to progressively more convergent thinking as initial ideas are developed into particular actions. It is not very clear, however, how to develop special conditions for facilitating the transfer from divergent and convergent thinking. This challenge was dealt with successfully by asking diverse WIN members general questions based on the restoration options in the multi-faceted design brief at the beginning and dropping some of these options throughout the project so as to have a smaller set of specific issues at the end. Thus, several restoration steps identified at the first workshop, such as controlling water levels and upgrading roads to rice fields, were dropped throughout the process as unrealistic or unimportant.

The engagement of research participants, which is one of the benefits of community-based ecocultural restoration projects, is also a considerable challenge. What truly helps is having diverse activities for the involvement of people, such as interviews, workshops, and hands-on activities as well as having liaisons for community outreach. The project would have not been successful without the participation of Elder M. McDonald and M. Scott, who played an important role in recruiting people for the interviews, workshops, and other events. They

triggered the snowball sampling process and always spread the word about upcoming events. A Facebook page created for this project also enhanced community engagement.

In addition, although design benefits ecocultural restoration projects due to its interactive adaptive nature and a fresh look on restoration projects, it is not a feasible methodology for projects which have very limited time and which cannot accommodate the change of the main objectives. The components of this project changed considerably since the design brief and the thesis proposal. Some new steps were added to the project due to community members' concerns. Some of the data described in the design brief were not collected because they appeared to be less important than other data as the research progressed. As Whitedog Lake, which was initially chosen as the main venue for wild rice restoration in the design brief, did not have any rice in 2014 due to flooding, additional field surveys took place. Due to all the changes, two amendments were sent to the University of Manitoba Research Ethics Board.

The final complication results from the fact that many design methodologies focus too much on the material value of the final product and designer-client relationships (Brown, 2009; Davidson-Hunt et al., 2012; IDEO, n.d; IDEO & Riverdale, n.d.) and less on the process of design itself; however, this understanding of design has recently started to change towards design for societies and global justice (Oosterlaken, 2009). Within community-based and community-driven ecocultural restoration projects, the main design value needs to shift from the final product to the creative process itself, which is decolonizing, empowering, expanding capabilities, and respectful to the intimate relationships people have with their land.

8.4. Wild Rice Future

At the last workshop, when the participants were asked what the community needs to do to restore wild rice, seven of them announced that teaching the younger generation is the main

priority, while the other seven participants underlined the importance of active site management. Also, interviews and workshops showed that some of the community members, mostly Elders, are totally against mechanized ricing, while young people, for whom profit is the main incentive for taking part in ricing, will not be involved if it is not possible to increase profit. Thus, because there is no unanimous decision in the WIN community yet, Table 13 presents a short restoration plan with two options. Although less exhaustive, this table was inspired by a similar restoration plan for Crowduck Lake presented in Roberts (2005).

No matter what ends up being the emphasis of community efforts - teaching, active management, or both - there is no time to lose as underlined by Elder M. McDonald (interview, Jul. 29, 2014) due to a very small number of Elders with traditional ricing knowledge left and their advancing age. As stated by M. Gowing (interview, Oct. 22, 2014), the momentum created by the wild rice camp in 2014, needs to be used now.

Table 13: Restoration Plan

	Teaching	Active Management
Goal	Involve young people into wild rice ecocultural restoration and ensure intergenerational knowledge sharing	Increase ricing opportunities within WTLUA and ensure practice continuity
Objectives and tasks	Actively involve school in the ecocultural restoration process	Involve many multi-aged community members in ricing practices done for subsistence, teaching, or selling purposes
	Include both TEK and Western science-based knowledge into the school curriculum	Cooperate with wild rice buyers for providing a possibility to sell rice and consider other possibilities for obtaining income
	Use materials developed within this project for teaching about wild rice	On Whitedog Lake, repair the culvert structure or find some other solution for stabilizing and reducing water levels
	Develop new materials based on the data included in the thesis, including materials in the Anishinaabe Language	On the Scot River, monitor aquatic vegetation and remove some of the vegetation if it is required
	Reiterate Anishinaabe vocabulary pertaining to wild rice	Search for other sites where wild rice is available in the WTLUA
	Teach starting from elementary school and build-up knowledge	Improve access to ricing cites and develop infrastructure next to the ricing sites
	Organize wild rice camps and wild rice finishing events annually	Establish a wild rice committee, or cooperation between the Social Services Department, the school, and the band office
	Encourage young people's involvement in ricing and knowledge sharing outside of the school	Involve the band office, and other external authorities in the restoration process; ensure internal and external authorities' support
Participants	Elders need to be able to pass on their teachings and show students how ricing was done	Social Services Department clients need to be the main participants of the wild rice camp and be able to earn money from ricing
	Teachers need to include knowledge about wild rice in both formal and informal school program	Other community members may also join the wild rice camp for the whole ricing period or just come for a day or a few days
	WTLUA Resources Information Office needs to assist with organizing a camp and coordinating work of several units	WTLUA Resources Information Office needs to assist with organizing a camp and coordinating work of several units
	Students need to participate in school activities and interact with Elders	The band office needs to support wild rice camps by providing resources and organizing
Equipment	Canoes can be borrowed from the youth camp at Jadel Lake	Additional canoes can be purchased or other community members' canoes can be rented; purchasing of an airboat may be considered
	Additional ricing sticks need to be made for practicing rice harvesting moves on grass and harvesting rice	If rice is hand-harvested, wild rice camp participants can make their own ricing sticks and use them year after year
	Elder P. Michaud may be able to provide his parching pan and hulling machine	Rice can be sold green or Elder P. Michaud's equipment may be used for finishing
Fund	Funding for the participation of the school in the wild rice camp and wild rice finishing event once a year is required	Funding for the participation of the Social Services Department and the school clients in the wild rice camp once a year is required

8.5. Limitations and Suggestions for Future Research

The primary need for additional research is for a better understanding of the economics of wild rice production, which is not included in the present study. As mentioned in the *Design Brief* (Appendix 1), ricing has economic opportunities, both local (e.g., wild rice dishes served as part of school meal programs) or national/international (e.g., export of wild rice). Thus, the main areas of future research refer to value chains, the pricing mechanism and factors that influence wild rice prices, wild rice businesses, wild rice demand and supply, the characteristics of wild rice important for the buyer, advantages and disadvantage of the wild rice industry - all this needs to be explored at the community, regional, national, and international levels.

Also, the restoration efforts within this study mostly focus on the Scot River area. If the WIN community decides to focus on Whitedog Lake, which requires water level control, the culvert structure at the entrance to the lake will need to be repaired. The data, maps, and drawing presented in this thesis may be helpful. The University of Manitoba Engineering Faculty could be a valuable partner in conducting a needs assessment and designing the control structure.

With regards to the involvement of young people and the school, several problems remain unsolved. Firstly, additional materials in Anishinaabe, both oral and written, need to be developed because at present there is a lack of teaching aids for native language classes. The unit designed for the Anishinaabe language classroom and described in Fairbanks et al. (2011) presents only a list of wild rice-related words and sources of information; however, does not contain any stories or legends in Anishinaabe. Secondly, more detailed links of rice and ricing knowledge and practices to other classes besides native language and technology/science can be examined. Thirdly, although young people aged 18-29 were actively involved in the restoration process within this project, younger community members did not express their thoughts.

Moreover, further research is required for understanding if the wild rice camp experience was truly transformative and not a single "feel good" event. As stated in Chapter 2, there are few studies on the transformative learning outcomes of practical camps and non-formal education; most studies focus on formal higher education and classroom learning (Taylor, 2007). The disadvantage of the present study is that the wild rice camp was very short-term and the number of participants was limited. As, according to Diduck et al. (2012), the transformative learning process ends up with actions based on newly developed perspectives, at present, it is not possible to see if the process is complete or will be complete. Therefore, monitoring of further camps and further studies are required to prove the transformative potential of such camps.

8.6. Concluding Thoughts

This study does not aim at offering an ultimate solution. It is not possible to ensure that ecocultural restoration efforts will result in the continuation of ricing practices. *Manominikewin* – wild rice harvesting – was disrupted a long time ago and due to a broad range of irreversible reasons. However, this research gives a reminder not to forget about cultural practices while focusing on the ecological processes and understand relationships humans have with their landscapes. Although there is no model for a perfect restoration project, this study is valuable for restoration scientists seeking for non-conventional methodologies.

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APPENDIX 1

Brief Overview of Proposed Research Work to be Conducted at Wabaseemoong
Development of a Restoration and Management Plan for Manomin on Whitedog Lake

Background

Whitedog Lake has historically been an important source of *manomin*, or wild rice, as well as waterfowl for the people of Wabaseemoong. It is likely that the location of the community is primarily due to the proximity to these important seasonal food sources. With the building of hydroelectric developments on the Winnipeg and English River systems in the 1950s, the water levels near the community and on Whitedog Lake became subject to the waterpower requirements of these structures and the natural water fluctuation levels required for wild rice were disrupted. As a result, the wild rice and waterfowl habitat utilized by the community were no longer as plentiful as in the past. With the construction of a roadway across the mouth of Whitedog Lake, a water control structure was installed at the downstream end of the culverts in attempt to modify the water levels in Whitedog Lake to mimic natural fluctuations and improve wild rice levels and waterfowl habitat for community use of these important food sources. This water control structure has since fallen into a state of disrepair and, while still present, is no longer able to carry out its intended function.

Proposed Project

The restoration of the wild rice and waterfowl habitat in Whitedog Lake has been identified as a community priority. In order to ensure that this project meets the needs of the community, a wild rice restoration plan and Whitedog Lake management plan are being proposed. With the similarities between Whitedog Lake and Crowduck Lake found on Iskatewizaagegan lands, the research conducted by Will Roberts for his master's thesis approximately 10 years ago may help provide direction on how best to proceed.

(http://umanitoba.ca/institutes/natural_resources/canadaresearchchair/thesis/wroberts%20masters%20thesis%202005.pdf)

The development of the restoration plan would involve the identification of how to bring the wild rice back to historical levels. This would involve interviewing Elders and community members to learn about the location and abundance of wild rice in Whitedog Lake historically, conducting field assessments of current status of wild rice in Whitedog Lake, and identify current needs (water levels, planting, seeding etc.) to restore the wild rice fields. There has been some discussion that the University of Manitoba Engineering Faculty could be enlisted to conduct a needs assessment and project design for the control structure to manage water levels. This could take the form of an undergraduate thesis.

