JOURNEYS, PLANTS AND DREAMS: ADAPTIVE LEARNING AND SOCIAL-ECOLOGICAL RESILIENCE

By

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A Thesis Submitted
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A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University of

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ABSTRACT

The research reported in this dissertation was undertaken in Canada and Mexico. The work in Canada took place between May and October of 2000 and between July and October of 2001. Verification workshops were held in January of 2001 and again between January and April of 2002. The work in Mexico took place during the fall of 1999 and again between the months of February and June 2001. The work in Canada was undertaken in the community of Iskatewizaagegan No. 39 Independent First Nation of Shoal Lake, Ontario. In Mexico, the major work was undertaken with the Rarámuri community of Basíhuare.

This dissertation presents a number of linked essays that chronicle my journey to understand the dynamics of social-ecological resilience. I chose an approach that would allow me to move toward a holistic, place-specific and problem-centric research paradigm. This required forming a research team of elders, community leaders, community researchers and scientists with an appropriate delegation of authority and power within the team. This approach to research reflects insights from ecological anthropology, sustainability science and resilience literatures. The Resilience Alliance has proposed that the resilience of social-ecological systems has three defining characteristics: (1) the amount of change the system can undergo and still retain the same controls on function and structure, or still be in the same state, within the same domain of attraction; (2) the degree to which the system is capable of self-organization; and (3) the ability to build and increase the capacity for learning and adaptation.

This dissertation focuses on the last of the characteristics noted by the Resilience Alliance: the ability to build and increase the capacity for learning and adaptation. The central problem addressed by this dissertation is the process of adaptive learning as a process of social-ecological systems. The resilience literature has identified adaptive learning as a key characteristic of resilience and hence of social-ecological resilience. However, the literature does not provide a mechanism in which individual creativity can respond to feedback of social-ecological systems and lead to change and development of social institutions and memory. The primary purpose of this dissertation is to address this gap in the literature by suggesting a model of adaptive learning that situates individual

learning into a social-ecological environment structured by institutions of knowledge and leading to institutional change.

The central problem and purpose of this dissertation leads to a number of secondary research questions summarized below:

- What theories can be drawn upon to understand the process of adaptive learning for social-ecological resilience?
- What research models and methodologies can contribute to adaptive learning and social-ecological resilience?
- What are the historical processes that influenced the social-ecological learning environment of Anishinaabe people?
- What are the historical processes that influenced the social-ecological learning environment of Rarámuri people?
- How do institutions of knowledge situate memory and creativity within social-ecological environments so that learning becomes adaptive?
- How do institutions of knowledge frame social-ecological learning environments so that learning becomes adaptive?

The above research questions correspond to Chapters II through VII of the dissertation. In **Chapter II** I begin the dissertation with a discussion of the theory that provides a theoretical framework for adaptive learning and social-ecological resilience. In **Chapter III**, I present the cooperative research approach that I developed with Iskatewizaagegan people and the research methodologies for fieldwork. In **Chapters IV** and **V**, I present two narratives which link technology, history, memory and institutions from the perspective of social-ecological resilience. In Chapter IV I look at the Anishinaabe use of fire in northwestern Ontario while I consider the Rarámuri use of fire in northwestern Mexico in Chapter V. In **Chapter VI**, I present the ethnoecological research about the spatial and temporal dynamics of the landscape, memory and institutions. I begin **Chapter VII**, the final chapter of my research results, with my understanding of the ethnobotanical knowledge of Anishinaabe people from Iskatewizaagegan No. 39 Independent First Nation. I address how cognitive memories, such as plant names, become adaptive through learning processes.

In **Chapter VIII**, I consider the lessons I learned about social-ecological resilience from the Anishinaabe and Rarámuri people. I present some novel insights that I gained regarding my understanding of social-ecological resilience. I suggest that social-ecological resilience is not to be found in the "knowledge" of indigenous people. Rather, social-ecological resilience can be built, along with indigenous people, in the process of answering place-specific problems through research teams. As noted in Chapters II and III, I suggest that this will require some new models to guide research. The material I presented in Chapters IV and V suggests that social-ecological resilience is rooted in people's adaptive learning processes. I argue in Chapters VI and VII that resilience is not just *what* people know, but *how* people go about knowing what they know and how they act on this knowledge.

I propose that adaptive learning as a process of social-ecological resilience is founded upon two key institutions. First, an institution that places learning into a social-ecological environment and requires that knowledge emerge from experience within that environment. This mechanism of feedback linkages allows individual creativity to respond to the dynamics of social-ecological systems and lead to a stream of innovation. Second, an institution that authorizes individual creativity. In the cases examined here, elders are authoritative through their experience on the land and can authorize learning processes. This provides the mechanism for individual creativity to lead to institutional development and changes in social memory. These two institutions of knowledge link innovation to the dynamics of social-ecological systems while maintaining the continuity between the past and the future. It is this process that allows indigenous peoples to write their histories into the cultural landscapes that sustain their survival as a people over time.

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I could not have completed this research without the help of many people in both Mexico and Canada.

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While this document is based upon the support of many people, I alone remain responsible for its shortcomings.

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CHAPTER I

INTRODUCTION

> "Although we mere humans are prone to seeing only the opposites, God, according to Heraclitus, sees the harmony instead. With everything in flux, Heraclitus observed, one thing was always changing into another, often into its own opposite: ice into water, day into night, life into death. He concluded that nothing is stable or permanent; that change, with fire as its symbol, is the only thing you can ever know for sure. It was Heraclitus who said you can never step into the same river twice" (Schoemperlen 2001:115).

A woman reaches toward a blueberry. A line emanates from her fingertips and disappears into the berry. The roots of the blueberry stretch outward and reach around the plant and the woman, joining with the sun. Algonquian art, such as the woman picking blueberries by Roger Kakepetum from Sandy Lake, Ontario, has long provided an Anishinaabe representation of resilience. This might be translated as maintaining the relationships necessary to keep life going. The network of relationships between the woman, the blueberry, the blueberry plant, the earth and the sun is one tracing of many that is necessary for survival. What is more interesting is what is missing from this painting: the force which allows the relationship between the woman and the blueberry to become established. Fire, which might be thought of as destructive, brings forth into the landscape the blueberries, which can then be harvested by the woman. Roger Kakepetum's painting captures a network of relationships arising from a catalytic event—fire—in a particular place at a particular time. Resilience, in this representation, emerges from events that set the environment for building memories and institutions, in particular places and times, through the mundane practices of life.

This dissertation began as an exploration of the ways in which Anishinaabe people of northwestern Ontario, and Rarámuri people of northwestern Mexico, perceived ecological dynamics. I was interested in exploring the linkage between the conservation of biodiversity by indigenous peoples and social-ecological resilience, that is, the flexibility and adaptability of linked systems of society and environment (Davidson-Hunt and Berkes 2003). Why do priority zones of biodiversity conservation seem to overlap indigenous territories (www.terralingua.org)? There is a large literature that documents biodiversity conservation by indigenous peoples (Alcorn 1989; Berkes, Folke and Gadgil 1995; Berkes, Colding and Folke 1997; Blackburn and Anderson 1993; Gadgil, Berkes and Folke 1993; Irvine 1989; Posey 1985). Some of this literature suggests that indigenous livelihoods present a mechanism of *in situ* plant conservation (Altieri, Anderson and Merrick 1987; Brush and Orlove 1996; Nabhan 1997; Oldfield and Alcorn 1991), and that biodiversity can increase the social-ecological resilience of livelihood systems (Berkes and Folke 1998). My interest in the use of fire technology as a management practice to create biologically diverse landscapes (Lewis and Ferguson 1988; Cronon 1983) seemed well matched with an interest in biodiversity conservation, social-ecological resilience and ecological dynamics.

Anishinaabe and Rarámuri elders with whom I undertook my research quickly made me realize that there was a problem with my approach to biodiversity conservation, social-ecological resilience and ecological dynamics. My representation of social-ecological resilience allowed ecological systems to be fluid and dynamic. However, at the same time, it required that the social, economic and cultural systems of indigenous peoples' livelihoods be marginal to, if not isolated from, the tides of history, the flows of technology and the cycles of markets (Roseberry 1989; Wolf 1982). I had assumed that indigenous people's taxonomies, practices, technologies, institutions and world views—traditional ecological knowledge—were prior to modern systems of natural resources management. Biodiversity was thus an artifact of the location of indigenous peoples on a trajectory of development from the primitive to the modern. In this argument, as indigenous peoples left behind their primitive technologies and economies there would be a corresponding loss of biodiversity. Biodiversity conservation was thus causally linked to an evolutionary stage. This proposition left little room for indigenous peoples to draw upon their traditional ecological knowledge in the pursuit of alternate trajectories of development for their contemporary livelihoods (Chapeskie 2001).

Indigenous peoples have often found support for their way of life from those who feel it may fulfill an ideal of conservation. Depending upon the conservation ideal in the mind of the beholder, the indigenous livelihood considered to meet this ideal will change. A conservation ideal often implied, if not stated directly, is the return of the pre-colonial landscapes of the Americas. This has deep idealistic roots in the notion of "natural" landscapes. This conservation ideal requires the existence of these landscapes so that they might then be protected from being ravaged and pillaged by the modern day "Visigoths" of modern society. These landscapes, protected by the aesthetics of the ideal and the idealists, are then available for their future enjoyment. For example, the literature of Woodland Caribou Provincial Park in northwestern Ontario promises visitors an experience in which a person can travel for days without seeing another person (Parks Ontario n.d.). During their travels the visitor can view ancient pictographs left by prehistoric aboriginal peoples and remnants of the fur trade. However, the reality is that this park was carved out of the traditional territories of four First Nations who, in spite of the burning of their cabins when the park was established, still travel this land to fish, hunt, trap, gather plants and visit ceremonial sites.

These conservation ideals require a strategy of discovering, surveying, regulating and bounding landscapes (Scott 1998). When people are found within these landscapes, they are often removed so that they will not despoil the newly bound landscape. A recent development of this conservation ideal considers indigenous peoples to be part of the "natural," or "wild," landscape when they follow "traditional" practices. Conservation ideals have expanded to include indigenous peoples who exhibit livelihoods with characteristics of "traditionalism," "naturalness," "wildness," "non-industriousness," and "non-commercialness." The Convention on Biological Diversity in Article 8(j), for example, mentions those peoples who exhibit a "traditional lifestyle" (Higgins 1998). Does this mean that Indigenous people who do not follow a traditional lifestyle somehow lose their rights regarding the use of biodiversity? Who defines the boundaries of traditional?

Many conservation organizations have supported the traditional resource rights of First Nations within parks when these are defined as the traditions of the fur trade period. Indigenous peoples and livelihoods—taxonomies, practices, technologies, institutions and world views—have been rendered as an "other": an "other" who can be supported—the noble savage—or vilified—the rapacious indian—as needed. While this conservation ideal of the "traditional indian" has often been beneficial for indigenous groups, it has also led to a pernicious outcome. The territorial rights of indigenous peoples have often become linked to conservation ideals and objectives (Smith and Wishnie 2000). The "other" has often been seen as a source of technologies, practices, information and institutions which dominant societies might incorporate into their plans and projects for particular landscapes (Scott 1998). There has rarely, however, been a corresponding transfer of authority and power for the "other" to narrate their own past, present and future (Nadasdy 1999). The approach, while often well intentioned, leaves us shipwrecked upon the hidden shoals of colonialism.

This dissertation presents a number of linked essays that chronicle my journey to understand the dynamics of social-ecological resilience. I chose an approach that would allow me to move toward a holistic, place-specific and problem-centric research paradigm. A research team was established with the overall goal to work for the well being of places, beings and peoples. This required forming a research team of elders, community leaders, community researchers and scientists with an appropriate delegation of authority and power within the team. This approach to research reflects insights from ecological anthropology (Scoones 1999), sustainability science (Gallopín et al. 2002; International Council for Science 2002; Kates et al. 2001) and resilience literatures (Berkes, Folke and Colding 2003; Walker et al. 2002).

Of these three bodies of literature, the role of resilience and the Resilience Alliance is particularly important. The Resilience Alliance is a research network bringing together these disparate sets of literature and practice into a research programme. The Resilience Alliance has proposed that the resilience of social-ecological systems has three defining characteristics (www.resalliance.org): (1) the amount of change the system can undergo and still retain the same controls on function and structure, or still be in the same state, within the same domain of attraction; (2) the degree to which the system is capable of self-organization; and (3) the ability to build and increase the capacity for learning and adaptation.

Research Questions: Adaptive Learning

This dissertation focuses on the last of the characteristics noted by the Resilience Alliance: the ability to build and increase the capacity for learning and adaptation. The central problem addressed by this dissertation is the process of adaptive learning. The resilience literature has identified adaptive learning as a key characteristic of resilience (www.resiliencealliance.org) and hence of social-ecological resilience (Berkes, Folke and Colding 2003). However, the literature does not explain the process of adaptive learning. The role of cognitive knowledge—memory—, institutions and management practices have been described in the literature (Berkes and Folke 1998; Berkes, Folke and Colding 2003). While we can identify changes in memory, institutions and management practices over time, institutions themselves do not learn. Rather, institutional learning refers to the process whereby individual learning, structured by institutions of knowledge, can result in institutional change and development. The primary purpose of this dissertation is to address this gap in the literature by suggesting a model of adaptive learning that situates individual learning into a social-ecological environment structured by institutions of knowledge and leading to institutional change.

The adaptive learning model developed in this dissertation treats social-ecological resilience as an emergent property of a system, that is, a property that "...cannot be predicted or understood simply by examining the system's parts" (Berkes, Colding and Folke 2003:5-6). Resilience emerges through those knowledge institutions, such as authoritative elders, which insist that individual learning occurs through the mundane practice of daily life. Institutions of knowledge thus create structured social-ecological learning environments within which learners can adapt memories, institutions and practices passed on by leaders (from within or outside the society) to present circumstances. In ecological anthropology, this has tended to be expressed as actors building agency, through practice, within richly structured environments of physical, biological, social and cultural relationships and networks (Ingold 2000).

In resilience terminology, events and disturbances (Folke, Berkes and Colding 2003) change the social-ecological environment so that adaptive learning results in modifications of memories, institutions, practices and eventually landscapes. Change is what is noted when these phenomena are sampled at different points in time. Resilience is the process by which particular memories, institutions and practices emerge through the adaptive learning of individuals. Institutions of knowledge, such as authoritative elders, allow some of these memories to become collective through processes of social learning while others are filtered out. Resilience is in part related to human creativity, in part to institutions that guide human behaviour, and in part to institutions of knowledge that encourage adaptive learning within structured contexts. Folke, Berkes and Colding (2003) suggested the term "framed creativity" to refer to this process. In order to understand the process of adaptive learning, or framed creativity, it was necessary to consider ecological perception, memory, history, technology, practices and knowledge institutions of specific places and peoples. The central problem and purpose of this dissertation leads to a number of secondary research questions summarized below.

- What theories can be drawn upon to understand the process of adaptive learning for social-ecological resilience?
- What research models and methodologies can contribute to adaptive learning and social-ecological resilience?
- What are the historical processes that influenced the social-ecological learning environment of Anishinaabe people?
- What are the historical processes that influenced the social-ecological learning environment of Rarámuri people?
- How do institutions of knowledge situate memory and creativity within social-ecological environments so that learning becomes adaptive?
- How do institutions of knowledge frame social-ecological learning environments so that learning becomes adaptive?

Plan of the Dissertation

The above research questions correspond to Chapters II through VII of the dissertation. In **Chapter II** I begin with a discussion of the theory that provides a theoretical framework for adaptive learning and social-ecological resilience. I address three main theoretical issues in the chapter. The first topic I review is the ontological separation of culture from nature and of society from environment. I seek a theoretical basis for discussing resilience as a process situated within a network of relationships amongst beings of a place. Second, I consider the idea of resilience, as an emergent property of social-ecological systems, through a discussion of culture, knowledge and memory. Finally, I position memory as a phenomenon arising from the dynamic relationships between perception, history, technology, institutions and worldview. I draw upon this discussion in order to provide a theoretical basis for proposing that resilience emerges from processes of remembering as opposed to fixed cognitive memories and institutions. My objective in this chapter objective is to provide a theoretical foundation, and identify the gaps in the literature, of adaptive learning for social-ecological resilience.

While I deal with the separation of environment from society in Chapter II, I do not discuss the related problem of the separation of science from society. This problem is rooted in the separation of culture from nature, providing a theoretical basis for scientists, such as myself, to separate our research from the objects of our attention. I address this problem in **Chapter III** through an examination of my research methods. I suggest that resilience can only be built through a research model that brings together a diversity of learners in an institutionally structured context to solve place-specific problems. Social-ecological resilience can arise from research structured as adaptive learning, which allows phenomena that are narrated and collective to emanate from holistic environments. I also present the institutional instruments that were developed for the research and the specific methodologies utilized during the research.

In **Chapters IV** and **V** I present two narratives which link technology, history, memory and institutions from the perspective of social-ecological resilience. This perspective recognizes that adaptive learning is situated in particular space-time locations emergent from political and cultural processes. In these chapters I focus on the technology of fire in two different geographic locations. In Chapter IV I look at the Anishinaabe use of fire in northwestern Ontario while I consider the Rarámuri use of fire in northwestern Mexico in Chapter V. I utilize the fire narratives to emphasize how innovation comes out of complex contexts made up of biogeophysical, social and cultural contexts through political processes occuring simulataneously at different scales. My intent in these two chapters is to create narratives, or case studies, with the idea that social-ecological resilience is not something that can be broken down, analysed and designed, but something that is lived through life in a fluid and dynamic manner. I draw from approaches in business management studies that stress that complex and uncertain environments, such as the market, require people to build their own abilities to learn and adapt (Hurst 1995).

Chapters IV and V present my attempt to construct two case studies of how people have adapted to complex events, such as colonialism and industrialisation, while striving to maintain the well being of themselves and their place. The two chapters also provide the context for Chapters VI and VII in which I take a more analytical approach to social-ecological resilience. In addition, I utilize Chapters IV and V to demonstrate that the knowledge discussed in Chapters VI and VII emerges from historical processes and commercial economies. The approaches utilized by the Anishinaabe and Rarámuri to maintain the well being of themselves and their place are not stranded from history, but have emerged from processes of colonialism and industrialisation. In these chapters I provide a narrative approach that emphasises the delegation of power and authority as a part of the puzzle.

In **Chapter VI** I present the research that I undertook with Anishinaabe and Rarámuri people regarding the spatial and temporal dynamics of the landscape, memory and institutions. I begin the chapter with the research I undertook to understand how Anishinaabe and Rarámuri people perceive landscape dynamics and how this is linked to memories of where plants are located in space and time. I follow this with a discussion of my understanding of how Anishinaabe and Rarámuri remember where plants are located in space and time. Anishinaabe and Rarámuri perceptions of the spatial and temporal dynamics, I suggest, weave together the biophysical and cultural memories of the landscape into a process of remembering. I was taught that Anishinaabe and Rarámuri institutions of knowledge require memories to be built through journeying the paths and visiting the places of remembering with knowledgeable people. I propose that this adaptive learning process passes on memories and allows learners to adjust memories of the landscape to current social and ecological contexts.

I begin **Chapter VII**, the final chapter of my research results, with my understanding of the ethnobotanical knowledge of Anishinaabe people from Iskatewizaagegan No. 39 Independent First Nation. I address how cognitive memories, such as plant names, become adaptive through learning processes. Anishinaabe ethnobotanical knowledge, in my interpretation, demonstrates that cognitive memories are built through processes of learning in a social-ecological environment. A cognitive structure, such as plant classification, is located in the mind, but the meanings of the categories of classification are given through institutions of knowledge, which structure the learning environment. I then turn from an ethnobotanical examination of cognitive memories to a discussion of how learning occurs from the perspective of Anishinaabe elders. Elders, from what I learned, stress the importance of maintaining the institutions of knowledge. The institutions of knowledge allow memories to adapt to current contexts while providing the social and ecological frame for continuity between the past and future. Adaptation and continuity are seen as integral to the survival of Anishinaabe ways of remembering.

In **Chapter VIII** I consider the lessons I learned from the Anishinaabe and Rarámuri people with whom I worked on these questions between 1998 and 2002. I present some novel insights that I gained regarding my understanding of social-ecological resilience and suggest that it is not to be found in the "knowledge" of indigenous people. Rather, social-ecological resilience can be built, along with indigenous people, in the process of answering place-specific problems through research teams. As noted in

Chapters II and III, I suggest that this will require some new models to guide research. The examination of social-ecological resilience (Berkes and Folke 1998; Berkes, Folke and Colding 2003; Walker et. al. 2002) has possibly provided the clearest articulation of this approach in relation to natural resources and environmental management. The material I presented in Chapters IV and V suggests that such resilience is rooted in people's adaptive learning processes. A case study approach, which provides complex scenarios, may be one tool to promote that type of learning. I argued in Chapters VI and VII that resilience was not just *what* people know, but *how* people go about knowing what they know and how they act on this knowledge. This leads to my proposition that social-ecological resilience emerges from learning contexts that provide direct feedback between actions and the consequences of those actions. I also propose that institutional learning environments are required which allow people to build holistic understandings that are narrated and collective. Technologies, practices, institutions and world views emerge from memories as remembered in specific places and times structured by ecosystems and institutions of learning.

Main Contribution to Knowledge

The main contribution I make in this dissertation regarding our knowledge of social-ecological linkages and resilience is a model of the adaptive learning process. The model demonstrates how institutions of knowledge create holistic learning environments. As this environment changes, an individual adjusts the practices they undertake or are taught. Institutions of knowledge also provide the means by which these adjustments can lead to changes in memories, institutions and practices within a society. Disturbance events can create quicker changes within learning environments and the emergence of individual creativity into societal change. This supports Holling and Meffe's (1996) observation that resource management of the future should focus less on command and control, and more on models of leadership and learning.

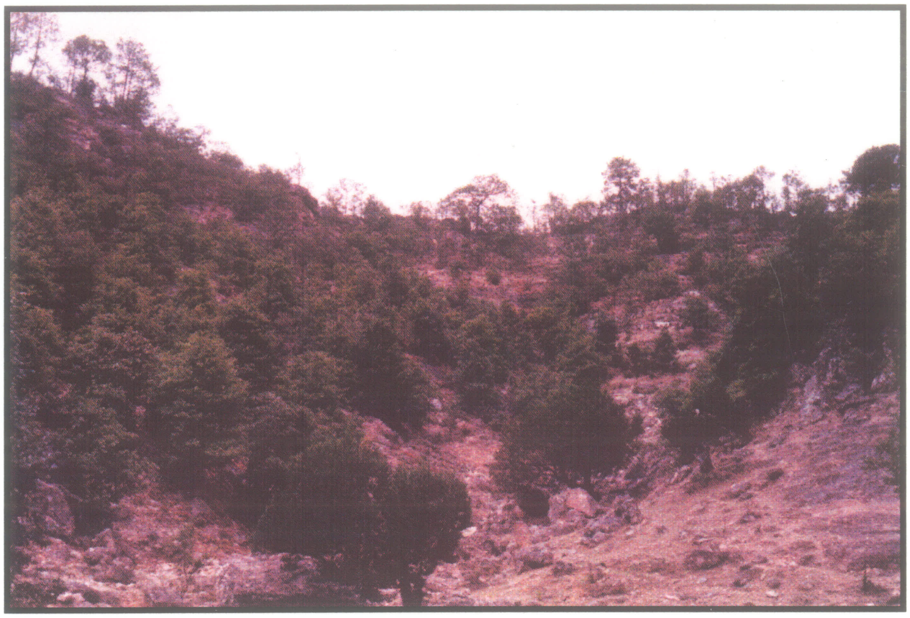


Plate 1. An arroyo in Basihuare, Mexico with oak trees that are coppiced for firewood.

Plate 2. A bear swimming in Shoal Lake, Ontario.

CHAPTER II

THEORY

> "As hunters and gatherers have explained to their ethnographers, with remarkable consistency, it is essential to "look after", or care for the land, to maintain in good order the relationships it embodies; only then can the land, reciprocally, continue to grow and nurture those who dwell therein."
>
> (Ingold 2000:149)

In this chapter I provide a critical review of the literature upon which a model of adaptive learning and social-ecological resilience can be built. I begin by reviewing the literature of ecological anthropology that examines the concepts of culture, nature and their articulation. The authors of this literature suggest that learning environments for social-ecological resilience should be considered as integrated systems. I then turn to an examination of how creativity can emerge from holistic learning environments. Authors within ecological anthropology and traditional ecological knowledge literature provide theoretical background that I draw upon to develop my theory of adaptive learning. Adaptive learning, these authors suggest, is a process of individual learners being taught to attune their perceptions, develop their skills and build their memories by experienced leaders within complex, dynamic and holistic environments. The authors who have developed the concept of social-ecological resilience, it was discovered, do not consider the mechanisms of an adaptive learning process. I identify the process of adaptive learning within these structured learning environments as a gap in the literature. Despite the fact that learning and adaptation are identified as key characteristic of social-ecological resilience this process has not yet received much attention from authors (Resilience Alliance 2001). This chapter brings together the idea of adaptive learning with concepts from the resilience literature, such as adaptive-renewal cycles, panarchy and memory.

SOCIAL-ECOLOGICAL SYSTEMS

There is a long history in several disciplines in trying to understand the relationship between social and ecological systems. The issue is often glossed as the nature/culture and environment/society dichotomies. Glacken (1967) has provided an extensive and wide-ranging survey of the ways in which the relationship between environment and society has been conceptualized within Western thought up to the 18th century. With the Age of Enlightenment, humans were extracted from the environment. The separation of environment and society became a foundational principle of Western thought and provided the organizational structure for academic departments. Since that time, Western thought has oscillated between positions in which environment and society were treated as distinct entities, and one in which articulations between the two were examined.

One of the early attempts to provide a model of environment-and-society articulation was the one constructed by Karl Marx in the 19th century (Ingold, 1980; Wolf, 1982; Harvey, 1996). The discussion on the relationship between environment and society has continued during the 20th century in many different disciplines. There has been the human ecology of Thomas Park (1936); the cultural ecology of Julian Steward (1955); the ecological anthropology of Gregory Bateson (1973; 1979); Netting (1974; 1986; 1993); Vayda and McCay (1975); the ideas of Carl Sauer (1956) and other human geographers; the environmental history of William Cronon (1983; 1995) and Donald Worster (1977; 1988); the ethnoecology of Conklin (1957) and others (Toledo, 1992; Nazarea, 1999); and the emerging political ecology of Greenberg and Park (1994) and Peet and Watts (1996). The literature pertaining to the environment-and-society relationship spans many disciplines and has consolidated in the last two decades or so into half a dozen subdisciplines.

Since the 1970's, an emerging body of literature has emphasized that ecological systems are characterized by non-linear processes and multiple equilibria instead of stability; surprises (perceived reality departing qualitatively from expectation, in the sense of Holling, 1986); threshold effects; and system flips. Implications of this perspective are being explored for social systems and social-ecological systems as well (Vayda and McCay, 1975; Zimmerer, 1994; Zimmerer and Young, 1998; Abel, 1998; Biersack, 1999; Kottak, 1999; Scoones, 1999). Taken as a whole, this body of thinking questions the utility of Cartesian models which maintain the separation between environment and society. Such a position reverses Descartes' c*ogito ergo sum* (I think therefore I am), to *sum ergo cogito* (I am therefore I think) which may be called a human-in-environment, or "dwelling", perspective (Descola and Palsson, 1996; Ingold, 2000).

Environmental determinism, possibilism and cultural ecology

Cultural ecology and ecological anthropology emerged from the tension between two contending "grand" theories that have been termed "anthropogeography" and "historical possibilism" (Geertz, 1963; Moran, 1979). Anthropogeography is a variant of environmental determinism, which has its origins in human geography. It proposes that the environment is the causal agent for the behaviour of social systems. According to environmental determinism, "a 'temperate', or 'balanced', climate, ethnocentrically defined, was responsible for the virtuous qualities of the area's inhabitants. As a result, they were destined to rule and control the 'lesser' domains where populations were more lethargic, less courageous, and less intelligent" (Moran 1979: 24). Environmental determinism was often used by many societies to explain the relationship between their own society and other people. The early Greek, Roman and Arab empires, along with the dominant European countries of the eighteenth and nineteenth centuries, all utilized environmentally deterministic theories in this manner (Moran, 1979).

Anthropogeography was a particular manifestation of environmental determinism, developed by Friedrich Ratzel in the late 1800s, which suggested that the interrelation of groups with their habitats produced specific kinds of cultural traits. Moran (1979) has suggested that Ratzel's main thesis included the following propositions: habitat was primary in bringing about cultural diversity; similarities between cultural groups were explained as occurring due to the diffusion of traits by migrating groups; and human cultural evolution emerged out of the territorial competition between migrating groups. Ratzel's theory began a trend that viewed human beings as limited by their habitat in their range of responses to environmental events; habitat was said to shape culture. According to this view, environment was postulated to cause change in human societies, thereby accounting for human evolution through a process of trait selection by the environment.

Historical possibilism was developed by Franz Boas in the early 1900's as an alternative theory to explain the interactions between environment and society. Historical possibilism suggested that "nature circumscribes the possibilities for humans, but historical and cultural factors explain what possibility is actually chosen" (Moran, 1979: 34). In Boas's view, humans chose what they want to use in nature, and it is those cultural decisions, not nature itself, which influence the trajectory of human societies and cultural change. In order to refute environmental determinism, historical possibilism constructed the concept of culture as the basis of human adaptation. Boas emphasized inductive studies that focused on the empirical cultural traits of different human groups as a means to counterbalance the deductive theories of environmental determinism.

Through studies carried out in the early and mid-twentieth century, anthropologists, geographers and other social scientists were able to demonstrate that many different cultural traits were found in areas sharing similar biophysical environments. It was culture, not geography, which led to differences between human groups. Traits shared by groups were explained by diffusion from one 'culture area' to another. How far a cultural trait had diffused from its origin was believed to demonstrate the antiquity of a trait. Although this approach compensated for environmentally deterministic theories, it led to another problem because of its emphasis on the idea of culture. Culture became a "superorganic" entity that subordinated individual humans to its patterns (Moran, 1990; Wolf, 1982). The causal agent shifted from the environment to culture; change emerged from historical and cultural forces while the environment acted as the setting in which these forces were played out.

The cultural ecology of Julian Steward came out of the debate between these two opposing theories as another perspective on the relationship between environment and society. One of Steward's objectives was to move social theory back toward a consideration of the evolutionary or adaptive relationship between human society and the environment (Steward, 1955). To return to the question of how societies change, the purpose of cultural ecology was to "develop a methodology for determining regularities of form, function and process which recur cross-culturally among societies found in different cultural areas" (Steward, 1955: 3).

Whereas other writers sought to formulate cultural development in terms of supposed universal stages, Steward's objective was to seek causes of cultural change. Cross-cultural comparisons were made through an examination of the "cultural core" which was defined as the "recurrent constellations of basic features ... which have similar functional interrelationships resulting from local ecological adaptations and similar levels of socio-cultural integration" (Steward, 1955: 6). The basis of Steward's evolutionary theory was "multilinear evolution", which he defined as "the methodological position [which] assumes that certain basic types of culture may develop in similar ways under similar conditions but that few concrete aspects of culture will appear among all groups of mankind in regular sequence" (Steward, 1955: 4).

Steward's cultural ecology, by focusing on empirical features, rather than on deductive and universal theories, was an important reframing of understanding the relationship between cultural change and the environment. First, he pushed the focus towards the relationship between nature and cultural features, and how adaptation or change emerged out of the relationship over time. Second, he emphasized empirical cases by which similarities could be found across cultures so that theories of process could be built. Third, he recognized that human perception of the environment played a role in the environment / society relationship and adaptation.

Ecological anthropology and the rise of systems approaches

Geertz in his book, *Agricultural Involution* (1963), provided a new challenge to the model of cultural ecology. He suggested that an ecological approach should utilize an ecosystem model, whereby humans were one component of an ecological system. As

Geertz put it, "the ecological approach attempts to achieve a more exact specification of the relations between selected human activities, biological transactions, and physical processes by including them within a single analytical system, an ecosystem" (Geertz, 1963: 3). This mode of analysis trains attention on the pervasive properties of systems *qua* systems (system structure, system equilibrium, system change) rather than on the point-to-point relationships between paired variables of the "culture" and "nature" variety (Geertz, 1963). One significant aspect of Geertz's (1963) approach is that he suggested a unified systems model that would include both biological and social entities and processes, an idea which would not be fully explored again until the 1990's. His main criticisms of Steward's (1955) cultural ecology model were that it still perpetuated the nature/culture dichotomy, and reduced the number of variables that might be considered in understanding cultural change to those arising from the adaptive relationship between environment and society.

Geertz showed in *Agricultural Involution* that changes in Indonesian society were not attributable to ecological processes; rather, they stemmed from political, commercial, and intellectual developments. The features of society do not change only as a result of changes in the cultural core, as those features adapt to the environment, but may also change for reasons that are unrelated to subsistence technology. Geertz's (1963) ecosystem approach attempted to put humans into a unified system, while insisting that the system account for social and political structures, functions and processes along with the biological.

The application of the systems approach and use of ecological concepts moved the field into what was termed the "new ecological anthropology" (Moran, 1979; 1990; Vayda and McCay, 1975). While Geertz (1963) recognized that social, political and biological variables should be included in a systems approach, it proved difficult to operationalize such an ecosystem approach. Rather, ecological anthropology turned toward the study of human adaptation by utilizing the principles of biological ecology (Vayda and Rappaport, 1968).

A number of different approaches were utilized to study human adaptation within an ecosystem framework. One of these is the use of energy flows and the use of cybernetics, or information flows, in the study of rituals (Rappaport, 1967). The systems approach was not without its critics. Some of the most glaring problems included the teleological fallacy which overemphasized organizational versus individual goal-seeking behaviour (Alland and McCay, 1973); an overemphasis on the role of energy (Moran, 1979;1990); the assumption of equilibrium and functional behaviour at the expense of historic change (Vayda and McCay, 1975); lack of consideration of the role of the individual (Borofsky, 1994; Keesing, 1976); and lack of attention to boundary and scale (Moran, 1979;1990).

Many of these criticisms emerged out of the renewed emphasis on the primacy of the individual in the theory of biological evolution (Alland and McCay, 1973; Richerson, 1977). However, the challenge for both the systems and the evolutionary approaches has been to account for Geertz's (1963) early observation that changes in societies cannot solely be explained either by the adaptation of socio-cultural systems or of individuals. The environment/society dichotomy, and the location of causality for adaptation within this dichotomy, has remained a continuing tension within ecological anthropology.

Another perspective on adaptation and change comes from a consideration of landscape and history. History as a social process has implications for system interactions because history helps explain why landscapes look the way they do. Ecologists' attention to history challenged the notions of climax and equilibrium by revealing cycles and multiple equilibria (Holling et al., 1995). Likewise, historians' attention to ecology revealed landscapes altered by human action (e.g. Cronon, 1983), leading to the questioning of notions of "wilderness" and pristine environments (Balee, 1998). Hence, not only are resources socially and politically constructed (Harvey, 1974), many landscapes of the world are also socially and politically constructed. The political ecology perspective has taken up the challenge; it "expands ecological concepts to respond to this inclusion of cultural and political activity within an analysis of ecosystems that are significantly, but not always entirely, socially constructed" (Greenberg and Park, 1994:1).

Social-ecological systems and adaptive learning

These new developments and the interaction of ecological anthropology, historical ecology (environmental history) and political ecology have brought new perspectives to the analysis of the old environment/society dichotomy. The main area of interest has been to explore different paradigms of environment and society in order to build a model which allows humans to understand themselves as an integral part of the environment (Descola and Pálsson, 1996; Escobar, 1999; Ingold, 2000). Model is used to refer to "any representation (art, writing, music or mathematics, for example) that allows people to manipulate or understand abstractions" (Walker et. al. 2002). A social-ecological model is an important first step, as models are the means by which humans translate perceptions into information, knowledge and institutions. Such models will exhibit similarities to many of those constructed by non-Western societies (Alcorn 2003).

The model which is utilized to examine social-ecological resilience is drawn from Berkes, Colding and Folke (2003). The model that they developed to analyze the dynamics of social-ecological resilience is reproduced in **Figure II-1**. This model proposes that knowledge emerges from a context made up of social and ecological systems. Adaptive learning is situated in a social and ecological context which leads to changes in ecological knowledge and understanding, which then leads to changes in management practices and local ecosystems. This can be thought of as an iterative process made up of dynamic ecological, social and knowledge systems. The schematic utilized by Berkes, Colding and Folke (2003) to illustrate this idea of resilience as an adaptive process is shown in **Figure II-2**. The next section of this chapter examines the dynamics of socially and ecologically situated knowledge in more detail. The final section examines the relationship between social-ecological resilience, scale and change. The interest in this section is limited to the articulation of the social with the ecological system.

One of the main problems for scientists who have tried to understand the articulation of social and ecological systems has been the complexity of bringing the two systems together (Ingold 2000). This has led to an active and expanding arena of research (International Council for Science 2002; Kates et. al. 2001; Walker et. al. 2002). Berkes, Colding and Folke (2003) suggest that one way to reduce the complexity is to focus the model. In this case, the appropriate focus is processes related to natural resources and environmental management. They propose that the focus of social systems be limited to processes of governance with an emphasis on property rights and access to resources. They also include "...different systems of knowledge pertinent to the dynamics of environment and resource use, and world views and ethics concerning human-nature relationships" (Berkes, Colding and Folke 2003:3). They consider ecological systems as the "...self-regulating communities of organisms interacting with one another and with their environment" (Berkes, Colding and Folke 2003:3). The integrated concept of humans-in-environment, as discussed above, is referred to as a social-ecological system or as social-ecological linkages. This provides the basic model of how social and ecological systems might be brought together in an analysis of adaptive learning and social-ecological resilience.