The management plan for Whitedog Lake would identify how the community would like to best utilize the wild rice and waterfowl opportunities once restored. There have been preliminary discussions that the community focus could be on subsistence use and intergenerational transfer of traditional knowledge. The harvesting and processing of the wild rice using traditional methods could be conducted in partnership with the Wabaseemoong School to encourage Elder and youth interactions and transfer of traditional knowledge. The proximity of Whitedog Lake to the community will provide a wide variety of potential uses to benefit the community. Potential economic development opportunities would also be explored. Economic opportunities could be local (e.g. wild rice dishes served as part of school meal program) or national/international (export of wild rice and wild rice products).

APPENDIX 2

UNIVERSITY OF MANITOBA | Research Ethics and Compliance
Office of the Vice-President (Research and International)

Human Ethics
208-194 Dafoe Road
Winnipeg, MB
Canada R3T 2N2
Phone +204-474-7122
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APPROVAL CERTIFICATE

July 16, 2014

TO: **Valeria Kuzivanova** (Advisor I. Davidson-Hunt)
Principal Investigator

FROM: **Susan Frohlick, Chair**
Joint-Faculty Research Ethics Board (JFREB)

Re: **Protocol #J2014:107**
"Restoring Manomin (Wild Rice): A Case Study with Wabaseemoong Independent Nations, Ontario"

Please be advised that your above-referenced protocol has received human ethics approval by the **Joint-Faculty Research Ethics Board**, which is organized and operates according to the Tri-Council Policy Statement (2). **This approval is valid for one year only**.

Any significant changes of the protocol and/or informed consent form should be reported to the Human Ethics Secretariat in advance of implementation of such changes.

Please note:

- **If you have funds pending human ethics approval, please mail/e-mail/fax (261-0325) a copy of this Approval (identifying the related UM Project Number) to the Research Grants Officer in ORS in order to initiate fund setup. (How to find your UM Project Number: http://umanitoba.ca/research/ors/mrt-faq.html#pr0)**

- **if you have received multi-year funding for this research, responsibility lies with you to apply for and obtain Renewal Approval at the expiry of the initial one-year approval; otherwise the account will be locked.**

The Research Quality Management Office may request to review research documentation from this project to demonstrate compliance with this approved protocol and the University of Manitoba *Ethics of Research Involving Humans*.

The Research Ethics Board requests a final report for your study (available at: http://umanitoba.ca/research/orec/ethics/human_ethics_REB_forms_guidelines.html) **in order to be in compliance with Tri-Council Guidelines.**

APPENDIX 3

Sample Letter of Consent for Multiple Activities

Natural Resources Institute
70 Dysart Rd,
Winnipeg, Manitoba
Canada R3T 2N2
General Office (204) 474-7170
Fax: (204) 261-0038
http://www.umanitoba.ca/academic/institutes/natural_resources

Research Project Title: Restoring *Manomin* (Wild Rice): A Case Study with Wabaseemoong Independent Nations, Ontario
Researcher: Valeria Kuzivanova

I am a graduate student at the Natural Resources Institute, University of Manitoba, and I am conducting field research for my Master's thesis. I have been approached by the Traditional Land Use Area (TLUA) Resources Officer to carry out this project in partnership with the band office and the school. This research focuses on the ecological restoration of wild rice on Whitedog Lake. Wild rice ecological restoration implies restoring a natural range of Whitedog ecosystem composition, structure, and dynamics, as well as relationships between humans and nature, language, appreciation of the culture, and traditional activities. From this research, an ecological restoration plan based on biophysical data and traditional ecological knowledge will be developed. Also, the project aims to include both adults and young people in the ecological restoration process and to identify learning outcomes of the restoration process. The study has been approved by the Joint-Faculty Research Ethics Board at the University of Manitoba.

This consent letter, a copy of which will be left with you for your records and reference, is part of the process of informed consent. It should give you a basic idea of what the research is about and what your participation will involve. If you would like to know more details about something mentioned here, or information not included here, please feel free to ask for clarifications. Please take the time to understand this information.

The project will have two stages. Stage A will include the initial workshop and interviews that will allow me to document traditional ecological knowledge, perspectives, and ideas about wild rice ecological restoration. During the workshop, no collected data will be revealed. This stage will last until August 31st, 2014. Stage B will include other workshops and interviews that will identify learning outcomes of the wild rice ecological restoration process. At this stage, the data collected during Stage A may be used. Stage B will last from September 1st, 2014 until December 31st, 2014.

The interviews and workshop discussions will be recorded on a digital recorder provided that you do not have any objections. You should be aware of the fact that the collected information

will be used for the development of a restoration plan and teaching purposes and, therefore, shared with the TLUA Resources Officer and the school. The TLUA Resources Officer and the school will keep your information as long as they need it. The data provided by you will be also used to complete progress reports, my Master's thesis, and will potentially be published in an academic journal. I will destroy all the data three years after my thesis is approved by the Research Advisory Committee.

During the interviews, you need to inform me verbally if some information you provide is not for public use and needs to remain confidential. This information will not be recorded. You may also choose not to answer questions you are not comfortable with. All data gathered during the research will remain under the strict supervision of the researcher and stored in encrypted form in a secure location: the researcher's field notes and logs will be kept under lock, while audio recordings and transcripts of the interviews will be encrypted and stored in the personal computer of the researcher. Your name and contact information will be kept in secure location and will be destroyed upon completion of the study.

If you do not want to be associated with the information provided during the interviews and prefer to be anonymous, you will be randomly assigned a three–digit number and a pseudonym will be further used when there is a need for direct quotation. Your contact information will be kept in a separate confidential database in order to contact you in case there is a need to clarify any data during the synthesis of findings. A key linking three-digit numbers to your contact information will be stored in an encrypted and password protected archived file. The key and the contact information will be destroyed once the thesis is approved by the Research Advisory Committee. However, you should be aware of the fact that there is a risk that your anonymity may be compromised because Wabaseemoong is a small community and participants can be identified despite the strategy of using three-digit numbers and pseudonyms.

With respect to the information provided by you during Stage A interviews, you can regain your rights for confidentiality and anonymity and withdraw from the study at any time until August 31st, 2014. With respect to the information provided by you during Stage B interviews, you can regain your rights for confidentiality and anonymity and withdraw from the study at any time until December 31st, 2014. To do so, you should contact me as soon as possible via contact information provided at the end of this form.

With respect to workshops, because I have no control over what other participants say outside of the workshop, I cannot guarantee you either anonymity or confidentiality. Also, you cannot be guaranteed anonymity or confidentiality if you decide to withdraw from the study an/or regain confidentiality or anonymity. However, if you choose so, I undertake to mask your participation in the results of the study written by me.

Overall, you are free to decline to participate in this research and/or choose not to answer any questions you may not be comfortable with. If you do decline to participate in the study or answer any questions, you will not face any negative consequences. If I have not explained the study clearly, please feel free to ask for clarifications or additional information at any time throughout your participation.

My cell phone number is _____ and my email is _____.

If you have any complaints or further questions about the nature of this research, your concerns may be directed to:
The Human Ethics Secretariat at the University of Manitoba
Phone: _____
E-mail: _____
or to my advisor:
Dr. Iain Davidson-Hunt
Phone: _____
E-mail: _____

Please be advised that the staff at the University of Manitoba has a right to look at my research records to see that the research is being done in a safe and proper way.

Do you understand and agree to the terms described here?
_____ I want to be referred by name and do no not want to be anonymous
_____ Verbal consent for the participation in the research has been granted
_____ Consent for audio recording has been granted
Date: _____
Participant's signature (optional): _____

APPENDIX 4

Annotated Bibliography: Wild Rice

Seven Generations Education Institute. (2013, October 1-3). *Dagwaagwanii maawindoosijigewin: Fall harvest*. Retrieved from www.rrdsb.com**.**

This booklet for grade 1-3 students focuses not only on wild rice, but also on other aspects of the Anishinaabe culture. The main themes include bird and fish preparation, bannock making, meat smoking, hide preparation, leather work, tea and jam making, trapping, and others. The booklet is in English, but the main concepts are presented in both languages: English and Anishinaabe.

Fisher, M., Bebamash, P., & Osawamick, I (2013). *Manoomini-miikans: The wild rice road*. Mt. Pleasant, MI: Saginaw Chippewa Indian Tribe.

The book provides creative ways to teach both about the Anishinaabe language and the stewardship of Mother Earth through fun games and activities. The main characters of the story Waas-kone (Flower) and her twin brother No-din (Windy) have a lot of interesting encounters on the trail to wild rice camps, help Elders to harvest and process wild rice, and participate in a wild rice feast at the end. Traditional activities related to wild rice are described in a very simple and entertaining way.

Seven Generations Education Institute. (2013, October 1-3). *Dagwaagwanii maawindoosijigewin: Fall harvest*. Retrieved from www.rrdsb.com.

This booklet for grade 4-8 Student focuses not only on wild rice, but also on other aspects of the Anishinaabe culture. The main themes include drum teachings, bird and fish preparation, bannock making, meat smoking, hide preparation, moccasin making, tea and jam making, trapping, and others. The whole booklet is in English.

Seven Generations Education Institute. (1997). *Fall/Wild Rice: An integrated unit of study for grades 4-6*. Fort Frances, ON: Seven Generations Education Institute.

This integrated unit of study for grades 4-6 consists of fifteen lessons. Some of the lesson themes are wild rice identification and habitat web, traditional harvesting and processing, nutritional values, and recipes. The book also contains many supplementary activity ideas related to wild rice.

Belcourt, G. (2000). *Mânomin (Cree): Ghínázë (Dëne): Wild rice*. Saskatoon, SN: University of Saskatchewan.

The unit contains ten lessons on wild rice for school science curriculum (grades 8-11). It promotes respect for Aboriginal knowledge and teaches ideas from ecology and biology at the same time. In her unit, G. Belcourt includes classroom learning as well as field trips to the rice stands and the rice processing facility, cooking, and conversations with Elders.

***Wild rice for educators*. (n.d.). Retrieved from** www.smartchoiceshastings.info**.**

This brochure presents nutritional, cultural, and scientific facts about wild rice. It also provides recipes and literature links for the elementary and secondary curricula.

Great Lakes Indian Fish and Wildlife Commission (GLIFWC). (n.d.). *Wild Rice*. Retrieved from www.uwex.edu**.**

The brochure focuses on the Western Great Lakes region. In the brochure, ecological and cultural significance of wild rice, as well as habitat requirements are descried. Also, the brochure contains some information on the wild rice life cycle and management practices. The brochure can be used for high school classes.