An important consideration for analyzing the dynamics of adaptive learning and social-ecological resilience is to match the scale of systems. The system model presented in **Figure II-1** includes a consideration of scale. Ecological systems are typically bound by considerations of spatial scale. Once bound by scale, they can then be considered as specific ecosystems, such as the ecosystem of the Shoal Lake watershed. This might then be included in a drainage system, such as the Winnipeg River drainage. Ecosystems can be easily thought of as a spatially nested set. Social systems are not so easily bound by spatial scale. Both ecological and social systems are difficult to bound temporally. In this holistic model, the social system is bound by a focus on the resource users of a defined ecosystem. The scale of interest is limited to the network of relationships of particular resource users within a local ecosystem at a particular time. The goal, however, is to consider the larger scale spatial and temporal context and the interlinkages with place and time specific resource users.

The harvesting practices of blueberry harvesters, for instance, are nested within their particular systems; however, these socio-cultural systems are at the same time linked to institutions which correpsond to larger scale ecosystems. A blueberry harvester may undertake specific management practices in the harvest of blueberries in a local ecosystem. However, her ability to harvest blueberries may be determined by the forest regeneration methods determined by the forest management policies of a province which pertain to a regional scale. On a local scale, the articulation of the ecological system (ecosystem) with the social system (management practices) is the ecological knowledge and understanding of resource users. While the model is spatially bound, it does include the recognition that local phenomena are influenced by larger scale processes. However, the focus of the model is the network of relationships which emerge from the local articulation of ecological and social systems and the cross-scale linkages amongst scale at a particular place in time.

The model situates knowledge in an ecological and social context. However, it does maintain a boundary between the ecological (relations amongst constituents other than human) and the social (relations amongst humans) system. Some authors have attempted to move to a more unified ecological model where the ecological would include the relations amongst beings (humans and other-than humans) within one system (Ingold 2000; Latour 1993). This, along with temporal constraints, might be considered to be one limitation of the model. However, it does provide a first step at situating resource users' knowledge in a linked system and an approach to analyze how adaptive learning occurs in that context. The next section turns to a focus on how resource users' ecological knowledge and understanding becomes adaptive in a social-ecological learning environment.

The dynamics of traditional ecological knowledge

The study of traditional ecological knowledge emerged from two main streams of theory (Berkes 1999). One of these was delineated above and is often described as ecological anthropology (Scoones 1999). The other main body of theory has been that developed within the area of ethnoscience, especially ethnobotany (Berlin 1992) and ethnoecology (Conklin 1954; Nazarea 1999). The literature has utilized a number of different approaches to characterize knowledge that is place-specific and experiential. Local ecological knowledge has been used as a term to refer to knowledge that is generated through observations of the local environment in any society, and may be a mix of practical and scientific knowledge (Olsson and Folke 2001). Indigenous knowledge is restricted to the local knowledge held by indigenous peoples, or local knowledge unique to a given culture and society (Warren, Slikkerveer and Brokensha 1995). A dynamic approach to place-specific and experiential knowledge has been provided by Berkes (1999:8) in his definition of traditional ecological knowledge as "a cumulative body of knowledge and beliefs, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and their environment." The advantage of Berkes' (1999) definition is it begins to move the discussion of knowledge away from a static cognitive approach to a more dynamic ecological position.

This section reviews theory that provides an approach for considering knowledge as a process of adaptive learning within dynamic social-ecological systems. The first step that is required is a movement away from a spatially and temporally bound understanding of culture to one that looks at cultural transformation as a fluid and dynamic process. A dynamic view of cultural processes moves our ideas about knowledge toward a process of knowing. Transmission of knowledge becomes the development of agency within the structured context of social-ecological systems. Likewise, change focuses on mechanisms of framed creativity rather than the concern with the transmission mechanism responsible for the effective replication of memories. When knowledge is situated in a dynamic social-ecological system, we are concerned about processes of adaptive learning, remembering and the spatial and temporal dynamics of the land. Adaptive learning of resource users is situated in a framed context structured by a system made up of local ecosystems and management practices.

One attempt to define culture conclusively was undertaken by Kroeber and Kluckhohn's in their 1963 review of the literature. They found that, within the anthropological literature alone, culture was defined in 150 distinct ways. Through an examination of commonalities they defined culture as "...patterns, explicit and implicit, of and for behavior acquired and transmitted by symbols, constituting the distinctive achievement of human groups, including their embodiments in artifacts; the essential core of culture consists of traditional...ideas and especially their attached values; culture systems may, on the one hand, be considered as products of action, on the other as conditioning elements of further action" (Quoted in Borofsky 1994:3). However, this definition is rarely utilized except to emphasize how difficult it is to define culture. Recent definitions have tended to be much less specific and broader in intent, such as the definition by Keesing which defines culture as "...the system of knowledge more or less shared by members of a society..." (Borofsky 1994:3). More recently, anthropologists and other cultural theorists have stopped even trying to define culture and many have abandoned the concept altogether. This recent development has occurred due to a number of reasons.

The holistic emphasis on the concept of culture has been used to suggest that culture is a thing which can be defined by its social structure and/or symbol system and which determines the behaviour of an individual. This conception of culture was most notably developed by Talcott Parson(Worsley 1997), who distinguished between: the social system; the social organization of society or structure; the personality system of the individual actor; and, the cultural system that guided the way people behaved. Following Durkheim, Parson considered that the existence of a social structure or symbolic system could only be considered a social fact if a function for the structure or symbol could be explained. One of the functions, which both Durkheim and Parson postulated for social structures and symbol systems, was the control of human behaviour. This has been dubbed the 'cultural dope' model, as humans do not behave out of their own volition, but as a result of the social structures and symbol systems of which they are a part. This, of course, has led to an opposing model of culture that has been termed the 'cultural genius' model. In this model of culture, human agency (i.e. the ability to affect the structures and symbols of which an individual is a part) is placed as central to the analysis of human behaviour. The result was that the concept of culture became polarized as either the thing which integrated humans into groups, or culture as the outcome of the interactions of humans to undertake collective behaviour. Kroeber and Kluckhohn tried to resolve this debate in the early 1960's when they included in their definition of culture the idea that culture systems should be considered as both the "products of action" and the "conditioning elements for further action" (Borofsky 1994:3). The positive outcome of this debate was the notion that culture was more complex than structures, symbols and functions that guided human behaviour. Culture needed to include a consideration of human practice and be conceived as something which includes ideas, values and forms of behaviour known as "the cognitive", the "normative" and the "conative." Put simply, culture included thinking, judging and acting (Worsley 1997:344).

The concept of culture moved away from social structures, functions and symbol systems to a consideration of ideas, values and customs (i.e. approved forms of behaviour). However, this led to a conception of culture that emphasized culture as heritage, that which is acquired, learned and transmitted. Culture became tradition, a set of ideas, values and customs, which could be passed on as a set from person to person and between generations (Worsley 1997). The communication of culture became the passing on of tradition. Culture was often treated as if it was undifferentiated across a group of people and between generations. Empirical fieldwork, however, continued to find that this ideal of continuity and community was challenged by research that found change and social divisions. The concept of culture not only had to integrate the idea that values, ideas, beliefs and customs emerged out of the relationship between social structures and cultural symbols, but also that it was differentially textured across both space and time.

Culture as an abstract entity, which could describe the essential core of values, ideas, beliefs, customs and social structures of a group of people for the purposes of comparison, was increasingly being undermined (Vayda 1994). The new perspective began to question the idea that culture could be a 'totality' with clear boundaries and an essential core that integrated people into primordial groupings that existed in a given location over time. However, it was difficult to jettison "culture" as it allowed both for the identification of groups with adhering characteristics and the comparison between groups. Classification and comparison depended upon the notion of bounded groups that were stable and persisted over time. The idea that culture was not a stable concept with clear boundaries and essential cores shook not only the discipline of anthropology, but also the other disciplines that utilized culture within their own theoretical frameworks.

The notion of culture was critiqued from a number of different angles; however, they all suggested that the concept of culture was being understood as a real 'thing', instead of an abstract concept. Culture did not contain an essential core, which could be identified and described, neither was it a symbolic, nor material thing. The strong critique went so far as to suggest that culture was simply created as an entity embodying underlying social relations—hence obscuring them—and should be deconstructed to reveal how the term was employed and by whom. The softer critique focused on the fact that culture was neither able to capture the relationships between ideas, values, beliefs and individuals, nor the interaction of the symbolic with the material. Culture was too static and rigid a concept when what was needed was a flexible and dynamic concept which could capture the idea that culture was a process, and not a thing, while realizing that there are social structures and symbol systems which do appear for a time as stable. This search for a concept of culture, which would reflect process, flows, scale, holism and uncertainty instead of stability, bound units and mechanistic dynamics, was not occurring in isolation. The concept of culture was being influenced by other philosophical theories of complexity and chaos. As Appadurai (1997:20) has noted:

> "Recent work in anthropology has done much to free us of the shackles of highly localized, boundary-oriented, holistic, primordialist images of cultural form and substance....But not very much has been put in their place, except somewhat larger if less mechanical versions of these images...What I would like to propose is that we begin to think of the configuration of cultural forms in today's world as fundamentally fractal, that is, as possessing no Euclidean boundaries, structures or regularities...I would suggest that these cultural forms, which we should strive to represent as fully fractal, are also overlapping, in ways that have been discussed only in pure mathematics (in set theory for example) and in biology (in the language of polythetic classifications). Thus we need to combine a fractal metaphor for the shape of cultures (in the plural) with a polythetic account of their overlaps and resemblances. Without this latter step, we shall remain enmired in comparative work which relies on the clear separation of the entities to be compared, before serious comparison can begin....in order for the theory of global cultural interactions predicated on disjunctive flows to have any force greater than that of a mechanical metaphor, it will have to move into something like a human version of the theory that some scientists are calling 'chaos theory.' That is, we will need to ask how these complex, overlapping fractal shapes constitute not a simple, stable (even if large-scale) system, but to ask what its dynamics are...the great traditional questions of causality, contingency and prediction in the human sciences...it is perhaps important to start asking them in a way that relies on images of flow and uncertainty, hence 'chaos,' rather than on older images of order, stability and systemacity."

This movement within anthropology has precipitated a return to what has been termed a relational or processual theory of society. The approach emphasizes a material, historical and relational approach to understand the relationships among humans and between humans and other organisms and the physical environment (Escobar 1999; Harvey 1996; Ingold 1993). The material aspect is included in recognition that, while there are both ideational and material elements of cultural processes, it is in the material outcomes those effects of cultural processes can be known. A historical perspective is utilized to move away from synchronic descriptions of cultural forms towards a diachronic understanding that captures how cultural forms transform, persist and emerge over time. The relational basis of the theory recognizes that there are different cultural moments or domains (i.e. discourse/language, power, social relations, material practices, beliefs/values/desires, institutions/rituals) that exist in relation to each other. A relational theory of how humans relate with each other and with other organisms allows us to account for the structures and symbol sets that exist, while understanding that these emerge out of the human engagement of each other and other organisms.

Knowledge is a concept that is tightly linked to the concept of culture. For instance, we often describe knowledge as part of a particular cultural group such as Quechua knowledge or a sub-group, like fisherfolk, knowledge. In fact, as noted in Keesing's definition of culture as "...the system of knowledge more or less shared by the members of a society...", they can be considered to be one and the same thing. In fact, most definitions of knowledge are similar to definitions of culture, and include levels of knowledge from the empirical or practical knowledge, through paradigmatic knowledge (i.e. the ability to contextualize relationships among things) to knowledge encoded in beliefs, institutions and/or ethics (Berkes 1999). Such a concept of knowledge, however, also needs to account for: the relationship between agency, structure and cultural symbol systems; the permeable boundaries of knowledge; the transformation of knowledge; and, the transmission of knowledge. The shift in theoretical perspectives on the concept of culture has also begun to influence theories of knowledge.

Relational theories of knowledge have begun to understand knowledge as a flexible and fluid process, as opposed to a static set of structures and symbols, which guide how humans interact with each other and other organisms, and which, is transmitted as a set across generations (Borofsky 1987; 1994). Knowledge, like culture, has begun to be understood as a process of knowing: the practical engagement of humans with each other and other organisms. Ingold (1993) considers that the moments of knowing should be thought of as song, craftsmanship and imagination as opposed to the moments of language, technology and intelligence. This is in keeping with the emphasis that knowing is the practice of engaging the world as opposed to a set of knowledge about the world. Ingold (1993) suggests that the shift from knowledge to knowing can be thought of as the difference between "understanding in practice" with "the culture of acquisition":

> "The latter phrase denotes the theory of learning long favoured by cognitive science (and by Western educational institutions), according to which effective action in the world depends on the practitioner's first having acquired a body of knowledge in the form of rules and schemata for constructing it. Learning, the process of acquisition, is thus separated from doing, the application of acquired knowledge. It is implied, moreover, that a body of context-free, propositional knowledge (i.e. a technology or, more generally, a culture) actually *exists* as such and is available for transmission by teaching outside the

> context of use. Learning, in this view, entails an internalization of collective representations or, in a word, enculturation. 'Understanding in practice,' by contrast, is a process of *enskillment*, in which learning is inseparable from doing, and in which both are embedded in the context of a practical engagement in the world, that is, in dwelling. According to this theory of learning, the kind of know-how thus gained, constituted in the settings of practice, based on rich expectations generated over time about its shape, is the site of the most powerful knowledgeability of people in the lived-in world" (Ingold 1993:463).

Knowing as the human engagement with each other and other organisms suggests that people will draw upon such cultural moments as language, institutions, worldview, classification and livelihood practices to build a perception of their environment. Perception will be structured by institutions of knowledge in a given space-time location. Knowing expresses the relationship between structuring processes of knowledge institutions and the practices that emerge from human agency. While this approach allows for framed creativity, it does not explain how institutions can be transformed within a social-ecological system.

An effort to develop a relational theory of human knowing of the natural world is developed in the book *Sacred Ecology* (Berkes 1999). Berkes considers that traditional ecological knowledge is a knowledge-practice-belief complex that consists of four interrelated levels: local knowledge of animals and plants; land and resource management systems; social institutions; and, worldview. As Berkes (1999) describes this complex:

> "First, there is the local knowledge of animals, plants, soils, landscape. This level includes knowledge of species identifications and taxonomy, life histories, distributions, and behavior. Based on empirical observations, all such knowledge has obvious survival value. But local knowledge may not be sufficient by itself to ensure the sustainable use of resources. At the second level of analysis, there is a resource management system, one that uses local environmental knowledge *and also includes* an appropriate set of practices, tools, and techniques. These ecological practices require an understanding of ecological processes, such as functional relationships among key species and an understanding of forest succession....Third, a traditional system of management requires appropriate social institutions, set of rules-in-use, and codes of social relationships....Finally, a fourth level of analysis is the *worldview*, which shapes environmental perception and gives meaning to observations of the environment....The fourth level includes religion, ethics, and more generally, belief systems, and rounds out the knowledge-practice-belief complex that describes traditional knowledge" (Berkes 1999:13-14).

This definition of traditional ecological knowledge is important as it moves towards understanding knowledge/culture as a set of interrelated cultural moments of taxonomy, encyclopedic knowledge, ecological knowledge, practice, institutions and beliefs (i.e. religion or other symbolic systems). Berkes (1999) represents this complex as a taxonomy of more abstract levels of knowledge, embedding less abstract types of knowledge. This description of traditional knowledge begins to move away from seeing knowledge/culture as a 'body' of knowledge, which is passed on to others as a complete set, to one in which knowledge/culture is a process of knowing or practice. Berkes (1999) also begins to move towards a relational understanding of knowledge/culture through his description of traditional ecological knowledge as a process which:

> "...shows the four levels of analysis as concentric ellipses, with the management system including local knowledge, the institutional level enveloping the management system, and all three levels embedded within a worldview or belief system. However, it must be emphasized that the four levels are not always distinct. In particular, the management system and the social institution that governs it are often so closely coupled that the distinction between them may seem artificial...One might argue that the management system and the institution are one and the same. It must also be pointed out that there are feedbacks among the levels, and the linkages are in dynamic relationships. Local knowledge may grow; both management systems and institutions may adapt, change, and fall apart and may be renewed. Worldviews shape observations and social institutions but may themselves be affected by changes occurring at the other levels, such as the collapse of the management system..." (Berkes 1999:14).

Berkes (1999) recognizes that the different cultural moments do not structure lower levels in a one-way direction, but are mutually influenced, or internalized by each other. Knowing can lead to stable knowledge in a given space-time location, but at the same time cultural processes such as knowing, enskilling, enacting, speaking, and performing continue. A focus on flows, processes and structures would focus on how knowledge becomes stable and how knowledge is transformed. How does the process of framed creativity allow knowledge to change within a social-ecological context structured by institutions of knowledge? How are perceptions, practices, technologies and other institutions transformed as the social-ecological context changes?

Memory and framed creativity

Knowledge consists, in a cognitive model, of the rules and representation held by individuals and which allow the individual to undertake culturally appropriate behaviour

(Ingold 2000). Knowledge, in this view, is the mental content that can be passed on from generation to generation as the heritage of a culture-bearing population. This leads to the basic assumption of cognitive psychology and anthropology; knowledge is memory, and human beings are devices for processing it (Ingold 2000). Memory is structured as plans, programmes, schemata, rules, recipes, instructions and representations that are processed through the brain to guide an individual's behaviour. In order for a memory to be transmitted from one mind to another, the memory must become public, so that it can move out of the originator's mind, and then be perceived by and inscribed into the receiver's mind.

An alternative view, consistent with a relational theory of knowledge, suggests that memories are not acquired. Rather, they are generated within contexts of development. It is the context of development that provides the structure for framed creativity. A person learns in a context structured by an ecosystem, language, livelihood practices, institutions and worldview. However, a person develops her own agency, through practice, within that structure. This is why traditional ecological knowledge is dynamic. Ecosystems change due to ecological processes, just as social systems change due to social processes. The social-ecological context of memory development is always different from when a person learns a memory, compared to when they transmit the memory to another person. This is true temporally, when an adult transmits a memory to a younger person, or when a memory is transmitted from a person situated in one place to a person in another. As the social-ecological context changes, the dissonance between the memory and the context increases. This, then, leads to the necessity of abandoning, or changing, the memory. Creativity is framed within this context of institutions of knowledge. Three aspects of memory and framed creativity are adaptive learning, remembering, and the spatial and temporal perception of the land.

Adaptive learning

A theory of learning, or the transmission of knowledge, usually starts from the premise of enculturation. Enculturation is the process by which memories, or cognitive representations, are transmitted from one mind to another. Adaptive learning is more akin to the process that Ingold (1996:40), drawing upon Gibson (1979), terms an "education of attention" (Ingold 2000:167). An education of attention is the process by which a skilled person creates a context within which a novice might build her own skill. Ingold (2000) provides the following summary of this concept:

> "For the novice's observation of accomplished practitioners is not detached from, but grounded in, his own active, perceptual engagement with his surroundings. And the key to imitation lies in the intimate coordination of the movement of the novice's attention to others with his own bodily movement in the world. Through repeated practice trials, and guided by his observations, he gradually gets the 'feel' of things for himself—that is, he learns to fine-tune his own movements so as to achieve the rhythmic fluency of the accomplished practitioner ... And in this process, each generation contributes to the next, not by handing on a corpus of representations, or information in the strict sense, but rather by introducing novices into context which afford selected opportunities for perception and action, and by providing the scaffolding that enables them to make use of these affordances" (Ingold 2000:353-354).

The 'wisdom of elders' is not transmitted as representations, but rather, through the structuring of situations in which the novice can build his own powers of perception of the environment. The novice is taught to be attentive through looking, hearing or feeling during the practice of an activity. A person builds wisdom, or what is often called "power", as she is able to distinguish or recognize critical features of the environment; features that the perceptual system of the novice has simply not become sensitive enough to notice and make necessary adjustments. Elders pass on their wisdom by setting up teaching moments that create a learning environment for the novice. As far as the subject of teaching is land-based, the context of learning includes ecological structures and processes. However, the social is never absent as a story, ceremony or place-names may situate the practice in a context of worldview and institutions. Adaptive learning takes place as a person develops his own skill, under the guidance of a mentor, in dynamic social-ecological contexts. Even the most experienced elder considers that more powerful spirits guide their perception and skill development. Since the social-ecological context is dynamic, memories adapt and change as each generation turns memories into skills. Adaptive learning never ends, as it is the guided process by which the perception of the world is built. The creative process, or innovation, is framed by the memories of the leader, as well as the learning environment. However, through the very practice of livelihood, the social-ecological context is not only shifting through ecological cycles, but by the actions of the learners themselves. Rather than memories being passed from mind to mind, adaptive learning is the process of remembering as you move through life.

Memory and remembering

Memory, in the cognitive model, is often held to be "...a corpus of traditional wisdom, handed down as a legacy from the past, and which is applied or expressed, rather than actually generated, in the contexts of present activity" (Ingold 2000:138-137). It is assumed that memories are stored as representations in the brain and that the process of remembering is the process of retrieving such memories. As representations, memories are brought preformed into a current context and are shared by people on the basis of a common cultural heritage. However, in a theory of adaptive learning, memories cannot pre-exist the act of remembering. This is to invert the order of priority. Memories do not dictate a certain way of life on the land; rather, living a way of life is a process of remembering which generates memories. A novice, learning a way of life, encounters and is shown things in the environment that generate that person's memories. The process of enskillment and the building of a novice's knowledge is a process of remembering and of building memories and practical skills.

Remembering occurs as a novice moves along the paths of his ancestors and is shown important places, artifacts or words by a skilled person. Tied to these places, artifacts or words are stories that are revealed to the novice by the skilled person. These acts of remembering help the novice build the memories that will guide his way of life. As the novice becomes more attuned to the environment, these stories will reveal new teachings and memories, so that memory may change over time and between people with different skill levels of perception. If these memories become frozen in time and cut adrift from the way of life and livelihood, then they become representations or memories that are no longer generated within the way of life. The change of memories within a way of life is to be expected; however, an overemphasis on a cognitive approach, which attempts to "traditionalize the traditional", cuts off the process of remembering from a way of life (Ingold 2000:148 quoting Bjorn Bjerkli 1996:18).

Memories and remembering are not so much focused on creating replicas of past performance, but on keeping a way of life going. As Ingold (2000:147) notes: "...Indeed 'keeping it going' may involve a good measure of creative improvisation. A skill remembered is one that is flexibly responsive to ever-variable environmental conditions...Just because people are doing things differently now, compared with the way they did them at some time in the past, does not mean that there has been a rupture of tradition or a failure of memory." As noted by Ingold (2000), creativity, or change, may be required if the social-ecological environment undergoes change. Some change will simply reflect on-going cycles of ecological and social life. Elders help novices build a temporal perception of cyclic events through ceremonies, rituals, stories and practices. This allows a novice to distinguish cyclic events based on seasonal and life stage changes from novel events that have not been experienced by a society. The social-ecological learning environment itself may reflect these cycles so that a novice builds their awareness of seasonal and life stage change in a dynamic context. Novel changes in the environment will create contexts where elders teach novices how to respond to events that have not been previously experienced. Remembering situates memories in both space and time, which are themselves structured by ecological and social processes.

Spatial and temporal perceptions of the land

The idea of 'the land' is integral to the concept of adaptive learning and remembering for people who make a living from ecosystem-based livelihoods. The land, as utilized in this sense, refers to more than a spatial concept of dirt. It is rather a gloss for the idea that life is immanent in the relations between persons and things (Ingold 1998). The land, in this perspective, is enchanted, animated by the vitality found in the relationships among persons and things, expressed by the Anishinaabe in such terms as *Aaki Anokiwin*, working the land, which suggests the idea of a relationship between two animate entities. As explained to me by Robin Greene, the idea of keeping it living, or in Ojibway, *Miinoo Naagatchitoonwin N'daakinan* (caring for the land), thus refers to maintaining the continuity of these relationships, a livelihood, as this embodies the life force of the land. There is, then, a temporal character to the concept of the land. As Ingold (2000:150, original emphasis) puts it: "Woven like a tapestry from the lives of its inhabitants, the land is not so much a stage for the enactment of history, or a surface on which it is inscribed, as *history congealed.* And just as kinship is geography, so the lives of persons and the histories of their relationships can be traced in the textures of the land." One way in which we can arrive at the concept of the land is by adding temporality to the concept of the landscape.

The idea of landscape has been utilized in a number of different manners. In the Cartesian perspective, landscape is often thought of as the cultural construct created by a human out of the raw material of nature. It is the representation created by humans in order to apprehend nature. The landscape has also been thought of as a representation of space to which human meaning is attached. Boundaries and places of significance are laid over the landscape as humans construct cultural maps. The problem with both of these approaches to landscape is that they presuppose a separation of persons from the environment in which human acts cloak the world. Adaptive learning and remembering require that we think of the landscape as "...the world as it is known to those who dwell therein, who inhabit its places and journey along the paths connecting them." (Ingold 1993:156)

What then is the difference between environment and landscape? Environment can be thought of as the affordances provided by the world as determined by the capabilities and projects of a human or non-human organism. In other words, the environment focuses on the function of the world in relation to a specific organism. The landscape, on the other hand, places more emphasis on form, instead of function. Landscapes can be thought of as the embodiment of a series of interlocking cycles that build themselves into the forms of the landscape (Ingold 1993). Landscapes do not exist as a pre-determined design in the mind of a person, but are generated out of the set of relationships among those persons and things that inhabit the landscape. It is in this way that, at a given point of time, the landscape congeals history, or reflects the history of social life itself at a particular time and space. However, to move from landscape to a concept of land, it is necessary to add this temporal dimension to the concept of landscape.

Ingold (1993) utilizes the idea of a "taskscape" to incorporate temporality into the concept of landscape. A task can be defined as "...any practical operation, carried out by a skilled agent in an environment, as part of his or her normal business of life...tasks are the constitutive acts of dwelling" (Ingold 1993:158). Tasks do not exist in a vacuum but are suspended in the current of social life. They are given meaning by their "...position within an ensemble of tasks, performed in series or parallel, and usually by many people" (Ingold 1993:158). The taskscape is the set of related activities made up by the mutually interlocking ensemble of tasks. Just as our view of the landscape emerges from our position within it, so our view of the taskscape is created, "...not as spectators but as participants, in the very performance of our tasks" (Ingold 1993:159). The temporality of the taskscape emerges not through the chronological occurrence of rites, feasts and ceremonies, but as the ongoing activity of relating to other persons in the social environment. The taskscape emerges as a network of ongoing cycles, each with its own rhythm.

The forms of the landscape arise from the activities of the taskscape so that the landscape becomes the social-ecological cycles in embodied form. Since the temporality of the taskscape is ongoing, so too, then, is the form of the landscape constantly in a state of being built. If we assume that the cycles of activity do not just emanate from the taskscape, but also exist within the landscape itself, then we find that it is not just the cycles of the taskscape to which people are attentive, but also to the cycles of the landscape. The concept of the land incorporates this idea that there are cycles of humans, other living beings and physical things, which grow and develop, although at vastly different scales and rates. The land, then, is a "...total movement of becoming which builds itself into the forms we see, and in which each form takes shape in continuous relation to those around it, ...the world itself takes on the character of an organism [and] dwelling in the world, we do not act *upon* it, or do things *to* it; rather we move along *with* it. Our actions do not transform the world; they are part and parcel of the world's transforming itself. And that is just another way of saying that they belong to time" (Ingold 1993:164). When we look at a picture of a landscape, what we are seeing is the resonance that has emerged from the multiple rhythms of the cycles of practical activities of humans, other animals and the life processes of the world itself. The land emerges as a spatially and temporally dynamic social-ecological system and the social-ecological learning environment of adaptive learning.

SOCIAL-ECOLOGICAL RESILIENCE

This chapter, up to this point, has reviewed the literature that provides the background for a conceptual model of adaptive learning. Adaptive learning, it has been found, emerges from the dynamics of a learner's environment and the structuring of a learning environment by knowledgeable individuals. The literature on social-ecological systems suggests that people do not learn about linked systems, but learn from within integrated environments. The chapter now turns to a review of the resilience literature to examine how adaptive learning can be integrated into that heuristic model.

Social-ecological resilience

The concept of ecological resilience developed by C.S. Holling (1973) forms the basis from which a broader idea of social-ecological resilience has been developed. The significance of Holling's approach to resilience was that he moved the concept from a stability-based paradigm to one of change. The former he called "engineering" resilience, while reserving the term ecological resilience for the dynamic model he was exploring (1973; 1986). Holling (1973; 1986) suggests that engineering resilience assumes that ecological systems exist close to a stable, steady state. Resilience, in this paradigm, is the ability of the system to return to a steady state following a disturbance. It is measured as the time it takes for the system to return to the steady state. Ecological resilience, as defined by Holling (1986:3), "...emphasizes conditions far from any stable steady-state, where instabilities can flip a system into another regime of behavior - i.e. to another stability domain. In this case resilience is measured by the magnitude of disturbance that can be absorbed before the system redefines its structure by changing the variables and processes that control behavior."

Engineering resilience focuses attention on questions such as: definitions of stable systems—composition and structure of a climax forest; their ability to resist disturbance—can a climax forest withstand a ground fire without losing essential components; and, recovery from a disturbance—length of time for a climax forest to re-establish after a crown fire. Ecological resilience changes the focus. As scholars have developed the concept of ecological resilience in recent years, it has focused more on the processes by which ecological systems change over time (Holling et al. 1995). This has led the Resilience Alliance (2001) to propose that ecological resilience has three defining characteristics: (1) the amount of change the system can undergo and still retain the same controls on function and structure, or still be in the same state, within the same domain of attraction; (2) the degree to which the system is capable of self-organization; and, (3) the ability to build and increase the capacity for learning and adaptation.

While the concept of ecological resilience has emerged from the ecological literature, it is also an idea that has been utilized in the social sciences (Davidson-Hunt and Berkes 2003). Berkes and Folke (1998) and Berkes, Folke and Colding (2003) develop the idea of social-ecological resilience. As noted earlier in this chapter, there is an extensive basis of literature to suggest that social and ecological systems are integrated. Berkes, Folke and Colding (2003) provide a model of social-ecological systems that attempts to move beyond the Cartesian separation of environment from society. This chapter also reviewed a large literature on the dynamics and institutions of knowledge that situates adaptive learning into structured learning environments. The ability to learn and adapt within a holistic context is one of the defining characteristics of resilience as noted above. A heuristic model, which has been utilized to understand the dynamics of linked systems, includes a focus on adaptive-renewal cycles, panarchy and memory (Berkes, Folke and Colding 2003).

Adaptive-renewal cycles

The adaptive-renewal cycle provides a visualization of the process of change. In **Figure II-3**, it can be seen that a system is proposed to go through four stages: exploitation, conservation, release and reorganization. While a system is dynamic, it does not mean that the rate of change is constant. The rate of change during the conservation stage decreases and may give the appearance of stability for a time. However, this is the period during which the dynamics of the system itself increase the rigidity of the system over time. This, in turn, can increase the likelihood of a disturbance event that would result in system changes. Eventually, a disturbance event will occur which moves the system from conservation into the "back loop", as shown in **Figure II-4**. The "back loop" of the cycle is the period of renewal, creativity and change. The release stage is a period when stored "capital" is released and becomes available for new purposes. During reorganization, this available capital is organized into new formations. These two periods are when rapid rates of change are experienced. After reorganization, the system goes through a period of growth whereby the rate of change diminishes and stability again becomes the dominant system characteristic.

The adaptive-renewal cycle provides a model consistent with other theories of change. Harvey (1996), for instance, also suggests that change generates out of the relationships and processes of societies and environments. The adaptive-renewal model suggests that social-ecological learning environments will change at differential rates. Remembering, during the conservation period, would result in memories that do not change quickly. Remembering, however, during periods of release and reorganization will result in more significant change in the learning environment and memories. Creativity emerges, not from a vacuum, but as learners build their own memories in learning environments, structured by leaders, but which may be novel, due to the dynamic nature of systems over time. Creativity is used to refer to the creative ability of humans to produce something original through intelligence and skill (Avis et al. 1983). It is similar to the concept of novelty, which is described by Berkes, Colding and Folke (2003) as the ability to innovate. The adaptive-renewal cycle describes the dynamics of holistic systems that provide an opportunity for creativity. However, it does not explain how individual creativity can lead to changes in collective features of complex systems such as institutions and worldviews.

Social-ecological resilience and panarchy

A complex systems theory, such as social-ecological resilience, also has to take into account scale. Scale has often been conceptualized as a hierarchical phenomenon in ecological and cultural systems theories. Structures, functions and processes of landscapes constrain tree stands, which constrain individual trees. Structures, functions and processes of societies constrain communities, which constrain individuals. At each scale, different systems and their associated adaptive-renewal cycles can be conceptualized. Moving up the scale would lead to adaptive-renewal cycles with slower rates of periodicity and larger spatial influence. Adaptive-renewal cycles not only have their own internal processes, which influence system behaviour, but are also affected by other adaptive-renewal cycles at different scales.

Structuring processes of adaptive-renewal cycles create stable forms during the growth and conservation periods. However, scale itself is a structuring process. Larger scale adaptive-renewal cycles constrain and limit the change that emerges when a smaller scale cycle is undergoing a period of release and reorganization. However, the linkages between scales also make them vulnerable to events at smaller and larger scales. An event at one scale can lead to change at both smaller and larger scale systems as the impact of an event cascades downward, or upward, to effect smaller, or larger, scale systems.

For instance, take a lightening strike in a forest. The lightening strike is a disturbance event at the scale of an individual tree system. It can lead to the destruction of that tree, which in turn may allow for the growth of a new tree to replace the old one. At the same time, a smaller scale cycle such as needle replacement, which was occurring yearly on that tree, has also been impacted. Other smaller scale cycles, such as the cycle of herbaceous plants, have also been impacted as there is now more light reaching the ground due to the opening of the canopy. This is an example of a disturbance event at one scale cascading downward and impacting smaller spatial and temporal scale systems.

The lightening strike of the tree may also lead to the ignition of that tree. The fire, which is ignited, may then spread to other trees and result in the destruction of an entire forest. What influences whether the disturbance event will cascade upwards or downwards? It is the larger scale systems. If the climatic system, for example, is in a period of high precipitation it is unlikely that the lightening strike will result in the ignition of a fire. This would limit both the downward and upward cascading of the disturbance event. If the climate is in a period of drying then it is likely that the fire will spread from the individual tree to the entire forest. The ability of a disturbance event at one scale to cascade downward, or upward, to smaller and faster cycling systems, or larger and slower cycling systems, is influenced by the environmental conditions of larger scale systems. This non-hierarchical approach to cross-scale linkages and dynamics has been termed panarchy.

Panarchy has been utilized in systems theory to describe dynamic symmetries across hierarchical scale rather than an asymmetrical static relationship across scales (Gunderson and Holling 2002). The panarchy conceptualization of cross-scale linkages, as shown in **Figure II-5**, suggests that larger spatial and temporal scale systems, such as climate, structure the environment of release and reorganization for lower scales, such as tree growth. Larger scale systems set the environmental context for system development at smaller scales. However, it also provides an explanation of how a disturbance event at smaller scale systems can cascade upward to impact larger scale systems and vice versa. Panarchy provides the means to conceptualize a linkage between creativity at the scale of individuals and social learning at the scale of societies. In turn, this provides a model of how adaptive learning by individuals can be both structured by institutions and lead to changes in institutions.

Social-ecological resilience and memory

The concept of adaptive-renewal cycles provides an approach on how creativity emerges while panarchy offers a suggestion on how adaptive learning of individuals can cascade upward into societal changes. Memory is a concept that provides the possibility to link the past, present and future, as well as one place to another, so that change does not mean loss of continuity.

Creativity emerges from within structured social-ecological learning environments: the interaction between larger-scale adaptive-renewal cycles in periods of growth and conservation, and the knowledgeable leaders who structure learning environments. Memory is partly the structuring of learning by knowledge institutions. However, memory also includes the palette of memories developed by other learners in the past and other places. It is this combination of institutions of knowledge and cognitive memories, which link the past, present and future, as well as one place with another. This combined set of institutions and cognitive knowledge is what Folke, Colding and Berkes (2003) refer to as social memory.

Berkes, Folke and Colding (2003), as shown in **Figure II-6**, develop the concept of social memory in parallel with the work of Nyström and Folke (2001) for ecological memory. Ecological memory is defined as the "...composition and distribution of organisms and their interactions in space and time and includes the life-history experience with environmental fluctuations" (Folke, Colding and Berkes 2003). They go on to say that ecological memory

> "...consists of at least three basic and interacting assemblages and their overlapping functional diversity. The first is the biological legacies, i.e. species and patterns that persist within an area hit by disturbance, like a tree surviving a fire or a seed that requires burning. The second is the functional or mobile links, i.e. species that passively spread from one area to another ... and that contribute to reorganization of the area hit by disturbance ...The third is the support areas of the functional links, i.e. a diversity of habitats in the landscape of which the disturbed area is a part" (Folke, Colding and Berkes 2003:363).

In ecological systems it is proposed that memory provides the biological information from one time period to another in a temporal sequence following a disturbance event. Memory also provides the functional links that allow biological information to spread spatially to an area that has experienced an event. Finally, they suggest that a diversity of systems in a region provides support for a smaller area that has experienced a disturbance event. Folke, Colding and Berkes (2003:364) summarize the role of ecological memory as connecting "...a system's present to its past and to its eighbours."

Folke, Colding and Berkes (2003) draw upon these ideas from ecological memory, and the ideas of McIntosh (2000) in relation to climate change and memory, to develop a concept of social memory.

> "Social memory refers to the long-term communal understanding of the dynamics of environmental change and the transmission of the pertinent experience … It captures the experience of change and successful adaptations. Social memory is the arena in which captured experience with change and successful adaptation, embedded in a deeper level of values, is actualised through community debate and decision-making processes into appropriate strategies for dealing with ongoing change" (Berkes, Colding and Folke 2003:20-21).