Archibold, O. W. (1995). *Wild rice in Saskatchewan: Agricultural development in harmony with nature: A reference manual*. La Ronge, Saskatchewan: Saskatchewan Agriculture and Food.

The book serves as a reference manual of the wild rice industry in Saskatchewan, the leading producer of lake-grown wild rice in North America. It contains a detailed practical guide to wild rice planting, growing, harvesting, and processing, as well as a discussion of the economics of a wild rice operation, mechanized harvesting equipment, and grading standards. The author also describes the nutritional value of wild rice and provides a few cooking recipes. The book can be used as a supplementary material for teaching science.

***Wild rice brochures.* (n.d.). Retrieved from** http://intersectingart.umn.edu/?lesson/45**.**

This project allows students to share what they know about wild rice through the creation of an educational brochure. The document includes a list of activities and vocabulary words.

Fairbanks, M., Norman, A., & Schroeder, S. (2011). *Wild rice harvesting*. Saint Paul, MN: St. Paul's Public Schools Indian Education Program.

The six-lesson course designed for the Anishinaabe Language Program teaches the vocabulary pertaining to wild rice harvesting. Students are introduced to traditional Anishinaabe activities and explore traditional teachings about wild rice.

Vennum, T. Jr. (1988). *Wild rice and the Ojibway people*. St. Paul, MN: Minnesota Historical Society.

It is the most comprehensive book on wild rice ethnobiology, in which T. Vennum shows the importance of wild rice to the Anishinaabeg through travelers' narratives, historical accounts, scientific data, photographs, sketches, and Aboriginal people's sayings. The author also describes the old and contemporary technologies of wild rice harvesting and ceremonies related to wild rice. The issue of Aboriginal people's rights is also touched upon.

DeAngelis, T. (2005). *The Ojibwa: Wild rice gatherers*. Blue Earth Books.

This book focuses on the Anishinaabe tradition of gathering wild rice. It includes a rice recipe and instructions for making a dream catcher.

Webber, H., & Woolsey, M. (2009). *Wild and wonderful: Wild rice*. Regina, SK: Centax Books.

The book contains the description of wild rice cooking methods and different recipes.

APPENDIX 5

Stage A Interview Guide

- What does wild rice mean to the people of Wabaseemoong/you?
- What do you know about the history of wild rice in WTLUA?
  - Which areas did you pick wild rice in?
  - Where exactly was it growing (*showing on the map*)?
  - Where were wild rice camps?
  - How much was harvested every year?
  - How was wild rice traditionally managed? How was it harvested? Who was participating in these activities? How were young people involved?
  - What kind of equipment was used for wild rice harvesting (other management activities)?
  - Did you participate in wild rice camps or any other traditional activities? What was your role? Where were these camps? When was it happening?
  - Would you like to share some interesting story related to wild rice?
  - Did the water control structure (mud dam) help to manage water levels in Whitedog lake? Who was controlling it?
- What is the current situation with wild rice?
  - Who is involved in management practices?
  - Are you involved? How?
  - How much rice is harvested at present?
  - What are the main problems?
  - What were the reasons for decreased wild rice harvesting?
- What do you think about the future of wild rice?
  - Does it need to be brought back on Whitedog Lake? Why?
  - How should it be used in the future?
  - How should it be managed?
- How can wild rice be brought back?
  - What could be done to bring it back?
  - Who should participate in this process?
  - How can Elders be involved?
  - How can young people be involved?
  - How can Elders and young people work in collaboration?
  - What equipment will be needed for the project?
  - What can the school do to help to bring wild rice back?
  - How can TEK be used in the school program? Which classes can use TEK on wild rice?
  - What do you think about the practice of wild rice camps? *To be explained.*
  - Would you like to participate in the project after the interview? If yes, what can be your role? If not, why?
- Do you still remember any words related to wild rice in Anishinaabe?

APPENDIX 6

Stage B Interview Guide

Overall experience and learning:

- ❖ Had you ever participated in wild rice camps before?
  - If yes, how was this wild rice camp different from the camps in the past?
- ❖ Has the way you think about wild rice changed after the camp? How?
  - How has your willingness to harvest rice changed?
  - How has the way you think about the future of rice changed?
  - How has the way you think about rice as food changed after the camp?
  - How has the way you think about camps as a place for teaching changed?
  - How has the way you think about the community involvement in wild rice harvesting changed after the camp?
- ❖ What skills did you take away (e.g., harvesting, canoeing, teamwork, or other skills)?
- ❖ What information did you take away (e.g., about rice/rice harvesting/rice finishing/rice cooking including technical information)?
- ❖ What do you feel were the best approaches to sharing knowledge about wild rice used during the camp (e.g., presentations, hands on harvesting)?
- ❖ Did you face any difficulties while harvesting rice?
  - If so, how did you overcome these difficulties?
- ❖ Who did you harvest rice with?
  - Did you share any experiences or teachings with your partner – or visa-versa?
- ❖ What was your favourite wild rice camp experience? Why?
- ❖ What was the most difficult wild rice camp experience? Why?
- ❖ What did you like/not like about this camp?
- ❖ Was the participation in the camp useful to you?
- ❖ Would you like to harvest rice/participate in wild rice camps in the future? Why/why not?

Learning conditions:

- ❖ Overall, what made the wild rice camp successful, or not, for you?
- ❖ How could the organizers make wild rice camps better for adults/young people?

- What other activities need to be included in wild rice camps in the future?
- Who should participate in wild rice camps in the future?
- Who needs to organize camps?
- Where should wild rice camps be organized?
- If the Scot River is the best place, what needs to be done to improve camping experience there?

- ❖ How can camps help to bring wild rice back?
- ❖ What can be the next steps of the wild rice restoration process?

APPENDIX 7

Biophysical Documentation of Whitedog Lake

Bathymetric Mapping

As described in Chapter 3, a bathymetric map of Whitedog Lake was made. Overall, 1,859,399 soundings were recorded through Lowrance LMS-520C sonar/GPS chartplotter combo and analyzed through ArcGIS 10.2. The data were collected on July 24-30, 2014, when the water level was still high but had already begun descending. During that period, wild rice should be in the emergent stage; however, no rice could be seen on the lake due to extensive flooding and abnormally high water levels.

As described in Table 1 in Chapter 2, suitable habitat for wild rice is 1-4 feet. The proportion of soundings conducted at this depth is ~ 4 percent, implying a small percentage of the lake's surface with an ideal depth for wild rice growth (Table 1). However, the description of the water level fluctuation in 2014 demonstrates that this was flooded riparian zone.

Table 1: Lowrance LMS-520C Sonar/GPS Chartplotter Combo Soundings

Depth (feet)	Number of Soundings	% of All Soundings	Depth	Number of Soundings	% of All Soundings
-1	3225	0.173443139	-16	51373	2.762881985
-2	5558	0.298913789	-17	49170	2.644402842
-3	17180	0.923954461	-18	30984	1.666344878
-4	48887	2.62918287	-19	27017	1.452996371
-5	159249	8.564541554	-20	21937	1.179789814
-6	198334	10.66656484	-21	11741	0.631440589
-7	260502	14.01001076	-22	7993	0.429870082
-8	181798	9.777245228	-23	925	0.049747257
-9	97663	5.25239607	-24	55	0.002957945
-10	96961	5.214641935	-25	2	0.000107562
-11	184075	9.899704152	-27	2	0.000107562
-12	184935	9.945955656	-29	6	0.000322685
-13	82797	4.452890423	-30	1	0.000000538
-14	65295	3.511618539	-33	7	0.000376466
-15	71724	3.857375421	-59	3	0.000161343

Water Level Fluctuations

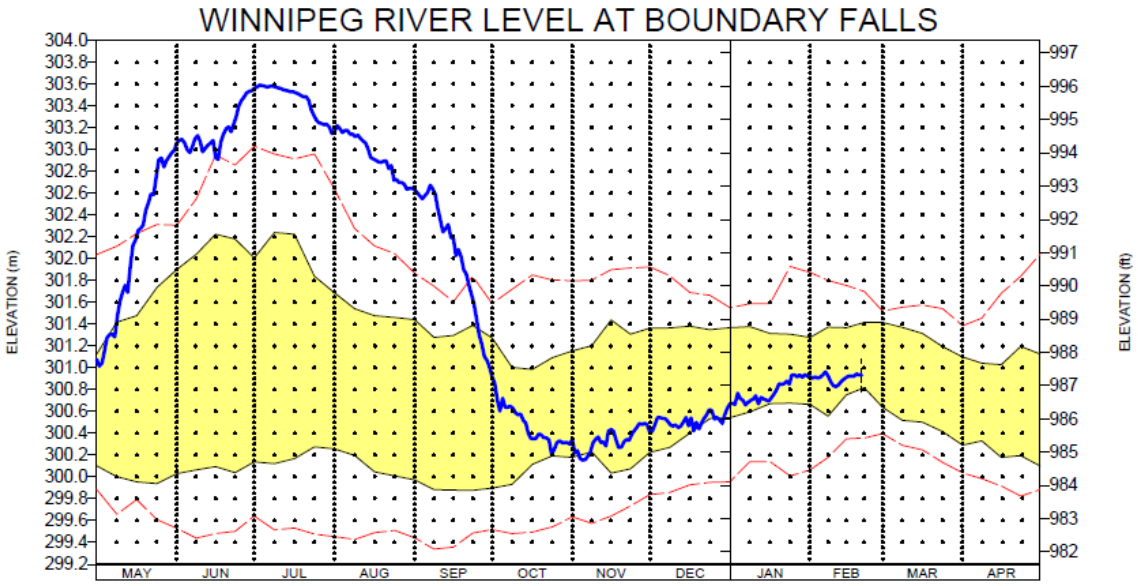
As described in Chapter 3, a baseline pole was installed on Whitedog Lake on July 16, 2014, and depth fluctuations were measured manually with a measuring tape every 9-14 days until September 12, 2014, and once on October 24, 2014 (Table 2). While on July 16, 2014, the depth was 2.02 m, on October 24th, 2014, the lake receded so much that the spot where the pole was installed appeared to be the shoreline. Thus, the overall depth fluctuation was at least 2.02 m or more, which is not suitable for wild rice that requires water level fluctuation of less than 6 inches throughout the growing season during the germination, floating leaf, and kernel production phases (Aiken et al., 1988; Moyle, 1944). Moreover, as stated earlier, the peak water level in late June to early July, during the most critical floating leaf period, resulted in plant drowning.