They also suggest that social memory consists of "...a diversity of individuals, institutions, organizations and other players with different but overlapping roles within and between critical functional groups" (Folke, Colding and Berkes 2003:367). Social memory emerges out of previous experience within a changing and uncertain social-ecological environment. The perception of the periodicity of adaptive-renewal cycles leads to the creation of institutions. These institutions allow people to respond appropriately to diurnal, seasonal and longer-term cyclic patterns of change. Institutions are used in the broad sense to refer to "not only rules but also norms and values, and at the very least as including both rules and the patterns of behavior that may or may not be shaped by rules and lead to changes in them…" (McCay 2002:362). This leads Folke, Colding and Berkes (2003:371) to propose that "…human actions and innovations framed by a dynamic, diverse and evolving social memory in tune with ecosystem dynamics has the potential to foster adaptive capacity in social-ecological systems." What Folke, Colding and Berkes (2003) do not explore, and has not been explored in other social-ecological literature, is how adaptive learning by individuals can lead to changes in social memory. In other words, the process by which social memory becomes dynamic. The literature of adaptive learning and social-ecological resilience would suggest that social memory emerges from the cross-scale linkages between cognitive knowledge, institutions of knowledge, and social-ecological systems and the dynamics of adaptive-renewal cycles and panarchy.

CHAPTER SUMMARY

An initial review of the social-ecological resilience literature established that the process of adaptive learning, one of the key characteristics of social-ecological resilience, had not been described. This chapter has provided a critical review of the literature to identify initial concepts that might be useful to understand the process of adaptive learning. This chapter has resulted in identifying six key ideas necessary to consider adaptive learning as a process of social-ecological resilience.

Cognitive knowledge. Cognitive knowledge includes the perceptions, information and technologies of people. It is the knowledge that exists in peoples' heads. Cognitive knowledge is employed during the practice of livelihood. This type of knowledge is that which is often explored in the literatures of ethnobotany, ethnoecology and traditional ecological knowledge.

Social-ecological Systems. Learning occurs in an integrated social-ecological environment. An individual is situated in a learning environment formed by a network of human and other-than-human beings. A novice hunter learning from a master hunter in the bush learns in an environment that might be said to include more natural constituents. A student learning computers in a school learns in an environment that might be said to include more built constituents. In either case, however, the learning environment is a complex network of relationships within which the learner is situated.

Institutions of Knowledge. Social-ecological systems provide environments that preclude the possibility that individual learning occurs in a vacuum. An individual, from the time of conception, develops within a holistic learning environment. Institutions of knowledge structure the context within which an individual builds her own memories. An important set of institutions of knowledge is the rules by which individual memories become authoritative and lead to changes in social memory. An individual must follow the institutions of knowledge if their memories are to become authoritative within a society. However, that alone is not enough for individual creativity to lead to a change in social memory.

Adaptive-Renewal Cycles. Adaptive-renewal cycles indicate that social-ecological systems result in dynamic learning environments. The dynamics include a component of periodicity whereby the learning environment will express differential rates of change, and diurnal, seasonal and longer-term patterns of change. Creativity emerges as memories are transmitted in structured, but dynamic, social-ecological learning environments. Creativity emerges from the learning environment and institutions of knowledge themselves. Creativity would be expected to emerge when the difference between the learning environment in which a memory was learnt, and in which it is being taught, increases.

Panarchy. Adaptive-renewal cycles pertain to social-ecological systems of different spatial and temporal scales. The system of a household has different spatial and temporally characteristics than those of a family, community, regional government and a nation. These systems also include socio-cultural properties; such as, perception, techniques, technologies and institutions that constrain individual practice. An individual can be a member of many different relational networks, just as systems themselves can be nested within one another. In this research I utilize social-ecological systems that are defined as legal communities that inhabit an identifiable territory. However, I borrow the concept of panarchy to understand how individual creativity is linked to the social memory of a small-scale society. The concept of panarchy, along with that of adaptive-renewal cycles, suggests that the dynamics of adaptive learning will include institutions which structure individual learning within dynamic and holistic systems. However, panarchy provides for the possibility that individual creativity can cascade upward and lead to changes in social memory. This possibility is important in that it provides a non-deterministic model that links system properties with individual creativity. Without this possibility, individuals and societies would be doomed to make the same mistakes through time eternal and their would be no mechanism of learning and change.

Memory. Memory provides the linkage between creativity, which is an individual process of learning, and knowledge, which is social and collective. Individual creativity does not emerge from an empty palette. Social-ecological systems include a legacy of cognitive knowledge and institutions of knowledge that provide the building blocks and structuring of individual creativity and learning. The concept of the adaptive-renewal cycle provides an explanation of how the system changes, resulting in moments of creativity, as individuals try to reconcile social memory with contemporary environments. This is what the term adaptive learning means. What people know and how people know what they know are the elements and the processes of social memory. Social memory links the past, present and future, as well as one place with another.

Problem Statement. The resilience literature has included the concept of social memory as a way to link the past, present and future as well as one place with another. However, the literature does not include a consideration of how cognitive knowledge, through individual creativity, can lead to changes in social memory within a system. In order to avoid the risk of becoming a deterministic model, and one without a theory of change able to resolve individual creativity and social memory, the concept of social-ecological resilience requires a model of adaptive learning. It is this problem identified in the literature of resilience which is addressed through the remainder of this dissertation.

In the next chapter I provide an overview of my research methodology. I then turn to a historical review of the two communities in which I undertook research. Next, I provide the results of ethnoecological results from Canada and Mexico and the ethnobotanical results from Canada in the following chapter. I return to a summary of adaptive learning and social-ecological research in the next chapter that concludes the dissertation.

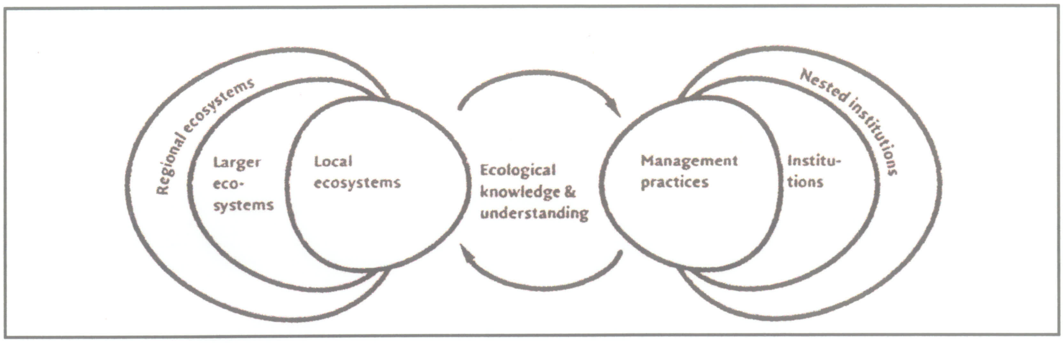


Figure II-1 A Model of a Social-Ecological System.
From Berkes, Colding and Folke 2003:22

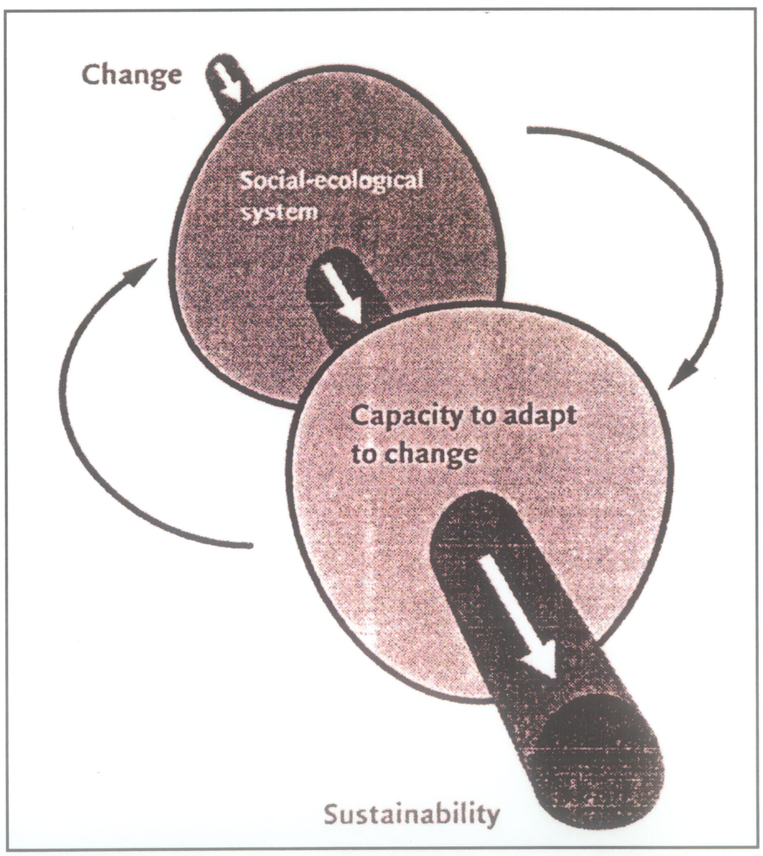


Figure II-2 Dynamics of Linked Social-Ecological System Model.
From Berkes, Colding and Folke 2003:4

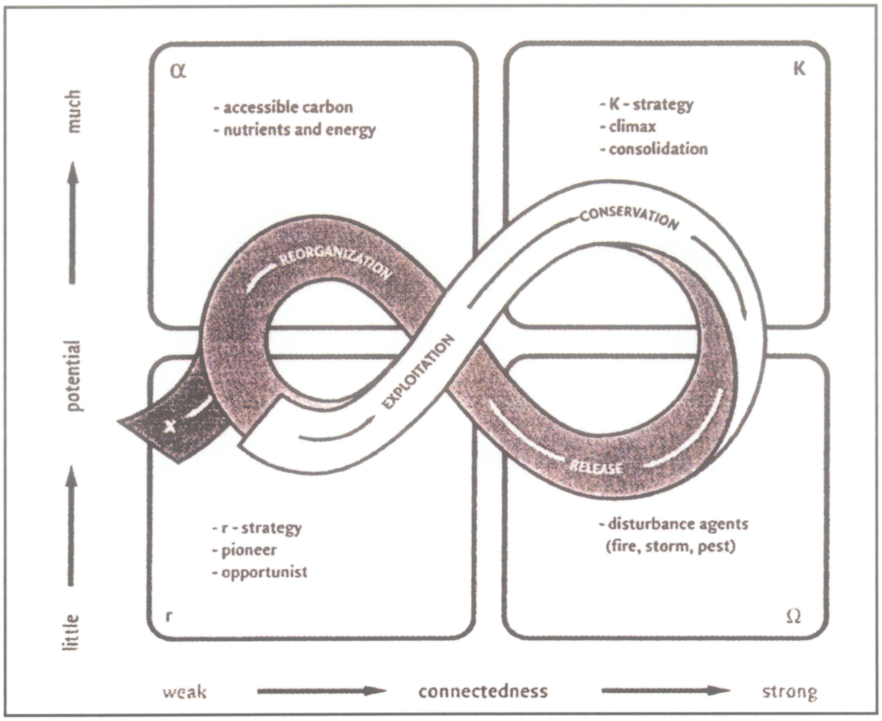


Figure II-3 The adaptive-renewal cycle as a heuristic model for system change.
From Berkes, Colding and Folke 2003:17.

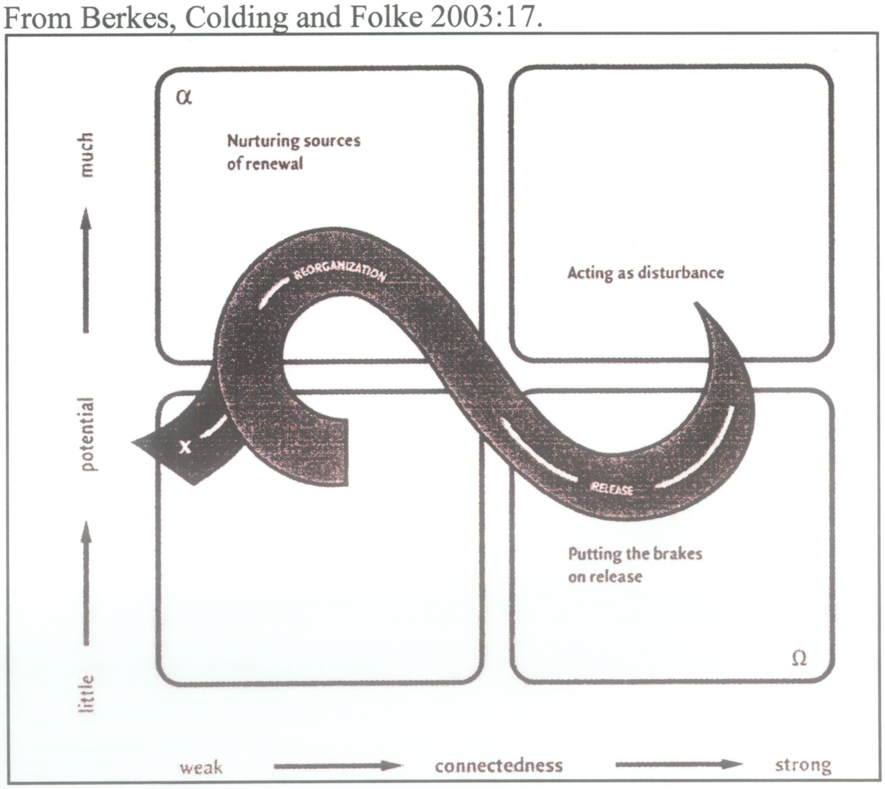


Figure II-4 The backloop of the adaptive-renewal cycle.
From Folke, Colding and Berkes 2003:358

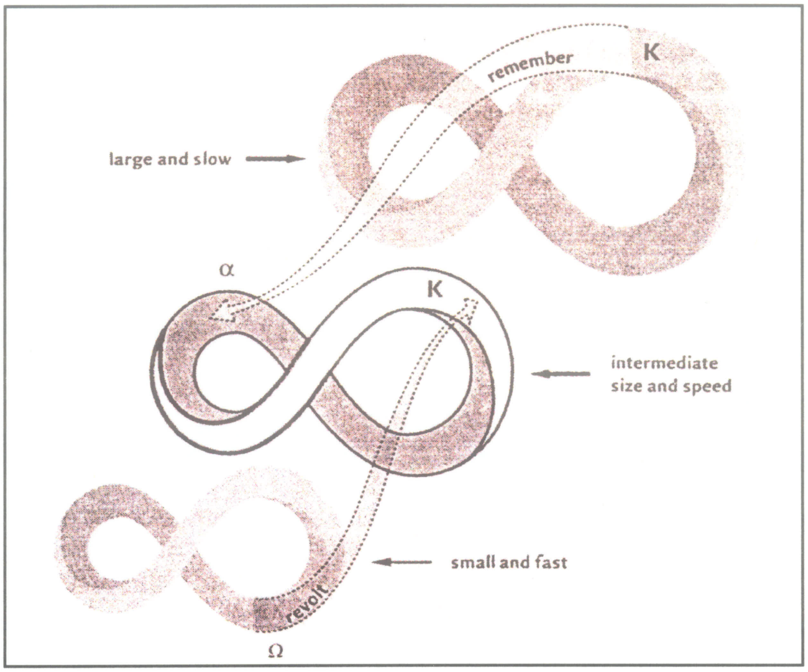


Figure II-5 Panarchy as an approach to scale issues for adaptive-renewal cycles.
From Folke, Colding and Berkes 2003:18.

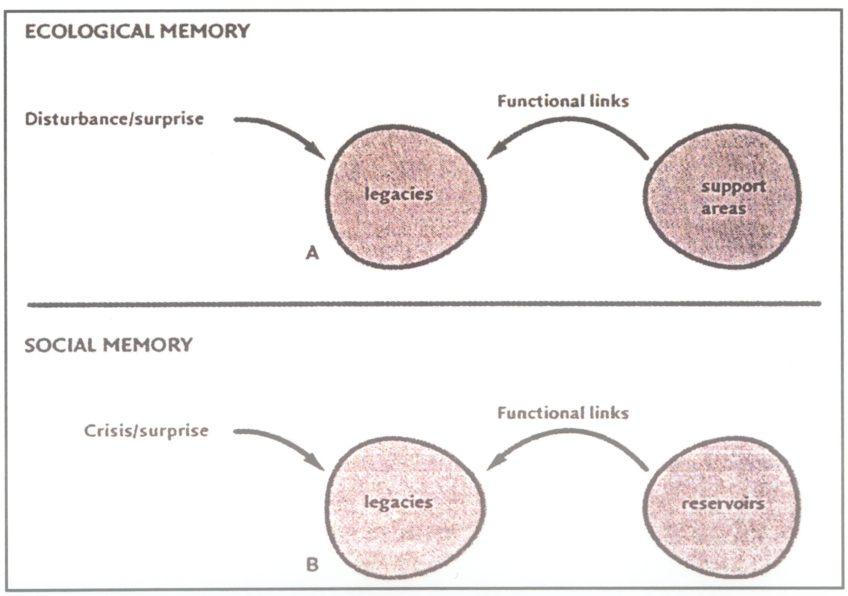


Figure II-6 A schematic of the parallel between ecological and social memory. Legacies are proposed as the functional groups which allow an ecological and/or social system to respond to a disturbance/surprise. Support areas and reservoirs provide the source of memory out of which change/learning can occur. For more detail see Folke, Colding and Berkes 2003:364.

CHAPTER III

RESEARCH METHODOLOGY

INTRODUCTION

> "In the last century and a half, scientific development has been breathtaking, but the understanding of this progress has dramatically changed. It is characterized by the transition from the culture of "science" to the culture of "research." Science is certainty; research is uncertainty. Science is supposed to be cold, straight, and detached; research is warm, involving, and risky. Science puts an end to the vagaries of human disputes; research creates controversies. Science produces objectivity by escaping as much as possible from the shackles of ideology, passions, and emotions; research feeds on all of those to render objects of inquiry familiar...Scientists now have the choice of maintaining a 19th century ideal of science or elaborating—with all of us, the hoi polloi—an ideal of research better adjusted to the collective experiment on which we are all embarked" (Latour 1998:208).

In 1988 I graduated from the University of Guelph with a degree in Crop Science and a focus on plant breeding. With that new degree, I was ready to take on the problems of the world and quickly signed on with a volunteer service agency to work in Bolivia. In Bolivia, I worked with a peasants' cooperative to help them obtain knowledge that might be of use in their struggle to improve their quality of life. One of our main partners was a research station that emerged during the period of the green revolution. The job of the research station was to produce new crops and production systems that would increase the production of food in the tropics. While the goal of the research station was to introduce the agricultural package to large producers, some of the results did trickle down to peasant producers. However, it trickled down in an indirect way, as most small agriculturists could not afford the complete technological package.

An extension agent, such as myself, would bring some seeds to the community. A few people from the community would take some of the seeds home and maybe decide to try growing a few. This process became apparent when I visited the house of Pablo Perez. I noticed a different type of bean growing in a newly prepared field of manioc. When I asked if that was a "traditional" type of bean, he replied, "No. Bruce, the person who was here before you, brought it to me a couple of years ago. I've finally found a good place for it to grow." Pablo had taken new genetic information, and found a place for it in his system of agricultural production. A system that was far from the flat, tilled, fertilized and weed-controlled fields of the agricultural research station where the bean was developed.

This recognition that small-scale producers did experiment led to many changes in development in the late 1980's and 1990's. I had the privilege of working with one of the first foresters who decided to work with small-scale producers on agroforestry in Bolivia. After an initial approach of establishing agroforestry research plots using species imported from Costa Rica, he decided to work with small-scale producers and local tree species. The approach was very informal. He would visit with small producers and talk about the characteristics of different types of tree species. He would then collect seeds and work on finding a way to germinate them in order to produce seedlings. Once the seedlings became available, he would work with a farmer to set up a small agroforestry system on his family's land. The forester, the farmer and I would then visit the site throughout the production cycle. We would discuss what was working, as well as possible modifications. The farmer might ask for new information, might make changes or, in some cases, might decide to abandon the system. The complexities inherent in small scale production—labour scheduling, capital shortage, sickness in the family, ritual and ceremonial obligations, perception, drought, flooding and market prices—made it difficult to design agricultural systems. A new system could only emerge from both the practice of small producers' livelihoods and the practice of the researchers. The trick seemed to be in bringing these two sets of practices together and establishing means to translate different systems of perception so that meaningful communication could occur.

I have reflected upon this happenstance model while observing the debates of the 1990's regarding knowledge systems (Agrawal 1995; Brouwer 1998; Sillitoe 1990). The debate has often taken the form of privileging one type of knowledge into which another type of knowledge is integrated. Rather than an integrationist approach to knowledge systems, I have sought one that starts from the premise of plurality (Berkes and Davidson-Hunt 2002; Davidson-Hunt 2000; Davidson-Hunt and Berkes 2003). People with whom I have worked, people who make a livelihood from the land, have not shied away from new information and technologies. They have always shown an immense interest in novelty and innovation, but often reject it due to a myriad of complex factors. What they have criticized is their lack of authority and power in relation to centralized organizations of knowledge production. Their knowledge has often been recorded, translated and transformed into forms which, at best, are irrelevant to, and, at worst prejudicial to, their own livelihoods. This has led to a complex debate about intellectual property rights (Berkes 1999; Posey and Dutfield 1996).

The transformation of research practice, which I have sought, is one that would allow people with land-based livelihoods the means to negotiate research questions as well as benefit from the outcomes. In the happenstance model of agroforestry research described above, this was the process that was followed. An experimental scientist, a research extension officer and an indigenous farmer held discussions that identified a problem. The problem was the inability to utilize a site for more than one or two seasons to produce crops. The knowledge of the participants was brought to bear upon the problem to identify possible solutions. Information was gathered and technical problems addressed, and then the farmer tried the proposed solution in his fields. The conversation continued, new information was sought, technical problems addressed and modifications made by the farmer. Authority was delegated according to the appropriate task to be addressed by each participant and the research was embedded in the site of its use. The result, over time, was a research team who brought their own knowledges into a conversation that attempted to solve a place-specific problem. The solution, to the agroforestry problem, was not a piece of information, nor a technological innovation, but the engaged practice of scientists, communicators / translators and farmers to solve a place-specific problem.

This chapter begins by exploring a conceptual model of cooperative research for social-ecological resilience. A cooperative research model requires the establishment of a research team in which different actors can share their knowledge about specific problems and places (Berkes and Davidson-Hunt 2002). The chapter turns to a discussion of instruments that can be utilized to delegate authority and power within research teams. This is followed by an examination of the specific protocols and approaches that emerged from the research presented in this dissertation. Differences in the success of the approach undertaken with Iskatewizaagegan No. 39 Independent First Nation, Shoal Lake, Ontario, Canada (see **Figure IV-1**) and the *Ejido* of Basíhuare, Chihuahua, Mexico (see **Figure V-1**) are noted. The chapter concludes by presenting the specific methodologies utilized in this research.

A COOPERATIVE RESEARCH MODEL

Theoretical and conceptual models

Bruno Latour's (1998) comment in *Science*, quoted at the beginning of this chapter, provides a concise summary of the movement from science to research. Latour (1998) discusses the example of the French association for the treatment of muscular dystrophy. People with muscular dystrophy who wanted to raise funds to finance research on muscular dystrophy formed this association. At one point in time they funded more basic research on the human genome than the French government. However, the association oversaw this research. Once it was determined that they had enough basic information, the focus of research turned to genetic therapies. Muscular dystrophy patients had taken the step to generate funding which allowed them to establish a cooperative research effort; a research effort which brought together patients, researchers and administrators into one site of knowledge production. The difference being, as Latour (1998) puts it:

> "The patients did not wait for results to trickle down from science into their daily lives, with no option other than to be open-minded or close-minded about progress toward a cure for the disease. They did not expect genes, viruses, or vaccines to transform their subjective suffering into an objective determination. *They took over.* They tailored a science policy adjusted to what they perceived as their needs. Far from expecting certainty from science, they accepted that they must share risk in research" (Latour 1998:208, *my emphasis*).

Patients, a classic category of research objects, transformed themselves into subjects. Active research participants who led funding efforts, sat on review boards, participated in new treatment therapies and, made decisions about research priorities. In this model of cooperative research, there was no separation between society and science; there were only those people who shared a goal of improving the well-being of people with muscular dystrophy.

Latour's (1998) insistence that there was not a separation of society and science was consistent with his earlier work (Latour 1993). He has followed an approach that he termed "non-modern", an ontological position that does not recognize a separation between society and environment, nor society and science. Epistemologically, he maintained the position that quasi-objects were things that were revealed during the practice of trying to answer a question. Quasi-objects were hybrid things that were social, natural, collective, narrated and outside of ourselves. Quasi-objects had an agency whose movement or trace could be detected through a network of relations. Some quasi-objects had a quality of humanness while others had more of a quality of naturalness or physiomorphism. A key element of this research paradigm was the granting of agency to all the actors involved in the research effort. The result was a research paradigm that recognized that the phenomena under study "...have the characteristics of being narrative, collective, and outside. They are quasi-objects; they are not of our own making. We build them collectively, and they are narrated. That is it: real, narrated, social" (Crawford 1993:264).

This research approach is similar to other efforts to break down some of the oppositions between nature and culture (Bateson 1973; 1979; Descola and Pálsson 1996; Ingold 2000) and local/indigenous/TEK and science (Agrawal 1995; Berkes, Folke and Colding 2003; Escobar 1999; Latour 1993). The stimulus for this shift in both ontology and epistemology can be found in many different disciplines. However, there are perhaps three main areas, summarized in Chapter Two, which have provided the main impetus to develop cooperative research paradigms. The first has been the renewed realization that humans are not outside observers of environment, but participants in the unfolding of life. The second is that institutions of knowledge structure a process of authorizing, legitimating and transmitting different narratives of the world. Finally, the literature of social-ecological resilience has emphasized that there are no final solutions for controlling the environment. Rather, natural resources and environmental management, and research need to become a process of on-going adaptive learning within the dynamics of social-ecological learning environments. Sustainability science and resilience are two research programmes that have emerged from this set of concerns related to natural resources and environmental management and research (Berkes, Colding and Folke 2003; International Council for Science 2002; Kates et al. 2001; Walker et al. 2002).

The review of the review of the theoretical literature related to adaptive learning and resilience led to the development of a cooperative research approach. The conceptual model is presented in **Figures III-1** and **III-2**. In **Figure III-1**, the general diagram utilized to discuss a cooperative research paradigm with people of Iskatewizaagegan No. 39 Independent First Nation is presented. The cooperative research model embeds the research into a particular site, in this case the Shoal Lake watershed. Specific actors in the model build their knowledge as part of a network of biogeophysical actors (people, plants, animals, vegetation, fish, water, rocks) and from within a specified social-ecological environment. The cooperative research approach forms a research team, composed of different actors, so they might contribute their knowledge regarding a specific problem in a specific place. The specific problem is embedded within the broader goal of ***Geminiigomozin Kaganoyndagonk***, or "Taking Care of What is Given to Us." A concept offered by and translated by Robin Greene when we were discussing how to translate terms such as ecosystem-based or watershed management. The idea is that the actors have the common goal of enhancing the well-being of the Shoal Lake Watershed.

The cooperative research approach translates, negotiates and documents knowledge regarding the specific problem or themes. The institutions of knowledge-keeping refer to formal organizations (schools, band councils, health organizations, resource management agencies), formal and informal institutions which may result from the research, and the individual elders, hunters and others who incorporate the knowledge into their livelihoods. In some cases, the research will result in research artifacts that can be stored by the formal organizations and utilized in a variety of formal contexts. However, the knowledge also becomes part of the artifice of people's livelihoods. Hunters, or farmers, who never read any of the documentation, may incorporate aspects of the research into their livelihood. Scientists may utilize the results of their research to publish papers, others may write reports, while teachers may write curriculum for their classrooms. In this way, the model recognizes that people are authoritative in different contexts, and knowledge becomes legitimate in different ways. There is a process of translation - documentation - communication - translation before knowledge produced by the research can become legitimate and have an influence within different contexts. As the results of the research are legitimated in different contexts, they can then come into practice and become transformed into perceptions, cognitive knowledge, technologies and institutions. These memories can then be brought to bear on emergent problems, emergent problems which lead to new research. Cooperative research approaches emerge from this specific, holistic and iterative process.

This conceptual model was then applied to the specific theme of non-timber forest products as shown in **Figure III-2**. In this diagram, the focus moved from an interest in the actors to the themes of the research and the possible outcomes. Knowledge from a variety of different actors was translated, negotiated and documented for a set of research themes. Actors learned through a number of different activities, from quantitative plot research, to qualitative ethnobotanical research, to workshops, to ceremonies. The research generated an Iskatewizaagegan knowledge legacy that was held in different forms (artifacts), processes (artifice), and by different actors. An organization, such as the Shoal Lake Resource Institute, was necessary to coordinate the activity and house some of the research artifacts that were generated. As the model was iterative, it was assumed that the themes, learning methods, and outcomes would change as the research team improved the effectiveness of communication. In **Figure III-3**, a flow chart is provided which outlines the specific steps that were taken to begin building the research team. As noted, one of the first steps was to negotiate a research protocol.

Power, authority and research protocols

The necessity to negotiate research protocols has emanated from the lack of research initiatives in which local research participants have had control of the goals, objectives and outcomes. In the example of the agroforestry research, and that provided by Bruno Latour, there was an assumption of a non-hierarchical delegation of authority and power. The reality of a hierarchical delegation of authority and power in contemporary society, including management and research, was a weakness of the conceptual model (Crawford 1993). To correct this problem, a research organization would need to be created in which authority and power were delegated fairly amongst farmers, scientists and practitioners. This would require that the board and review panels were made up of farmers, scientists and practitioners who negotiated research priorities, objectives and approvals. The board and panel would also have to negotiate performance indicators and advancement within the organization. In Latour's (1998) example, the patients took over fund-raising, and established an organization that met the above criteria. In the case of many farmers, communities, indigenous peoples and other local peoples, they have not been able to establish research organizations over which they have control. The ideal, as noted above, is where authority and power are delegated fairly amongst the participants in research teams and organizations.

The cooperative research approaches presented in Figures III-1, III-2 and III-3 account for the current situation in which different actors are embedded in different organizations and institutions of knowledge. The hierarchical distribution of authority and power between these organizations and institutions is also considered in the approach. Scientists who participate in cooperative research approaches are often embedded in institutions that reward research publications. If they are going to participate in a research team, they require the ability to publish. Community members may work for government-funded agencies that require reports to be generated. Funding priorities, objectives, methodologies and approvals are determined by organizations dominated by centralizing institutions of knowledge production, management and enterprise. This hierarchical delegation of authority and power, within which the research paradigm is currently embedded, requires instruments, such as research protocols and ethics reviews, to take into account this imbalance. It would be deceptive to present such a research model to a community assuming that all actors held an equal delegation of authority and power.

NEGOTIATING A RESEARCH PROTOCOL

The first step of formalizing the research partnership and negotiating the research protocol occurred through informal discussions with two members of the Shoal Lake Research Institute regarding non-timber forest products. Ed Mandamin, Phyllis Jack and myself had been involved in organizing a conference on non-timber forest products in Kenora in the fall of 1999 (Davidson-Hunt, Duchesne and Zasada 2001). One outcome of this conference was recognition that more research was required to understand the non-timber values of First Nations. However, it was also recognized that a methodology was needed which would allow those values to be related to categories of ecological land classifications, as well as specific harvesting locations. Due to Ed and Phyllis's participation in land-use mapping projects with elders, and forest management based on scientific forestry, they were interested in looking at these questions from both perspectives. Through these informal discussions, it was decided that the preliminary focus of the research project would be non-timber forest products. These informal discussions took place over a three-month period during the fall of 1999.

Once the goals, objectives and methodology of the research had been discussed, the researchers from the Natural Resources Institute prepared a discussion paper that described the proposed research project in clear language. At this time, a letter, reproduced in **Appendix III-1**, was also submitted to the Shoal Lake Research Institute. This letter summarized the interest of the Natural Resources Institute in undertaking the research project. This was presented to the First Nation council along with opportunity for questions and discussion. At this meeting, a Band Council Resolution, shown in **Appendix III-2**, was passed. This Band Council Resolution gave permission for members of the Shoal Lake Resource Institute to work with the Natural Resources Institute to solicit funding and draft a research protocol for the proposed research project. Shortly thereafter a workshop, the agenda of which is presented in **Appendix III-3**, was held. The content of a research protocol and the proposed theme of the research project were discussed with elders selected by the Shoal Lake Resource Institute. Elders were selected by the Shoal Lake Resource Institute due to their knowledge about the forest and/or their ability to provide spiritual guidance for the project. The general topics that can be included in a research protocol are presented below. The detailed research protocol for the research with Iskatewizaagegan No. 39 Indpendent First Nation, and the Band Council Resolution which authorized the research, can be found in **Appendices III-4** and **III-5**.

Content of a research protocol.

Project Duration. This item allowed the two partners to negotiate a degree of comfort and security over the minimum and maximum time of the commitment. It was important from a researcher's point of view, as they had the commitment of the First Nation that they would be given permission to finish their research. From a First Nation point of view, it provided the community with the ability to end the research process after a certain time period. It also provided both parties with an idea of each other's time commitment to the research process.

Preamble. The preamble put down on paper why the research partnership was being negotiated. The preamble articulated why both sides were interested in undertaking the research partnership.

Research Project Summary. A summary of the research project provided the boundaries on the topics that would be researched, along with a description of the methodologies utilized.

Project Partners. It was important that both sides indicate who will be involved in the project as partners. This allowed the community to know who would be active on the First Nation territory as well as present at meetings.

Research Team. A research team was identified who undertook the research activities of the project.

Accountability. This section laid out a number of mechanisms by which the members of the research team would be accountable to their respective communities. The Shoal Lake Research Institute, as part of the First Nation government, was directly accountable to the community through the band council. NRI researchers were accountable to the academic community through traditional academic mechanisms, such as graduate committees and ethical statements.

Research Advisory Council. An advisory committee was set up in order to monitor the activities of the research team and the knowledge generated by the research project. The members of the advisory committee, in this case, were: a representative of the First Nation council; elders; members of the Shoal Lake Resource Institute; and, members from the university. Members from the First Nation were invited to meetings where the students presented their research results. When specific problems arose, which the research team, could not solve, special meetings of the advisory council were called to resolve problems through consensus.

Review of Research Results. There were a number of mechanisms set up to review the research project and its results. Research proposals were presented orally to the advisory committee. A written copy was submitted to the members of the advisory committee so that consensus could be reached on research proposals. In addition, a number of workshops were structured into the research project in order to provide oral presentation of the research results to the advisory committee. Written results of the research project were also submitted to the advisory committee for review. These included student dissertations; reports; academic and popular publications; and, any other written material that was released into the public domain. A consensus-based approach was utilized to resolve disputes over interpretation of results before they were released into the public domain. It was decided by the advisory committee that some results were too sensitive to be released into the public domain. When interpretations over data differed, alternative interpretations and objections to the conclusions drawn were included in written documents released to the public. A two-month review period was utilized for such objections to be raised and included in the written documentation.

The advisory committee ensured that due recognition was given to the participants in the written documentation of the project. When it was decided that a person's name should not be utilized in the written documentation, an alias was utilized to protect the research participant's privacy. However, at times it was more appropriate to give due recognition to the information provided by research participants through the use of their names. The advisory committee also ensured that participants in the research were given a chance to review written documentation for which they provided information anonymously or in which they were identified. Individuals were provided with copies of photos in which they appeared.

Archiving of Knowledge Artifacts. A copy of all written documentation (transcriptions of interviews; reports; publications), audio, video and photographic materials generated by the research project was provided to the community. When it was decided that knowledge artifacts should be stored at other organizations, with appropriate storage facilities, the First Nation negotiated agreements.

Sharing of Research Results. The research results were available for use by the First Nation community for other purposes. The research team also shared the results of their work for use in school curriculum and other forms of teaching about the topics of the research.

Communication. The research results were presented to the community in a manner, which facilitated the understanding of the results, during workshops and in written materials.

Community Researcher. Researchers worked with a community researcher in a manner that provided the community researcher with an opportunity to learn field methods of research. The use of a community researcher during interviews also provided a manner in which knowledge was transmitted between elders and future generations.

Compensation. The advisory committee set a fair and equitable level of compensation for the community researcher and other participants in the research project through a process of consensus.

Informed Consent. Participants in the research process were made aware of the purposes of the research and the uses that would be made of information provided to the research team. Any participant was free to withdraw from the research at any time with no penalty. The letter of informed consent, which was prepared for the research, can be found in **Appendix III-6**.

Sources of Funding. The organizations that provided financial support for the project were identified. Attempts were also made to make First Nation participants aware of other funders so that the results of the research could be implemented.

In summary, what we discovered was that the process of developing a research protocol through workshops, review of written documents and oral presentations became the negotiating arena out of which a final written document resulted. Trust, respect and partnerships were negotiated orally amongst the research team and council through the process. The signing of the final agreement signified that these conditions had already been established orally through the process. The protocol document was not so much a legal or ethical document, but a symbol of the degree of trust that had become established through the negotiation process. The process forced us to engage in a detailed process of communication in order to reach a common understanding of the research project and the use of the results. Formally, the signing of a band council resolution signified the band administration's agreement with the research project. Informally, elders involved in the project indicated their agreement by attending a pipe ceremony and feast that was held to start the field component of the research. Further agreement by the elders was demonstrated by their willingness to show up for interviews. Those that chose not to become involved in the project chose not to attend interview sessions or trips to the bush.

The process of writing a research protocol may seem officious. The importance was not found in the written document, but the building of intercultural (Aboriginal / Euro - Canadian; Scientist / Practicioner; Botanist / Ethnoecologist) communication and trust. The mechanisms to build intercultural communication and trust were prerequisites to the establishment of a research team to address place-specific problems. If communication and trust had not been already established, it would not have been possible to undertake the research. One of the parties would have walked away from the negotiating table before the protocol was completed. The protocol was also necessary to deal fairly and openly with the delegation of authority and power within the research team. It was not possible to implement the ideals of the conceptual cooperative research model due to current constraints of research organizations and institutions of knowledge. However, the protocol did help to move the yardstick toward a more fair and open delegation of authority and power.

RESEARCH METHODOLOGIES

The research reported in this dissertation was undertaken in Canada and Mexico. The work in Canada took place between May and October of 2000 and again between July and October of 2001. Verification workshops were held in January of 2001 and again between January and April of 2002. The work in Mexico took place during the fall of 1999 and again between the months of February and June 2001. The work in Canada was undertaken in the community of Iskatewizaagegan No. 39 Independent First Nation of Shoal Lake, Ontario. In Mexico, the major work was undertaken with the Rarámuri community of Basíhuare, while some fieldwork on burning practices was also undertaken with the Tepehuan community of Baborigame. The research in Mexico was focused on the burning practices of the Rarámuri. The primary research was undertaken in Canada regarding plant knowledge (NTFPs), perception of ecological dynamics and landscapes, use of fire and the transmission of knowledge. Research in Mexico was undertaken on the use of fire by indigenous peoples. Comparative material on perception and institutions was also collected while in Mexico. However, that was not the primary intent of the Mexican fieldwork.

Cooperative Research Paradigm

The research followed the research paradigm described above with some exceptions. A summary of the model has also been presented in Berkes and Davidson-Hunt (2002). In Canada, the research followed the model described above, including the writing of research protocols and agreements. One exception in Canada was that elders were not comfortable utilizing the written informed consent forms shown in **Appendix III-6**. They stated that once they agreed to participate in the research, they would participate; otherwise they wouldn't show up for research activities. In Mexico there was a major exception. The writing of a research protocol was attempted. However, the ***gobernador*** (customary leader) was not willing to sign a document. The process that was agreed upon was that I would present my research during one of the public meetings held in the courtyard of the church on Sunday afternoon. I was required to state what I was going to research, what I planned to do with the results, how community members who would participate in the research would be compensated for their time, and the products that would be left with the community. This was translated into Tarahumara and then people were asked if they were willing for the research to go ahead. After some discussion, the community approved the research.

In both Canada and Mexico, the issue of authority and power was partly dealt with through the establishment of trust. I had worked with people from both communities, since 1995 in Canada and 1996 in Mexico. The reason the community accepted the research I proposed was because people who were trusted within the community sponsored me. This is a customary process of delegating authority and power for research to occur. If the trust is betrayed, then people from the community will stop working with the scientists and practitioners. This preference for face-to-face processes to establish trust and delegate authority and power are partly based in cultural preferences. However, both Anishinaabe and Rarámuri have experienced the negative consequences of signing pieces of paper. There is a preference to limit the delegation of authority and power, and determine how much trust they should accord to an individual over time. Part of the work of establishing a cooperative research paradigm is finding the appropriate institutional contexts. A further check on the research occurred through a review of the research by a university ethics committee.

Field Methodologies

In both Canada and Mexico, the original methodology planned to utilize known habitat types to generate a discussion about what the habitat might be called in Anishinaabe or Rarámuri. These field excursion were attempted in both locations with community researchers, fluent in the indigenous language and English or Spanish, and elder members of the community. For instance, an ecological unit, such as a jack pine stand in Canada, or an oak stand in Mexico, would be identified through previous field excursions. These were to be the same sites, in Canada, where quantitative plots had been established during other research (Ruta 2002). The site would then be visited and the community researcher would ask elders what they would call such a site. Elder community members, and often the community researcher, found this approach quite disconcerting. The methodology changed after Walter Redsky expressed his opinion that he could not understand how the approach was legitimate. If we wanted to know about birch, then he thought we should go to a certain place, and not where our analysis of the forest resource inventory led us. After that discussion, we began to undertake field excursions to find a particular plant, visit a place where an activity had been customarily undertaken, or collect materials necessary for a given activity. The result ended up being similar to that originally intended, although it wasn't possible to specify the habitat type prior to the trip. I also utilized this same methodology for site selection in my Mexican fieldwork.

The resultant methodology was a combination of site visits to a place where elder community members knew a plant could be found and transects determined by known travel routes. During these site visits and transect walks, the themes of the research were utilized to generate conversations. The major themes of plant nomenclature and plant uses occurred during site visits, while habitat descriptions, biophysical landscape nomenclature and place names would be discussed during both site visits and transect walks. Plant vouchers, photos, videos, GPS readings and informal interviews were utilized to obtain specific information about plants and to determine the scientific name. Photos and/or videos, along with GPS readings, would be taken of different types of habitats, biophysical landscape nomenclature and place names. As new habitats, biophysical landscape descriptions or place names were encountered; an informal conversation would be initiated about those topics. In both Shoal Lake and Basíhuare, map interviews were also held with elder community members about place names. Such discussions often led to stories about places and the activities that used to occur in such a place. On a few occasions, such an interview would lead to new site visits. The main methodologies that were utilized are described in detail below.

Community Researcher. In both Canada and Mexico, a community researcher was involved as a participant in the research team. In the research project there was a lot of knowledge that was passed on by elders in their own language. When the knowledge was translated and documented, knowledge was both lost and transformed. The involvement of a community researcher allowed some of the knowledge to be passed on in an oral format to a younger member of the community. The research itself provided a new context for the transmission of knowledge between generations. The other reason a community researcher was needed was pragmatic. While some elders were comfortable in English, or Spanish, there were other cases when translation was necessary.

Ceremonies. In Canada, ceremonies and workshops were held at the beginning and end of each field season. In Mexico, for purposes of verification and presentation of the results workshops were held, but not ceremonies. Ceremonies in Canada consisted of a feast and prayers by elders, followed by the research team presenting the research they wanted to undertake during the upcoming field season. Elders would then provide comments and decide if they wanted to participate in the research. A workshop was held with the advisory council at the beginning of the research to discuss the research problem to be addressed by the research team. An advisory council workshop was also held during the fall, following each field season, to discuss the results, written documents and interpretations of the research.

Site Visits. In the research at Shoal Lake, more emphasis was placed upon collecting the names of plants. As the elder community members knew that I was interested in recording information about the names of plants, they would take me to visit sites where they knew a given plant occurred. In some cases, an elder community member decided that we should visit a place where customary activities (medicinal plant harvesting, maple syrup harvesting, blueberry harvesting or wild rice harvesting) occurred. This worked well for those plant species that were found in mature forest types, or tended to be stable from year to year. For early succession species, such as blueberries, this was not a useful approach. The customary harvesting locations were no longer representative of a 'good' blueberry patch. Instead, it was necessary to search out some people actively harvesting blueberries to talk to them about blueberry sites. In Mexico, I asked people to show me sites which were currently being prepared for burning or had been burned 1, 5, 10 and 20 years previously.

Transects. Transects were a more useful methodology in Mexico than in Canada. In order to obtain a variety of current and previous burn sites, it was necessary to work with a number of different elder community members. Each elder belonged to a different ***rancho*** (hamlet within an ejido) and so the sites were spread out in different areas.

Transects became established along the paths of travel from one valley bottom, over ridges and to another valley where the burning had occurred. This allowed us to traverse a number of different habitat types, encounter a variety of physical features and places where different events had occurred. In Canada, many of the sites that were visited occurred along waterways, or lakeshores. The customary travel paths were along these waterways so that transects tended to provide more discussion about habitats found close to these travel routes. However, these trips also led to discussions about different types of habitat, physical features, and places where different events had occurred.

Livelihood Activities. Another approach that worked well in Canada, and was utilized in Mexico by LaRochelle, was to focus on an activity (LaRochelle and Berkes 2002). One activity that we utilized in Canada was the making of birch bark baskets. This required us to find different types of plants and habitats that could be documented while collecting the materials. It also led to discussions of institutions regarding the appropriate way to harvest a plant; ceremonies, which should be undertaken before carrying out the activity, and ceremonies that should be followed after finishing the activity. It also provided an opportunity for participant observation regarding institutions of knowledge and transmission of knowledge. This approach was not utilized in Mexico due to the focus on burning. The research period did not correspond to the time of the activities related to burning.

Thematic Conversations. This approach assumed that people were able to reflect philosophically upon themes of common interest. A theme would be chosen, such as how a person learned about plants, and the elder would talk about the theme. When the conversation was in English, or Spanish, prompts would be utilized to follow different threads of the conversation as they emerged. When the elder felt more comfortable in Anishinaabe or Rarámuri, the theme would be discussed in English or Spanish, and then the elder would talk about the theme. Conversations were recorded using a Sony digital mini-cd recorder or a Sony digital video recorder. They were transcribed and translated in Canada by the community researcher and in Mexico by a language teacher at the Basíhuare Intercultural School.

Map Interviews. Map interviews were utilized to record the names for places. In both Canada and Mexico, 1:100 000 map sheets were utilized. In Canada, the elders were comfortable with reading paper maps and could list the names of lakes, rivers, streams, islands and other places. In Mexico, people would name places as they were encountered or as could be seen from a location in a valley. These places would then be recorded onto the map by the community researcher.

Ethnobotanical Documentation. In the early stages of the research, the elders were not convinced that it was necessary to pick plants for voucher specimens. As an alternative, it was decided that a digital video would be taken of the plant. This allowed a documentary record to be constructed of plant names, uses, stories and harvesting ethics related to a plant species. Photos of plants were also taken as a secondary record. The principal researcher, and the researcher who undertook the biometric research (Ruta 2002), were also quite knowledgeable about the flora of the region. Determinations were often made in the field. If a determination was not possible, a detailed set of photos was taken for consultation with a plant taxonomist at the University of Manitoba herbarium.

During the first field season, the elders began to discuss how this knowledge could be documented for use in the school. Examples of the materials prepared for schools by Robin Marles and his colleagues (Marles et al. 2000) were obtained and shown to the elders. It was decided at this time that the need to document this knowledge for use in the school provided a strong reason for collecting voucher specimens. Voucher specimens were collected during the different activities from this point forward. If a plant was not abundant or was a rare species, photos and videos were utilized instead of voucher specimens. Digital video was also utilized to record names, uses, stories and plant harvesting ethics. When a specimen was collected, or other harvesting activities undertaken, the elders offered prayers and tobacco, and other ceremonies were undertaken as determined by the elders. A documentary record was created for each plant named or recognized by the elders and recorded on a form as shown in **Appendix III-7**. The form recorded the location where the plant was identified, voucher specimens, uses, photos, video and audio records about the plant and other information. The documented information was then organized according to the scientific name of the plant. Voucher specimens were deposited in the University of Manitoba herbarium with scientific name, Anishinaabe name, location of collection, habitat, and general use categories. Vouchers can be accessed, in the herbarium, by either scientific classification (family, genus species) or an index of Anishinaabe ethnobotany vouchers.

Verification. Verification workshops were undertaken in both Canada and Mexico. In Mexico, verification was undertaken with the community researcher, research participants, language teacher and community leaders. The place-name maps and the landscape terminology diagrams were presented and discussed. Corrections to the place names and terminology were recorded. In Canada, workshops were held with the advisory council to discuss the project. Smaller workshops were held with the elders and community researcher to discuss the specific results of the research. Workshops were held with Ella Dawn Greene, Walter Redsky and Brennan Wapioke in which each plant name was verified. The plant voucher, photos of the plant, and photos from books were examined and the proper name for the plant discussed. Photos of the different habitat types and landscape features were also utilized to verify terminology. A printout of a map was examined to verify place names. All corrections that elders wanted made to spelling or terminology were recorded. In cases where we could not clearly verify field data we removed the item from the final data set.

Orthography. In both Canada and Mexico, the orthographic conventions, chosen for transcribing plant names and texts, was determined by the community. In Canada, the community researcher and the elders, who are literate in Anishinaabe, agreed upon the spelling of words in workshops. In Mexico, the language teacher at the secondary school undertook the transcription. In both cases, the orthographic convention is based upon Roman orthography. As well, in Mexico and Canada, Rarámuri and Anishinaabe respectively, are two of the largest indigenous languages. There is much variation in vocabulary, pronunciation and orthography. Given this variation, both communities preferred that we utilized local language "experts" instead of attempting to standardize the vocabulary and orthography.

Historical Research. The narratives presented in Chapters IV and V drew upon a number of archival sources. The primary source material for Chapter IV was the Hudson

Bay Company Archives. Donna Sutherland, a historical researcher, was asked to review a number of files for references to blueberries, fire, and wild rice harvesting. As the interest was in the Lake of the Woods watershed, she was asked to geographically limit her search. The following archives were utilized in Chapter IV: Grassy Narrows Post Journal HBCA B.498/a/1 1932, B.489/a/2 1932-33, B.489/a/3 1938-39, B.498/a/4 1940-41; Lac La Pluie Post Journal HBCA B.105/a/1 1793-94, B.105/a/2 1794-95, B.105/a/3 1796, B.105/a/4 1796-97; Dinorwic Post Journal HBCA B. 273/a/1 1938-39; B.273/a/2 1940. Other post journals, manager reports and inspection reports (Rat Portage; Grassy Narrows; Dinorwic; Fort Alexander) were reviewed for the years between 1880 and 1920. However, they did not contain information on the search topics.

A limited amount of other primary source material was also reviewed for Chapter IV. The Provincial Archives of Manitoba, Manitoba-Ontario Boundary Commission File MG1-A10 turned up a notice in syllabics outlining fines for prairie and bush fires. The Annual Report of the Department of Indian Affairs was reviewed from 1892 to 1915. Ontario Statute Law from 1867 to present, Ontario Statute Citator and the Canadian Law Abridgement were utilized to trace the development of forest fire legislation. The Temporary Government of Rupert's Land Act, 1869, 32-33 Victoria, c.3 (Canada) and The Manitoba Act, 1870, 33 Victoria, c.3 (Canada) were reviewed in regards to the transition from a fur trade to a settler economy. The archives of the Rat Portage Miner (1897-1905) and the Kenora Miner and News (1910 to present) were reviewed for references to blueberries and forest fires. Each year, from 1897 to 1930, was reviewed for the months of April through October. From 1930, to the present, only every fifth year was reviewed for the same months.

Chapter IV also drew upon a review of secondary source materials of explorers' journals and reports. These materials proved to be the richest source of observations on the relations between First Nation people, their activities and the environment. The main secondary sources focused on people who traveled through the Lake of the Woods watershed. These included the journals and reports of: Alexander Henry the elder (Bain 1969); Alexander Henry the younger (Coues 1897); David Thompson (Coues 1897; Glover 1962; Tyrrell 1916); John Bigsby (Bigsby 1969); the Long Expedition (Keating

1959); the Palliser Expedition (Spry 1968); the Canadian Expedition (Dawson 1968; Hind 1860; Hind, Dawson and Gladman 1858); the Sir Sanford Fleming railway surveys (Fleming 1879; Grant 1877); and the Canadian-American Boundary Commission (Carroll 2001).

Another source of secondary materials was the book and papers written about the history of the region, ethnography of the Anishinaabe people, and the biophysical environment. A number of authors contributed ideas related to the description of the fur trade and the role of the Anishinaabe in the fur trade in Chapter IV (Bishop 1974; Lund 1984; Lytwyn 1986; Ray 1974; Van Kirk 1980). The ethnography of the northern Anishinaabe people included a review of key ethnographic materials (Cooper 1936; Densmore 1928; 1929; Dunning 1959; Hallowell 1976; 1991; Holzkamm, Lytwyn and Waisberg 1988; Lovisek, Holzkamm and Waisberg 1997; Schoolcraft 1978; 1997; Tanner 1830; Vennum 1988; Waisberg 1993). The main source consulted for describing the biogeophysical environment of northwestern Ontario was Perera et al. (2000) while McRae et al. (2001) and Perera et al. (2000) were consulted regarding fire ecology. Descriptions of *Vaccinium angustifolium* and *V. myrtilloides* taxonomy and ecology were obtained primarily from Vander Kloet (1988) with supplementary information from Duchesne (personal communication 2002), Moola and Mallik (1998) and Moola, Mallik and Lautenschlager (1998). The history of fire and fire legislation were gleaned from Pyne (1982) and Lambert (1967).

The primary source materials available in Chihuahua, Mexico were much more limited than those available in Canada. The Chihuahua State archives were examined from the 1800's and early 1900's, but only provided limited information on the use of fire by Rarámuri people. It was necessary to depend upon secondary source materials from other authors. The main sources which were utilized for the historical context of Chapter V included: Francisco Almada (1955); Robert Bye (1976); COSEDECH (1999); François Lartigue (1983); Carl Lumholtz (1902); William Merrill (1988); Campbell Pennington (1963); and, Robert Zingg (1940). There were also very few references to the history of fire use and forest fire legislation in the Sierra Tarahumara. Only two references were found in the Chihuahua State archives. They were letters from the *Secretaria de*

Agricultura y Ganaderia, Direcion General de Proteccion y Repoblacion Forestales, recognizing the formation of forest fire brigades in two different ranchos. However, the works of Bye (1976), Pennington (1963) and Zingg (1940) do comment on the use of fire by Rarámuri people. Another article which was found to be useful was that written by Peter Fulé and Wallace Covington (1996), which analyzed the relationship between forest fires and forest fire policy in the Sierra Madre Occidental. The most useful historical documents on forest fire legislation were the relevant Mexican laws: *Leyes Forestal* (Forest Laws) of 1948, 1960, 1986, 1992 and 1997, and *Ley General Del Equilibrio Ecologico y La Proteccion al Ambiente* (General Law for the Ecological Equilibrium and Environmental Protection) of 1994.

Community Research Products. All materials (photos, digital audio, digital video, interview transcriptions and publications) produced during the research were duplicated and provided to the community. The Shoal Lake Resource Institute of Iskatewizaagegan No. 39 Independent First Nation stored these materials in Canada while the Basíhuare Intercultural School kept them in Mexico. In Canada, a set of colour photocopies of mounted plant vouchers were produced. In Mexico, a map-based, multimedia cd-rom was produced for the school using CultureScapes™ software. Intellectual property rights for the products created during the research were shared between the community and the researchers. All materials were made available to the community for purposes of education, healing, interpretive tourism, and political negotiations.

CHAPTER SUMMARY

The cooperative research model, which formed the basis of this research, worked well to establish trust between the community and the research institution in Canada. Over time, a degree of trust was built among the research team and the advisory council. The advisory council through a process of negotiation and consensus solved most problems. In Mexico, the physical distance between the community and the university made it difficult to strictly adhere to this model. In this case, it was necessary to work with an organization already established in the community. The main problem, as discussed above, is the lack of place-specific organizations where a delegation of power and authority amongst community members, scientists and practitioners has occurred. While this type of institutional development may have occurred among medical patients, it has not yet occurred amongst people with land-based livelihoods. The second-best solution was to work with organizations that had established cooperative research relationships with local communities. However, while a temporary solution, this did not solve the broader problem regarding the delegation of authority and power.

The lack of place-specific research organizations required the use of instruments, such as research protocols, research agreements, intellectual property rights, and ethical review. The purpose of these instruments was to explicitly delegate authority and power amongst those involved in the research. The one weakness of this approach was that it was based in western legal conceptions of how authority and power can be delegated. In both cases, Canada and Mexico, the communities were more interested in establishing face-to-face trust amongst the research participants. There was a need to somehow establish researchers as part of the social network based upon kinship. The emergence of place-specific research teams required much negotiation about the institutions that guided the research. This presented a challenge to researchers who were part of centralizing organizations of knowledge production. Place-specific research will require organizations where the authority and power of knowledge production is less hierarchically delegated

The other weakness of the model was in problem definition. A more structured process of problem definition was required. The participatory approach to resilience management, proposed by Walker et al. (2002), establishes a research team that undertakes problem definition as a first step. It starts with a multi-stakeholder team, as resilience management is a multi-jurisdictional approach. The research problem we were investigating required a more focused composition within the research team. The problem-centric and place-specific research approach requires that the research team emerge out of the definition of the problem. Since place-specific research organizations do not currently exist, there is no clear guidance on who to include in the research team. This is not a trivial problem. The solution utilized in this research was to establish a network that linked a place-specific organization with a centralized organization of knowledge production. While we could ensure that the delegation of authority and power was fairly and openly distributed on the research team, this did not extend to the boards and panels of the funding organizations. The lack of place-specific organizations and fair distribution of authority and power within funding organizations required that we spend time on problem definition and research protocols.

The methodologies utilized during the research had to be modified through negotiation with other members of the research team. The main modification was in allowing the elders to structure the learning about topics presented by the researcher. This was required, in this case, as the research attempted to translate and document knowledge of community members. Since a diversity of knowledge, related to a research problem, was drawn upon to produce new knowledge, there had to be an ability to communicate cross-culturally during the research project. Collective solutions require the ability to understand each other's narratives, which can then lead to new knowledge. There is, then, a necessity to re-translate knowledge so that it can be seen as legitimate by other actors in a research team. This requires arenas of oral communication (ceremonies, workshops, field trips) so that discussion and negotiation occur during the research project. Communication is an important part of the methodologies that requires further development cooperative research approaches to be successful.

In the next chapter I turn to a historical review of the social-ecological context of northwestern Ontario that is followed by a similar review of northwestern Mexico. I then provide the results of ethnoecological results from Canada and Mexico in Chapter VI and the ethnobotanical results from Canada in Chapter VII. I return to a summary of adaptive learning and social-ecological research in Chapter VIII, which concludes the dissertation.

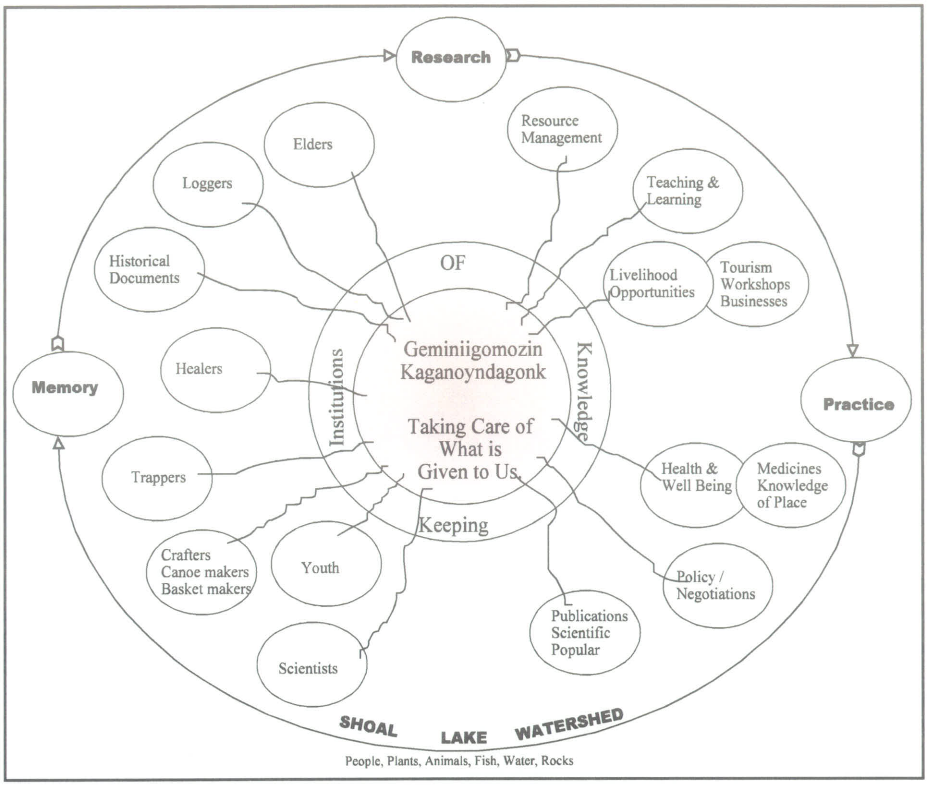


Figure III-1 A Schematic of a Cooperative, Place-based Research Model.

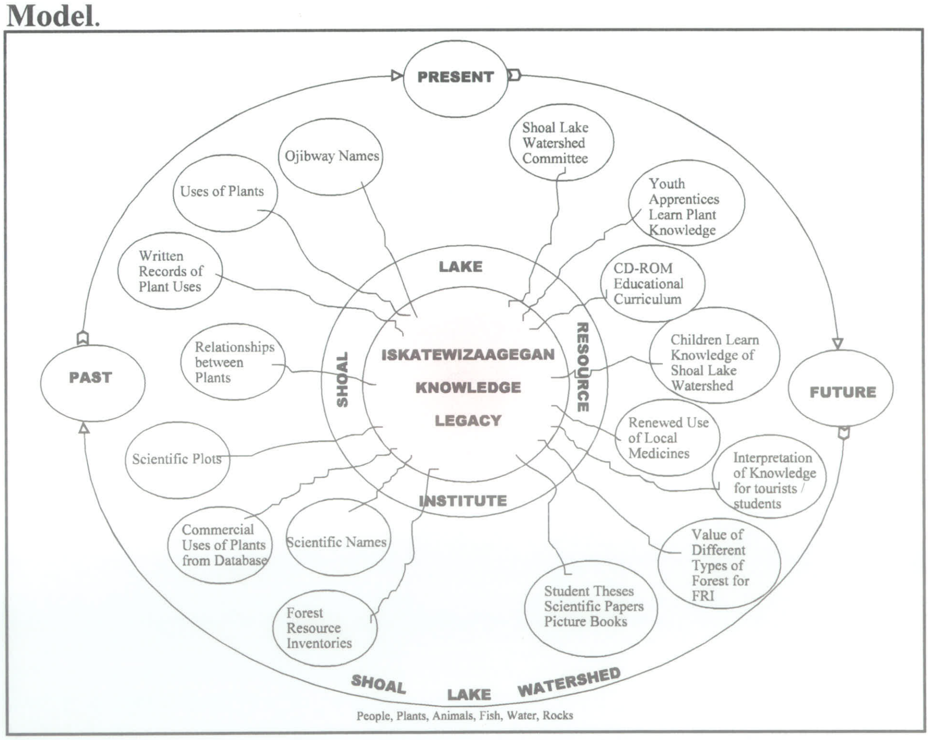


Figure III-2 A Schematic of a Cooperative, Place-based Research Model for Non-timber Forest Products.

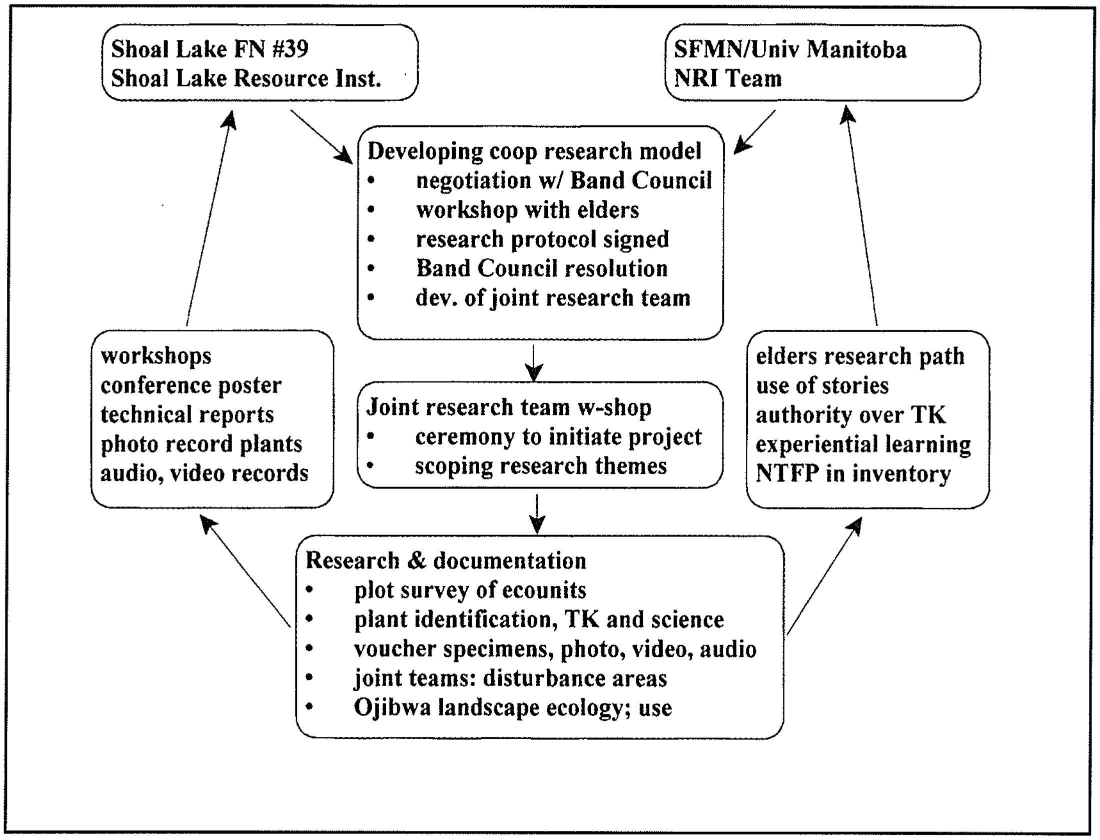


Figure III-3 Process and Steps of a Cooperative, Place-based Research Model. An Example from Shoal Lake, Ontario.

Plate 3. Walter Redsky, Ella Dawn Green and author following an outing on Shoal Lake.

Plate 4. Brennan Wapioke, Robin Greene, Ella Dawn Green and Walter Redsky looking at plants growing in a clearcut.

CHAPTER IV

FIRE, BLUEBERRIES AND ANISHINAABE PEOPLE OF NORTHWESTERN ONTARIO

INTRODUCTION

> "What are meant by natural resources are game, fur, fish and their supplementary adjuncts, such as wildberries, rice, roots, maple sugar &c., which contribute to or entirely provide the maintenance of a large proportion of the Indian population, not only directly as food and covering, but further as articles of commerce." (Department of Indian Affairs Annual Report 1905:xxix)

In this chapter my objective is to explore the long-term adaptive cycles of the Iskatewizaagegan Anishinaabe. Indigenous knowledge and traditional ecological knowledge are often presented as knowledge systems without histories (Wolf 1982). My aim is to provide a history for the ethnoecological and ethnobotanical knowledge that is discussed in Chapters VI and VII. My historical narrative of fire and blueberries emphasizes that Iskatewizaagegan have both shaped, and been shaped by, the social-ecological systems in which they have participated. I am interested in examining how we, as humans, participate in the social-ecological dynamics of a place and write our histories onto the land. The theoretical background for this chapter is found in Chapter II while the research methodologies are presented in Chapter III. In Chapter III, I also present a short commentary on bibliographic sources. I reference those sources, which I directly draw upon in this chapter, but there are many others that provided me with indirect observations that helped me form this narrative. I also have to acknowledge many Anishinnabe people who have provided me with the teachings to think about the histories that I have read about northwestern Ontario.

BLUEBERRIES, FIRE AND PINE FORESTS

One of the first things that I learned about picking blueberries in burns is that you always pick near a forest fire tower if possible. This teaching came from one of the stories I remember my mother telling me about growing up during the 1930's in Jacobs, Ontario.

The first story I remember is how her father, a Swedish immigrant, had to take the hand cart five sections down the line to Sioux Lookout and back to bring a nurse. His wife, an Ukrainian woman he had met in Winnipeg, was about to give birth to my mother. Things were not going as well as the two Finnish women, married to the other section men, had hoped. So they sent Jon Alessander Johnnsson, or John Johnson as he was named by the immigration official, off on the handcart to Sioux Lookout. Of course, by the time that he returned, my mother, Florence Johnson, had been born to Iryni Johnson, nee Baziuk. January 8, 1930 was a cold day to travel 4 sections and back on a handcart.

Jacobs in the late 1920's and 1930's was an odd spot for a Swedish and Ukrainian couple to give birth to their first child. However, at that time a Swede and an Ukrainian who could barely speak English were willing to move anywhere to work. The Winnipeg general strike and the First World War were still on the minds of many people and any job in the 1920's was not to be refused, especially by non-Anglophones. The Grand Trunk railway, finished in the early part of the century, became home to many Swedish and Finnish people. In fact, they were encouraged to immigrate to Canada as it was felt that they would be able to survive the cold and isolated conditions of what became the Canadian National Railway northern line.

A section stop was usually composed of three section men and their families. The section men were required to travel the section, ensure that the rail bed was in good order, clear brush from the right-of-way to keep down fires and provide water to the trains if required. The community was made up of three log cabins, housing the section men and their families. Of course, there was the inevitable Finnish sauna, which was the most important building at the section stop. While traveling along the CN northern line, in the middle of the bush, it was possible to find better Finnish saunas than could be found in the major southern cities of Canada.

Food, or the lack thereof, made up a large number of the stories I remember being told by my mother. These stories seemed to fill my mother's memory during the early 1930's and the great depression that her family lived through while in Jacobs. Her mother would have her, and her eldest brother Roy, sneak into the grain cars while her father was putting water into the locomotives. They would sweep out the grain left in the cars returning from the Lakehead so that they would have grain to feed the chickens and enjoy some fresh eggs. This had to be done on the sly as her father was dead set against this type of pilfering.

It was also possible to go out to fish and hunt. Section stops were always located near lakes as a source of water for the steam run locomotives used in the years the line was built. As the children only attended school for one week a month, the week that the school in a train car was at the section stop, there was plenty of time to go fishing. When her father had time it was also possible to step out the door into the boreal forest and go on the chase to obtain some fresh meat. First Nation people from Allan Water, and further away, were also likely to drop by to sell some fish or wild rice (*Zizania aquatica*). While food was often on the mind of my mother's family, it was also something that they could obtain from the forest and their small gardens of potatoes and vegetables. It required a great deal of time and work, though they managed to fill the cold cellar dug into the ground to make it through the winter.

While obtaining food may have required constant attention, it was the prospect of fire that dominated their fears. Fire in the boreal forest was a constant threat as Canada became industrialized. Industrialization required opening up the prairies to produce grain for the increasing population in urban centres across Canada. Railways were required to link production of grain to these growing markets. Development of agricultural land began along the areas north of Canadian border. The settlement process associated with agricultural development required the burning of slash piles left over from the timber harvest undertaken to clear the land (Lambert 1967; Pyne 1982). The slash of timber harvesting and land clearing operations led to a number of large conflagrations between

1870 and the 1930's. These resulted in a tremendous loss of life, property and standing green timber. In my review of the Kenora Miner and News a sense of moral outrage and palpable fear was evident.

This sense of dread and foreboding of fire in the boreal forest reached beyond the settlement zone to those living along the northern railway line. Sparks from a train's engine or brakes could set the grass in the clearings besides the rail lines on fire during a dry period. Section men were required to patrol their sections for fire starts and extinguish them as quick as possible. If a fire got away the section men were required to work with the forest rangers to put out the larger fires. The Ontario Department of Lands and Forest had also established a system of forest fire towers on heights of land near the rail lines as a means of quick detection (Lambert 1967). When a tower happened to correspond with a burn, these became the ideal blueberry picking patches.

Heights of land in northwestern Ontario resulted from ancient volcanic processes; were later modified by glacial activity, and more recent soil formation processes (Perera, Euler and Thompson 2000). These geologic processes led to a landscape made up of rocky hills interspersed by areas of deeper soils and till from glacial depositions of clay, silt, sand, gravel, rocks and boulders. Bedrock areas, which were scraped clean by the glaciers, are characterized by thin organic soils over rock with a dominant, mature vegetation of pines. Glacial rivers led to formations, such as eskers that resulted in ridges, made up of different types of till (gravel, rocks, boulders along with mixtures of clay, silt and sand). Ridges predominately made up of gravel, rocks, boulders and a high concentration of sand led to mature vegetation dominated by white pine (*Pinus strobes*), red pine (*P. resinosa*) and jack pine (*P. banksiana*). Glacial lakes and seas, which were formed as the glaciers receded from northwestern Ontario, often resulted in soil formations of clays and sand beaches. Soil formations dominated by clays frequently led to mature vegetation dominated by white spruce (*Picea glauca*) and trembling aspen (*Poplus tremuloides*) on highlands and black spruce (*Picea mariana*) in low lying areas. Sand beaches characteristically have mature vegetation composed of pines. More recent soil formation processes have resulted in low-lying areas where deep organic soils have developed into wetlands. Along the numerous rivers in the region seasonal flooding has created alluvial soils with a variety of riparian plant communities.

Fire predated the establishment of the rail line throughout this landscape. Explorers of the 1700's reported fires burning as they passed through the country (Bain 1969). Fire ecologists suggest that the boreal forest had become a fire-adapted forest by the end of the last ice age (McRae et al. 2001; Perera, Euler and Thompson 2000). Spatially, this resulted in a forest consisting of a mosaic of different patches of vegetation. These patches are influenced by slow cycles, such as geological processes of landform and soil formation, which impact a large spatial scale. Medium scale cycles, such as temperature and precipitation, influence a smaller spatial scale and shorter temporal cycle. These processes establish the conditions for fire which result in the age structure of forest patches across the boreal landscape. The boreal mosaic of plant communities has a spatial aspect resulting from geologic and climatic cycles. This mosaic is then further modified by a temporal structure generated by fire events. The spark of a train's brake can begin a process that turns a mature pine forest into a blueberry patch in a matter of seconds.

Blueberries are members of the Ericaceae or heath family. The heath family is composed of 100-125 genera and 3000-3500 species found throughout the cooler, temperate, or subtropical regions (Woodland 1997). Many species of this family are recognized on the basis of their leathery leaves, urn or bell shaped flowers and anthers that have pore like holes at their terminus. The members of the heath family are also known for their ability to grow in acidic soils with low nutrient content. The heath family includes many well-known genera such as rhododendron (*Rhododendron*), heath (*Erica*), madrone (*Arbutus*), heath (*Calluna*), and blueberries (*Vaccinium*).

There are approximately 400 species found within the genus *Vaccinium* worldwide (Vander Kloet 1988). They are found in the circumpolar north temperate regions and also on some mountains in the sub-tropics and tropics. In North America, Vander Kloet (1988) estimates that there are 26 species. Members of the genus *Vaccinium* share the characteristics of the heath family in that they have leathery leaves, urn or bell shaped flowers and anthers with terminal pores. However, *Vaccinium* is probably best known for its many-seeded red, blue or black berry species. These red, blue and black berries have provided sustenance and commercial opportunities for people in circumpolar temperate forests since time immemorial (Vander Kloet 1988).