Table 2: Water Level Fluctuations on Whitedog Lake in July-October 2014

Date	Water level change (cm)	Span (days)	Depth (m)
16.07.2014			2.02
27.07.2014	30	11	1.72
10.08.2014	13	14	1.59
19.08.2014	21	9	1.38
01.09.2014	29	13	1.09
12.09.2014	27.5	11	0.815
24.10.2014	81.5	42	0

The water level fluctuations presented in Table 2 correspond exactly to the water level fluctuations measured by a gauge located on the Winnipeg River above Boundary Falls between the Whitedog and Point du Bois Generating Stations (50° 12' 44" N, 95° 05' 31" W) (Figure 1). This gauge # 05PF051 located at the Ontario-Manitoba border and run by the Water Survey of Canada has been serving as a flow gauge since 1981.

Figure 1: Winnipeg River Level Boundary Falls. Source: Lake of the Woods Control Board, 2015a



Vegetation Surveys

Table 3 presents the plants collected on Whitedog Lake. No wild rice (*Zizania palustris* L.) was observed at the site. Due to flooding, many meadow and pasture plants were found in water next to the shoreline, such as wild rose (*Rosa spp.*), bluegrass (*Poa spp.*), and timothy-grass (*Phleum spp*.). These plants were not included in the table because they were not characteristic of aquatic habitats. The most abundant species collected on the lake was water smartweed (*Polygonum amphibium* L.), which competes with wild rice for habitat. Cattail *(Typha latifolia L.)* and bulrush (*Scirpus spp.)* stands did not occupy extensive areas, probably due to considerable water level fluctuations. Floating bog could be found in different parts of the lake, especially after the drop of the water level. In August-September 2014, locally excessive algal bloom was observed throughout the lake.

Table 3: Plant Species Collected on Whitedog Lake

Common Name	Scientific Name (Species or Genus)
Water Smartweed	*Polygonum amphibium* L.
Common Coontail	*Ceratophyllum demersum* L.
Burreeds	*Sparganium spp.*
Pondweeds	*Potamogeton spp.*
Bladderwort	*Urticularia spp.*
Milfoil	*Myriophyllum spp.*
Broadleaf Cattail	*Typha latifolia L.*
Bulrushes	*Scirpus spp.*
Water Horsetail	*Equisetum fluviatile L.*

Sulphate and pH

A raw water chemistry analysis conducted by Health Canada in August 2011 revealed that the water parameters of interest for wild rice were within normal limits. The water was sampled from the Winnipeg River upstream from Whitedog Lake. In accordance with these results, Whitedog Lake refers to the first type of lakes with suitable wild rice habitat, characterized by alkalinity around 40 m/l and pH around 6.9 (Aiken et al., 1988).

As described in Chapter 3, sulphate content and pH were measured again in October 2014 (Table 4). These measurements were conducted to exclude water pollution as a factor contributing to the absence of wild rice on Whitedog Lake. Sulphate results do not exceed the limit of 4 mg/L identified in Chapter 2; therefore, the possibility of water pollution by sulphates is excluded and there is no risk of the formation of sulphide, which is toxic for wild rice. The pH in the same water samples was within the ideal wild rice habitat range (6-8.5).

Table 4: Sulphate and pH Results, Whitedog Lake, 2014

Samples	Sulphate (mg/L)	pH
11,12	3.48	7.07
13,14	3.33	7.29
15,16	3.31	7.35
17,18	3.39	7.19
19,20	3.32	7.21

APPENDIX 8

Biophysical Documentation of the Scot River

Transects

As described in Chapter 3, transects were used for the biophysical documentation of the areas, where wild rice was present in 2014. Overall, 23 transects (A-W) and 175 measurements were made. Transects contained different numbers of measurements due to the variation in the width of the river. While Transects G and H consisted of only one measurement, Transect U in the Big Bend area had 22 measurements. The overall depth fluctuated from 0.15 to 1.7 m; Transect A was the deepest transect. In most cases (169 sampling plots or 96.6% of plots), the Secchi disc transparency readings were equal to depth readings, which was an indicator of high water clarity and a low amount of particles. As the water was very shallow and a general rule is that wild rice plants tolerate a depth of one and a half times the Secchi depth (Minnesota Department of Natural Resources, 2010), water clarity in the area of the transects on the Scot River was sufficient for plant growth. Wild rice found at 161 sampling plots, or 92% of all the plots, varied in density from 0 to 70%. In all of the cases, the midstream area often had no rice or rice stands with very low density, as well as no vegetation or vegetation stands with low density.

Other aquatic plants found at 152 plots (86.9%) included floating-leaved, free-floating, emergent, and submerged species (Table 1). Floating-leaved species such included yellow pond lily *(Nuphar variegatum* Engelm. Ex Durand) and bur reed (*Sparganium spp.).* Lesser duckweed (*Lemna minor* L.) was the only free-floating species found on the river. The emergent plants included wild rice *(Zizania palustris* L.), stiff arrowhead *(Sagittaria rigida* Pursch.*)* and bulrushes (*Scirpus spp.).* The following submerged species were also found: milfoil (*Myriophyllum spp.*), common coontail (*Ceratophyllum demersum* L.) and bladderwort

(Urticularia spp.). Both floating-leaved and submerged species of pondweeds (*Potamogeton spp.)* were collected as well. The most common plants were lesser duckweed, found at 107 plots (61.1 % of the sample); stiff arrowhead, found at 43 plots (24.6%); bladderwort, found at 38 plots (21.7%); and pondweeds, found at 26 plots (14.9%). After wild rice, the largest and thickest single-species stands were those of stiff arrowhead (*Sagittaria rigida* Pursch), which could be found along the shoreline and which "blocked" the river completely in one area. Overall, aquatic plant stands were denser than on Whitedog Lake.

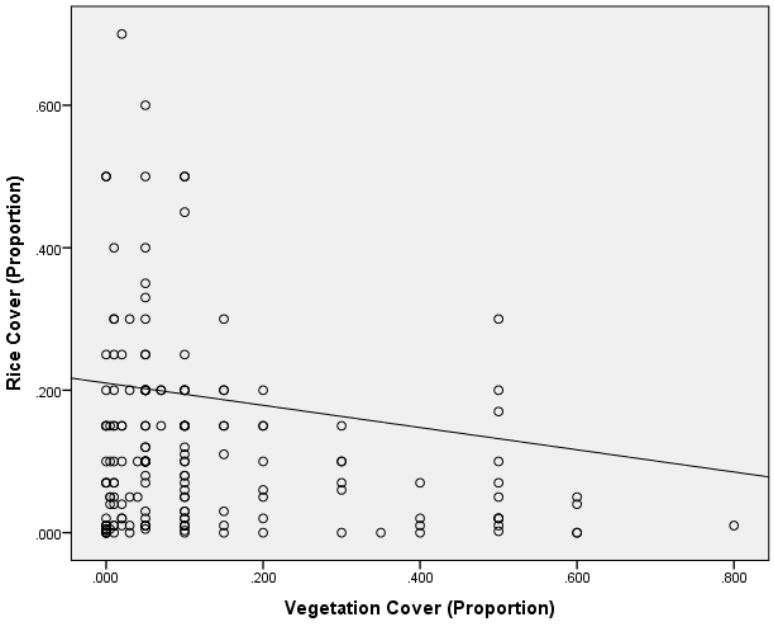
Table 1: Plant Species Collected on the Scot River

Common Name	Scientific Name (Species or Genus)
Wild Rice	*Zizania palustris* L.
Stiff Arrowhead	*Sagittaria rigida* Pursch
Yellow Pond Lily	*Nuphar variegatum* Engelm. Ex Durand
Common Coontail	*Ceratophyllum demersum* L.
Bur reed	*Sparganium spp.*
Pondweeds	*Potamogeton spp.*
Lesser Duckweed	*Lemna minor* L.
Bladderworts	*Urticularia spp.*
Milfoil	*Myriophyllum spp.*

An analysis of variance (ANOVA) was conducted with wild rice as a dependent variable and depth, transparency, and density of other plant species as independent variables. Multiple regression (adjusted R^2=0.063, F(3,168)=, p=0.003) showed that increased vegetation cover (B=-0.156, p=0.01) decreases the proportion of wild rice present in plots (Figure 1), but water depth (B=0.044, p=0.873) and water transparency (B=-0.189, p=0.538) do not have a statistically significant influence. The value of B=-0.156 for vegetation indicates that for each unit of vegetation increase, there is a 0.156 decrease in rice units. The adjusted R^2 shows that 6.3% of variance in the rice cover is accounted for by all three variables. As there were no transects without any wild rice and the range of depths was limited, the correlation between depth and

wild rice density is statistically insignificant. Transparency, which corresponded to depth in most cases on the Scot River, also does not have any statistically significant impact on the density of wild rice.

Figure 1: Proportion of Wild Rice in Relation to Proportion of Other Plants on the Scot River



Since the relationship between the density of wild rice and other aquatic vegetation is significant, an analysis of co-variance (ANCOVA) was done with rice density as a dependent variable, plant species presence or absence as a fixed factor, and water depth as a covariate. The analysis showed how depth interacts with presence/absence of each other plant to affect rice cover (Table 14). Depth was included because aquatic plants have different depth preferences.

As seen from Table 2, there was no statistically significant relationship between rice cover and other variables for yellow pond lily, common coontail, bladderworts, stiff arrowhead, and lesser duckweed. Pondweeds ($F_{1,167}$=0.006, p=0.937) did not influence rice cover. There was no interaction between pondweed presence and depth ($F_{1,167}$=0.014, p=0.907). Only water depth ($F_{1,167}$=6.00, p=0.015) influenced rice cover after accounting for pondweed presence.