In northwestern Ontario, the common species of *Vaccinium* are: low-bush, or low sweet blueberry, (*V. angustifolium*); high-bush, or velvet-leaved blueberry (*V. myrtilloides*); lingonberry, or mountain cranberry (*V. vitis-idaea*); and, small bog cranberry (*V. oxycoccos*). Other less well-known species which can be found in northwestern Ontario are: dwarf bilberry (*V. caespitosum*); and, bog bilberry (*V. uliginosum*). What makes the *Vaccinium* interesting is their ability to produce an abundance of edible fruit in nutrient poor environments such as rock barrens, sand flats and bogs. It is thought that mycorrhizal associations allow them to exist in these environments along with morphological adaptations such as the leathery leaves. Mycorrhiza allow *Vaccinium* to increase the uptake of nitrogen and phosphorus which improves their growth rate on acidic and peaty soils (Vander Kloet 1988). Leathery leaves help reduce transpiration rates in droughty environments such as sandy soils and bogs. In bogs, water remains frozen underneath the peat for much of the year. Cranberries and bog bilberries are found in the bogs of northwestern Ontario. Blueberries are found on bedrock, large till and sand flat landfroms of northwestern Ontario

While blueberries are ubiquitous in the boreal forest, they especially thrive in the early years following fire (Moola and Mallik 1998; Moola, Mallik and Lautenschlager 1998). Blueberries can reproduce by seed. More often underground parts will survive a disturbance and colonies will re-establish by bole and rhizome sprouting (Vander Kloet 1988). If establishing by seed, a single blueberry plant can give rise to many new plants as it sends out rhizomes and establishes a colony of genetically identical blueberry plants. Blueberry plants exist in mature pine forests and in bedrock areas interspersed with grasses and other plants. However, it is a fire that can turn a jack pine sand barren into a productive blueberry heath or barren. The acidic, low nutrient environment where blueberries often thrive following a disturbance is often called a barren, or heath, due to the dominance of heath (Ericacea) species in those environments (Vander Kloet 1988). Since there is no preferred term to refer to the extensive fields of blueberry dominated barrens, which follow a disturbance in the boreal forest, the term blueberry heath will be utilized to refer to such fields.

Blueberries require a deep fire that will prune back old bushes and clear off competing vegetation. On dry landforms such as bedrock, till or sands, old blueberry bushes exist within a mature jack pine forest along with mosses, grasses, small shrubs such as bearberries (*Arctostaphylos uva-ursi*) and bunchberries (*Cornus canadensis*) as well as the dominant pine trees (*Pinus* spp). The old bushes are scattered and each bush only produces a small amount of berries. Blueberries, like many other berry plants, produce flower buds only on second year growth. As the bush matures it reaches a threshold of growth habit, producing less new branch material, and berry production declines (Vander Kloet 1988). Jack pine, and the plants which prefer to grow in shade, lock up most of the resources only allowing a scattered distribution of blueberry bushes.

However, when a fire strikes such an area, the old bushes are pruned back and the competing vegetation destroyed. Rhizomes of the blueberry colonies respond with vigourous re-sprouting and can produce a productive blueberry heath in as little as three to five years (Vander Kloet 1988). A fire changes the environment for the blueberry by releasing resources. The blueberry is a plant that can take advantage of the quickly available resources such as sunlight, nutrients and water (Moola, Mallik and Lautenschlager 1998). The vigourous flush of new growth provides a proliferation of flower buds and, if followed by the right climatic conditions, can lead to an abundance of berries. Fire creates an environmental palette out of which a productive blueberry heath can emerge. Temperature and precipitation in the years of the blueberry heath influence whether the heath will meet its productive potential. Frost during flowering, drought during fruit set or fill, can all result in a thick blueberry heath with few berries. In those years when fire is followed by favourable climatic conditions the blueberry turns barrens into a banquet table for boreal inhabitants such as the bear.

My mother was also thinking of bears when she was picking a blueberry patch near a forest fire tower. The boreal landscape of a burn is clear and it is possible to see for a great distance. However, even on sand flats there are outcrops of bedrock and hills making it impossible to see everything that is approaching. This becomes even more of a problem when you are focusing on picking the blueberries. If a bear comes up from behind you while picking blueberries, there are two choices: give the bear the pail of berries, or climb a forest fire tower taking the blueberries with you. When food is short, and you have been picking all day in a great blueberry heath, giving the blueberries to the bear is not the preferred option. Hence, my mother chose to run with the berries and climb the fire tower. While foresters have been interested in the mature jack pine period, bears and my mother were considerably more interested in the period following a fire.

ANISHINAABE PEOPLE OF THE LAKE OF THE WOODS WATERSHED

Anishinaabe people have inhabited what they knew as the lake of many islands since time immemorial. This is a difficult claim for European descendents to understand as the Anishinaabe migration stories tell of a long history of moving from the east coast of North America to the area around present day Sault St. Marie (Schoolcraft 1978). However, Anishinaabe identity expresses a multiplicity of possible groupings.

Early explorers often used terms from indigenous languages to describe groups of people. These terms reflected how Anishinaabe people were accustomed to describing themselves as people of a certain place: people of Berens River, for example (Hallowell 1991). The places which people took on as their identity were those places at which a number of related extended families would gather for certain livelihood activities.

Family units would separate at certain times of the year for hunting while gathering in larger kin groups at different times of the year for fishing and gathering of berries and wild rice (Vennum 1988). These groups of extended families came to be called bands by the early missionaries, and then the anthropologists. The bands followed leaders who were most often men, but sometimes women. Leadership was not hereditary but a position of authority obtained through people's willingness to follow a person in the pursuit of a given activity (Lovisek, Holzkamm and Waisberg 1997). These pursuits included livelihood activities such as hunting, fishing, berry picking, ricing, and sugaring; political events such as war and alliance building; and, spiritual teachings and religious ceremonies (Densmore 1979; Vennum 1988). Leadership was earned for different types of activities and people could drift away from the leader as they lost people's trust. Early missionaries, explorers and later government representatives often called these leaders chiefs.

What became known as bands also shared an identity on the basis of language. The Anishinaabe of northwestern Ontario speak, as linguists defined it, the Ojibway language (Holzkamm, Lytwyn and Waisberg 1988). This language varies from place to place but is mutually intelligible among Anishinaabe people. Historically, missionaries and explorers created a classification of language families. Anishinaabe people spoke Ojibway, a part of the Algonquian language family, including Cree, along with a number of smaller language groups. Algonquian was considered to be a language which was distinct from other language families such as Siouan, Iroquoian and Athapaskan.

As recorded by the early missionaries, explorers and anthropologists, it appears that a shared identity, based upon language, was strong enough to lead to political alliances for purposes of war and territorial expansion (Schoolcraft 1978). However, a system of *dodems*, or clans, was shared by many of the people of northern Canada. Clans provided an institution that allowed people to transcend family, band and language boundaries. A person was not able to marry within his or her own clan. This required that alliances be established between different families and bands through marriage. Ideally, members of a clan provide mutual aid and avoid conflict with each other. Clans can also extend beyond the boundaries of identity established by language. The same rules of mutual aid and conflict avoidance were followed when a clan crossed language boundaries. Indigenous people of northern North America often shared institutions which provided a means to carry out livelihood activities in another individual or group customary harvest area. Conflict followed when these institutions were ignored. Institutions, such as marriage and clans, provided a means to cross boundaries of identity and peacefully build alliances. Place, language, band and family all played a role in identity. However, identity also shifted as people moved location, established alliances and sometimes went to war.

Anishinaabe identity also emerged from a shared worldview along with spiritual beliefs and practices. As with many North American Indigenous peoples there was little separation between spirituality and daily life. Ceremonies, harvesting plants and the preparation of animals for consumption were all interwoven with spiritual beliefs. However, the Anishinaabe were also somewhat unique in that they also had a more formalized form of spiritual belief and practice. The Medewin, Great Medicine Lodge, was made up of the Mide, or priests, who devoted themselves to the Medewin teachings (Hallowell 1976, 1991; Hoffman 1891). Also unique to the Anishinaabe were the transcription of these teachings onto birch bark scrolls in a form of writing. Currently, some Anishinaabe would consider themselves followers of the Medewin teachings, while others may follow the less formalized teachings of Anishinaabe spirituality. In contemporary communities, there are also those who define themselves as Anishinaabe, and are following Christian teachings. Spiritual beliefs and practices have created boundaries within Anishinaabe identity. However, this forms one element of identity; there are many other aspects that provide linkages across such a boundary.

Geographic boundaries also emerged within Anishinaabe identity during the period of colonization. The Anishinaabe of the Rainy River / Lake - Lake of the Woods - English River - Winnipeg River watershed entered a Treaty, Treaty #3, with the Canadian Crown in 1873. Shoal Lake people may consider themselves to be Anishinaabe people of Iskatewizaagegan No. 39 Independent First Nation, part of the Kenora Tribal Area and Treaty # 3. Other people may prefer to refer to themselves as people of Iskatewizaagegan and the Anishinaabe Nation without referencing the administrative structure set up under the Indian Act. In either case geographic boundaries and administrative structures are only part of the complex Anishinaabe identity emerging from place, language, family, clans, spiritual beliefs and practices and livelihood. While ancestors of the Shoal Lake people have been classified as Chippewa, Saulteaux, Ojibwa, Ojibway, along with lesser known names, today they refer to themselves as Anishinaabe.

PEOPLE AND LAND OF THE FUR TRADE

The ancestors of Shoal Lake people are said to have moved into northwestern Ontario along with the early fur traders (Lund 1984). The first set of traders through the

Lake of the Woods were Radisson and Des Groseilliers who were said to have traveled by the Pigeon River / Rainy River route into Lake of the Woods during 1659 and 1660. Coincidentally, this is the time that the Anishinaabe moved west from the east end of Lake Superior. During this period the Hudson's Bay Company was formed in London and given access to all the lands drained by the Hudson's Bay watershed. This provided more stimulus for the French to find the boundary of the Hudson's Bay watershed, as well as ways they could challenge the hegemony of the English. The divide between the Hudson's Bay watershed and the Great Lakes watershed is just east of Lake of the Woods. One of the favoured routes from the Great Lakes watershed to the Hudson's Bay watershed was to travel, as did Radisson and Des Groseilliers, along the Pigeon River. From there, one would cross the height of land, move into the Rainy River system and then Lake of the Woods.

The next recorded French explorer to enter Lake of the Woods was Du Lhut who also journeyed into Lake of the Woods along the Pigeon and Rainy River system during the years 1679 and 1680 (Lund 1984). Du Lhut establised the first forts on the western end of Lake Superior at Fond du Lac (Duluth). The St Louis River out of Duluth provided an opportunity to enter the Mississippi or the Hudson's Bay watersheds. However, the main interest of the French at this time was to establish a water route to the west. This led them to focus on the more direct route along the Pigeon River and into the Hudson's Bay watershed. In 1689 De Noyon was the first French explorer to construct a fort in the Lake of the Woods watershed at Rainy Lake.

De Noyon merely set the stage for the most active French explorer of that period. The French had long been establishing alliances with the Anishinaabe as they established posts around Lake Superior. By the time De Noyon was exploring into Lake of the Woods there were many marriage alliances made between Anishinaabe women and French men. Prior to this time the written record suggests that Cree and the Assiniboine peoples inhabited Lake of the Woods (Cooper 1936; Lund 1984). The Cree, an Algonquian group, and the Assiniboine, a Siouan group, had been transporting and selling furs to the Hudson's Bay Company on the Hudson's Bay coast. They discouraged the establishment of French posts in the Lake of the Woods watershed. The Anishinaabe, who were allied at the time with the French traders, were interested in the establishment of French posts in the region. This led to a time of protracted conflict and negotiation between the Anishinaabe and their Cree and Assiniboine neighbours. It was during this time the French withdrew to Lake Superior.

In 1731 the Anishinaabe and French felt confident enough to make another attempt at establishing posts in the Hudson's Bay watershed (Lund 1984). In that same year La Verendrye was able to re-establish the Lac La Pluie fort (Fort St. Pierre) at Rainy River. The following year he was able to establish Fort St. Charles at what is today known as Northwest Angle. He then quickly moved through the Lake of the Woods to establish posts at locations today known as Fort Alexander (Fort Maurepas) at the mouth of the Winnipeg River, at the forks of the Assiniboine and Red Rivers (Fort Rouge) and further south along the river at what is today known as Pembina, North Dakota, in the years of 1733 and 1734. Of course his main goal, the passageway to the west, led to his establishment of a post at Cedar Lake (Fort Bourbon II) on the Saskatchewan River system.

The years between 1733 and 1756 were the height of French-controlled fur trade in the interior of North America (Bishop 1974; Ray 1974). By establishing forts and subsequently posts along the inland route to the west and again along the Saskatchewan River system, they were able to divert some of the furs away from the Hudson's Bay Company. As the French moved west, so did the Anishinaabe (Bishop 1974). The Anishinaabe became established in the areas around Lake of the Woods, through to Lake Winnipeg, Lake Manitoba, Lake Winnipegosis (Fort Dauphin) and the rivers leading into those lakes. The Anishinaabe, along with their new Cree and Assiniboine allies, became the main suppliers of furs and provisions at the cross roads of the fur trade. The main challenge to the alliance was from the Plains Sioux who came up to the southwestern corner of Lake of the Woods. They had been accustomed to accessing rice beds in the Lake of the Woods watershed, as well as buffalo from the Red River watershed. The French, Anishinaabe, Cree and Assiniboine alliance focused on pushing the Plains Sioux out of this territory. This led to the establishment of the French fort and post on the Assiniboine River at Fort La Reine. The Assiniboine became the main provisioners for these western most forts of the Red River watershed. The alliance was only able to push a short way into the eastern and northern edges of the prairies. On the plains, the Sioux were at an advantage due to their possession of horses. Horses had moved north through the plains from the territories of Spanish colonization. This period also saw those Cree loyal to the Hudson's Bay Company move north towards the Hudson's Bay.

La Verendrye established the main routes of communication and economic organization that the fur trade was to follow in this region for the next one hundred years (Lund 1984). The main posts were established at the western end of Lake Superior. Furs, or supplies, were deposited at the main posts and then transferred to ships or canoe depending on the direction of movement. From Lake Superior the main route of communication became the Pigeon River - Rainy River - Lake of the Woods route. Traffic moved north from Lake of the Woods through the Winnipeg River system to Lake Winnipeg. The communication route then divided. It was possible to travel to the north through the inland lakes of Manitoba. The Saskatchewan River also provided the route further west to the Rocky Mountains, as well as northwest into the present day regions of the Yukon and Northwest Territories. From Lake Winnipeg it was also possible to go south along the Red River. Continuing along the Red River that swung south into North Dakota or west along the Assiniboine River allowed one could access the prairies of this region.

The establishment of Fort Pembina on the Red River led to the use of two old routes between the Red River and Lake of the Woods (Lund 1984). As these routes contained extensive portages they were only utilized for light travel. The Winnipeg River and Lake Winnipeg route to the Red River required fewer portages that meant less unloading and loading of cargo. Both routes left from the south end of Lake of the Woods. One route left Lake of the Woods along the Warroad River and then hooked up to the Rousseau River via Hay Creek. The other left Lake of the Woods along the Reed River, also meeting with the Rousseau River. La Verendrye also established a route into the Mississippi watershed during a trip south to the Mandans. The Mandans lived on the Missouri River that led into the Mississippi, and further west. In order to reach the Missouri it was necessary to travel south along the Red River and then travel by land to the Missouri River. These became the main communication and trade routes during the remainder of the fur-trading period of the 18th and 19th Centuries.

The wars between the French and English in the years between 1756 and 1763 led to the decline of French fur trade in the region. This period of war was ended by the Treaty of London, whereby the French surrendered the lands to the east and south of Rupert's Land to the English, while the lands to the west of the Mississippi were given to Spain (Carroll 2001). After the war was settled, the fur traders of the Canadian colony, and those of the Seaboard colonies, became interested in the lands to the west. This period began with a visit by Jonathan Carver to Grand Portage. Grand Portage was a critical location established by the French, ideally located at the mouth of the Pigeon River leading to points westward. John Askin who established a fort for the XY COMPANY followed Carver's visit. Askin had been active in fur trading in the Ohio valley and in the southern Great Lakes basin. Canadian fur traders such at Peter Pond and Alexander Henry quickly followed him.

The diaries of Alexander Henry, the elder, provide one of the earliest written accounts of the role of the Anishinaabe in the economic organization of the fur trade in the Lake of the Woods region (Bain 1969). As Alexander Henry moved into Rainy Lake and along the Rainy River he began to record the resources that would be necessary to provision the fur trade. He noticed, for instance, how the banks rose gradually from the Rainy River and were covered with a luxuriant grass. As the soil was of a fine grain he thought that these lands would be good lands for agriculture. As he traveled through Lake of the Woods he noted how wild rice grew in abundance throughout the lake and into the Winnipeg River system. Birch, maple, cedar and spruce trees, along with moose and elk are all recorded in his journal. The "frothing waters" during sturgeon spawning were also noted with great interest. Once he arrived on the prairies his emphasis changed to the existence of the large herds of buffalo. Alexander Henry re-traced the economic organization of the fur trade established by the French in the 17th and 18th Centuries.

Alexander Henry knew that these resources were key to the provisioning of the fur trade. Maize had long been a staple food that was obtained by early Europeans from the Anishinaabe around Sault Ste. Marie. This required the existence of fertile lands, cultivated by the Anishinaabe in the manner to which they were accustomed. Birch trees were a necessity as the Anishinaabe were the main suppliers of canoes for the fur trade that they built and repaired out of birch bark. Cedar and spruce were also important in this regard as the bark of cedar and the roots of the spruce were utilized to sew the seams of the canoes. The Anishinaabe were also accustomed to trading sugar made from the sugar maple (*Acer saccharum*) or the Manitoba maple (*Acer negundo*). Waterfowl were hunted in the spring near the sugar groves and in the fall as people were harvesting wild rice. Large game and fish were also an important source of food at this time and which the Anishinaabe traded to the fur posts. While all these resources were critical for the existence of the fur trade, the buffalo were the key to the operation of the inland posts. As such, it was essential to establish posts at the eastern and northern edges of the prairies. Buffalo, turned into pemmican, provided the main staple for the woodland fur posts that provided the bulk of the furs. Alexander Henry's journal provided an inventory of the routes of communication and the resources needed for the reestablishment of the fur trade in the region.

The most significant event of this period was the American Revolution of 1776. The American Revolution led to the Treaty of Paris in 1783 that established, at least on paper, the boundary between British North America and the United States of America (Carroll 2001). The resolution of the terms of the treaty was not, in fact, resolved until 1842. The boundary between Lake Superior and Lake of the Woods was to be the Pigeon River, west along the normal canoe route to Rainy River and then to the Northwest Angle of Lake of the Woods. Upon reaching the northwest Angle, the boundary was intended to run west to the Mississippi. West of the Mississippi belonged at this time to Spain. In response to these events the British government established the Northwest Territory in 1787. The Northwest Territory was to include everything to the west of the colony of Upper Canada that was not included in Rupert's Land. Shortly after the American Revolution of 1776 Alexander Henry, along with Peter Pond and others, established the Northwest Company in 1778.

A number of events in the late 1700's and early 1800's challenged the operation of the Northwest Company. As these events unfolded the Northwest Company became more and increasingly interested in finding a Canadian route to the west from Lake Superior. This was the first organized attempt by the Canadian fur traders to challenge Hudson's Bay Company claims to the furs throughout the northwest. David Thompson was hired to find an alternative route from Lake Superior to the Northwest Territories through Lake of the Woods. The Jay Grenville Treaty of 1794 provoked this. The treaty gave the United States control of the border region from Lake Champlain to upstate New York and further west to Fort Michilmackinac and the straits between Lake Huron and Lake Michigan (Carroll 2001). In exchange, Canadian fur traders were given free access to the Mississippi River and Natives who worked with the fur traders were given free passage across the border to carry out their pursuits. The Northwest Company needed a Canadian route to the Northwest Territories and an alternative route to the Mississippi. Once the United States convinced Napoleon Bonaparte to sell the Louisiana Territory, which included everything west of the Mississippi to the Rocky Mountains, a Canadian route became imperative. In 1804 the Northwest Company established their headquarters at Fort William and began to utilize the Kamanistiquia River route west to Namakan Lake and onto Rainy River and Lake of the Woods. The period from 1780 to 1880 became the golden age of the fur trade in the Lake of the Woods watershed.

During this period the Anishinaabe were critical to the success of the Northwest Company for the supply of furs and provisions (Bishop 1974; Lytwyn 1986). The 1793 post journal of the Northwest Company at Lac La Pluie reflects the importance of the Anishinaabe people. John McKay of the Lac La Pluie post records in the years between 1793 and 1796 how he had traded for wild rice, venison, goose eggs and other provisions that he needed to survive (Lac La Pluie Post Journal HBCA B.105/a/1-4). What is not reflected in the early records is how the Anishinaabe people crafted the landscape to provision the fur trade. While the economic organization of the fur trade drew upon the Anishinaabe livelihood, the crafting of the landscape was necessary to intensify the production of resources. The dual action of flooding and soil deposition and the firing of those lands by the Anishinaabe for instance, created the meadows along the Rainy River over time. It was this practice that created the disturbances, which provided berries; browse for some of the ungulates and birch stands for the canoes. As the demand for provisions increased, Anishinaabe families tended and expanded groves of sugar trees and wild rice stands. On the prairies, Anishinaabe fire practices expanded the tall grass prairie and increased forage production for the buffalo. Since the time of the French fur traders, this was a landscape tended by the Anishinaabe for the commercial fur trade.

The role of the Anishinaabe in crafting the fur trade landscape can be gleaned from J.B. Tyrell's 1916 version of the Thompson diaries and E. Coues's 1897 version of Henry's diaries. David Thompson noted that the best meadows for haying were found along the Rainy River (Coues 1897; Glover 1962; Tyrell 1916). Thompson was very specific in his definition of a meadow. A meadow was a grassland where the grass was tall enough to be cut by a scythe and as a result produce hay. A plain was made up of grass too short to be cut for hay but long enough to be grazed. Lake of the Woods was noted as being at the transition between the stony, or rocky, lands to the north and the great plains to the west. The stony lands were made up of granite, greenstone and clay slate and met the plains at the southwestern side of Lake of the Woods where limestone shores dominated. As established by the French and the Anishinaabe earlier in the 17th Century, this transition from Canadian Shield to Prairie was critical to the success of the fur trade.

The Anishinaabe procured for themselves, and the Northwest Company through trade, the provisions necessary to maintain the supply of furs (Bishop 1974). The commercial activity probably intensified what had been a pattern of livelihood for this part of the Americas since time immemorial. The livelihood that was followed by the Anishinaabe had both a temporal and a spatial aspect determined by the timing and location of different resources that were needed. The stony lands were made up of a multitude of lakes and forests. These lands ran into the great grasslands of the west. As defined by Thompson these contained large extensions of meadows and grasslands populated by large quantities of buffalo (Tyrell 1916). The fur trading posts located on the stony lands were known as the fur houses while those located on the grasslands, the buffalo houses. These two labels signified their principle activities.

The main posts of the region were the Lac La Pluie, Fort Alexander, Fort Garry and Pembina Posts. These posts, along with numerous outposts, drew together the varied livelihoods that the Anishinaabe pursued at the time. The main products sought by the fur traders were furs, maple sugar, wild rice and pemmican (HBCA 105/a/1-4). While these provided the staples of the fur trade other items such as game, corn, wild fruits and vegetables were also procured by the Anishinaabe for their own use as well as trading to the posts as provisions. It was common for fur traders located at outposts to have survived on the provisions obtained from the Anishinaabe of the stony country for the whole winter. The fur trade existed through the Anishinaabe ability to craft and weave together the rocky lands and the prairies in a commercial livelihood; driven by the ability of the Northwest Company to sell furs in Europe.

CRAFTING FUR TRADE LIVELIHOODS AND LANDSCAPES

The prairies provided the clearest evidence of how the Anishinaabe people utilized fire to influence the landscape. Both Thompson (Coues 1897; Glover 1962; Tyrell 1916) and Henry (Coues 1897) mentioned fires in the stony country during their frequent travels through Lake of the Woods to Fort William. However, these fires were usually noted in passing and no reflection was made upon the source of these fires. The fires of 1803 to 1804 around Rainy River, however, were noted as being particularly extensive. Neither Thompson nor Henry made a connection between fire and the meadows along the Rainy River.

When David Thompson and Alexander Henry the younger, moved onto the plains they made constant reference to fire. Henry mentioned that the plains were on fire every spring and every fall (Coues 1897). Henry and Thompson agree that these fires were intentionally set for a variety of reasons. One reason mentioned by both is for the purposes of warfare. Both the Sioux and the Anishinaabe used fire as a method of war. When the Sioux had horses, and the Anishinaabe were still on foot, the Sioux would set a fire upwind of an Anishinaabe camp. This would force the Anishinaabe to move and the Sioux would sweep down upon them with their horses. Thompson and Henry also both comment on how spring fires were noted as useful for greening up the plains and meadows in the spring. Whatever the motive, the result was that there was an extensive band of meadows that ran along the eastern and northern fringe of plains and extended into the plains along river valleys.

Thompson was the first European to reflect upon the result of these fires in both the pinelands and in the meadows and prairies. For this reason it is worth reproducing his observations in detail from Tyrell's (1916:248) version of his diaries as he neared the Pembina post on the Red River.

> "We journeyed on the west side of the River; the whole distance was meadow land, and no other Woods than saplings of Oak, Ash and Alder. From the many charred stumps of Pines it was evident this side of the River was once a Pine Forest. In the more northern parts, where Pine Woods have been destroyed by fire, Aspins, Poplars and Alders have sprung up, and taken the place of the Pines; but along this, the Red River from the mildness of the climate, and goodness of the soil, Oak, Ash, Alder, and Nut Woods have succeeded the pines.
>
> This change appears to depend on soil and climate; for in the high northern latitudes, where in many places there is no soil, and the Pines spread their roots over the rocks, Pine grounds, when burned, are succeeded by Pines; for Aspins Poplars and Alders require some soil. Along the Great Plains, there are very many places where large groves of Aspins have been burnt, the charred stumps remaining; and no further production of Trees have taken place, the grass of the Plains covers them: and from this cause the Great Plains are constantly increasing in length and breadth, and the Deer give place to the Bison. But the mercy of Providence has given a productive power to the roots of the grass of the Plains and of the Meadows, on which the fire has no effect. The fire passes in flame and smoke, what was a lovely green is now a deep black; the rain descends, and this odious colour disappears, and is replaced by a still brighter green; if these grasses had not this wonderful productive power on which fire has no effect, these Great Plains would, many centuries ago, have been without Man, Bird or Beast. "

Thompson recognized that the result of the burning was the production of what he termed meadows. These meadows occurred on the deeper soils of the eastern and northern fringes of the plains. Burning changed aspen bush into a lush meadow. As meadowland increased there was a concurrent increase in the grazing lands of the buffalo and the buffalo population. In other observations, Thompson notes how these meadowlands could be easily opened by the plow as the work of removing the trees had already been undertaken. Thompson was also one of the first to notice the difference between burns on different soil types. On stony pinelands he noted that fire tends to reproduce pinelands. When pines growing along rivers were burned, however, the plant community tended to shift toward oak, ash and alder in the south. In the north, fire in riparian areas tended to move the plant community toward aspen, poplar and alders.

David Thompson provided the first description of how First Nation people utilized fire to open and maintain meadows.

In the writings of Thompson and Henry, the younger, we begin to see how the landscape emerges through the agency of the Anishinaabe in order to procure their own needs as well as items for commercial trade. Thompson, through his diaries, also proved to be an astute observer of the ways in which Anishinaabe thought about their world (Coues 1897; Glover 1962; Tyrell 1916). He related how the Anishinaabe maintained that all beings were animate and had an agency to act. It was for this reason, he said, that many ceremonies were held for the various activities undertaken by Anishinaabe people. For example, ceremonies were held after a successful hunt, before harvesting sugar or wild rice, after successful trapping and integrated into activities related to the procurement of their own needs and for trade. When groups came together in the spring to trade furs and sugar, and in the fall to trade rice and obtain provisions for the winter, there were larger collective gatherings and dances. At the time that Thompson traveled through Lake of the Woods Anishinaabe livelihoods exhibited a complex set of characteristics that included temporal and spatial movement, ceremonial life, landscape modification and commercial trading.

A seemingly minor event in 1812 signaled the coming end of the fur trading livelihood and landscape (Van Kirk 1980). In 1812 Lord Selkirk formed the Red River Colony and brought over a group of settlers to farm the land near Fort Garry. At the same time tension between British North America and the United States broke out into the War of 1812. The War of 1812 was finally settled by the signing of The Treaty of Ghent (Carroll 2001). This treaty established that the boundary between the United States and the Northwest Territories of British North America was to be determined by a line drawn north or south from the northwest angle on Lake of the Woods to the 49^{th} parallel. The boundary was then to run along the 49^{th} parallel to the western mountains. Once this was established the United States expelled the Northwest Company and the Hudson's Bay Company from U.S. territories in 1816. Shortly after, in 1821, the Northwest Company and the Hudson's Bay Company decided to merge.

In the years 1822-1824 a joint U.S. and British boundary commission was established to determine the boundary from Lake Superior to the Northwest Angle and from there a line to the 49th parallel (Carroll 2001). It was decided that the boundary would be along the Pigeon River system and then west to Lake of the Woods along the established canoe route through Lac La Croix, Namakan Lake, Rainy Lake and along Rainy River into Lake of the Woods. The next task was a survey of Lake of the Woods in the year 1823 to establish the Northwest Angle and the line to the 49th parallel. This boundary story is interesting in itself but moreover Bigsby was somewhat of a natural historian and provided insightful comments on the landscape through which he traveled (Bigsby 1969).

Bigsby, a commissioner of the 1822-1824 joint U.S. and British boundary commission, was an astute observer of the Anishinaabe use of fire to craft the landscape. In his book entitled *The Shoe and Canoe or Pictures of Travel in the Canadas*, Vol. II, he wrote "The Indians burn large tracts of pine barrens in order to favour the growth of very useful autumnal fruits" (Bigsby 1969:207). Later he mentioned how the portage leading from Lake of the Woods to the Winnipeg river had been burnt. He also noted how some points and islands on Lake of the Woods have been burnt. Later in his journey he mentioned how a party of Anishinaabe were gathering black bilberries that he calls Vaccinium Canadense. He commented on the berries in great detail:

> "This fruit is incredibly abundant all over these countries. For miles we cannot tread without crushing them under our feet; and we owed much of our health and strength to the free use of them. The berries are very deep purple, as large as the out-door English grape, and they grow on a low creeping shrub. Their flavour is sweet and agreeable; most so in the spring, when they have lain a winter under snow" (Bigsby 1969: 313-314).

He also noted how the promontory, near Pipestone Island, was well wooded but became naked towards its middle as the Anishinaabe purposely fired it. The comments by Bigsby completed the picture of the landscape and clearly drew the linkage between fire, Anishinaabe people and the fur trade livelihood.

In the year 1857 the Palliser (Spry 1968) and the Canadian expeditions (Dawson 1968; Hind 1860; Hind, Dawson and Gladman 1858) passed through Lake of the Woods. The former was sent by the British Government to assess the suitability of the Northwest

Territories for settlement. The latter sent by the colonial government of Upper Canada to find a Canadian route to the Northwest Territories. These expeditions confirmed the basic pattern of the fire-generated landscape reported since the time of Alexander Henry the younger and David Thompson. In the Canadian Shield country there were many reports of burnt forests that seemed to be noted mainly in the pinelands (Spry 1968). Often the pinelands were burnt so that berries could be obtained, or the berry patches themselves were burned to maintain the berries. The birch that sprang up in the pinelands following fire was utilized to produce canoes, containers and many other useful things. The spruce and pine found in more mature forest patches were utilized to obtain roots and pitch to sew and seal the canoes.

The banks of rivers were often burnt and these were covered by meadows. Palliser at points noted that these meadows were the sites of Anishinaabe camping grounds (Spry 1968). There were swamplands which provided decent hay especially if burnt off in the spring. These open meadows created safe places to camp as well as providing pasturage for the main ungulates which were hunted. Wild rice was obtained from the lakes and ponds as well as sturgeon and other fish. Wild game such as moose, elk, caribou and deer were hunted for food. Other plants were utilized as medicines and foods. Some plants, such as rock tripe, were especially important in the times when food was scarce. The fur bearing animals such as beaver, wolf, lynx, muskrat, fisher, mink and others provided the main driver for all this commercial activity in the woodlands of the late 1600's and into the 1800's. The woodlands were a mixture of vegetation in different stages spread across the landscape and modified by natural and anthropogenic fire.

Moving onto the prairies the basic pattern of meadows and open groves of oaks and other hardwoods were found along the rivers. Fire also expanded the open meadows and pushed back the aspen woodlands to the east and the north. The expedition of Palliser picked up this early observation of Thompson's. It was Palliser who divided the prairies into the short grass and tall grass prairies (Spry 1968). The latter, he notes, was created by the long practice of setting fire to these lands by the inhabitants. This tall grass prairie zone extended from the southwest corner of Lake of the Woods and swept in a great arc toward the northwest. These were the lands determined to be suitable for settlement due to deeper soils and higher precipitation. They had the added attraction of already being opened by the aboriginal inhabitants for settlement. The long practice of burning had made it unnecessary to clear trees and dig out roots. The tall grass prairie was also important as it had created a large expanse of grasslands and increased the number of buffalo found on the prairie. Buffalo, turned into pemmican, provide the mainstay, along with wild rice and sugar, for the fur trading houses found deeper in the woodlands. As with the woodlands, the prairie was a landscape shaped by fire and central to the success of the fur trading enterprise.

The Lake of the Woods watershed, of which Shoal Lake is a part, was at the heart of this fur trading landscape. The woodlands graded into the prairie as one moved from the northwest corner to the southwest corner. The five ungulate species, moose, caribou, elk, deer and buffalo were found on various parts of the lake. Northern and southern woodland species of plants and trees intermixed along with prairie species. It was a main source of wild rice, sugar and blueberries along with sturgeon and other fish. The fur trading landscape was a fire generated landscape. How much of this was attributable to human agency? If the written record is taken as accurate, it suggests that there was a mixture of human agency and natural ignitions from lightening. In areas where burning was a frequent occurrence there was little fuel to create large fires. As most burning occurred in early spring and late fall it is likely that the burning along rivers and in berry patches was localized. On the prairies the fires that are reported appear to have been quite widespread. However, even in the woodlands it is likely that in dry years, large fires, such as those reported in 1803 and 1804, may have started small and expanded into large conflagrations. Regardless, it is clear there was little attempt to suppress fire. Rather, it was managed by reducing the fuel load through frequent burnings.

In one of the few recorded Anishinaabe voices on this topic Madeline Theriault, an Anishinaabe woman from Temagami, has this to say in her story entitled *Moose to Moccasins: the Story of Ka Kita Wa Pa No Kwe*.

> "White man makes a farm to grow hay to feed his animals. He also grows vegetables for food. Indians also feed their animals, only in a different way. Around the middle of April, the Indian trapper looks around to find a bare spot, mostly up on the rocks where the snow goes first, where there is still a lot of snow at the bottom of the hill. They set a

match to this bare spot and only burn where it is dry and bare, so there's no danger of a big forest fire because the fire stops when it reaches the snow.

Two years later you would find a big patch of blueberries in amongst the bushes. And you would see all the hungry animals feeding on those blueberries: fox, wolves, black bear, partridge, squirrels, chipmunks, and all kinds of other birds. No doubt they were happy to find those berries. It was the trapper that got it for them by setting the fire.

This is what I mean when I say Indians feed their animals too. As we would preserve them for our winter use. After a few years, young trees would grow on that burnt place. Then the rabbits would get to feed from those young bushes. In later years, the little trees would get bigger. Then the moose and deer get to feed from it. So, you see the setting of these small fires can go a long way in feeding many animals" (Theriault 1992: 74-75).

BLUEBERRIES, TIMBER AND FIRE

Seven years after the Palliser expedition Canada became an independent Nation with the signing of the Constitution Act. Two years later the Temporary Government of Rupert's Land Act transferred the lands of the Hudson's Bay Company, Rupert's Land, to Canada. This led to the first of the clashes between a fur trading way of life and settlement, when Louis Riel staged a rebellion against Canada. Troops were sent out via Lake of the Woods from Canada to the Northwest Territories to put down the rebellion. In 1870 the Manitoba Act was signed which created a new territory for the Dominion of Canada. In 1873 Treaty #3 was signed at the Northwest Angle.

In the same year that the treaty was signed Simon Dawson surveyed and built what later became the Dawson trail. The Dawson trail was a mixture of corduroy roads and steamships that brought settlers through Canadian territory to the Red River and points beyond. 1873 was also the year that Sir Sanford Fleming passed west surveying the line for a railway (Fleming 1879; Grant 1877). Part of the stimulus for signing Treaty #3 was to establish the Dawson trail as well as to begin planning for the Canadian railway that became the Canadian Pacific Railway.

These Canadian communication routes allowed settlers to move to the prairies and ship their products back to the markets of the east. They proved to be vital to the development of a Canadian Nation. The best route to the west at this point in time was to use the railway through the U.S. and then travelling by paddleboat up the Red River. However, the Canadian government feared that all produce from the west would start flowing in that same direction. Canada needed the grain produced in the west to feed the steady stream of immigrants entering into eastern cities during the industrial development of eastern Canada. In order to build the railway, they would also need access to timber for ties and bridges. This had led to an order-in-council being issued to a man named Fuller for a timber lease on Lake of the Woods in 1872 (Lake of the Woods Museum, Kenora). Although this order-in-council was not approved until 1875 it indicated the need for a Treaty in the Lake of the Woods watershed.

The 1870's were an active period on Lake of the Woods as settlers moved across the lake via steamship to the Dawson trail and onto the prairies. In 1878, John Mather, a timber merchant from the Ottawa valley, bought the Fuller timber lease and by 1879 was in Rat Portage (Kenora) looking at a site for a sawmill (Mather Walls House, Kenora). By 1882 the Canadian Pacific Railway had made its way to Kenora, and Mather was supplying ties and timbers for the construction of the railway into the prairies. Seven other sawmills were operating around Kenora by 1886 supplying the railway and the building boom taking place on the prairies. These seven mills supplied 50% of what was needed by the railway with the other 50% coming from Minnesota. Between 1892 and 1895 Mather built a dam at the outlet of the Lake of the Woods to the Winnipeg River. The purpose of the dam was not only to supply electricity but also to raise the water level on the lake so that it would be easier to move log booms.

In 1878 the first Fire Act was passed in Ontario. During the fur trade era fire was a danger but not of grave concern. By the late 1800's however, fire was seen as a destructive force to be combated and suppressed. Timber, along with mining to a lesser extent, became the main economic drivers for northwestern Ontario. Interest in the forest shifted from provisioning the fur trade toward an interest in mature timber for railway sleepers and lumber. As a result, it was necessary to eradicate fire from the forest.

While the economic interest in timber was the main driver for eradicating fire, the fear of fire also had roots in a number of catastrophic fires that occurred in the late 1800's. The latter half of the 1800's was the greatest period of settlement in both Canada and the United States. Settlement depended upon the construction of railways to move people west and to take the emerging products of their labour to the east. Settlement and railways led to an increase in the number of conflagrations that occurred in the northern woodlands of Canada and the United States. Stephen Pyne in his book *Fire in America: A Cultural History of Wildland and Rural Fire* traces the devastation of the Wisconsin fires of 1871; the Minnesota fires of 1881, 1894 and 1910 (Pyne 1982). A similar pattern of fires was reported from the clay belt of northeastern Ontario and the settlement areas along the Rainy River.

Settlement created a complex set of factors that led to an increased incidence of fire (Pyne 1982). In a dry year virtual firestorms broke out. With settlers lighting fires to clear their land, the increased amount of slash found on the landscape from land clearing and logging could lead to tremendous fires. Railways themselves also led to an increase in the amount of fire. Sparks from the steam fired engines or the wheels during breaking and wheel slippage going up inclines could also start fires. As more people and built structures became established in these regions, there was also a corresponding loss of life and infrastructure. The protection of timber, however, was the main impetus for fire suppression legislation. The political will to implement the legislation came from the increase in deadly fires due to settlement, logging and railways.

Pyne (1982) identifies the primary years of firestorms between 1850 and 1930. In Canada the period from around 1880 to the 1930's was a time of active legislative development and enforcement regarding fire suppression. After the first Fire Act in 1878 it was revised in 1887, 1897, 1913, 1914, 1917, 1927 and 1930. After that active period of legislative development it was only revised again in 1937, 1948, 1950 and finally in 1960 (Lambert 1967). This legislation became increasingly punitive in the fines and jail terms that could be given to a person causing a fire. The first charge laid on Lake of the Woods was in 1914 to two fishermen who left a campfire burning as reported by the Kenora Miner and News. Legislative tools were created allowing the province of Ontario to hire fire rangers with the power to charge people with breaking the legislation. These same fire rangers also held the power to detain people, question them and require them to leave the bush. Finally, fire rangers were responsible to find areas of high ground upon which to establish fire towers. It was during this period that the province began to establish the legislative and technological tools for the surveillance of fire risks and the enforcement of fire suppression (Lambert 1967).

The same time period also saw an increase in efforts to educate the public about the danger and economic loss resulting from forest fires. There are few recorded incidents about fires being caused by the Anishinaabe people. In the book by Richard Lambert entitled: *Renewing Nature's Wealth: A Centennial History* a 1899 fire in northeastern Ontario was attributed to the burning of a blueberry patch by an "Indian". Such incidents led the Ontario Department of Lands and Forests in 1900 to ask the Hudson's Bay Company to distribute copies of fire proclamations in the Indian languages along the main canoe routes. One such proclamation in Cree syllabics was found in the Ontario - Manitoba boundary archives from the period (MG1-A10). The Kenora Daily Miner and News reported on all forest fires during this period. The month of April often contained a week called forest fire prevention week. During that week information would be published on the economic cost of fires, danger to the public and the cost to infrastructure. The cause of fires was said to be 90% human with a variety of sources from settlers, campers, railways and timber operations. There was a strong moral tone to these campaigns with one using the title "Are you a Canadian Nero = Fiddling while Forests Burn?"

The use of fire by Anishinaabe people became increasingly difficult. However, as a result of the increase of fires during this time period, it also was a time when Anishinaabe people were very active in the commercial blueberry trade. As well, the Annual Reports of the Department of Indian Affairs from the early 1900's note how the Anishinaabe people were active in many aspects of early industrialization. The reports state that Anishinaabe people worked in timber and mining camps, with railway survey and construction crews, on the steamers and for commercial fishermen. However, the reports always mention that they were involved in harvesting berries, hunting, ricing, fishing and trapping. The reports also indicate how trapping was becoming less and less renumerative for Anishinaabe people. It is during this period of transition from a fur trading to a timber harvesting landscape that Anishinaabe people become involved in the commercial blueberry harvest.

The period between 1880 and 1930 was one of immense change in the Lake of the Woods area. In the early 1900's permission was granted to the Mather timber interests to blast a channel through Ash Rapids that joined Shoal Lake to Lake of the Woods (Shoal Lake Watershed Working Group 2002). Corresponding with a need for the timberlands to move north, the Grand Trunk Railway, which later became the Canadian National Railway, opened the north line, providing access to the timber lands of the English and Winnipeg River system (Lake of the Woods Museum). This railway linked the northern woodlands to the markets of western Canada. The growth of population on the western plains, especially in Winnipeg, also led to the need to find a source of water. In 1913 an order-in-council was passed by Ontario that allowed Manitoba to draw water from Shoal Lake. The Greater Winnipeg Water District aquaduct was completed in 1919 along with a railway that ran from Shoal Lake to Winnipeg. The period of early industrial development between 1880 and 1930 saw the development of the lumber industry; culminating with a pulp and paper mill in Kenora in the mid-1920's. It was the intense period of settlement and agricultural development on the prairies that drove developments in northwestern Ontario. However, it was also the period of great fires, great employment shortages as manifested in the Winnipeg General strike and the Great War.

This same time period was also a time of tremendous change for the Anishinaabe people of Lake of the Woods. The establishment of the reserve system for Anishinaabe people was implemented following the Treaty of 1873. The commercial development of sturgeon roe led to the loss of sturgeon for food (Holzkamm, Lytwyn and Waisberg 1988). The damming of the Lake of the Woods resulted in the loss of wild rice fields and hay meadows (Waisberg 1993). Trapping, however, remained an important source of income during this period. Yet, the Annual Report of the Department of Indian Affairs reported an unstable demand and decreasing price for furs during this same period. For the Anishinaabe, it is evident that this period was one in which Anishinaabe people were increasingly having to adjust to changing landscape and markets as a result of settlement and industrialization. This is, perhaps, best summed up by an observation of the Indian Agent, John Semmens, in his 1915 annual report about the Kenora Agency of the Department of Indian Affairs.

> "This agency has 11 bands of Indians, all of whom speak the Ojibway language. These people are hunters and fishermen who love the wild woods and roam about a good deal, living according to the practices and traditions of their pagan ancestors. In the summer time they dwell in tents for the most part; and in winter they live in log houses on their reserves, or in temporary shacks erected near their hunting-grounds or fishing stations. A few of the Indians have made good progress in agriculture and stock-raising, and such persons are prospering. They have money and enjoy a good degree of comfort. They have good homes, and their families are respectably dressed. They enjoy pointing out the evidences of their thrift, and we commend them for following the counsel of the department. Officers are proud of such people; but they are all too few. The majority will not cheerfully and persistently engage in anything that ties them to a certain dwelling-place.
>
> My experience does not show that the natives are lazy. They are splendid workmen. They excel as axemen, river-drivers, portagers and voyageurs. If they have a fault in regard to labour, it lies in their unwillingness to continue long in one place, or at one class of employment. When they have accumulated a little money, they love to go home and have a good time with their friends in spending it. Employers do not like this, and prefer to give work to those who will remain faithful to duty month in and month out, or if necessary, for years. There are certain seasons in the Indian's life that afford him special pleasure. There is the hunt for geese and ducks in spring and fall; there is the berry-picking time, and the rice-gathering in the autumn. He takes such pleasure in these things that he will leave common day labour for the more poetic duties peculiar to his people. His love of change is his fault, if fault it may be called; but it should not be called laziness."

The livelihood of Anishinaabe people of this period developed by bringing forward practices from the fur trading era and adapting them to the changing social-ecological environment of the period. One of the changes, which were introduced as part of the industrial and settlement period, was the development of residential schools. The Methodists on Shoal Lake established the Cecilia Jeffrey boarding school in 1905. The Anishinaabe people saw these schools as a mixed blessing. In 1906 the Indian Agent John Semmens reported, "The day schools of this agency are in a most unsatisfactory state. The Indians object most seriously to the religious teaching carried on in them. They profess to be favourable to secular and national instruction but desire that the children be left free to choose for themselves what shall be their religious learnings" (Annual Report of the Department of Indian Affairs 1906). Residential schools resulted in many impacts on the Anishinaabe. One impact was the tension that emerged, as children were unable to be with their families during much of the year.

Ella Dawn Green and Walter Redsky of Iskatewizaagegan No. 39 Independent First Nation often mentioned how residential school interrupted their time on the land with their families. It was not until their teen years that they were able to rejoin their families during the winter trapping season. However, the summer activities became especially important as they brought together families, extended families and communities during the time of berry picking and ricing in July and August. These activities were important not only for the income they provided but also for the ability to join together in activities on the land. The importance placed upon these activities by Anishinaabe families was, in part, evidenced by a comment made by a frustrated missionary as reported in the 1910 Miner and News: "The Indians had gone off on a berry-picking exploit, he told the board, and consequently there was nothing left for him to do."

The confluence of events during the 1880 to 1930 period led to the emergence of a vigourous commercial blueberry enterprise throughout the Lake of the Woods and the Winnipeg and English River system. The fires of 1910 led to great blueberry heaths throughout the district by 1915. The Miner and News reported in 1915 "The area in this district covered by blueberry plants is so large that the crop gathered is only limited by the number of pickers available." The crop was reported as a prolific one for that year with many people picking due to the employment shortage as well as the Anishinaabe people who were well known for their involvement in the industry. In the year of 1915, pickers were paid 0.07 cents / lb. which was up from the year before when they were paid 0.03 cents / lb. Other prolific crop years were between 1926 and 1927. In 1926 it was estimated that 260,000 lbs. of blueberries were shipped west from the Kenora C.P.R. station. In 1927 this amount had increased to 350,000 lbs. at 0.10 / lb. for a value landed at Kenora of $35,000.00. During this time period the Kenora Miner and News claimed that Kenora was setting records for blueberry production in the whole Dominion of Canada.

At the same time that the blueberry industry was thriving on account of the large berry lands created through fire, the effort to suppress the fire was increasing. Throughout the 1920's The Miner and News reported on the increase in fire rangers and the use of seaplanes to spot fires and deploy men to put them out. There was also a corresponding increase in the effort to educate the public. Careless use of fire was seen as an economic and moral insult. However, this did not stop fires from breaking out throughout the next cycle of dry years during the late 1920's and early 1930's.

Large fires were recorded during the 1920's to the west of Whitefish Bay and surrounding Redditt (Ontario Forest Research Institute 1998). In the 1930's fires broke out on the Aulneau Peninsula and again around Redditt. It is difficult to know what started these fires. Fires were often attributed, in the Kenora Miner and News from this time period, to careless berry pickers, campers and fishermen as well as some activities from logging. The fires around Redditt occurred near the rail line so it is possible that they were started due to the railway. It is also possible that they could have been due to natural sources such as lightning. Regardless of the source of fire ignition, there is little doubt that dry years combined with settlement, logging and railways resulted in a blueberry landscape. It was a landscape that provided my mother, Ella Dawn and Walter with their memories of blueberry picking during the 1930's and into the 1940's. Ella Dawn and Walter still had vivid memories of this time period when they were interviewed in 2001.

"I have been asked to talk, to remember, about where they used to pick berries and how they used to travel. As far as I remember in Iskatewizaagegan, the people would gather together, the ones who were going to go berry picking. Once there were enough people that wanted to pick, they would go to Indian Bay. From there they would get on the freight train. They all got on the freight train. The boxcars that were connected. They would have with them their clothes, their boats, their dogs. They would not leave their dogs; they would take everything they owned. They go toward Winnipeg, but not as far as that because they would get off and get on another one. When we got on the other train we would go toward Redditt. We rode the freight train all the way there and this is where we got ready. They would all paddle, we would all paddle to where we were going to set up a camp at a place they called Ena. Once we got to Ena, we all supported each other to get the camp ready and settle in. We stayed there all season to pick berries. There was a man there who ran a store and to whom we would sell the berries to make money. I remember the old people would play cards in the late afternoon. The kids would play what ever they enjoyed to play. Everyone got sent to bed early in the evening. Very early in the morning they would get ready. They had to canoe a long way. They canoed for a distance and it took awhile every day. They would be gone all day. They didn't get back until the sun was setting. I was amazed at how every one supported each other, even the kids supported themselves. They would pick their own berries. I was happy that my mother made me pick berries and she told me to try and fill up my container. At the end of the season people would meet and decide when to move to the wild rice fields."

Ella Dawn Green, Shoal Lake, Ontario, 2001

"I am going to tell you about when we used to go berry picking. My kids were very small and this is where one of them learned to walk. When we were finished picking berries, at the end of Armstrong Lake, the buyer would come to buy the berries. We also lived with people from Sageeng at Armstrong Lake. I used to hear that at Ena that they played

> moccasin games. I wished I could go. And over by Reddit there was a field, they had a baseball tournament. Once a month they would play ball on that field. And over by Reddit they would pick berries. As I was saying, we used to pick berries all over. We camped all over. A man named Duggan would come to buy the berries. People would come from all over to pick berries, Sageeng, Whitefish Bay, Shoal Lake, Whitedog, Northwest Angle, Grassy Narrows, everywhere.
>
> I am going to talk about where they used to pick berries. They picked all over. Across the lake in the river there was a big fire. And over there, there is a river, that river is long. Its about three miles in the bush. And here it was burnt black. The fire burnt a long way, almost to the Manitoba boundary where the big border cut is, that is as far as it went. After the fire that was when the berries came. There were berries all over. There were about three seasons after the fire, that is when the berries grew. After that fire they didn't have to go to other places. They could pick all the berries here on Shoal Lake and sell them to John Holmstrom."
>
> Walter Redsky, Shoal Lake, Ontario, 2001

Ella Dawn and Walter remember the time when the families from Shoal Lake would travel west on the Greater Winnipeg Water District Railway toward Winnipeg. They would load up their canoes, dogs, tents and anything else they needed for berry picking and ricing into the boxcar. Where the rail lines met east of Winnipeg they would transfer everything into a boxcar on the C.N. north line and head east to Redditt. There they would get off and go to the lakes where their families would pick. While Ella Dawn's family went to Ena Lake, Walter's would go to Armstrong Lake. Anishinaabe from all over the Lake of the Woods watershed would be travelling to lakes near Brinka, Farlane, Jones, Favel or McIntosh. The section stations along the railway often served as the names remembered as the place they went picking. The Hudson's Bay Post records of Grassy Narrows indicate how people would leave the community to go down to the "line", or Jones, to pick berries. As far east as Dinorwic the Hudson's Bay Post reports on people going to pick berries. Clearly, the blueberry harvest was an activity with widespread involvement by Anishinaabe people.

Some of the men would precede the family group to an area and scout out different picking locations. They would indicate where their families were to go and pick that year. Before picking began, ceremonies were held and the respected leaders would indicate when picking should start for that year. Leaders from different groups would also indicate when picking should start and stop for the day, when a particular area should be rested, and when it could be picked again and also when picking should stop for the year. The leaders would meet with their "messengers" who would go and deliver these instructions to the various families in the area. The people respected these leaders, and families would respect where other families were picking. Men would either go into Redditt to deliver the berries to the store owned by the Duggans, or the Duggans would send buyers out to the various picking areas. At the store people from Winnipeg and Redditt were involved in making baskets and loading them to be sent to western markets. At the end of the blueberry season the Shoal Lake people would then travel to other spots known to them for wild rice. They travelled by the C.N. or the C.P.R. line into what later became the Whiteshell Provincial Park, to lakes such as Lonepine Lake to harvest rice. After the rice harvest, they would travel by the C.P.R. line back to Kenora to sell their rice and purchase supplies for the fall. They would then travel by canoe back to Shoal Lake as there was no road connecting the Trans-Canada highway to Shoal Lake until 1965. Once back at Shoal Lake, the children would go to residential school while the rest of the family would head out to the trap line.

The dry years of 1929 and 1930 led to poor blueberry years as reported by the Kenora Daily Miner and News with record low shipments in the range of 45,000 lbs. At the same time this shortage saw prices increase by 25 - 30%. However, these dry years also led to fires that once again created extensive blueberry patches. By 1935 the blueberry crop was again reported as being large. The Kenora Miner and News reported that in 1935 20,000 baskets, or 360,000 lbs., were shipped out of Kenora and was the largest crop in several years. These estimates are probably low for a number of reasons. The Trans-Canada highway was completed through Kenora in 1930; therefore many blueberries were being shipped by truck. The estimates reported in the Kenora Daily Miner and News were only based on shipment receipts through the C.P.R. station in Kenora.

John Duggan and Larry Maki, both active in the harvest activities around Redditt during the 1940's, provide an idea of the scale of the blueberry industry at that time. They suggest that more berries were shipped out of the Redditt C.N. station than the Kenora C.P.R. station. They estimate that they may have shipped between 300,000 - 400,000 lbs. out of the Redditt station during the years of abundant blueberry crops. This, then, needs to be added in to the estimates made by the Kenora Miner and News of 250,000 - 300,000 lbs. as it was only reporting the shipments from the Kenora C.P.R. station. The blueberry harvest provided Anishinaabe people, and others, with critical income during the difficult years of the 1910's, 1920's, 1930's and 1940's.

The bounty of the blueberry landscape and livelihood in northwestern Ontario came to an end with the advent of the Second World War. By the late 1930's a road had been built into Redditt, and blueberries began to be shipped by truck. The biggest period of blueberry shipment by truck occurred during the war when freezer trucks would travel to Redditt to obtain blueberries from the Duggans. As told by John Duggan and Larry Maki, these trucks were buying up blueberries for the United States Navy. With the advent of the Second World War, the United States Navy lost access to their source of blue dye. Blueberries provided a North American source of blue dye which was readily accessible. The use of blueberries as a dye was well known to the Anishinaabe people who utilized it for dying porcupine quills and other materials. Following the Second World War, the era of large commercial harvests of blueberries fade into history. By 1955 the only mention of blueberries in the Kenora Daily Miner and News is that it seems to be a good year for blueberry picking and making pies.

Competition from the developing industry on the east coast and lack of labour following the war may explain the loss of the commercial blueberry industry from northwestern Ontario. However, another explanation is the loss of the blueberry heaths generated by fire. The post-war period saw dramatic improvement in the fire fighting technology. By 1935 radios had been deployed in fire fighting. This development allowed patrol planes to radio fire ranger crews who could extinguish a fire before it grew to a large size. While railways may have started fires, they were also useful to quickly gain access to fires. As the logging road network was built, this also provided quicker access to fire starts. By the end of the war an efficient system of fire management had been established and was in place. Planes were able to deploy men to isolated fire starts before they grew to huge conflagrations. The success of this system can be seen from the fire data that shows a disappearance of large fires (>200 ha) from the northwestern

Ontario landscape during the 1940's, 1950's, 1960's and 1970's (Ontario Forest Research Institute 1998).

The result was that large fires were pushed north and into areas that were not easily accessed by permanent road. As helicopters and water bombers were integrated into the fire management system the size of fires, as demonstrated in the fire data, decreases. This was more noticeable in areas like the Lake of the Woods watershed, which had extensive road networks, easy access to fire starts by water, and were heavily populated. In the post war period there have only been a few fires greater than 200 ha with one notable fire in 1980. The landscape of northwestern Ontario became that of an industrial logging landscape. The use of fire management to restrict large fires was undertaken to protect property and timber. As a result, the most frequent disturbance in this landscape was a logged clear cut. In recent years, the only commercial blueberry operation has been harvesting in clear cuts.

Bill Paranteau, a member of Wabigoon First Nation, has worked with the Wabigoon Métis Corporation and on his own to commercially buy and sell blueberries. During the late 1980's and early 1990's the Wabigoon Metis Corporation was able to market organic, wild blueberries into Winnipeg for between $2.00 and $2.50 a lb. They often paid the pickers between $1.75 - $2.25 a lb. At these prices they were able to sell, in a good year, around 50,000 lbs. of berries. Recently, Bill Paranteau has been working on his own and he estimates that he sold around 20,000 lbs. into Winnipeg during the summer of 2001. His cousin also buys and sells berries and estimates another 10,000 lbs. Clearly, that is a drastic decrease from the approximately 500,000 lbs. sold during some years of the 1920's and 1930's.

These contemporary commercial picking operations depend upon the clear cuts made upon sand ridges. A large band of sand ridges runs throughout the northwest, from south of Atikokan, through Dinorwic, Dryden and Sioux Lookout to the northwest of Pikangikum. There are other remnant glacial depositions of sands and small till but they are either not easily accessed or of a small size. Each spring Bill Paranteau travels the logging roads to look at the development of blueberry heaths on the clear-cut land. He travels during flowering to see how much frost kill is occurring in the lower and higher lying lands. He then visits the patches again to see how fruit set is occurring and if there is enough moisture in that year. In drier years it is necessary to pick where ferns or other plants might shade the blueberry plants. At this point he makes a decision where the blueberry camp will be set up and informs the harvesters.

Bill Paranteau applied his knowledge of berries to the new social-ecological environment created by industrial forestry and clear cuts. Bill Paranteau talked about how the best thing for a blueberry plant is to be knocked back to the ground. In the old days this was done by fire. While he would have preferred to harvest on a fire site, the only fires that recently occured were not accessible. The only current blueberry landscape is a clear cut on sand, and regeneration techniques that allow a blueberry heath to establish itself. Paranteau not only visits current productive heaths, but also those that are developing. He does this to establish which areas might be picked in upcoming years. Bill Paranteau identifies a type of bunch grass, not identified during fieldwork, which establishes following site preparation. As the blueberry heath fills in, this bunch grass starts to disappear. When the bunch grass has mostly disappeared, leaving only a few patches, the heath is ready to be picked.

The establishment of a blueberry heath takes anywhere from 3-5 years. While the heath was structurally at its prime during these years, the weather in any given year influenced its productivity. A heath could be picked for 4-7 years. The duration for picking a heath depended upon how quickly the bush honeysuckle (*Diervilla lonicera*) established and shaded out the blueberries. Once the bush honeysuckle overshadowed the blueberries, the heath became increasingly less productive. These were the types of heaths that were the focus of the Anishinaabe in the past. They were extremely productive and produced large berries. While most of the berries were the traditional low-bush and high-bush berries, the Anishinaabe also recognized black blueberries, a translucent type and an ashy or white type. According to Vander Kloet (1988) these latter types are most likely varieties of *Vaccinium angustifolium* that demonstrates greater phenotypic plasticity for berry colour than other species.

As we visited the blueberry heaths picked by Bill Paranteau, it became possible to understand how 500,000 lbs of blueberries could be picked in one year. The capacity and importance of the blueberry during the fur trade and early industrial period became apparent. On the other hand the old blueberry picking sites on Shoal Lake left doubt as to how a person could pick enough to eat let alone sell. The blueberry heaths shown to us by Bill Paranteau provided a glimpse of how important the blueberry was to Anishinaabe people.

In the summer of 2001 Ella Dawn Green travelled four hours to pick blueberries. Ella Dawn knew that the only good picking sites left in the northwest depended upon a clear cut on sand. Forest management in northwestern Ontario has altered the interactions from fire, blueberries and the Anishinaabe people toward clear cuts, silviculture and sand. The rocky pinelands, which predominate the landscape around Lake of the Woods, Shoal Lake and Redditt, are not often logged. This is an area where black spruce and poplar currently predominate the harvest. Early in the 1900's the red and white pines were logged off the rocky lands, although this no longer occurs to any great extent. The blueberry heaths on the rocky lands depended upon fire. When fire was taken out of the landscape in this region, the demise of the blueberry heaths and commercial harvest was set in motion. The blueberry heaths shifted to the east where logging could mimic the effect of fire on the sand barrens. As Ella Dawn's family moved to the blueberry heaths established around Redditt on the rock lands in the early 1900's, so she went to were they had been established around Wabauskaang by logging in the 2001.

The story of fire, blueberries and the Anishinaabe people is one of agency and adaptation. The Anishinaabe helped shape the landscape of the fur trade period while adapting to the landscape created by an industrial period interested in timber and settlement. Ella Dawn Green and Bill Paranteau have drawn upon their memories and knowledge, allowing their people to both procure their subsistence and participate in the commercial economy of northwesten Ontario for over 400 years. They have been able to express their agency regarding fire during the fur trade period and the early industrial period. The recent industrial period of forest management has been one in which they have been forced to adapt. The results are old, unproductive blueberry patches that became recorded as Anishinaabe values on forest management maps.

In the next chapter I turn to a historical review of the social-ecological context of northwestern Mexico. The two historical reviews of the social-ecological systems of northwestern Ontario and northwestern Mexico provide the context for the ethnoecological research that is presented in Chapter VI. That chapter is followed by a summary of Anishinaabe ethnobotanical research in Chapter VII. I return to a summary of adaptive learning and social-ecological research in Chapter VIII, which concludes the dissertation.

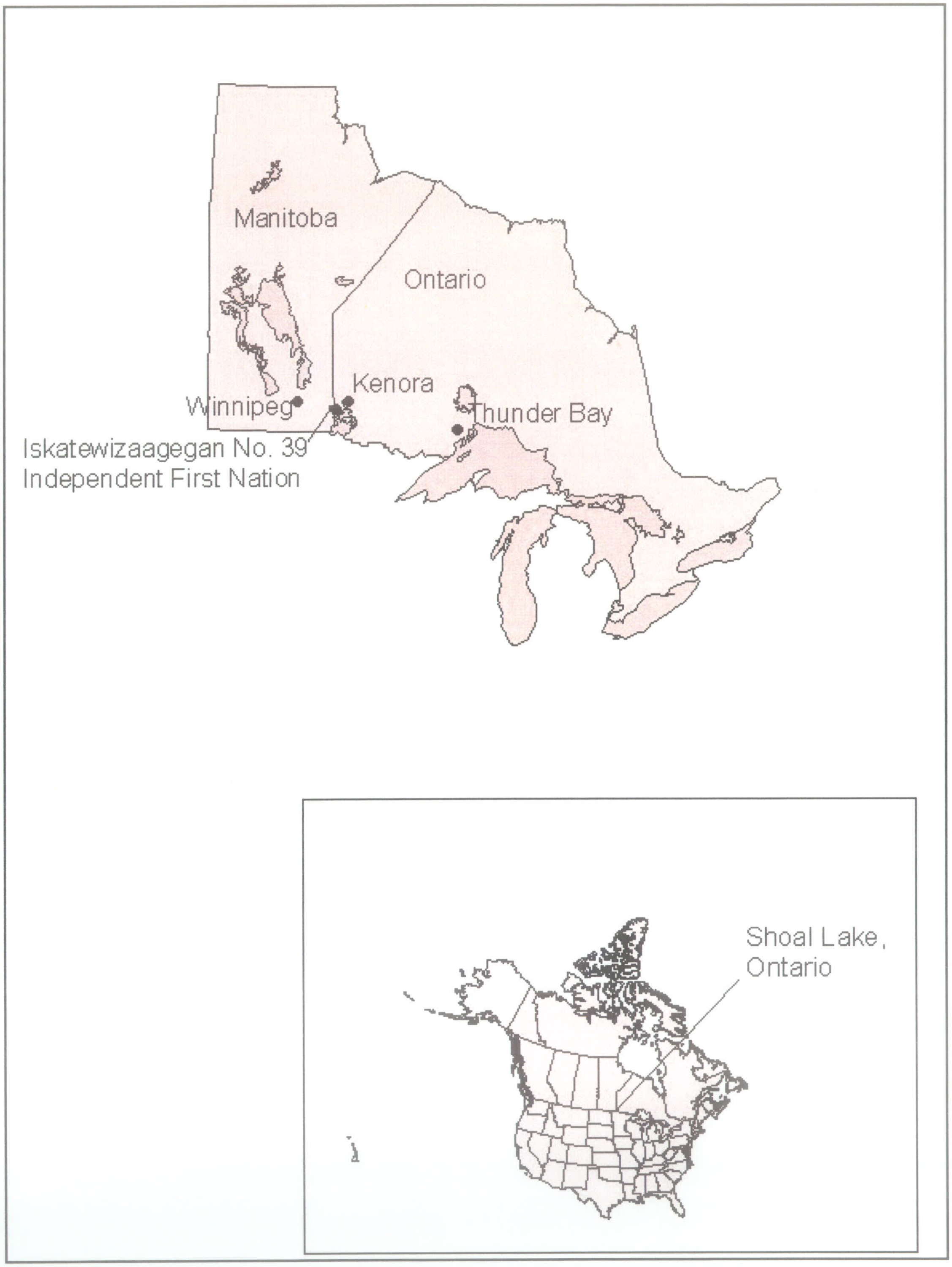


Figure IV-1 Location of Shoal Lake in a Continental and Regional Perspective.

Plate 5. Bill Paranteau of Wabigoon Lake First Nation picking blueberries.

Plate 6. Woman picking blueberries by Roger Kakepetum, Sandy Lake.

CHAPTER V

FIRE, KUMERACHI AND RARAMURI PEOPLE OF NORTHWESTERN MEXICO

INTRODUCTION

> "Fire has a paradoxical nature in long-needled pine forests as both an essential ecological process and a potential destroyer of the forest. The contradictory nature of these perspectives on fire is evident in the Sierra Madre Occidental. As human populations rise and as the infrastructure needed for timber exploitation is developed, land-owners and foresters become increasingly aware of the value of timber, a view that opposes their historical preference for agricultural use. In the present study area, managers have recently initiated campaigns to prevent, detect and suppress forest fires, and ejido members are proud of their contributions to fire prevention and suppression crews. However, the regime of frequent, low-intensity fire that prevailed until recently in these forests is a key ecological process contributing to the present health and low destructive potential of fuels in many of these forests today" (Fulé and Covington 1996:37).

> "Land-owners and possessors of lands with forest cover, or potential of forest cover, and bordering lands, as well as those who make use of forest resources, forestry and reforestation, are obliged to carry out works to prevent, combat and control forest fires, according to applicable Mexican regulations. In the same manner as the civil and military authorities, they shall report to the Ministry of Environment, Natural Resources and Fisheries (SEMARNAP) the existence of forest fires that they detect" (CAPITULO VII, Artículo 29, *Ley Forestal y Su Reglamento*, SEMARNP, 1997, my translation).

My objective in this chapter is similar to those stated for Chapter IV. In this case I wanted to explore the long-term adaptive cycles of the Rarámuri of northwestern Mexico. I did not want to strand the ethnoecological results presented in Chapter V from the history of the people of Basíhuare (Wolf 1982). I was interested in undertaking research in this region as it was the northern most location in North America, where, according to my studies, indigenous peoples have continuously utilized fire to shape the landscape. In this chapter I trace how the ability to utilize fire technology, in Mexico, as in Canada, parallels the loss of authority over forest management. In the previous chapter, I reviewed the changes of the social-ecological system that both shaped, and for a time were shaped by, Anishinaabe people. In this chapter, I also utilize a historical approach to examine the practice of *Kumerachi* and the changing social-ecological system of Basíhuare. The theoretical background for this chapter is found in Chapter II while the research methodologies are presented in Chapter III. In Chapter III, I also present a short commentary on bibliographic sources. I reference those sources, which I directly draw upon in this chapter, but there are many others that provided me with indirect observations that helped me form this narrative. I also have to acknowledge many Rarámuri people, and others in Mexico, who helped me understand this story "a little bit."

FIRE, PINE FORESTS AND MOUNTAINS

On Sunday, April 15th, 2001 I was sitting on the porch of the house my family had rented in Basíhuare, Mexico when I noticed smoke rising upslope from us. I quickly put down the field notes I was writing on the well documented Rarámuri Easter ceremonies which we had been experiencing during the last week (Bonfiglioli 1995). I picked up my digital video camera and set out to find the source of the smoke. I walked past my neighbour, Mauricio, a well-known ***Owíruame*** (healer) who was still sleeping off the labours of his previous day's curing ceremonies for the fields of his neighbours. I walked down the Basíhuare river to where it was met by a smaller ***arroyo*** (small valley) by the old mule train station. The ***Estacíon*** (mule train station) was a large structure built out of rock; built when mule trains were utilized to export the minerals from the mines of Batopilas. I walked up the arroyo until I could see the flames of the fire that were far upslope and moving upwards toward a cliff face and the highway. After taking some pictures and shooting some video, I returned to the house where I found Mauricio stirring. I pointed out the fire to Mauricio and asked whether we should inform anyone of the fire. Mauricio shrugged his shoulders and said it probably started from a campfire left by people returning to their ranchos from the ceremonies. He then walked over to the shade of some apple trees and quickly went back to sleep.

I had travelled six days from northwestern Ontario, Canada, into Chihuahua, a state in northwestern Mexico to talk to people who still used fire as part of their livelihod practices. The only smoke I had seen to this point was that belched out by my old Toyota 4-Runner during our trip to Basíhuare. February and March had been spent talking to people about burning practices, but this was the first fire I had seen. This was not exactly the type of fire that I had in mind. Coming from northwestern Ontario, I am used to fires in the pine forests, which can quickly move from the ground to the crown, and result in large conflagrations. Since I was with Kerril and my two young children I was not particularly interested in experiencing such a fire first hand. Since Mauricio didn't seem too interested in the fire, I decided to see if anyone else was around.

I walked toward the ***templo*** (Catholic Church building) that was located upstream from the house. On the way, I passed some small houses of wood and caves that people utilized for housing when they came to town from their ***ranchos*** (outlying hamlets). The community of Basíhuare was the administrative centre of the ***Ejido*** (land holding collective formed after the Mexican Revolution) of Basíhuare. The templo formed the main site of gathering for the Rarámuri people of the surrounding ranchos. Every Sunday the traditional leaders and people met for mass at the templo. Following mass they moved to the plaza outside the church. A talk by the ***gobernador*** (elected leader) followed, in which he exhorted the people regarding proper behaviour. Community planning, issues, disputes, discipline, food aid and any other necessary business was discussed following his talk. Over time the location of the templo also became the location where other organizations, such as the ejido, schools, health clinics and government stores, built their structures. As I approached the centre of town it quickly became apparent that people had returned to their ranchos. There were not even any youth playing basketball. I returned to the house and decided that I would wait and watch the fire from the balcony.

Over the course of the day, and during that night, I watched the progress of the fire as it moved upslope. Basíhuare was located in a narrow valley with a strip of flat land along either side of the river. On either side of the river were steep slopes that led up to flat ***mesas*** (table lands) and ridges 300 metres above the valley bottom. During the night it was possible to look up and watch the fire move upslope as the flames were visible in the dark. When I awoke the next morning I went to talk to Mauricio about the fire. As we no longer noticed any smoke he pointed out to me that often this was the way with these fires. Later in the day I went up to the site of the fire and noticed how the fire had moved along the ground, burning up the grasses, scorching shrubs and small pines but never moved up into the crown. As it was a ground fire it burned out at the edge of the highway, and when it reached cliff faces it could not pass. While this was not the type of fire that I had come to observe in Mexico, I did see why many of the large pines had fire scars along their trunks. For Maurecio this fire was part of the normal course of events, and not overly remarkable. For me, this was something I would rarely have the chance to observe. The event would have at least brought out fire crews, if not helicopters and water bombers in Canada. Apparently, fire was still an integral part of the landscape in Basíhuare.

The Sierra Madre Occidental was in a transitional period regarding the human use of fire and a policy of fire suppression. Some indigenous people still actively used fire. Forest fires were often allowed to burn if they occurred far from the major centres of population. In my main geographic area of fieldwork, the boreal forest, the agency of humans to use fire and the agency of fire itself had largely been suppressed. In contrast, the Sierra Madre Occidental, especially the pine and pine/oak forests of the mountains, provided the most northern example of a temperate forest where fire still shaped the landscape (Fulé and Covington 1996).

During my first trip to the region in October of 2000, the Tepehuan people in the Baborigame region introduced me to the use of fire. A Tepehuan colleague quickly introduced me to the technical aspects of burning and the mosaic of forest patches that resulted from this practice. When I returned to Mexico in February of 2002, I decided to work with the Rarámuri regarding the use of fire. When I first talked to people they insisted that they no longer utilized fire. Some said they could no longer use fire because the forest technician had prohibited them from cutting down oaks and clearing patches with fire. Others mentioned that it was because they had been told that cutting down the trees and the use of fire made the forest disappear. They were, however, willing to show me where old patches had been cut and/or burned. I asked them why there were still oaks and pines growing on these patches. They shrugged their shoulders and responded that what the forest technicians said did not always correspond with what happened in the forest. The landscape of the Sierra Madre Occidental was a cultural landscape strongly influenced by human use and non-suppression of fire. However, it was also a landscape in the early stages of transition.

I undertook my fieldwork on the use of fire by the Rarámuri in the ejido of Basíhuare. It was located in the mountain range known as the Sierra Madre Occidental. Considered one of the biodiversity "hotspots" of Mexico (Salmón 2000). The Sierra Madre Occidental is a southern extension of the interior North American mountain chain known as the Rockies. The Sierra Madre Occidental begins 50 km south of the United States border and runs for 1, 250 km in a northwest to southeast direction through the Mexican states of Sonora, Chihuahua, Durango, Nayarit and Jalisco. The state of Chihuahua is located in the north of Mexico. It is bordered on the north by the United States, on the south by the Mexican states of Durango and Sinaloa, on the east by Coahuila, and on the west by Sonora (**Figure V-1**).

Chihuahua can be divided into three or more biophysical or physiographic regions, depending upon how the flat lands of Chihuahua are categorized (Almada 1955; Lumholtz 1902; Pennington 1963)). The flat lands extend northeastward from the foothills of the Sierra Madre Occidental. The flat lands are essentially composed of extensive prairies, rolling basins and desert. Grass is the predominate vegetation of the prairies and rolling basins, while a small variety of trees and shrubs can be found growing along stream beds. The desert regions have very limited vegetation. These regions would be classified as arid to dry.