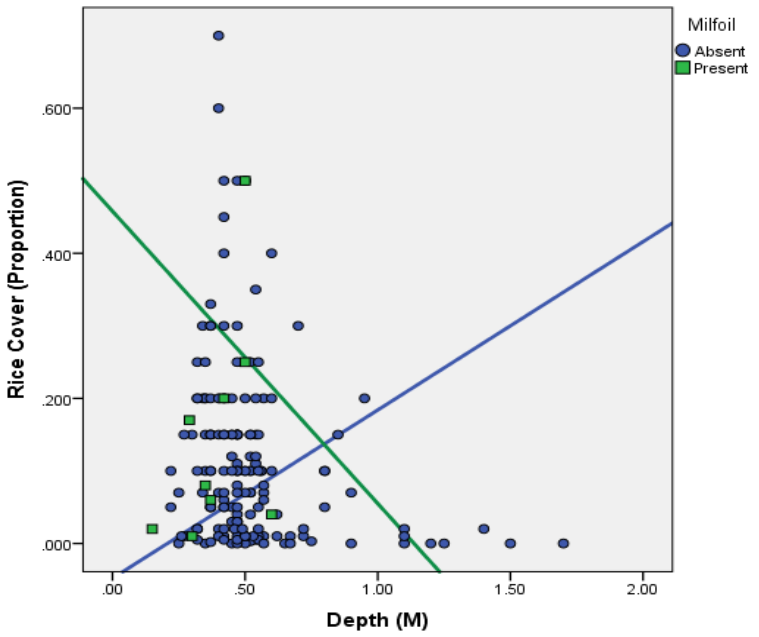
Results for bur reed are similar to the results for pondweeds described above. There was no relationship between the presence of bur reed ($F_{1,168}$=0.801, p=0.372) and wild rice cover, as well as between the presence of bur reed and depth ($F_{1,168}$=1.099, p=0.296). However, water depth ($F_{1,168}$=4.892, p=0.028) influenced rice cover after accounting for bur reed presence.

Table 2: ANCOVA Results

Source	Type III Sum of Squares	Mean Square	F	p
Pondweeds	.000	.000	.006	.937
Depth	**.098**	**.098**	**6.000**	**.015**
Pondweeds * Depth	.000	.000	.014	.907
Yellow pond lily	.015	.015	.930	.336
Depth	.006	.006	.342	.559
Yellow pond lily * Depth	.007	.007	.449	.504
Common coontail	.001	.001	.065	.799
Depth	.046	.046	2.797	.096
Common coontail * Depth	.001	.001	.081	.777
Bladderworts	.000	.000	.006	.937
Depth	.044	.044	2.727	.101
Bladderworts * Depth	.002	.002	.138	.710
Stiff arrowhead	.016	.016	1.036	.310
Depth	.024	.024	1.490	.224
Stiff arrowhead * Depth	.003	.003	.167	.683
Lesser duckweed	.013	.013	.796	.373
Depth	.046	.046	2.869	.092
Lesser duckweed * Depth	.001	.001	.079	.779
Milfoil	.046	.046	2.880	.092
Depth	.020	.020	1.279	.260
Milfoil * Depth	**.058**	**.058**	**3.636**	**.058**
Bur reed	.013	.013	.801	.372
Depth	**.079**	**.079**	**4.892**	**.028**
Bur reed * Depth	.018	.018	1.099	.296

Milfoil ($F_{1,168}$=2.880, p=0.92) and depth ($F_{1,168}$=1.279, p=0.260) did not influence the rice cover. However, there were differences in water depth where northern water milfoil was present and absent as depth was a marginally significant covariate ($F_{1,168}$=3.636, p=0.058) (Figure 17). Figure 2 shows how much rice cover changed with each increase in depth for milfoil present or absent.

Figure 2: Rice Proportion in Relation to Depth and Milfoil



The species collected at the vegetation plots are presented in Table 3. The abundance of broadleaf cattail *(Typha latifolia)*, which expands very fast and prefers habitats with minimal water level fluctuations such as the Scot River, is a concern. Further monitoring of cattail stands is required.

Table 3: Plants Collected along the Shoreline on the Scot River

Common Name	Scientific Name (Species or Genus)
Broadleaf Cattail	*Typha latifolia*
Sweet Flag	*Acorus calamus*
Reed Grass	*Phragmites spp.*
Small Reed	*Calamagrostis spp.*
Sedges	*Carex spp.*
Bulrushes	*Scirpus spp.*
Dock	*Rumex spp.*
Common Rivergrass	*Scolochloa festucácea*
Willow Herb	*Epilobium spp.*
Bur Marigold	*Bidens Cernua* L.
Bulrushes	*Scirpus spp.*

Sulphate and pH

According to Table 4, the results of water analysis for sulphates are below 4 mg/L, which is the upper limit defined in Chapter 2 as suitable for wild rice habitats. Also, water on the Scot River is slightly more acidic than on Whitedog Lake, but pH is close to neutral.

Table 4: Sulphate and pH Results, the Scot River, 2014

Samples	Sulphate (mg/L)	pH
1,2	1.19	6.9
3,4	1.15	6.71
5,6	1.16	6.6
7,8	1.15	6.75
9,10	1.15	6.64

APPENDIX 9
Possibilities for the Incorporation of Materials about Wild Rice into the Native Language Curriculum

Grade	Group of expectations	Specific expectations	Information/sources
Grade 4	Vocabulary	Words associated with obtaining food (e.g., words used in gathering, fishing, hunting, and shopping)	Poster 1 in Appendix 11: Manominikewin - Wild Rice Harvesting, Kiishtoon Manomin – Finished Rice
Grade 6	Oral communication	Demonstrate an understanding of spoken language in various situations and contexts (e.g., summarize a Native story told to the class by a native speaker from the community)	A native speaker or a teacher can share her/his personal story on wild rice or a legend
		Participate in oral presentations (e.g., prepare a presentation on a Native tradition or a custom)	Internet sources: http://www.nativewildricecoalition.com/ecological-importance.html; http://www.nmai.si.edu/environment/ojibwe/Challenge.aspx Printed sources: DeAngelis, T. (2005). The Ojibwa: Wild rice gatherers. Blue Earth Books Seven Generations Education Institute. (1997). Fall/Wild Rice: An integrated unit of study for grades 4-6. Fort Frances, ON: Seven Generations Education Institute
		Read a variety of simple written texts (e.g., traditional Native stories and legends, short stories by Native authors)	A book of stories in Anishinaabe needs to be created. The school can prepare this book in collaboration with WIN Elders
	Vocabulary	Words associated with eating, nutrition, and table setting	Poster 1 in Appendix 11: Miichim – Food
Grade 7	Oral communication	Participate in informal conversations as well as in more formal dialogues (e.g., interview a Native speaker from the community on some local issues)	One of the topics for an interview can be wild rice harvesting and finishing. These practices can be discussed in the past and present-day context
		Demonstrate an understanding of a variety of short oral texts (e.g., compare short oral stories; identify ideas in short oral texts)	A native speaker or a teacher can share her/his personal story on wild rice or a legend

		Give oral presentations on aspects of Native culture studies (e.g., legends, values, traditions)	Internet sources: http://www.nativewildricecoalition.com/ecological-importance.html; http://www.nmai.si.edu/environment/ojibwe/Challenge.aspx Printed sources: DeAngelis, T. (2005). The Ojibwa: Wild rice gatherers. Blue Earth Books
		Read a variety of simple written texts (e.g., short stories by Native authors, local newsletter in the Native language)	A book of stories in Anishinaabe needs to be created. The school can prepare this book in collaboration with WIN Elders
	Writing	Participate in a variety of writing activities appropriate for the grade (e.g., write a dialogue based on an interpretation of a short story)	A book of stories in Anishinaabe needs to be created. The school can prepare this book in collaboration with WIN Elders
	Vocabulary	Words associated with plants and trees	Poster 1 in Appendix 11: Manomin - Wild Rice, Wiigwaas – Birch Bark
Grade 8	Oral communication	Give oral presentations on aspects of the Native culture studied, using information gathered through research (e.g., give a talk on Native values and traditions based on interviews with speakers of the Native language in the community)	Students may interview Elders in their families about the times when they harvested and finished wild rice and share the findings with the class
	Vocabulary	Words associated with outdoor and leisure activities, current events	Poster 1 in Appendix 11: Gabeshiwinan – Campsite
NL1	Oral communication	Demonstrate an understanding of Native legends and stories enacted or told with visual support	A book of legends and stories in Anishinaabe needs to be created. The school can prepare this book in collaboration with WIN Elders
		Retell simple Native legends and stories	A book of legends and stories in Anishinaabe needs to be created
		Listen to tapes of Native Elders telling stories	Elders' stories in Anishinaabe need to be recorded
	Reading	Build a knowledge base on a Native topic	Wild rice harvesting and finishing may be a topic for research
	Grammar, language conventions, and vocabulary	Use of basic vocabulary including seasons, clothing, food, and games	Poster 1 in Appendix 11: Miichim – Food, Makizini Ataatiwinin - Moccasin Game

	Oral communication	Use story patterns to create short oral narratives	Narratives can be about wild rice harvesting and finishing
		Retell Native legends and stories	A book of stories in Anishinaabe needs to be created. The school can prepare this book in collaboration with WIN Elders. Also, Elders' stories can be recorded
		Listen to tapes of Native Elders telling stories	Elders' stories in Anishinaabe need to be recorded
	Reading	Read four to six texts of different forms (e.g., short essays, stories, legends, journals, media works) containing basic a new vocabulary	A book of stories in Anishinaabe needs to be created. The school can prepare this book in collaboration with WIN Elders
	Writing	Create visual material for a presentation on a Native topic	Diverse visual materials are available in Wikimedia Commons, including U.S. National Archives and Records Administration photographs, which are in public domain
	Grammar, language and vocabulary	Use of basic vocabulary including plants	Poster 1 in Appendix 11: Manomin - Wild Rice
	Oral communication	Use interviews with Elders or relatives to construct a family or community history and present findings to class peers	Students may interview Elders about the times when they harvested and finished wild rice and share the findings with the class
		Produce and record short skits depicting a Native event	A Native event can be a wild rice finishing event or a wild rice camp
		Make announcements in a native language (e.g., on the school's public address system, at Native events on local radio broadcasts)	Announcements can be about the upcoming wild rice finishing event or wild rice camp
	Reading	Read six to eight texts of different forms (e.g., short essays, stories, legends, journals, media works) containing basic a new vocabulary	A book of stories in Anishinaabe needs to be created. The school can prepare this book in collaboration with WIN Elders
	Writing	Use familiar and new combinations of writing patterns and vocabulary in a variety of forms (e.g., stories, journals, skits, articles, notes, lists, book reports, and news articles)	Stories, journals, skits, articles, notes, lists, book reports, and news articles may focus on wild rice

	Grammar, language conventions and vocabulary	Use of basic vocabulary including seasonal activities, weather	Poster 1 in Appendix 11: Manominikewin - Wild Rice Harvesting, Kiishtoon Manomin – Finished Rice
NL4	Oral communication	Demonstrate an understanding of and respect for Native cultural traditions and arts	Poster 1 in Appendix 11: Manominikewin - Wild Rice Harvesting, Kiishtoon Manomin – Finished Rice
		Describe the concept of relationships in Native North American culture (Aboriginal worldview)	Inter-relationship between people and wild rice are described in most sources
	Grammar, language conven tions, and vocabulary	Use of words related to kinship as it applies to ecology (Mother Earth), seasonal activities, weather	Poster 1 in Appendix 11 needs to be extended
NL5	Oral communication	Express a point of view on contemporary issues (e.g., environmental issues, political issues) from a Native perspective	Issue of wild rice habitat disruption and wild rice harvest reduction can be discussed
		Use specialized language to explain traditional skills (e.g., planting and harvesting, canoe making, etc.)	Poster 1 in Appendix 11 contains many words related to traditional activities and skills
	Reading	Demonstrate an ability to read written works that contain specialized material	A book of stories in Anishinaabe needs to be created. The school can prepare this book in collaboration with WIN Elders
	Writing	Use specialized vocabulary relating to familiar topics	Poster 1 in Appendix 11: vocabulary related to wild rice
	Grammar, language, vocabulary	Use of vocabulary related to kinship as it applies in cosmology. Seasonal activities, weather, and activities	Poster 1 in Appendix 11: Manominikewin - Wild Rice Harvesting, Kiishtoon Manomin – Finished Rice

APPENDIX 10

Possibilities for the Incorporation of Issues Related to Wild Rice into the Science and Technology/Science Curriculum

Grade	Strand/ course	Course number	Topic	Specific expectations	Sample issues related to wild rice
Grade 1	Understanding life systems		Needs and characteristics of living things	Describe changes or problems that could result from the loss of some kinds of living things that are part of everyday life, taking different points of view into consideration	If wild rice disappears from the WTLUA, a part of Anishinaabe culture will be lost as well. Moreover, WIN residents will lose a source of income and a nutritious food, which they have been eating for centuries
				Investigate and compare the basic needs of humans and other living things, including the need for air, water, food, warmth, and space using a variety of methods and resources	Like humans, aquatic plants including wild rice need water, food in the form of nutrients, light, warmth and space
				Investigate and compare the physical characteristics of a variety of plants and animals, including humans	Wild rice has roots, a stem, leaves, and flowers. Not all the aquatic plants have roots, for instance, duckweed is a plant that floats on the surface of water and, therefore, is called free-floating
				Investigate the physical characteristics of plants and explain how they help the plant meet its basic needs using a variety of methods and resources	Roots anchor wild rice and help provide the plant with food and water. A stem transports nutrients to different parts of the plant. Flowers allow seeds to develop. Leaves absorb energy in the form of light from the sun
				Identify the physical characteristics (e.g., size, shape, colour, common parts) of a variety of plants and animals	Mature wild rice plants, which are very similar to other grasses and grains, are up to 10 feet tall, with thick and spongy stems, flat leaves, and green to reddish brown fruit
				Assess ways in which plants are important to humans and other living things, taking different points of view into consideration, and suggest ways in which humans can protect plants	Wild rice is healthy, nutritional, and culturally appropriate food. It is also food for diverse birds and animals including waterfowl, muskrats, beavers, and moose. Also, wild rice fields provide an excellent habitat for wildlife

				Describe the characteristics of a healthy environment, including clean air and water and nutritious food, and explain why it is important for all living things to have a healthy environment	Clean water is not polluted by industrial and municipal discharges and does not have limiting factors for wild rice growth
				Identify what living things provide for other living things	Wild rice fields provide food for humans, birds, and animals, as well as habitat for birds and animals
Grade 2	Understanding Earth and space systems		Air and water in the environment	Assess the impact of human activities on air and water in the environment, taking different points of view into consideration, and plan a course of action to help keep the air and water in the local community clean	Fertilizers (run-off from farms) deteriorate wild rice stands. Regulations are needed for controlling run-off
				Describe ways in which living things, including humans, depend on air and water	Wild rice grows and water and requires certain water depth. The depth may fluctuate from 0.5 to 4 meters. The ideal depth is 2-4 meters
Grade 3	Understanding life systems		Growth and changes in plants	Assess the impact of different human activities on plants, and list personal actions they can engage in to minimize harmful effects and enhance good effects	Mechanical wild rice harvesting by airboats, which is too efficient and does not allow seeds to fall into the water, impedes wild rice germination. Community members need to be informed about it. *No airboats* signs need to be installed in rice harvesting areas
				Observe and compare the parts of a variety of plants	The main parts of a mature wild rice plant are female flowers, male flowers, tillers, leaves, a stem, and roots
				Describe the basic needs of plants, including air, water, light, warmth, and space	The basic needs of wild rice are described in Table 1 (Chapter 2)

				Identify the major parts of plants, including root, stem, flower, stamen, pistil, leaf, seed, and fruit, and describe how each contributes to the plant's survival within the plant's environment	The main parts of a mature wild rice plant are a panicle (female flowers and male flowers), tillers, leaves, a stem, and roots, which all perform different functions. Wild rice seeds mature starting from the uppermost part of the panicle. Roots soak up nutrients, for instance, nitrogen and phosphorous, to the plant, and stems deliver nutrients to all the parts of the plant. Leaves produce nutrients through photosynthesis
				Describe the changes that different plants undergo in their life cycles	Wild rice has the following stages of growth: germination, floating leaf, aerial leaf, tillering, flowering, milk stage, and maturing (seeds do not mature at the same time)
				Describe how most plants get energy to live directly from the sun	Wild rice gets energy from the sun through photosynthesis. Therefore, the transparency of water is very important, especially before the floating leaf stage, because water needs to allow the light to penetrate. Also, different plants compete with rice for space and light. Therefore, competition is a negative factor
				Describe ways in which humans from various cultures, including Aboriginal people, use plants for food, shelter, medicine, and clothing	Wild rice is food, but it also has numerous other values described in Figure 10
				Describe ways in which plants and animals depend on each other	Birds, animals, and humans feed on wild rice. Wild rice stands also provide a unique habitat for fish and waterfowl
				Describe the different ways in which plants are grown for food and explain the advantages and disadvantages of locally grown and organically produced food, including environmental benefits	Most of wild rice in Canada still grows naturally. In the USA, wild rice often grows in paddies. Wild rice growing in wild stands tastes better and is overall healthier because it does not come in contact with any fertilizers

				Identify examples of environmental conditions that may threaten plant and animal survival	For example, in WTLUA, the main negative factors are flooding and water pollution
	Understanding earth and space systems		Soils in the environment	Assess the impact of soils on society and the environment, and suggest ways in which humans can enhance positive effects and/or lessen or prevent harmful effects	Wild rice requires large amounts of mineral nutrients, such as oxygen, nitrogen, phophorous, and potassium. Sometimes, the use of fertilizers is recommended so as to add nutrients, but fertilizers can create other additional problems
				Identify additives that might be in soil but that cannot always be seen	Fertilizers in case of wild rice fields, and especially during paddy wild rice production
Grade 4	Understanding life systems		Habitats and communities	Analyze the positive and negative impacts of human interactions with natural habitats and communities, taking different perspectives into account	Hydroelectric dams in WTLUA affect natural habitats and destroy rice fields; however, hydroelectric dams are also one of the cleanest, safest, and the most environmentally friendly sources of energy
				Identify reasons for the depletion or extinction of a plant or animal species, evaluate the impacts on the rest of the natural community, and propose possible actions for preventing such depletions or extinctions from happening	Wild rice, which used to be abundant in WTLUA, is very scarce at present, which leaves waterfowl and animals without a source of food and suitable habitat. The main reason is high water levels that result from the operation of hydroelectric dams. The construction of mud dams and culvert structures may allow rice harvesters to control water levels
				Build food chains consisting of different plants and animals, including humans	A possible food chain is presented on Poster 4 in Appendix 11
				Use scientific inquiry/research skills to investigate ways in which plants and animals in a community depend on features of their habitat to meet important needs	Wild rice plants receive nutrients from soil and use light for photosynthesis. Humans involved in traditional harvesting also contribute to wild rice germination and expansion by dropping seeds into the water

				Identify factors (e.g., availability of water or food, amount of light, type of weather) that affect the ability of plants and animals to survive in a specific habitat	Wild rice has very specific habitat requirements (see Table 2 and Poster 3 in Appendix 11).
				Demonstrate an understanding of a community as a group of interacting species sharing a common habitat	Wild rice is a part of an aquatic plant community, which is a group of interacting species sharing a common habitat and often competing for the same habitat
				Classify organisms, including humans, according to their role in a food chain	Wild rice is a producer
Grade 5	Understanding Earth and space systems		Conservation of energy and resources	Use scientific inquiry/research skills to investigate issues related to energy and resource conservation	Students may interview Elders about their traditional teachings on the conservation of wild rice fields and traditional sustainable harvesting practices
Grade 6	Understanding life systems		Biodiversity	Analyze a local issue related to biodiversity, taking different points of view into consideration, propose action that can be taken to preserve biodiversity, and act on the proposal	In June-July every year, during the most critical floating leaf and aerial stages of wild rice growth, lakes and rivers in WTLUA are flooded. The level fluctuations due to the operation of dams need to be regulated
				Explain how invasive species reduce biodiversity in local environments	Invasive narrowleaf and hybrid cattails, which tend to grow in thick and large stands and expand very fast, reduce biodiversity of aquatic habitats and wild rice abundance
Grade 7	Understanding life systems		Interactions in the environment	Assess the impact of selected technologies on the environment	The airboats have a negative influence on wild rice germination
				Analyze the costs and benefits of selected strategies for protecting the environment	The construction of culverts for controlling water may have adverse effects on the lake ecosystem