The foothills run along the eastern edge of the Sierra Madre Occidental in a narrow band. The eastern margin of the foothills is composed of rounded slopes that were created due to the eastern flows of volcanic material during the tertiary period. The average altitude of this region is 2000m in the south and 1500m in the north. At the western margin of the foothills the v-shaped valleys begin to take on the characteristics of the upland country. The foothills are characterized by open savannahs composed of grass and oaks. In lower regions there are also large savannahs of chaparral while at higher elevations there can be pine savannahs.

The uplands can be characterized as a rolling plateau at an average elevation of 2000m. It has been dissected by streams and contains peaks that can reach as high as 3300m in the southern reaches of Chihuahua. The uplands were formed through the uplifting of a volcanic plateau. The upper strata of the uplands were formed out of extruded volcanic rock and ash duff during the mid-tertiary period (37 - 23 million years before present). This was laid over folded Cretaceous (135 - 100 mybp) and older sedimentary rocks. The northern third of the uplands is made up of wide valleys with distinct ridges separating the valleys. The southern two-thirds is made up of v-shaped valleys and shallow, flat-bottomed marshy valleys.

The slopes and tablelands of higher elevations are the location of the great pine (*Pinus* spp.) forests of Chihuahua (Bye 1976; Elmore 1976). The tablelands consist of a predominately pine forest while the valley slopes have a pine - oak (*Quercus* spp.) complex. The pine forests also contain many genera of the Ericaceae (heath) family including blueberry (*Vaccinium* spp.), madrone (*Arbutus* spp.), and manzanita (*Arctostaphylos* spp.). Alamo (*Populus* spp.), juniper (*Juniperus* spp.) and willow (*Salix* spp.) are common along the valley bottoms and lower slopes. The uplands have an average temperature of 10.5 C with a range from - 6 C to 34 C. The mean annual precipitation is 775 mm and includes three climatic zones from semi-dry to semi-humid to sub-humid. Snow is common in the winter months although it did not stay longer than 2 weeks in exposed areas. Most of the precipitation occurred in the months from June to September with a secondary peak in the months of December and January.

The most dramatic landscape of the Sierra Madre Occidental was the canyon country (Lumholtz 1902; Pennington 1963). This is located in the southwest corner of Chihuahua and the northeast corner of Sinaloa. The canyon country was formed through stream dissection of gently tilted lava flows. The summit elevations of the canyons range from 1500m to 2000m. The canyons contain numerous spurs, left in the margins where streams enter into the canyons, and benches that break up the descent into the canyon. In some canyon areas there are steep cliff descents. The upland plateau is covered by pine forest while benches and gentle slopes have pine-oak complexes (Bye 1976). Canyon bottoms are characterized by dry, sub-tropical vegetation such as sycamore (*Platanus* spp.), chaparral (*Garrya* spp.) and various species of the *Cactaceae* and *Fabaceae* families. The canyon summits have an average elevation of 2000m while the canyon bottoms averages 500m. The climate is dry and sub-tropical with hot and humid summers, and dry but moderate winters. The average annual temperature is 24.5°C with a range from -1°C to 45°C (Pennington 1963). The mean annual precipitation is 650mm. Most of the precipitation occurs in the months from June to September with a secondary peak in the months of December and January.

The Sierra Tarahumara is a region of the Sierra Madre Occidental located primarily in the state of Chihuahua (Pennington 1963). It consists of the uplands and canyon regions. The soils of Chihuahua divide the state into three regions. The Sierra Tarahumara includes the uplands and canyons; central mesa, which includes the foothills, plains and basins; and the desert. This corresponds to the dominant economic potential of those regions. The poor, thin soils of the Sierra Tarahumara restrict agriculture to narrow bands found alongside the watercourses or shifting cultivation on the canyon and upland slopes. In spite of the low agricultural potential of the soils, there is extensive forest cover. The state of Chihuahua is one of the most important commercial forestry zones in Mexico.

In 1990 the Sierra Tarahumara provided 97 % of the volume of authorized timber harvests for the state (COSEDECH 1999). The central mesa has the deepest and richest soils. This has resulted in the widespread development of agricultural farms and livestock ranches (Pennington 1963). The desert areas have limited agricultural development. Some horticulture is possible when permanent stream courses allow for irrigation. These biophysical and physiographic characteristics lead to the dominant pattern of the development of natural resources. The Sierra Tarahumara is dominated by timber extraction while the central mesa focuses on agriculture, horticulture and ranching.

The uplands of the Sierra Tarahumara also contain the headlands of a number of important river basins (COSEDECH 1999). For example, the east-central portion of the uplands is the headwater for the Conchos river watershed. This drains a portion of the uplands and the central mesa into the Río Grande. The Urique, Batopilas and Verde rivers drain toward the Pacific and empty into the Fuerte River of Sonora and subsequently into the San Blas River of Sinaloa. The former watershed is integral to the irrigation system of the Río Grande. The latter is the main source of water for the extensive horticultural lands of Sinaloa. Forestry has been the dominant economic driver for the Sierra Tarahumara during the twentieth century (Lartigue 1983). Water, and the protection of upstream watersheds, may become the main driver in the twenty first century.

Administratively, the state of Chihuahua has been divided into 67 municipalities (COSEDECH 1999). In 1962 a new municipality was carved out of the existing municipalities of Batopilas and Urique. The purpose of this municipality is to provide for the special needs of the dominant Rarámuri population. The municipality includes uplands as well as some canyon lands. The Rarámuri population makes up the majority of inhabitants of the municipality. The municipality is also one of the main locations of forest resources in the Sierra Tarahumara. The combination of Rarámuri and forests is a common pattern found throughout the Sierra Tarahumara. In 2001, it was estimated that there were 60,348 people who identified themselves as Rarámuri in the state of Chihuahua. The 19 municipalities of the Sierra Tarahumara were home to 56,904 Rarámuri, encompassing 94% of the Rarámuri population. These same 19 municipalities produced 97% of the forestry production in the state. The new municipality is called Guachochi, after the old Jesuit mission town of Guachochi, where the administrative offices are located.

Basíhuare, where I carried out fieldwork, was part of the municipality of Guachochi. Prior to the formation of Guachochi it was part of the Batopilas municipality (Merrill 1988). Basíhuare is also the name for the ejido that was formed after the Mexican revolution. The ejido of Basíhuare is composed mostly of uplands. The Urique River delineates its southern border. Downstream from the ejido lands the Urique River forms the Copper Canyon that is one of the main canyons of the Sierra Tarahumara. The ranchos of the ejido are mostly located along stream courses that drain into the Urique River. The ejido lands form part of the northern watershed of the Urique River. The hamlets and agricultural lands of the ejido are found in the v-shaped valleys with fast moving streams or in broader, marshy valleys with more intermittent streams. Some hamlets and the majority of forestlands of the ejido are located on valley slopes and uplands. The town of Basíhuare is located on one of the main permanent watercourses in a steep sided v-shaped valley with narrow bands of agricultural land along its course.

My interest in fire focused on the upland areas of the Sierra Tarahumara characterized by the pine and pine-oak forests. Fire was much more common, at this point in time, in the canyon country than in the cold, temperate zones of the pine forests. However, there were practical reasons to stay away from the use of fire in the canyons. A colleague from SEMARNAP informed me that the canyons are the main sites where Oriental poppy (*Papaver somniferum*) and marijuana (*Cannabis* sp.) are grown in the Sierra Tarahumara. These fields, as it turned out, are also prepared using a fire based agricultural system. As these fields are clandestine, owners do not stay around to watch the fires and the fires often escaped. The fire incidence has changed greatly in the canyons in the last 20 years. Given the nature of the poppy and marijuana industry, people are even more reticent to talk about the use of fire. The canyon landscape represents the latest fire landscape to emerge in the Sierra Tarahumara. However, my interest in this chapter is the use of fire in the pine and pine-oak forests.

MINES, MISSIONS AND THE TARAHUMARA

It is not known exactly how long the Rarámuri have occupied the upland region in which Basíhuare is located (Lumholtz 1902). Archeological research has been limited in the uplands to the headwaters of the Urique River near Norogachi and in the canyons to Batopilas (Merrill 1988; Pennington 1963; Zingg 1940). However, the outcome of this research suggests that the oldest remains of the area are linked with other early societies of North America. This is called the basketmaker culture by archaeologists. Cultural artifacts from later periods suggest that other cultural constellations arose in the area. These have been categorized as the Río Fuerte Transitional Culture and the Cave-dweller period. The result of these investigations has shown that the uplands and canyons were occupied prior to 1000A.D. and remained occupied up to the start of the historical record in approximately 1600A.D (Zingg 1940).

The Tarahumara were first identified in the colonial record as the Spanish began to move northward during the colonial period (Pennington 1963). The northward movement occurred after the Spanish defeated the Aztec capital of Tenochtitlan in 1521

(Almada 1955). The northward push proceeded along the coast into Sinaloa and up the centre of Mexico through Durango and into the central mesa of Chihuahua. The impetus for this northward movement followed the return of the legendary expedition of Alvar Núñez Cabeza de Vaca. He undertook an expedition that began in Mexico City and traveled through the lands bordering the Gulf of Mexico to Florida. He returned to Mexico in 1533 by crossing through northwestern Mexico and traveling down the Pacific coast through Sinaloa and Sonora on his way to Mexico City. In the 1550's Francisco de Ibarra was given Royal permission to colonize the lands to the north of Zacatecas. The push into the north accelerated with the discovery of gold at the Santa Bárbara mines in the 1560's. These mines were located at the head of the Allende river valley and southwest of present day Parral, Chihuahua. Gold strikes continued to be made near the headwaters of the Parral River at San Francisco del Oro and Parral in the 1560's, 70's and 80's.

Rodrigo Río y Loza, the founder of the Santa Bárbara mines, invited the Company of Jesus, the Jesuits, to begin mission work around the mining region (Pennington 1963). The pattern of mine and mission establishment is one which persisted through the late 1500's into the 1600's and finally ended when the Jesuits were expelled from Spanish America in 1767. Mining itself had little impact upon the original inhabitants of the Sierra Tarahumara (Pennington 1963). While the late 1500's saw the establishment of numerous mines there were only 53 Spanish inhabitants of the Santa Bárbara mining region by the early 1600's. It was the establishment of missions by the Franciscans and Jesuits that had the biggest impact upon the early colonial period in the Sierra Tarahumara (Merrill 1988).

The Franciscans and Jesuits moved into the region around Parral from Durango in the late 1500's (Pennington 1963). The people they encountered in the Santa Bárbara region were mostly, what they termed, Tepehuan (***O'dami***) in the south and west and Concho to the northeast. Early disputes between the Franciscans and Jesuits led the ***Audiencia de Guadalajara*** (administrative region of Royal Spain) to divide the region up between the two mission orders. The Franciscans were permitted to work in the Allende river valley east of Santa Bárbara while the Jesuits were to work in the Balleza river valley to the west. Upon entering the Balleza river valley the Jesuits denoted a linguistic difference between the Tepehuan, who occupied the headwaters of the Balleza, and the Rarámuri whom they encounted downstream.

The establishment of missions in the river valleys was critical to the success of early mining ventures (Almada 1955). Missions attempted to bring the original inhabitants of the region into a settled agricultural livelihood. These agricultural settlements were important for the mines, as they were the only source of food. The best agricultural lands, and sources of water, were found in the river valleys of the central mesa. These floodplains were also the same locations that the Tepehuan, Rarámuri and Concho peoples utilized for their agricultural systems of maize, beans and curcubits (Pennington 1963). However, their systems were based upon dispersed households who procured their livelihoods through floodplain agriculture, hunting, fishing and gathering instead of settled agricultural villages. The importance of the river valleys can be seen as the Jesuits moved into the Sierra Tarahumara during the 1600's and 1700's.

The first watershed, which provided the focus of mission establishment activities, was the Concho river watershed that drained a small portion of the uplands and the central mesa (Pennington 1963). The Jesuits established a mission at San Miguel de los Bocas in 1630 on the headwaters of the Florida River. The Florida River drained the southern lands of the Conchos watershed. Next they established missions at San Felipe de Conchos, San Gerónimo de Huejotitlán and San Pablo Balleza in 1639 while San Javier Satevó was founded in 1640. San Felipe de Conchos was located on the main Conchos river which drained the central portion of the watershed from the uplands and into the central mesa. The other three missions were all established in the headlands of the Balleza watershed. The Balleza drained the southwestern portion of the Conchos watershed meeting the Conchos River upstream from San Felipe. The foundation of these missions gave the Jesuits control of the best agricultural lands with which to supply the growing mining economy in the early 1600's (Almada 1955).

The missions established by the Jesuits and Franciscans in the region were undertaken under permission of those who founded the Royal mines of the region. The missions were also founded under the existing laws from the Spanish crown of 1535, 1551 and 1570 (Almada 1955). These laws recognized the land rights of the aboriginal inhabitants for lands they occupied. The missions were allowed to settle and "civilize" the original inhabitants of the lands while introducing them to a village system of agricultural production. However, they could only hold the lands as a collective trust for the original inhabitants. Assumedly, as institutions of formal governance became established, the aboriginal inhabitants would have administered their own lands.

Missions were developed around a central temple and in locations with the best agricultural lands. During the time of the missions the missionaries also introduced a form of local government (Merrill 1988). A governor (***gobernadorcillo***) was elected by the people of the mission to oversee the religious and civil affairs of the mission. Captains (***capitanes***) were picked to help the governor carry out his duties and enforce the rules of the mission. These elections were to be freely undertaken by the people of the mission under the observance of the local missionary or a Royal delegate. Other duties and obligations (***cargos***) were distributed amongst the people of the mission. These included religious rites and ceremonies along with communal works such as agriculture and road building. The benefits of agricultural production were put toward the needs of the mission. As these missions were founded under an agreement with the Royal mines, they were not expected to pay tribute beyond a yearly fee (Pennington 1963). In return for becoming part of the mission the original inhabitants were exempt from tribute and impressed labour in mines and ***haciendas*** (Spanish estates). These practices were supported by Royal pronouncements throughout the 1600's in 1674 and 1686.

Once established in the central mesa the Jesuits then began to move into the uplands of the Sierra Tarahumara between 1648 and 1684 (Pennington 1963). Missions and outposts (***visitas***) were established in the headwaters of the Papigochi River. The Papigochi River drains the northern portion of the uplands through the Yaqui River of Sonora and into the Pacific Ocean. The headlands of the San Pedro River, which drain the northern portion of the central mesa into the Concho River, also saw the establishment of missions. Other missions were established north of the Laguna de los Mexicanos. The headwaters of the Concho River also received missions at present day Bocoyna and Sisoguichi. While many other missions were established during this period the movement into the headwaters of the Urique watershed occurred when a mission was established at Norogachi. The region of missions, which were established in the central mesa, became known as the ***Tarahumara Baja*** while those of the uplands were known as the ***Tarahumara Alta***. However, there was another region of missions that was known as the Mountain Tarahumar.

The Mountain Tarahumar was the western portion of the Sierra Tarahumara that roughly corresponded with the physiographic region of the canyons (Pennington 1963). This missionary activity had its base in Sonora. It first moved into the region of the Chínipas River, which formed the northwestern arm of the Fuerte River watershed, and drained into the Pacific Ocean through Sinaloa. While the first mission was established at Chínipas in the 1620's, it was not until 1676 that a permanent mission was established. The Jesuits continued to move up the Chínipas River and established a mission at Batopilas by the late 1670's. They also moved up the Urique River that drained the central canyons and uplands into the Fuerte River. Jesuits had moved into the Urique canyon with a mission at present day Urique in the 1680's and further up the river to Pamachi with a mission established in 1714. In the early 1700's they also proceeded up the Verde River, which drained the southern portion of the uplands into the Fuerte River. Missions were established at Baborigame and Nabogame shortly after 1708. By the 1700's this area of missionary activity was known as the ***Provincia de Chínipas***. The other two regions were either referred to as the Tarahumara Alta and Tarahumara Baja or lumped together as the ***Provincia Tarahumara***.

The establishment of the missions in the Tepehuan and Rarámuri territories was not a peaceful event. The Tepehuan initiated the first indigenous uprising in 1616, which centred on the region of present-day northern Durango and south-central Chihuahua (Almada 1955). As the Tepehuan were the first group to come into contact with the establishment of missions, it is not surprising that they were the first to rebel. This uprising, however, was only the first of many to occur during the 1600's. The Guazapares led an uprising in 1632 that expelled the Jesuits from the Chínipas mission. This mission was not reestablished until 1676. As the Jesuits moved into the Balleza valley this led to an uprising by the Rarámuri in 1641. As they moved eastward into the

Conchos territory there was more conflict with the Conchos and Tobosos in 1645. Further uprisings occurred as the missions were established in the Tarahumara Alta with rebellions in 1652 and 1690. When an uprising occurred the Jesuits, through their agreement with the Royal mines were able to call on the military to suppress the uprising. As the most important lands were the agricultural lands of the central mesa, these rebellions were quickly suppressed during the 1600's. Eventually, by the early 1700's, the Jesuits were also able to establish stable missions in the Tarahumara Alta and Mountain Tarahumara regions.

The establishment of the Jesuit missions throughout the Sierra Tarahumara also allowed the mining activity to move into the upland and canyon regions. Mines were established north of the Laguna de los Mexicanos in the 1680's, Chínipas in 1758, Urique in 1691 and Batopilas in 1708 (Almada 1955; Merrill 1988). The establishment of missions in the Sierra Tarahumara provided a stable environment in which the mines could be developed and the mineral exported from the region. The missions also provided the necessary food supplies for the mines to operate, while the mines provided a local market for mission products. The 1600's and the first half of the 1700's saw the establishment of a livelihood and landscape in the Sierra Madre Tarahumara which was formed out of the relationship between mines, missions and the Rarámuri.

The identity of the Tarahumara (Rarámuri) first emerges in this period of contact between the missions and the people who they called the Tarahumara. It appears that the people who the Jesuits and Franciscans called Tepehuan, Tarahumara and Conchos were linguistically distinct, though likely related (Pennington 1963). It also appears that the Tepehuan occupied the southern portion of the uplands and central mesa, the Conchos occupied the eastern part of the central mesa and the Tarahumara the north-central region of the uplands and central mesa of the Sierra Tarahumara. Since that time, these groups have all been identified as part of the great linguistic family called "Uto-Aztecan" by linguists (Pennington 1963). This large linguistic family stretches down from the southwestern United States to south-central Mexico.

The missionaries of the Tarahumara Baja and Alta seemed to group the people of the region on the basis of linguistic affiliation, differentiating the Tarahumara from the

Tepehuan and from the Concho (Pennington 1963). The missionaries who encountered peoples in the Mountain Tarahumara utilized a different pattern of creating smaller groupings based upon linguistic affiliation and location. Groups such as the Pamachi, Batopillares, Guazapar, and Chínipa were all noted by missionaries as being distinct groups. However, in later years they have all been grouped together as members of the Tarahumara language group. Early records indicate that there was no overarching indigenous political entity that united the language groups. People lived in dispersed households based upon kinship groupings. The most important factors, which influenced location of households, were arable land along watercourses and permanent sources of water. The only evidence that linguistic boundaries may have led to a supra-group identity is the reports by the early missionaries of fighting between Tepehuan and Tarahumara (Pennington 1963). However, there was probably also integration between linguistic groups through marriage and livelihood practices in contact zones where the two groups met. Political leaders of rebellions often brought together different linguistic groups into political processes. Most of what we understand of identity from this period comes to us through the documentary record of the missions and colonial Spain (Almada 1955; Bennett and Zingg 1935; Lumholtz 1902; Merrill 1988; Pennington 1963).

Early ethnic categories established by missionaries were based upon linguistic and geographic characteristics (Merrill 1988). However, during the 1600's and the 1700's missionaries also began to differentiate Rarámuri people on the basis of their relationship with the missions. Those Rarámuri who chose to accept the religion of the missionaries were often termed ***Cristianos*** (Christians), ***Bautizados*** (baptized ones) or ***Conversos*** (converts); distinguished from the ***Gentiles*** (gentiles) who did not. Those who accepted the religion of the missionaries were further distinguished on the basis of whether they chose to live within the mission system.

People who chose to live outside the mission system were called apostates, fugitives, or ***Cimarrones*** (Escapees). Those people termed cimarrones often integrated with gentile households that were established on lands outside of Spanish, or mission, control. Over time, as the lands controlled by the Spanish colonial systems and the mission expanded, there was a corresponding decrease in the gentiles and cimarrones.

However, while the templo of a mission served as the seat of the mission government, the people resisted moving into a settled mission. By the end of the 1700's many Rarámuri had become associated with a particular mission. At the same time they jealously guarded their dispersed pattern of settlement, as well as migration between canyon and upland households. The mission served more as a place at which they would gather and undertake collective ritual, ceremonial and productive activities. To the dismay of the Jesuits, it did not become an agricultural village in the European sense.

William Merrill provides an extensive discussion of the influence of the Jesuit missions on the Rarámuri in his 1988 book *Rarámuri Souls: Knowledge and Social Process in Northern Mexico*. He sums up his discussion by noting that the Jesuits had a minimal influence. The Rarámuri did not settle close to the mission centre of the templo. Rather, they maintained their dispersed pattern of settlement. The mission centre was a site of business and ceremony. He also notes that Basíhuare was even less influenced by missionary activity. Basíhuare was located in lands between the eastward and westward expansions of the Jesuits into the mountains. Furthermore, the people inhabited streams off the main branch of expansion into their region that was along the Urique River. Basíhuare became a region where people could escape the direct influence of the Jesuits. At the time of the Jesuits expulsion in 1767, no mission had been established in the region. A missionary presence did not reach Basíhuare until the time of Mexican independence in the mid 1800's. At this point, the Franciscans established a ***visita*** that lasted 30 years at Basíhuare. A visita was a mission post where a priest would visit as opposed to establishing a permanent residence. The Jesuits returned in the early 1900's and established another visita. While the Rarámuri of Basíhuare incorporated some of the governance, ritual and ceremonial practices of the Jesuits, they also maintained a distinct settlement pattern and identity.

SETTLERS, REVOLUTIONS AND THE TARAHUMARA

The expulsion of the Jesuits from the Sierra Tarahumara was part of a larger effort undertaken by Spanish colonists throughout Spanish America (Almada 1955). The Jesuit missions of the Sierra Tarahumara and foothills of Chihuahua provoked settlers in a number of ways. The Jesuits upheld Royal Spanish ordenates that stated that the original inhabitants of land maintained title to that land. The authority of the Jesuits over the lands of a mission was linked to the permission given them by the Spanish crown to "civilize" the indigenous inhabitants. During this process they were allowed to bring those lands into production in order to maintain the mission. During the period of the 1700's, more and more Spanish settlers, and an increasing number of settlers of mixed descent, moved into Chihuahua (Pennington 1963). The settlers found that the missions had claimed the most productive lands of Chihuahua on behalf of the indigenous inhabitants. Thus, settlers were constrained as they unable to obtain title to productive lands. Royal Spanish ordinates stated that title to land bought from indigenous inhabitants would not be recognized under Spanish law. As the number of settlers continued to increase in Chihuahua, and throughout Spanish America, pressure on the Spanish authorities to make lands available for settlement became intense. The Jesuits actively defended the indigenous title of the mission lands. Whether they took this position out of self-interest or altruism, ultimately they took the brunt of settler anger. Similar situations played out across the Americas and led to the expulsion of the Jesuits from Spanish America.

The period following the expulsion of the Jesuits in 1767 was characterized throughout the northern reaches of Spanish North America by shifting political and administrative organization. In the midst of this larger struggle by settler populations for independence from the Spanish crown, the Rarámuri were attempting to maintain their right to occupy the lands of the mission (Almada 1955). Following the Jesuit period, the Franciscans had been given authority over all the missions of the Sierra Tarahumara. Their lack of personnel, coupled with their interest in ecclesiastical duties over defense of indigenous title, resulted in a sparse Franciscan presence in the Sierra Tarahumara. The Spanish colonial authorities sent in personnel to ensure that the Jesuits left the missions. As the Franciscans lacked personnel to take over the Jesuit missions, Spanish colonial authorities often assumed governance of the missions. However, the role of the Rarámuri in a formal system of governance through the Jesuits missions was not so easily displaced. The Rarámuri argued that the Spanish Crown had granted them collective title and recognition of their system of governance. In 1786 the Spanish government supported the Rarámuri position. They obtained collective title to the former mission lands and recognition for their system of governance through elections supervised by a Royal representative. Yet, settlers continued to protest against the Spanish protection of indigenous title. The pressure was particularly intense over the agricultural lands of the foothills.

Settlers throughout Spanish America continued to pressure the Royal government in order that a mechanism for settlers to purchase land from indigenous inhabitants be established (Almada 1955). The pressure for the Royal government to open indigenous lands to settlement, along with a number of other issues, led to the independence struggles during the first two decades of the 1800's. In 1824 Mexico became an independent Nation that included both New Mexico and Texas in the north. Chihuahua, including the previous province of New Mexico, became a Mexican state that same year. Shortly after, both New Mexico and Texas left to become part of the United States. In 1825 the Royal ordinances against the sale of indigenous title were overturned.

The 1825 Law of Colonization stated that individual title was to be freely granted to the Indians for the lands on which they were settled (Almada 1955). At the same time, if the land needed by the Indians for subsistence was less than the total land available they could sell the excess land to settlers. Land not used for subsistence was deemed 'unoccupied'. In the Sierra Tarahumara unoccupied lands reverted to the State that in turn could sell those lands to settlers. Additionally, once individual title had been given to an Indian, he/she could then sell that land to settlers. In the foothills this led to a rapid turnover in land ownership. Settlers became the dominant holders of agricultural land by the end of the 1800's though some Rarámuri land owners integrated into dominant settler society (Pennington 1963). Other Rarámuri integrated into the Rarámuri communities of the Sierra where there was less pressure for agricultural land. This process was facilitated by the secularization of the remaining missions in the Baja Tarahumara. Although the Jesuits were allowed to return to Spanish America in 1816, a law established in 1856 prohibited religious orders and civil authorities from holding communal lands. This prevented a re-emergence of Jesuit administered mission communities.

Throughout the period of the 1800's there was no large influx of settlers into the Sierra Tarahumara. The Chihuahua government and population were instead focused on threats from Apache and Royalist groups (Almada 1955). Apache groups were harassing settlers in the central mesa as well as the open valleys of the northwestern uplands. As a result, attention throughout the 1800's was placed on pacifying Apache society, though this ended with the Apache defeat in 1880. The War of Reform also occupied the residents of Chihuahua as Royalist forces periodically occupied Mexico City between 1858 and 1864. The defeat of the Apache in 1880 signaled a new epoch in which settler attention would turn to the uplands and special interest in timber resources.

The period of 1880 to 1910 provided a period of relative stability (Almada 1955). The State of Chihuahua was no longer fighting the Apache, and the Mexican Nation had finally defeated the Royalist forces. This period is referred to as the ***Porfiriato***, after the infamous president Porfirio Diaz. Diaz was able to achieve social peace, though through strong-arm tactics against labour, peasants and indigenous peoples. This period of relative stability, however, did create a climate for American investment in Mexico. One project attractive to American investors was the construction of a railway line linking the U.S. railway network to the port of Tobobolampo, Sinaloa (Lartigue 1983). This railway would have provided the shortest route between the Atlantic and Pacific Ocean, as well as and the shortest route between Western Europe and Asia. The major obstabcle to constructing the railway was to cross the Sierra Madre Occidental. Work on the railway began in 1871. A line was constructed which linked Ciudad Juarez, on the Chihuahua border with the United States, which then connected, in 1882, into the railway network of central Mexico. However, financial problems of the company, which proposed the Chihuahua-Pacific railway, forced the project to a halt.

Railway construction began once again in the late 1800's and the early 1900's as a means to transport forest resources of the uplands to the United States (COSEDECH 1999; Lartigue 1983). Companies from the United States and Mexico had been purchasing extensive forest concessions in the north central uplands (Papogochi River) since the middle of the 1880's. In the first decades of the 1900's a railway line was built through the Papogochi River valley from Chihuahua to Minaco and then northward to Madera, Casas Grandes and Ciudad Juarez. This line also extended south through the southern headwaters of the Papigochi River, crossed into the headwaters of the Conchos River through Boycoyna and ended at Creel. These railway lines were completed by 1907 and provided linkages between the forest resources of the northern uplands of the Sierra Tarahumara and markets in the United States. While this forestry activity was extensive it did not, yet, reach into the heartland of the Sierra Tarahumara. While, the railhead at Creel did provide a point of access to the pine uplands of the Sierra Tarahumara, world events would forestall further expansion of the forest industry into the Sierra Tarahumara (Lartigue 1983). The battles of the Mexican Revolution between 1910 and 1920, world depression in the 1930's and the second world war of the early 1940's all contributed to the delay.

Although the railway did not immediately affect the community of Basíhuare through forestry, mining did have a major impact upon the community. A mule road was built from the mine in Batopilas that had been reactivated by "Boss" Shepherd at the turn of the century (Merrill 1988). The road linked the mine at Batopilas with the railhead at Creel. This road passed through Basíhuare where the mule station, ***Estación,*** was constructed. The people who oversaw the mule station became, in fact, the first settlers of Basíhuare. Their descendents formed the settler population of Basíhuare during the twentieth century. These descendents were also central players in the expansion of forestry into the ejido of Basíhuare.

FIRE, BEANS AND TIMBER

Following the post-war period there came a renewed interest in extending forestry into the pine mesas of the central Tarahumara (COSEDECH 1999; Lartigue 1983). Construction began in 1955 to finish the southward railway line extension that had begun in the pre-war years to join Creel with a port on the Pacific Ocean. This was finished in 1961. Interest in harvesting wood continued to be strong in the central mesa and northern upland valleys. The forest along the southern extension of the railway line between San Juanito and Creel was closed to harvesting during the early 1950's. Uncontrolled harvesting during the war period by medium sized logging operations led to massive deforestation. In the 1950's the government changed to a system whereby they gave companies the right to harvest trees even through the ejido maintained rights to use of the ejido lands. One such license extended into the central region of the Sierra Tarahumara where the extensive pine uplands between the Urique and Conchos watersheds, and Basíhuare, were located.

As economic interests in the forest resources of the Sierra Tarahumara intensified, so too did the pace of agrarian reform (Lartigue 1983). Article 27 of the 1917 Mexican Constitution established a process by which land could be redistributed from ***latifundistas*** (large landowners) to landless peasants and indigenous communities. This land was then held under collective title by the land-owning unit called the ejido. The land reform process had not been carried out in most of the Sierra Tarahumara until stimulated by a burgeoning interest in forest resources in the 1950's. While officially established in the 1930's, the forest ejido of Basíhuare did not become active until the 1950's (Merrill 1988). It is not clear on what basis the boundaries of the ejido were delineated. At present, the ejido appears to group ranchos associated with the Basíhuare templo. The ejido also allowed settlers to become founding members.

Membership and governance of the ejido is decided through general assemblies of the ejido (Alcorn and Toledo 1998). Forest ejidos were distinguished from agricultural ejidos as the former held extensive tracts of forestlands. By 1971 the majority of the central uplands of the Sierra Tarahumara were held by forest ejidos that varied in size from 15,000 to 40,000ha (COSEDECH 1999). In comparison, the agricultural land along rivers in the uplands and central mesa was divided, more or less, equally between ejido and private land. The ranch lands of the central mesa were mostly held under private ownership. This pattern of land ownership was recently challenged following the North American Free Trade Agreement (Alcorn and Toledo 1998).

Changes were made to Article 27 that allowed ejidos to distribute ejido lands amongst current members (Alcorn and Toledo 1998). Members would receive individual title to the distributed lands that they then could sell to another individual. Most Rarámuri communities of the Sierra Tarahumara, to date, have voted against dividing up their lands by individual title (COSEDECH 1999). In my conversations with Rarámuri people of the Basíhuare ejido most expressed the sentiment that they prefered to hold land under collective title. This gives the community the ability to approve land transfers and settlement on ejido lands. Once land was distributed; an event like the recent period of drought could lead to the massive sale of land. In turn, this would lead to the breakdown of the customary Rarámuri system of governance for their lands.

Since the time of the missions there had been very little pressure on forest and agricultural lands in Basíhuare. The establishment of a network of railways and roads during the 1900's provided access to Basíhuare lands (Merrill 1988). In the 1940's, the long-standing mule track was made into a road with the discovery of silver and gold at La Bufa, near Batopilas. This occurred during the same period in which a national forestry industry, including sawmills and a paper factory, were leading to an increased demand for timber (Lartigue 1983). Article 27 of the Mexican constitution, however, now allowed forest communities to organize in response to this demand for timber (COSEDECH 1999). It was no longer possible for the government to establish licences for the forests of the Sierra Tarahumara uplands. Instead, the government had to establish a system that would work with the ejidos to facilitate the supply of timber and wood fibre to the forest industry.

In 1962 an office of the ***Instituto Nacional Indigenista*** (National Indigenous Institute, INI) was established in Guachochi (COSEDECH 1999). In the same year, the forest ejidos south of the Chiahuahua-Pacific railway to the Sinforosa canyon were grouped together as the Guachochi municipality. Shortly after, a road network was completed which linked Guachochi to the main locations of forestry activity. A highway was built linking Guachochi to Parral, Guachochi to Creel and Creel to the main highway linking Chihuahua and the forest heartland of the Papigochi River and the headwaters of the Concho River. The highway from Guachochi to Creel followed the original mule track, and also upgraded the road through the Basíhuare ejido (Merrill 1988). During the

1960's and 1970's secondary roads were constructed up the main valleys of the Basíhuare ejido in order that timber could be extracted from the pine uplands.

The 1970's, 1980's and 1990's were periods of massive extraction of timber from the Basíhuare ejido, and also through the entire municipality of Guachochi (COSEDECH 1999). During this period the administration of forests moved away from the issuance of forest concessions to the forest industry. Instead, it turned toward the administration of forests by the ejidos under relevant Mexican Federal Laws: *Leyes Forestal* (Forest Laws) of 1948, 1960, 1986, 1992 and 1997 and *Ley General Del Equilibrio Ecologico y La Proteccion al Ambiente* (General Law for the Ecological Equilibrium and Environmental Protection) of 1994 (COSEDECH 1999). In order to administer their forestlands, the ejido had to decide how much timber should be extracted from their lands and establish contracts with timber buyers. This meant the ejido was required to write forest management plans that were to be approved by the government agency overseeing forestry. And unfortunately, this was not a process the ejido was able to undertake without technical support.

When INI was founded in 1962 in Guachochi one of its principal functions was to facilitate the process of establishing contracts between forest ejidos and industrial purchasers of timber and fibre (COSEDECH 1999). This initiated a sequence of different programs sponsored by the Mexican and Chihuahua governments that worked with forest ejidos to manage their forestlands. During the period of the late 1900's (1960-present) forest management was undertaken by forest technicians writing forest management plans for the ejido who was the owner of the forest resource. These plans would then be approved by a general assembly of the ejido and the relevant government authority.

Throughout the post-war period these forest technicians have worked for various parties: INI; the forest industries; the government (SEMARNAP); and, in recent years as private consultants for ejidos (COSEDECH 1999). Technical support programs also allowed many communities to establish their own sawmills. This allowed the ejido to obtain a greater return from their forest resource as they moved from selling round wood to selling rough sawn timber. Over this same time period the ejido was able to extract greater and greater benefits. Under the system of forest concessions the ejido did not obtain a benefit as the government would simply licence the companies to harvest wood from a forested area. When the laws changed and allowed ejidos to obtain ownership of forestlands, INI worked with the ejido so that they would receive a fee for standing timber harvested from their lands. As the ejido had no money to build roads and no machinery to harvest or transport timber, the company simply bought standing timber. Through a number of government programs the ejido was able to obtain capital to build roads, buy machinery, and even in some cases build sawmills.

The ejido of Basíhuare was one of those able to obtain a sawmill (Merrill 1988). The Basíhuare sawmill had been established on ejido lands by a private company in the 1950's. However, a government credit programme allowed the ejido to build its own sawmill in the early 1960's. This provided the ejido with jobs to mark the trees to be cut, cutting trees, transporting trees to the sawmill and jobs in the sawmill. While the Rarámuri members of the ejido participated in some aspects of forestry operations, administration was carried out by settlers and forest management plans were written by technicians. During the year of 2001, when I undertook fieldwork in Basíhuare, the sawmill was closed. During the 1980's and early 1990's the sawmill had been operating twelve months a year. In one of my interviews, the administrator of the sawmill estimated that in the past they extracted between 20,000 and 25,000 cubic metres per year from forestlands of the ejido. In the forest management plan for 2001, the technician reduced the annual cut to 5,200 cubic metres. This only allowed the sawmill to operate for approximately three months of the year. The sawmill was closed during my fieldwork season as SEMARNAP had not yet approved the annual cut nor the five-year forest management plan.

The system of forest management that developed in the municipality of Guachochi was theoretically based upon the community management of their forestlands (COSEDECH 1999). The ejido as a collective land holding unit of Rarámuri people were the owners of the forest resource (Alcorn and Toledo 1998). They could manage the forest as they chose as long as they met minimum standards required by the forest and environmental laws. Unfortunately, there was a disjuncture between the system of forest management and its practice on the ground. The distortions that have occurred in the management of forestlands by forest ejidos have been well documented in the literature (COSEDECH 1999; Lartigue 1983).

The classic work on the Sierra Tarahumara and forestry, *Indios y Bosques: Políticas Forestales y Comunales en la Sierra Tarahumara* (Indians and Forests: Forestry and Communal Policies in the Sierra Tarahumara, my translation) was written by François Lartigue in 1983. This has recently been updated by the report *La Industria Forestal y los Recursos Naturales en la Sierra Madre de Chihuahua: Impactos Sociales, Económicas y Ecológicos* (The Forest Industry and Natural Resources in the Sierra Madre of Chihuahua: Social, Economic and Ecological Impacts, my translation) written by the Commission of Solidarity and Defense of Human Rights in association with the Texas Center for Policy Studies in 1999. The result of this work over the past twenty years has been the documentation of how forest resources have been liquidated during the latter part of the 1900's through a complicated set of distortions. In my own research I reviewed forest management plans archived at the SEMARNAP office and interviewed Basíhuare people. It became clear that the larger story was also one which applied to the experience of Basíhuare people with forest management.