				Use scientific inquiry/research skills to investigate occurrences that affect the balance within a local ecosystem	For example, the presence of invasive species such as Eurasian water milfoil, hydrilla, narrowleaf, and hybrid cattails influences the health of the whole aquatic ecosystem, including wild rice stands
				Demonstrate an understanding of an ecosystem as a system of interactions between living organisms and their environment	Wild rice interacts with its environment and has very strict habitat requirements in terms of water depth, water clarity, water chemistry, bottom soil chemistry, etc. It also competes with other aquatic plants
				Identify biotic and abiotic elements in an ecosystem, and describe the interactions between them	Wild rice, other aquatic plants, muskrats, beavers, and moose are examples of biotic elements, while soils, water, and sunlight are examples of abiotic elements
				Describe the roles and interactions of producers, consumers, and decomposers within an ecosystem	Wild rice plants are producers. Waterfowl, muskrats, and carp are primary consumers. Red foxes are secondary consumers
				Describe ways in which human activities and technologies alter balances and interactions in the environment	Hydroelectric developments disrupt natural water level fluctuations needed for wild rice
				Describe Aboriginal perspectives on sustainability and describe ways in which they can be used in habitat and wildlife management	The overarching themes of Anishinaabe teachings presented in Table 7 are respect to wild rice and nature, patience, discipline, and responsibility. These teachings contribute to the sustainability of aquatic ecosystems
Grade 8	Understanding earth and		Water systems	Assess how various media sources address issues related to the impact of human activities on the long-term sustainability of local, national, or international water systems	Data on mercury contamination, flooding, or sulphate pollution can be collected using newspapers, scientific journals, or the Internet. There are very different points of view regarding these issues

	space systems			Assess the impact on local and global water systems of a scientific discovery or technological innovation	An example can be the impact of mowing aquatic plants to prevent their spreading. The method is relatively simple, inexpensive, and effective; however, wild rice plants may be damaged and some species may sprout with increased vigor after being mowed
				Test water samples for a variety of chemical characteristics (e.g., pH, salinity, chlorine)	During the wild rice restoration process, water needs to be sampled for pH, alkalinity, and sulphate
				Use scientific inquiry/research skills to investigate local water issues	For instance, in summer 2014, the water level fluctuations on Whitedog Lake amounted to more than two meters. Students may explain the reason(s) for such drastic water fluctuations
				Demonstrate an understanding of the watershed as a fundamental geographic unit and explain how it relates to water management and planning	With respect to WIN, the Winnipeg River and the English River watersheds can be discussed
				Explain how human and natural factors cause changes in the water table	Students need to explain how hydroelectric developments cause changes in the water regimes of the WTLUA lakes and rivers
Grade 9	Biology		Sustainable ecosystems/Sustainable ecosystems and human activity	Assess, on the basis of research, the impact of a factor related to human activity that threatens the sustainability of a terrestrial or aquatic ecosystem	Large-scale hydroelectric generating stations built WTLUA in the 1890s-1950s altered hydrological cycles of the lakes and rivers. The peak water levels on the Winnipeg and English Rivers are now observed in summer (in most cases, June-July) during the most critical floating-leaf stage of wild rice growth, which differs from natural spring flooding substantially. The low-lying water bodies in the WTLUA that are connected to the Winnipeg and English Rivers follow the flooding pattern of the main rivers

				Evaluate the effectiveness of government initiatives in Canada and/or the efforts of societal groups or non-governmental organizations, such as Aboriginal communities, environmental groups, or student organizations, with respect to an environmental issue that affects the sustainability of terrestrial or aquatic ecosystems	At present, the International Rainy-Lake of the Woods Joint Commission Watershed Board is doing research on wild rice-related issues such as sulphate levels affecting wild rice roots, impacts to wild rice such as algal blooms, loss of wild rice due to flooding and absence of economic compensation, spiritual connection of Aboriginal people to their water resources such as wild rice, and governance mechanisms
				Plan and conduct an investigation, involving both inquiry and research, into how a human activity affects water quality and, extrapolating from the data and information gathered, explain the impact of this activity on the sustainability of aquatic ecosystems	Mercury contamination of the English River in 1962-1969 mostly affected mercury levels in fish, but may have also affected water quality. An investigation is needed
				Analyze the effect of human activity on the populations of terrestrial and aquatic ecosystems by interpreting data and generating graphs	Students may analyze the data from the Lake of the Woods Control Board website and make a conclusion about how water fluctuations influence on wild rice abundance in WTLUA
				Describe the limiting factors of ecosystems (e.g., nutrients, space, water, energy, predators), and explain how these factors affect the carrying capacity of an ecosystem	The limiting factors for wild rice are nutrients, space, light, energy, predators, and diseases
				Identify various factors related to human activity that have an impact on ecosystems and explain how these factors affect the equilibrium and survival of ecosystems	E.g., invasive species such as Eurasian water milfoil push out native species such as wild rice and upset the equilibrium in an ecosystem
Grade 11	Biology	SBI3U		Analyze some of the risks and benefits of human intervention to the biodiversity of aquatic or terrestrial ecosystems	When wild rice is harvested by airboats, which are too efficient, seeds do not fall into the water; thus, less rice may germinate in the future

			Diversity of living things	Use proper sampling techniques to collect various organisms from a marsh, pond, field, or other ecosystem, and classify the organisms according to the principles of taxonomy	Wild rice and its competitors can be collected from a lake or a river and classified in accordance with the principles of taxonomy
			Plants: anatomy, growth, and function	Evaluate, on the basis of research, the importance of plants to the growth and development of Canadian society	In the 20th century, wild rice became an important source of income for Anishinaabe people. The demand for it was very high, and during several weeks of harvesting, Anishinaabe people earned enough money for supporting themselves during several months
				Evaluate, on the basis of research, ways in which different societies or cultures have used plants to sustain human populations while supporting environmental sustainability	Since time immemorial, Anishinaabe people have relied on wild rice for food. Their traditional harvesting and finishing practices have always been environmentally sustainable. Due to ecological and socio-economic changes that occurred in the 20th century, these practices were disrupted and WIN community members buy rice in the store at present
				Design and conduct an inquiry to determine the factors that affect plant growth	The quantity of nutrients (nitrogen, phosphorous, potassium, etc.) in bottom soils, the quantity of light, annual temperature, water levels, and water level fluctuations are the main factors that influence wild rice growth
				Compare and contrast monocot and dicot plants in terms of their structures (e.g., seeds, stem, flower, root) and their evolutionary processes (i.e., how one type evolved from the other)	Wild rice is a monocot. Its leaves are typical monocot leaves - narrow with parallel venation. Grass flowers are arranged in spikelets, and the individual florets do not have petals or sepals.
				Explain the reproductive mechanisms of plants in natural reproduction and artificial propagation	Wild rice is reproduced through the germination of seeds

	Biology	SBI3C	Plants in the natural environment	Analyze, on the basis of research, and report on ways in which plants can be used to sustain ecosystems	Wild rice is important to the biodiversity of the lakes and rivers where it grows. The grains are a large part of the diet of many migratory birds. Mammals such as the muskrat use rice stalks as food and for their lodges. The rice beds provide habitat for many other species from invertebrates to large mammals such as moose
				Assess the positive and negative impact of human activities on the natural balance of plants	Aspen trees take over areas which have been commercially logged. As beavers are attracted to aspen trees, their populations increase in the areas where aspen is abundant. As a result, the number of beaver dams goes up, which leads to the destruction of water levels and water level fluctuations required for wild rice
				Investigate various techniques of plant propagation	The main propagation techniques are self-seeding for wild stands and commercial planting for paddy stands
				Investigate how chemical compounds and physical factors affect plant growth	For paddy production of wild rice, fertilizers are often used in order to increase soil productivity. For instance, nitrogen is applied within the range from 33-56 kg/ha. However, in Ontario, fertilization is prohibited. One of the physical factors that influence wild rice growth is light. When other aquatic vegetation is abundant and impedes light penetration, wild rice growth is disrupted because photosynthesis cannot occur in such an environment
	Chemistry	SCH3U	Solutions and solubility	Analyze the origins and cumulative effects of pollutants that enter our water systems (e.g., landfill leachates, agricultural run-off, industrial effluents, chemical spills), and explain how these pollutants affect water quality	Mining exposes sulphates that are pernicious to wild rice. Bacteria in the sediments convert sulphates to sulphides, which are toxic to wild rice

	Environmental science	SVN3M	Scientific solutions to contemporary environmental challenges	Analyze, on the basis of research, social and economic issues related to a particular environmental challenge and to efforts to address it	Hydroelectric dams disrupt natural water fluctuations and wild rice stands, which require shallow waters and low water level fluctuations. Water levels can be controlled by constructing water level control structures (mud dams, culverts); however, these structures are very costly and are not always effective
				Use a research process to locate a media report on a contemporary environmental issue, summarize its arguments, and assess their validity from a scientific perspective	Numerous reports on factors that disrupt wild rice growth are available online. Potential topics for research can be *Wild Rice and Mercury, Wild Rice and Sulphate, Hydroelectric Generating Stations and their Influence on Wild Rice*
				Identify some major contemporary environmental challenges, and explain their causes and effects	A potential issue can be the disruption of aquatic habitats. The main causes are flooding due to the operation of hydroelectric dams, the introduction of invasive species, sulphate pollution, etc. The effects are the destruction of habitats for waterfowl and animals, the abundance of other vegetation, etc.
Grade 11	Environmental science	SVN3M	Sustainable agriculture and forestry	Evaluate, on the basis of research, the impact, including the long-term impact, of agricultural and forestry practices on human health	Fertilizers such as nitrogen, phosphorous, and potassium are often used for paddy wild rice production. Phosphorus in paddies can move into surface waters. When phosphorus is surface applied, it can cause algal blooms. Erosion from ditches should be minimized to prevent phosphorus from entering drainage waters
				Describe the basic requirements for plant growth (e.g., growing medium, light, moisture, nutrients)	The main requirements are presented in Table 2 (Chapter 2) and Poster 3 (Appendix 11)

Grade 11	Environmental science	SVN3E	Human impact on the environment	Propose possible solutions, on the basis of research, to a current practical environmental problem that is caused, directly or indirectly, by human activities	Overdevelopment of lakes is a serious threat to wild rice habitats. Boat traffic, the use of insecticides and pesticides, and many other factors caused by human activities disturb wild rice habitats. One of the possible solutions is the foundation of indigenous and community conserved areas
				Analyze the risks and benefits to the environment of human recreational activities and the leisure industry	Recreational boat traffic can pull up wild rice plants, break the stalks, and damage the roots
				Explain how human activities have led to the introduction of invasive species, and why it is important to measure and monitor the impact of invasive species on native species	Purple loosestrife is a very aggressive invasive species that expands very fast and reduces wild rice habitats. It was brought to North America in the 1800s for flower gardens
Grade 11	Environmental science	SVN3E	Human health and the environment	Analyze how environmental contaminants can affect the health of different populations in Canada	As the analyses of water, bottom soils, and fish from the rivers and lakes in the English-Wabigoon-Winnipeg River system still have increased mercury concentrations, wild rice can be also contaminated because of the possibility of mercury uptake. However, this study shows that mercury content in wild rice grains collected on the Scot River is very low and not dangerous for human health
			Natural resource science and management	Assess the environmental impact of industrial practices related to the extracting or harvesting of natural resources, and describe ways in which that impact can be monitored and minimized	Harvesting machines, which were introduced in in the 1940s, have a very high harvesting efficiency. These machines collect 90 percent of the rice available, and seeds needed to replenish the crop hardly fall into the water. As suggested by some of the WIN residents, if these machines are used, rice needs to be first harvested manually so as to allow some of it fall into the water

				Analyze, on the basis of research, the impact that an environmental contaminant, parasite, or bacteria has on the sustainability of a natural resource in Canada	Sulphates in water can occur naturally or can result from municipal or industrial discharges. Sulphates in water in the concentration of higher than 4 mg/L diminish wild rice stands
Grade 12	Chemistry	SCH4C	Chemistry in the environment	Evaluate, on the basis of research, the effectiveness of government initiatives or regulations and the actions of individuals, intended to improve air and water quality, and propose a personal action plan to support these efforts	In March 2014, the Minnesota Pollution Control Agency presented Wild Rice Sulphate Standard Study Preliminary Analysis: http://www.pca.state.mn.us/index.php/view-document.html?gid=20743. This analysis resulted in numerous debates and discussions of the applicability of the results
				Evaluate the importance of quantitative chemical analysis in assessing air and water quality and explain how these analyses contribute to environmental awareness and responsibility	Health Canada has established an aesthetic objective of less than 500 mg/L of sulphate in drinking water. This standard cannot be used for wild rice fields because the concentration of 4-16 mg/L already impedes plant growth

APPENDIX 11

Poster 1

Poster 2

Wild Rice: Memories and Teachings

Paul Michaud

- People do not pick rice anymore. That is why rice is disappearing. We get punished because nobody wants to go out. Nobody has been to Scot Lake for at least twenty years. Wild rice is still there. That is why the water comes up. Mother Nature…

- When you are picking rice, you should not zigzag. You go one way and back again. It is like cutting grass. That is why my Dad picked a lot of rice. Then, he came back again when rice was ripe and did the same thing.

John Hunter

Years ago, people made fires by the shoreline, came together for big gatherings, almost like pow-wows, and put food into the water to give thanks for wild rice. They put tobacco as well. My Dad used to put snuff into the water before we started picking rice.

Ilene Muckle

We used to make a lot of rice. We lived in cabins without any electricity. My Dad used to make a big two-foot hole in the ground and put rice there after roasting it in a big pan. We had moccasins on and danced on rice back and forth. Back and forth. Then, we held rice against the wind and let the husks flow away. For storing rice, people made big holes in the ground using logs. These holes looked like underground cabins. Rice was preserved very well. It was very exciting!

Ron R. McDonald

It was important to choose good campsites without many mosquitoes and waves, but with an access to wood for making fires. Of course, it was also important to have clean water and not just beaver pond water. Overall, wild rice camps were family centered. People helped each other from morning till bedtime.

Marvin McDonald

We used to go hunting. Wild rice was a food source for animals as well. Near small rivers, we could see people who shot beavers, deer, and moose in the fall and in the spring. Many ducks also fed themselves on wild rice fields. At present, when we went there (*Whitedog Lake*) the other day, we saw only half a dozen ducks. Usually, in the spring, there used to be many more.

Teresa Tikanye

One of the teachings is that everything needs to be respected during rice harvesting. If you are crazy, rice will not function right. You need to be calm. You need to be happy. When my grandfather took us rabbit snaring, he told us that if we did not go to bed in the evening, rabbits would see our shadows on the snare. So, we went to bed because we did not want rabbits to see us. Then, the following day, everyone had rabbits. The same teaching applies to wild rice harvesting. Everybody at the wild rice camps used to behave well. No one went to other rice camps to destroy tents or steal food. No one played with rice sticks so as not to make them dirty.

Personal stories were collected through interviews.

Poster 3

Wild Rice and Its Habitat

Water Depth

Water depth is the most critical factor influencing a wild rice plant. Wild rice grows best when the depth during the plant life cycle is about 0.3 – 0.9 m. Deep water does not allow sufficient light penetration for normal photosynthesis to occur.

Shallow water affects grain production and harvesting due to stem breakage and lodging. Sudden fluctuations in water depth are also detrimental to wild rice. Flooding damages and uproots plants.

Flooded Mud Dam, Whitedog River, June 2014.

Plant Competition

Because wild rice is an annual plant with high light requirements, it does not compete well with many emerging, submerged, and floating leaf plants. The main wild rice competitors are spike-rush, bulrush, cattail, water milfoil, coontail, pond weeds, pickerelweed, bladderwort, duckweed, water lilies, burreed, etc.

Fragrant White Water Lily, Pakitpot Lake, August 2014.

Wild rice plants also compete with each other.

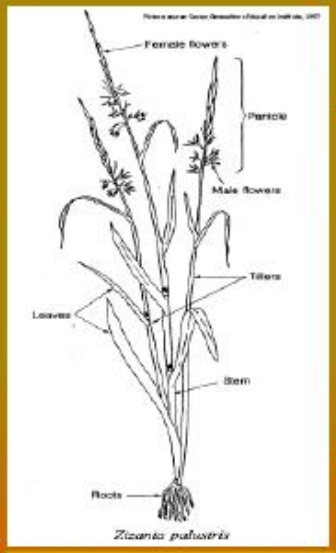
Water Clarity

Wild rice grows best in clear water that is free of algal scum and mud. Clear water allows sun light to pass through to the seedlings.

Underwater Picture of Water Smartweed, Whitedog Lake, June 2014.

Bottom Soils

Wild rice absorbs most of its nutrients from the bottom soils. A muck, organic sediment at least 45 cm thick is ideal for the grain. The most important soil nutrients are phosphorous and nitrogen.



Zizania palustris

Diseases and Insects

There can be considerable losses from fungal, bacterial, and viral diseases. Most damage results from the riceworm which feeds on the developing grain.

Water Circulation

Moving Water, the Sast River, August 2014.

Water movement is essential for wild rice growth. Due to water circulation, oxygenated surface waters and nutrients reach the bottom and dead plants are carried away.

Therefore, stagnant ponds are typically unproductive.

Water Quality

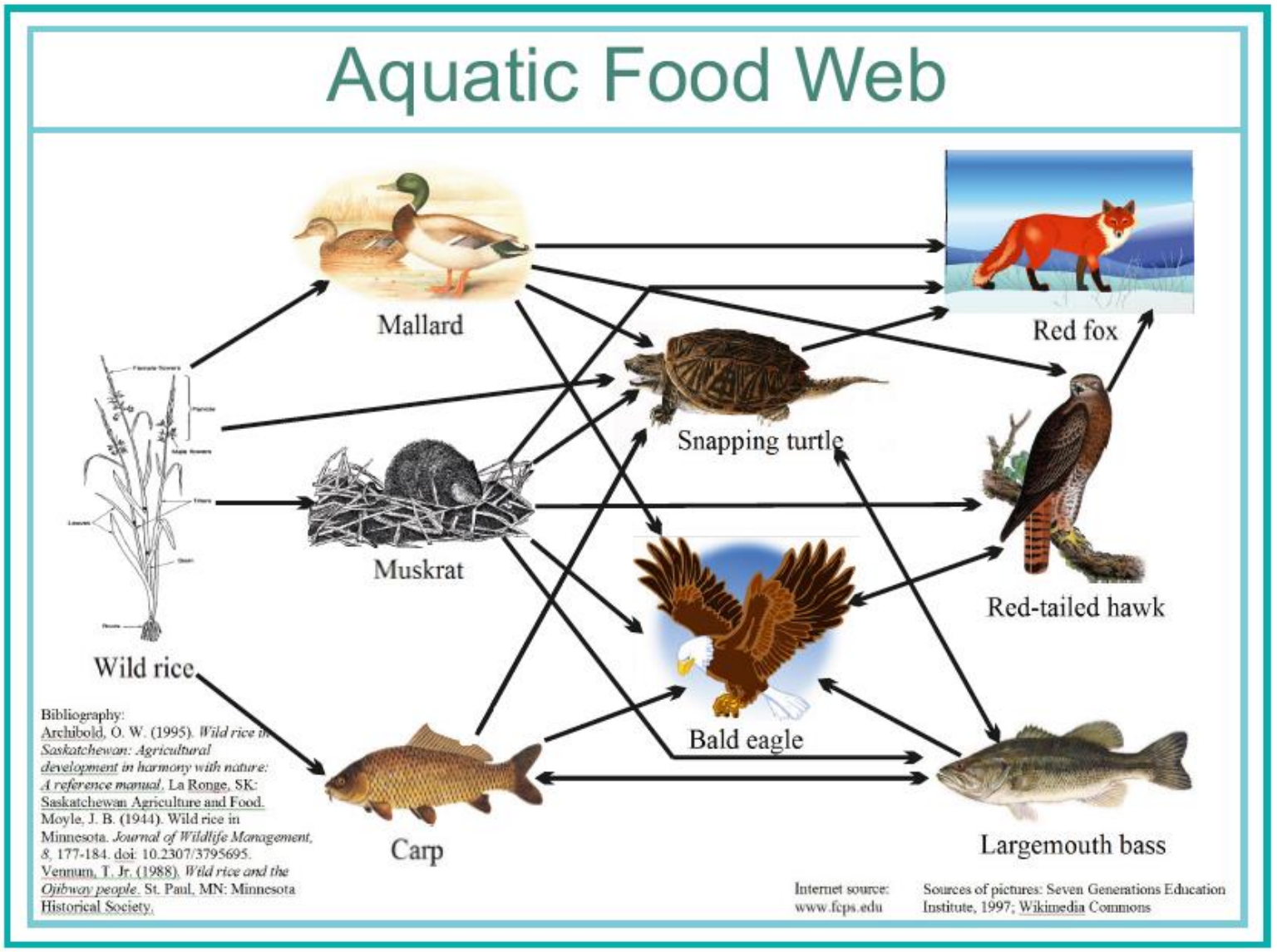
Waterbodies with a pH of 7-8 are the best for wild rice, but growth has been reported over a pH range of 6-8.5. Very acidic water (pH 4-5) that drains from bogs is not good for rice because it is low in essential nutrients. Best growth occurs in water with a conductivity reading of 100-250 units. The quality of water is also influenced by dissolved salts, particularly sulphates, and gases like carbon dioxide. Moreover, water bodies polluted with industrial oils and detergents are not a good for wild rice.

Animal Consumers

Ducks and Ducklings, the Sast River, August 2014.

Wild rice stands are a good food source for wildlife. The main consumers are waterfowl (mostly ducks), muskrats, beavers, and moose.

Poster 4


Aquatic Food Web
Mallard
Red fox
Snapping turtle
Muskrat
Red-tailed hawk
Wild rice
Bald eagle
Carp
Largemouth bass
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