The Basíhuare ejido's involvement in forest management and timber extraction had largely been facilitated by the descendents of the mule station families. It could be argued that these families participated in the conversion of forest resources into capital that they then moved to other regions. There is some truth to this characterization as most of the younger generation of these familes left the community, became educated and worked in the cities of Chihuahua. These family homes in Basíhuare have become more of a family retreat in the mountains during the holidays. However, this would over simplify the relationship between the Rarámuri and these families. In many ways, the Rarámuri depended upon the settler families to mediate relationships with other sectors of Mexican society. Forestry provided a means by which Rarámuri people could obtain access to cash employment while remaining in the community. Other ways of obtaining cash meant that Rarámuri people would migrate at some point during their life, and during different times of the year, to Chihuahua city, the horticultural zones of Chihuahua, Sonora and Sinoloa and even into the United States. The horticultural zone of Chihuahua is found in the central mesa where there are extensive orchards. Sonora and Sinaloa both have extensive export industries that produce greenhouse vegetables located on the Pacific coast. The United States offers many similar jobs for migrant labour in the horticultural industries.

In interviews that I held with Rarámuri people there was recognition of the paradox that they faced. Because of the need for a cash income, the forest resource of the ejido was disappearing; this of course resulted in less cash income from the forest resource. Naively I asked the question as to why they still approved a forest plan that appeared to be terminating the forest. The response I received was that they had no say over the forest management plan.

Forest management in the Sierra Tarahumara had become a technical excercise of maximizing the short-term timber yield of the forest. Timber yield was the focus of two forest management plans that I examined in the SEMARNAP offices in 2001. They were based upon standard forest inventory, as well as growth and yield methodologies to determine the level of extraction. A secondary focus was the protection of forests through the establishment of fire suppression policies. This included building an infrastructure of fire suppression. Other matters such as regeneration, protection and gentically improved forest plantations also received mention. However, there was no consideration of how the owners of the forest, the Rarámuri, utilized the forest or how forest management might enhance or detract from this use. Nor was there any mention of the landscape modification practices of the Rarámuri as tools of forest management, such as the practice of ***Kumerachi***.

Kumerachi was the term utilized by Rarámuri people to describe a clearing made in the forest. Although other authors have noted this practice it has never been described in detail (Bye 1976; Pennington 1963). The term ***mahueche*** was also utilized to describe the same process. I first encountered the practice of kumerachi in the Tepehuan area of Baborigame in October of 2002. When a Tepephuan person described it to me he told me how they would use these areas to produce beans. Baborigame was located in a mountain bowl to the south of the large Sinforosa canyon. Rising out of the bowl were steep slopes covered by a pine-oak forest. The slopes moved upward to peaks and mesas that were dominated by pines with some heath species. The Tepehuan of Baborigame began to cut a patch of forest in December and January. These patches were most often created where oak trees dominate. The branches were left to dry until the rains began to arrive in June. Once the rains began to arrive the field was burned and planted with beans. After one year of planting, the field would be abandoned until the oak canopy had closed and a layer of leaf litter had built up.

Essentially, I thought kumerachi was a system of shifting cultivation using fire in the pine-oak belt of the forest. What caught my attention was that a patch of forest was only cleared in Baborigame on east to southeast facing slopes. The reason given for this practice was that the early morning light and heat was needed in order for the beans to mature. The result was a landscape of oak made up of disturbed patches on the east and southeast slopes with a non-disturbed area of oak on the north and northwest slopes. The practice of kumerachi in Baborigame created a patchwork of different aged oak stands and environmental gradients—a perfect example of how a livelihood practice created the conditions for an increase in biological diversity.

On my next trip to the Sierra Tarahumara I wanted to explore the use of fire in a different region. Through a number of contacts I ended up in Basíhuare asking people about kumerachi. While I was assured that people had made kumerachi, it was a practice that they relegated to the past. When I asked why people no longer practiced kumerachi I was informed that it was because the forest ***técnicos*** (forest technicians) had prohibited them from cutting firewood and burning. I was also confused as to why the cutting of firewood and burning were both included in reference to a question about kumerachi. As I talked to a number of people throughout my time in Basíhuare it appeared that kumerachi referred to the act of clearing or cutting an area of wood. When an area is cut for firewood the wood is gathered and taken to the home. If it is to be used for planting, then the wood is left on the ground to dry and be burned. As I was waiting for the community to grant me permission to undertake fieldwork in the community I decided to find out who had prohibited kumerachi.

In interviews undertaken with SEMARNAP officials it became obvious that there was no regulation that prohibited kumerachi. However, while the ejidos were the owners of the forest they also had to comply with the Forest Law. Article 11 of the Forest Law required that the use of wood from forestlands be approved by SEMARNAP. In order to be approved Article 12 stipulates that a request must be accompanied by a management plan. Article 13 deals with non-timber forest products and suggests that the commercial harvest of NTFPs requires a management plan. However, in Article 13 SEMARNAP is given the authority to approve the domestic use of all primary forest products and grazing in forestlands subject to derived norms. Domestic use is defined as those resources and primary forest materials used by indigenous communities in their rituals. Article 27 states that SEMARNAP can determine the norms for the prevention, combat and control of forest fires as well as the methods and means by which fire can be used. Articles 28 and 29 establish that owners of forestlands must work to combat forest fires. Articles 52 and 53 establish the information required to approve a change of land use. Since the practice of kumerachi could be seen to change the use of land from forest cover to agricultural land it may require approval under these articles. The result of my review of the Forest Law and interviews with SEMARNAP officials was that fire, firewood collection and creating bean patches was not prohibited under the law. However, as these practices have never been included in forest management plans for ejidos, they have also never been approved.

During my stay in Basíhuare from March to June 2002 it became clear to me that there were two systems of management in place on Basíhuare lands. The way in which I characterized these different systems was (a) a firewood and beans system and (b) a timber system of forest management. The ejido system, in Basíhuare, was overlain onto a customary system of Rarámuri governance dating back, at least, to the 1700's (Merrill 1988; Pennington 1963). The ejido system of forest management was put in place to extract timber (COSEDECH 1999; Lartigue 1983). While the Rarámuri participated as labourers and received benefits from forest management, the writing of forest management plans did not include their customary use of the forest. While the ejido paid for the forest management plans, the technicians who wrote the plans only included a consideration of timber management. When I asked the commissioner of the ejido and the administrator of the sawmill why customary uses were not include in the plans, they just shrugged their shoulders. When I asked the commissioner why he told people that making kumerachi was prohibited, he told me that they just repeated what the technicians had told them. They had been told that making kumerachi and the use of fire damaged (***hace daño***) the forest. It was the job of the technicians and SEMARNAP to enforce the rules of forest management. That is why forest management plans were always approved by a general assembly of the ejido and never during Sunday meetings (i.e. customary meetings).

The purpose of the forest management plans was to protect and extract timber. This included telling people that they were not allowed to use fire, cut firewood, make kumerachi, cut wood for houses nor make use of any other forest product. The contradiction that resulted was that the forest was managed by the ejido, of which the Rarámuri were the majority of members. Forest management was seen as a foreign process imposed upon the ejido by forest technicians and the government. The settler population, technicians, government and companies also manipulated it. It was a necessary imposition in exchange for obtaining some benefits from timber extraction. The practice of forest management, as experienced by the Rarámuri, was completely separate from their customary use and governance of the forest. People still undertook their customary practices and uses of the forest even if prohibited under the forest management plan. The forest management plan did not have authority over customary uses and governance of their lands. While kumerachi and the use of fire were prohibited by the forest management plan, customary governance did not prohibit it. One of the main objectives of customary governance was to assure access to resources such as food and firewood. The prohibition of kumerachi and fire would run counter to that objective. Nor would customary governance prohibit other uses that provided for the basic necessities of life.

As Chavez Moreno, a man in his eighties from Rejogochi (a rancho of the Basíhuare ejido) noted, the Rarámuri people had been making kumerachi for as long as he knew. He provided three reasons why a kumerachi, or forest clearing, was made. When people first moved into a new area they would clear the land to be utilized for permanent agriculture by cutting the trees and burning them. However, permanent agriculture was only possible on relatively flat land with deep soils. The slopes of the valleys and the canyons did not allow for permanent agriculture. The main stay of the food supply was the production of corn on the flat lands. Kumerachi was utilized to create patches of land where beans could be grown. This supplemented the food that could be produced.

In 2001, I visited the fields of two people from valleys associated with Basíhuare who were making kumerachi to produce beans. I also went to sites with three other people where kumerachi had been made one, five, ten and 20 years previously. I wanted to see how the forest regenerated after kumerachi had been made. The making of kumerachi is a careful process of selecting the right site, cutting down the wood in an appropriate pattern, making firebreaks, building fences and selecting the right time to burn the field. These five men helped me to understand how kumerachi provided a sophisticated example of using fire and ecological cycles to increase food production.

A site to make kumerachi was selected on the basis of the size of the oak trees, canopy closure and the amount of leaf litter on the ground. Other characteristics were also considered such as the direction of slope exposure, natural firebreaks and soil. It was, preferable to utilize an east or southeast slope although some kumerachi were made on northeast slopes. The site of a kumerachi may be on a valley bench or a slope where there was a cliff up the slope from the kumerachi. Cliffs act as a natural firebreak when the fire moves upward. The size of the oak trees, canopy closure and leaf litter were important to create the ash into which the beans were sown and from which they received nutrients. A closed canopy provided a wide distribution of leaf litter across the sites. Along with the size of the trees this provided an even distribution of woody matter across the site. Trees were felled in December and January after the harvest of corn. This provided enough time for the trees to dry for an even burn in June when the rains arrived. The trees were felled in such a manner that they were evenly distributed over the site. In areas where the soil is poor there was not as much tree cover. In this case the woody matter was bunched together in order to provide enough ash. On sites where there were no natural fire breaks the woody matter was cleared around the edges to provide empty strips. At this point the site was ready to be burnt.

The burning of a site was linked to the arrival of the rains in June. The timing of burning was critical. The ideal timing of a burn was when the regular pattern of rain began. If a person waited too long, the woody material became wet and an even burn was difficult. The regular pattern was necessary because the burn was timed to occur just before a rain. This was important as it prevented, or suppressed, fire from escaping the kumerachi site. However, the most important reason given was that the rain was needed to settle the ash. A person observed the pattern of weather. Once the regular pattern of rain arrived he waited for a day when he saw clouds building for a storm. The kumerachi was then burnt. If he predicted the rain correctly, it arrived and the ash settled. If not, the ash remained dry and blew away. The ash was critical to the success of the bean crop.

A number of different types of beans were planted into a kumerachi. Some of these varieties were disappearing, as people were not making kumerachi as in the past. Varieties such as ***chibábusira*, *rosémari*, *recómari* and *ojo de cabra*** are still planted. Along with the beans, squash and ***quelites***, such as ***mikwasaré*** and ***rochiwaré***, were planted. Quelites is a term utilized for edible wild greens. However, Rarámuri people have long collected the seeds of wild greens and seeded them into their fields (Bye 1976; Salmón 2000). Through the careful and calculated use of forest clearing and burning the Rarámuri people were able to extend the land available for food production (Pennington 1963).

Along with documenting how fire was utilized I also wanted to observe how the forest regenerated following a kumerachi made for beans. As I visited a number of these sites, from 1 to 20 years following kumerachi, I was able to see how the oak regenerated. What I noticed was that when a kumerachi was made, the pine and juniper trees would often be left standing. The trees that were cut were species of oak and heath along with a number of other shrubs. Often the older pine trees would survive the fire. The oak would coppice from the trunk that was left. Most regeneration of oak was from coppicing and not from the seed. This is an important component of the kumerachi system.

With kumerachi being practice on the slopes, a possible negative consequence was soil erosion due to the removal of the canopy cover. However, since the root structure of the oaks was not removed, they held soil in place. Kumerachi did not result in a permanent change in land use; it was not utilized to create a permanent agricultural field. Rather, it was a temporary change in which some of the existing vegetative structures were left in place for regeneration. The regeneration of the oak from the existing root structure allowed for quicker re-growth. Regeneration following coppicing allowed the energy of the tree to be put into shoot production. A sufficient structure of roots was already in place. The large root system drew water and nutrients from the soil and led to a quicker regeneration of the canopy structure. A kumerachi site, depending upon the soil quality, could take from 20 to 40 years to be ready for another kumerachi. In all the sites that I visited, there was regeneration of the oak along with some pre-existing or regenerated pine. However, it should be noted that the structure of the forest was changed through the practice of kumerachi.

The making of kumerachi seemed to result in a change from a pine-oak forest to an oak-dominated forest. The most intense use of kumerachi, during the time of this research, seemed to be for firewood. The activities of kumerachi for food production often conflicted with periods when migrations were undertaken for cash employment. Coupled with the harassment by forest technicians and SEMARNAP it was also necessary to create kumerachi in isolated locations. It was also difficult to ensure that animals did not enter a kumerachi located far from hamlets and eat the beans. These factors have discouraged people from making kumerachi. In spite of this, there were still many remnant oak forests where kumerachi had been carried out for many years. When these oak stands were utilized for firewood, or in the rare instance bean production, the regeneration of the stand was through coppicing from trunks. Coppicing led to a different canopy structure than seed regeneration. Oak from seed led to a single bole with branching in the upper canopy. The single bole provided a nice trunk for timber. Coppice regeneration resulted in a thick, short bole with many upright coppices. Even in a kumerachi made for beans, where cutting only occurred on a 20-40 year cycle, the oak retained a characteristic structure. In areas of intensive firewood collection there were 100-year-old trunks with 20 - 30 coppices. These coppices were seen as ideal firewood as they could be cut and did not require much splitting (Smith and Berkes 1993). However, while these forest stands were ideal for beans or firewood, they were useless for timber.

The term Tarahumara was a term placed upon people who spoke a common language in the Sierra Tarahumara. In recent years, these people have preferred to identify themselves and their language as Rarámuri (Merrill 1988). Likewise, the management of forestlands for timber was a system that was imposed through the establishment of ejidos. The system of forest management established during this period emphasized timber production and fire suppression. The Rarámuri of Basíhuare, during this period, continued to utilize fire, plant beans, cut firewood and collect other plants from the forest. While the customary system of governance did not play a role in timber management, it indeed continued to guide the ritual, ceremony, and production of a customary Rarámuri livelihood. What has yet to emerge is a means by which customary practices, livelihood and governance can be articulated within forest management planning. Rarámuri people have managed to change the label by which other people identify them. A further step will be to insist that forest technicians write forest management plans that respects their customs.

In the next chapter I present the results of the ethnoecological research undertaken in Canada and Mexico. This is followed by a summary of Anishinaabe ethnobotanical research in Chapter VII. I return to a summary of adaptive learning and social-ecological research in Chapter VIII, which concludes the dissertation.

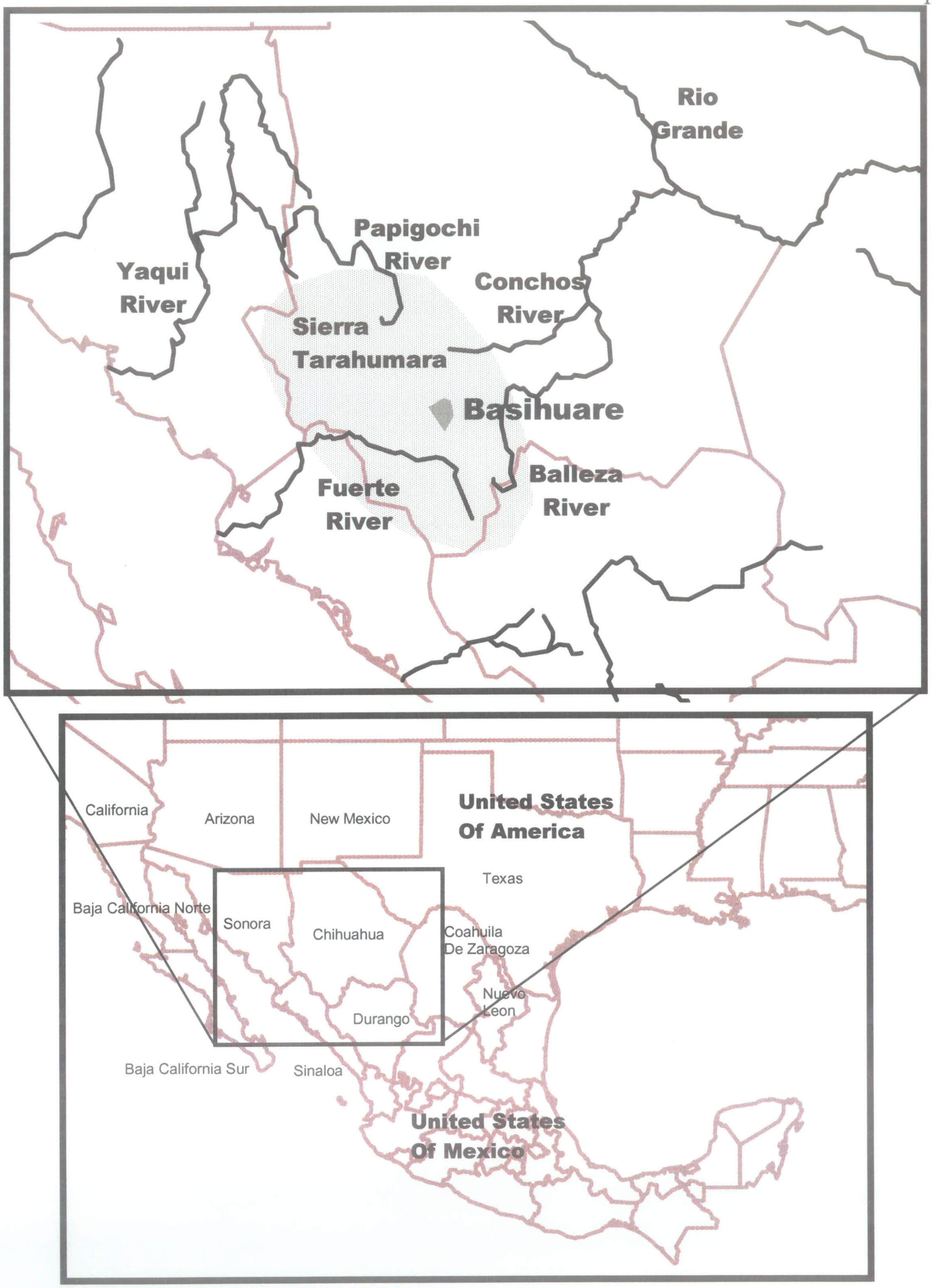


Figure V-1 Location of Basihuare, Chihuahua, Mexico.

Plate 7. Old oak tree that has been repeatedly coppiced for firewood, Basihuare, Mexico.

Plate 8. Jose Maria in a 15-year-old kumerachi, Ejido of Basihuare, Mexico.

CHAPTER VI

ETHNOECOLOGY: LEARNING AS YOU JOURNEY:

INTRODUCTION

Wiingushk (*Artemisia frigida*), or sage as it is called in English, is one of the sacred plants of the Iskatewizaagegan Anishinaabe. Sage is often used as one component of smudging mixtures for ceremonies and healing. The people of Iskatewizaagegan, or Shoal Lake as it is known in English, consider themselves fortunate as they have an abundance of sage which can be found within their territory. For two days in July, 2000 I worked with the late Dan Green, Walter Redsky and community researcher Brennan Wapioke to document the habitat of sage. I offered tobacco to the elders and we were on our way to look at some of the places where they harvest sage. Dan took us to two of his harvesting locations where we identified the sage as a member of the genus *Artemisia*. At the same time, I also began to notice similarities in the harvest locations. This species of *Artemisia* prefers to grow in the cracks and ledges found on the cliffs that rise steeply out of the lake. I asked Dan and Walter whether there was a name for this type of place. After some discussion, they offered two names for this place: ***Taashkaapkaang*** and ***Giishkaapiikaang***. The former describes the ledges or cracks found in a rock face, while the latter more generally describes a rock cliff. I was quite elated, as we seemed to have found names for a type of habitat on our first journey.

We then were on our way to visit a place where Walter had harvested sage in his younger days. Walter remembered harvesting sage on a small island in the middle of a bay. Walter, who is now 86, spent time in his younger days on the Gull Bay reserve lands at the south end of the lake. While he was not exactly sure which island we were looking for, he did remember that it was part of a group of islands found in that particular bay. He suggested we look more closely at one of the islands. We circled the island, but could not find sage. Instead, we came ashore to have lunch and almost sat on ***Animoziitens***, the small prickly pear cactus (*Opuntia fragilis*) and hops (*Humulus lupulus*).

After lunch we went out in the boat to look at the other islands. Driving by one of the islands, I noticed a rock formation that looked very similar to the type of cliff where Dan picked sage. I turned to Brennan Wapioke, the community researcher, and pointed out the island. After a look, he agreed that it was very similar to where we had already found sage. As we approached the rusty coloured, south-facing rock face, we began to perceive the cracks and ledges, and, then, sage itself appearing from the rock. Walter offered tobacco and prayers to sage, as Brennan and I picked some for him to take home.

This event left me quite confused. If Walter and Dan named the rock faces and ledges of sage's habitat, why did they not recognize such a habitat in a different location? My training led me to quickly create a category that I thought of as south-facing, rusty-coloured rock faces which emerged sharply from the water. Instead of remembering every place that sage grew, I utilized that category to look for places where it was likely I would find sage. It was apparent that Walter and I were drawing on very different processes of remembering where things occurred within the landscape.

This chapter describes my journey of trying to understand how Walter was remembering sage. This experience forced me to ask myself a couple of questions: how do institutions of knowledge situate memory and creativity into social-ecological environments, so that learning becomes adaptive? And how do the temporal and spatial dynamics of the land become part of a holistic environment? The answer to these questions, I thought, might tell us something about the process of adaptive learning and institutions of knowledge.

This chapter presents the result of my original field research in northwestern Ontario and northwestern Mexico. In this chapter I draw upon the theory that was reviewed in Chapter II. I attempt to bring together theoretical understanding on the dynamics of knowledge and memory with the recent literature on social-ecological resilience. The goal is to demonstrate how Anishinaabe and Rarámuri people situate learners into dynamic systems, in this chapter referred to as cultural landscapes. Of course, this requires that there is the perception of space and time as a unified and dynamic social-ecological system. The methodology utilized for this research may be found in Chapter III. The historical context of the systems presented in this chapter may be found in Chapters IV, Anishinaabe, and Chapter V, Rarámuri. I would like to acknowledge the elders and community researchers who worked with me and helped me to begin to understand the information presented in this chapter.

I begin the chapter by presenting the rich technical vocabulary that is utilized to describe the spatial nature of the biophysical environment. I then turn to an examination of the perception of temporal dynamics. It was during this part of the research that I became aware that perception was based on more than just biogeophysical dimensions. There was a socio-cultural framework that seemed to organize time. This led me to re-examine how space was perceived. I present the perception of a dynamic system as a cultural landscape that is multidimensional. At the end of the chapter, I discuss the institutions of knowledge that construct the social-ecological environment as the context of learning in Anishinaabe and Rarámuri societies.

ANISHINAABE AND RARAMURI SOCIAL-ECOLOGICAL ENVIRONMENTS

The Anishinaabe and the Rarámuri peoples drew upon a memory made up of a diverse set of cognitive knowledge and institutions that created their social-ecological environment. This section presents my understanding of the holistic environment within which they journeyed and learned. My understanding of resilience and adaptive learning models influenced how I interpreted my field research. However, that grounding in literature, which presented models of different ways to perceive the world and learn, also provided me with some tools to understand and interpret what I experienced. The model, which I developed through my research and writing, is a pale shadow of the ways by which Anishinaabe and Rarámuri understand their world and learn about it. However, the model does provide some guidance on how adaptive learning occurs from within social-ecological environments. It also points out some basis for tensions between indigenous systems of knowledge and western traditions of natural resources and environmental management.

Tracing the spatial patterns of a biogeophysical landscape

Physical, Climatic and Biological Zones. In Basíhuare ejido, there was a steep climatic gradient due to the mountainous nature of the terrain. This led to different climatic zones within a limited horizontal space. An idealized landscape of the uplands of the Basíhuare ejido was presented in **Figure VI-1**. When community members were asked to describe the different climatic zones found in the ejido, the first response was in terms of temperature gradients. On the far right of **Figure VI-1**, the terms that were elicited are shown. The same idealized landscape, with terms translated into English is shown in **Figure VI-2**. The canyon bottom ('barranca') was denoted as ***We ratuchi.*** This was glossed as 'tierra caliente' by the community researcher and could be glossed as 'hot lands' in English. **Figures VI-1** and **VI-2** do not illustrate the canyon bottoms since the focus of the research was the upland pine and pine-oak forests near the hamlet of Basíhuare. The mid-elevation valleys were termed ***Pei ratachi***, 'tierra templado' or 'temperate lands', while the high mountains could be described as ***We rulachi jú***, 'tierra fria', or 'cold lands'. These descriptions of the temperate gradient might be considered secondary to the terms utilized to elicit these descriptions. The terms for canyon, upland valley and mountain were a primary axis of differentiation. However, these were the terms that were used to elicit the temperature gradient.

The physical structure of the landscape, and the corresponding temperature gradient, strongly influenced the biology of the region. A coarse habitat gradient included the sub-tropical forest found in canyon bottoms at one end to the high altitude pine forest at the other. As this research did not focus on the canyons, the description of vegetation shown in **Figures VI-1** and **VI-2** is restricted to the upland valleys and mountains. As the main belts of dominant forest were encountered on transect walks, people were asked to describe the forest. A pattern emerged whereby the dominant tree type was utilized to characterize a forest place. The zones which emerged for the temperate zone were ***rojéachi***, 'oak place,' and ***napawika hajá oko rojá yua*** which was glossed as 'many oak and few pine.' In the cold zone, the vegetation was described as ***okéachi*** that was translated as 'pine place'. Dominant vegetation provided a perceptually salient character for the description and differentiation of forest places within the broader differences captured by the language for physical and climatic zones.

Landform and Vegetation Terminology. During site visits, transects and while undertaking activities, community researchers and elder community members were asked what they would call different places encountered on the land. The results of this research are illustrated in **Figures VI-1, VI-2, VI-3** and **VI-4**. **Figures VI-1** and **VI-2** demonstrate an idealized landscape with a sample of corresponding Rarámuri terms. **Figures VI-3** and **VI-4** show a landscape with a sample of Anishinaabe terminology. **Appendix VI-1** provides a more exhaustive list of Anishinaabe landscape vocabulary.

Community researchers and elders of Iskatewizaagegan demonstrated the sophistication with which the Anishinaabe language described the prominent—and subtle—features of their biogeophysical landscape. This research was not a linguistic classification of landscape terms; however, the research demonstrated a deep perception of the environment. Obvious things, such as lakes, ***zaagaigan***, rivers, ***ziibi***, hills, ***pikwatinaa***, were present in the Anishinaabe vocabulary. More subtle physical features, such as river inlet, ***koochichiing***, river mouth, ***saagiing***, spring, ***mookijiwanibiig*** and a rocky slope on the banks of a water body, ***niisapkaang***, also emerged in discussion about how different features on the land might be described.

Places on the landscape were also described by word placement and compound word construction. The construction of compound words drew upon descriptions of physical and biological structures. Other places would incorporate the name of a plant in relation to a physical or biological structure. One elder described a grove of birch trees as ***wigwasaatigoog***, which is the plural form of birch tree. Elders also described a patch of trees as ***okwokizowaag*** plus the plural form of the tree in question. For example, a grove of birch trees was described as ***okwokizowaag wigwasaatigoog*** to emphasize the dominance of birch at that place. A name, which described a biological structure, was the example given for a clump of trees found on a plain. The plain itself was referred to as ***shiibeshkoteyaang*** while the clump of trees was known as ***babiikwaakwaa***. The linguistic unit of ***-kwaa***, and variants (***-kaa***), was another way to refer to the biological structure of patches of vegetation. A blueberry patch was referred to as ***miiniikaa***. The elders provided linguistic terms, which denoted biological structure as well as the combination of structure, with specific types of plants.

Elders would also construct words out of combinations of physical structures, landform, and biological features. Willows that grew on a sand bar where water was located on both sides were called ***shiibaakobang***. A point that contained a specific type of tree was described by combining the name of the physical feature with the vegetation that was growing. For example, a bur oak (*Quercus macrocarpa*) point was referred to as ***Giineyaamitigomiizhikaag*** that would be directly translated as "there point bur oak place". The linguistic unit of ***-kaag*** (along with ***-kaang***, ***-aang***, ***-gaang***, ***-aag*** and other variants) was often added as a locative that might be glossed as 'place of'.

A similar pattern was found when working with community researchers and elder community members for the Rarámuri language. Again, the research undertaken was not a linguistic treatment of the Rarámuri language. However, the research results indicated a rich perception of the land. This was demonstrated by the existence of a sophisticated vocabulary for the physical and biological features in the Rarámuri language.

The words utilized by the Rarámuri elders to describe physical structures often referred to specific types of landscape features. Elders provided names for a variety of landscape features. For example: mountain, ***kawí***; spring, ***bajíchi***; seep, ***samíachi***; rapids, ***baliwachi***; cave, ***resochi***; grassy plain, ***ipo***; and forks of two rivers, ***akichi***. An example of Rarámuri biogeophysical vocabulary is provided in Figures **VI-1** and **VI-2**. A locative, ***-chi***, was often added to a feature to specify a place as opposed to an abstract feature. The pattern utilized by Rarámuri elders to describe the places in the land was often similar to that utilized by Anishinaabe elders. For instance, biological structures, such as dominant vegetation, were used to describe a type of forest grove. For instance, ***okéiachi*** was used to describe a place of many pines, while ***rujisárare*** was used to describe a place of many oaks. In this research, the pattern of creating compound biogeophysical words was not encountered among Rarámuri elders while it was among the Anishinaabe.

Remembering temporal dynamics

The forest landscape was not only made up of spatial biogeophysical patterns but also temporal cycles. In order to discuss temporal cycles, it was necessary to visit different areas following a disturbance. Elders would be asked to describe these different forest stages. A primary post-disturbance activity was chosen for northwestern Ontario and northwestern Mexico. In northwestern Ontario, the conversations were held about blueberry-picking following fire and logging disturbances. In northwestern Mexico, conversations focused on the practice of shifting cultivation utilized to produce beans and/or corn on mountain slopes.

An Idealized Anishinaabe Perspective of Forest Dynamics. During verification workshops, held in the fall and winter of 2001-2002, Ella Dawn Green and Walter Redsky were asked to construct a temporal forest cycle. The different names that were gathered during field research were put together into a diagram, **Figure VI-5**, and the processes of forest changes were discussed. The cycle started with "forest," called ***Nopoming*** in Anishinaabe. While the elders did not know an equivalent term for forest fire, the word that they said was used to talk about a fire was ***Ishkote***. ***Ishkote*** referred to the action of burning. The first year or two following a fire was described as ***Ishkwaakite***, which was glossed as 'newly burned trees.' At this stage, following a fire disturbance, herbaceous vegetation was absent or just beginning to emerge. What was present in abundance was standing dead wood. This stage provided a place favoured for harvesting firewood. The elders stated that many people still preferred to harvest standing dead wood rather than live trees. However, since there were no longer many fires in the area this type of place to harvest firewood has become increasingly rare.

Ishkote was used to refer to both those fires set by people and those that occurred naturally. Often a fire was set to clear an area for a garden. Steve Mandamin described how gardens were often established on islands. In this case, ***Ishkote*** was used to convert ***Nopoming*** into ***Ishkwaakite*** and then ***Gitigaan***. ***Gitigaan*** referred to the process of planting or gardening. Many islands in the region were known as ***Gitigaan Minis***, glossed as 'gardening islands.' The old gardening sites were found on islands with deep, loamy soils and with a mixed hardwood forest cover. These were unique sites of deep soil found in the midst of the rock of the Canadian Shield. Once a garden was established by clearing the standing dead wood, it was burnt each spring to prepare it for planting. The process of burning and planting eventually led to an area that was free of roots and easily planted. When it was no longer utilized as a garden, the burning would stop and the area would revert back to forest. Sites that were utilized as gardens more than 50 years ago, however, still showed evidence of gardening activity.

When a fire occurred, or was set, on sandy or rocky sites, these sites were not used for gardening. In these places, ***Ishkwaakite*** changed to ***Oshkwaakite***. This term was glossed as 'older burnt trees.' At this stage, much of the standing dead wood would have fallen or been harvested for firewood. It was also at this point, three to five years after the disturbance, that the blueberry heath would have become established and ready for blueberry harvesting. Three to five years after the establishment of the blueberry heath, bush honeysuckle (*Diervilla lonicera*) would begin to shade out the blueberry plants. In order to prevent this from occurring, some people burned off the blueberry plants every couple of years to renew the blueberry plants and knock back other vegetation. This led, over time, to a ***Miiniikaa***, glossed as a 'blueberry patch.' If the blueberry patch was not burned, then it would revert back to forest.

The elders described a similar cycle for a logging disturbance. This cycle was shown in **Figure VI-5**. In this case, the site that followed logging was described as ***Gaagiidazhigiishkaakweyag***. This word was roughly translated as "there the trees were cut down". A blueberry heath would be established following a clear-cut that occurred on sandy soils. However, this appeared to be dependent on post-harvest site preparation. Some methods of silviculture led to a full and productive blueberry heath. Others resulted in a patchy heath with poor production. Elders suggested that the timing of the cycle was similar to that which followed forest fires. A blueberry patch established itself three to five years after a clear-cut and lasted for a further three to five years. As burning of blueberry patches had been prohibited in the first half of the 20th century, there was little experience as to the impact of burning on a blueberry patch. The elders stated that it was likely that a forest would re-establish following a clear-cut, but expressed concern that it did not come back the same as following a fire.

An Idealized Rarámuri Perspective of Forest Dynamics. In Mexico, anthropogenic fire had not been completely removed from the landscape to the extent that it had in Canada. While not encouraged, the use of fire by Rarámuri people still occurred in the Basíhuare ejido. The research in Mexico focused on the use of fire by people to create planting sites. After three months of interviewing people regarding how fire was utilized, an idealized version of forest cycles was created with the community researcher and two elder community members. This idealized Rarámuri version of the temporal dynamics is shown in **Figure VI-6**. In this case the focus was specifically on the cycles as initiated by the intentional felling of trees and burning.

Rarámuri people utilized the term kumerachi most often in order to describe a place where trees were felled. At first, it was thought that this referred specifically to the felling of trees for burning. However, further interviews also suggested that this refers generally to the felling of trees and described a site where trees where felled for firewood. This term referred, in general, to a forest disturbance caused by the felling or lopping of trees. Trees were felled, or coppiced, in order to produce firewood or a field for planting.

A field for planting was established by felling trees, often oak, but sometimes pine, and then burning. ***Ikotúkame*** was offered by the community researcher as the word for burning and which described the process by which the felled vegetation was burned prior to planting. The burning process led to a site that was described as ***ikotaché*** or burnt. Depending upon the location and the desires of the person, this site could be turned into ***ichétuachi***, "place where corn is growing," or ***munéchi***, "place where bean is growing." The sites visted during the field research were all located on the sides of mountains and bean was the crop planted. Sites were mostly planted for one year. In the rare site with a thicker layer of soil, it was sometimes burned a second year and replanted. However, the most common pattern was that a field would be left following one year of planting and vegetation was allowed to re-grow.

The elders offered an interesting comment during the construction of this diagram. They pointed out that at one time all of the cornfields on the valley bottoms were created out of forested lands. As these areas had thicker soils, and were less susceptible to erosion, they were developed into permanent cultivated fields. Sometimes, however, they rested those fields, ***ké ichétuachi risíbase***, so that the field regained its ***fuerza*** (life-force). These lands were still considered as part of the forest cycle. The difference was that people continued to intervene in the cycle so that corn would grow on those lands. Once the people abandoned those lands, the forest cycle would emerge again. People were seen to intervene in forest cycles so that the conditions would be created for the development of other beings. They considered themselves, for example, to create the conditions for corn or beans to grow.

When people no longer created a place for corn or beans to grow, then it could be described as ***o'chéria okeí (rojárare)***. This was translated as "the pines (oaks) are beginning to grow". These terms were elicited by visiting sites where it was possible to estimate how many years had passed since they were used as bean fields. The community researcher asked the elder community member to describe the site. The basic pattern was the use of modifiers added to describe the dominant vegetation. ***Mawe ku okeí*** (again lots of pine) became ***wabé okeí*** (many pines) and finally ***ochérame okeí*** (old pines). The dominant vegetation became the perceptually salient focal point that was utilized to describe the temporal dynamics of a place where a forest disturbance had occurred.

Anishinaabe Seasons. While it was possible to construct forest cycles with Anishinaabe elders, drawing upon existing vocabulary and recognition of processes, these cycles were not in everyday use. One way in which Anishinaabe elders did talk about the dynamics of the biogeophysical landscape was by referencing activities in relation to the yearly cycle of biological change. This became apparent during the activity of learning to harvest birch bark for the construction of birch bark baskets. Walter Redsky and Ella

Dawn Green mentioned that this activity had to be done when the birch bark was ready to be peeled. The timing of the birch bark harvest did not correspond to the calendar, but to the development of the birch tree in a given year. There was a time in the early summer when the bark loosened from the tree and could be peeled. Before or after this time, the bark did not peel cleanly and ripped when harvested. This time corresponded to the time when raspberries ripen, according to James Cameron. Perception of temporal dynamics meant being aware of the changes that were occurring in the biological environment. The elders emphasized that perception of the right time to undertake an activity required frequent journeys within the lands of Shoal Lake.

Walter Redsky and Ella Dawn Green also emphasized this teaching in the Anishinaabe concept of seasons that were discussed. The six seasons did not correspond to dates on a calendar, but to changes in the biogeophysical environment as it changed throughout the year. The seasons utilized by the Anishinaabe of Iskatewizaagegan are shown in **Figure VI-7**. Environmental changes signaled when the season was changing. ***Tagwaagin***, for instance, began when the leaves began to turn colour and fell from the trees. ***Tagwaagin*** was said to be turning into ***oshkibiboon*** when all the leaves had fallen from the trees and the first snows were falling. Another example is that ***biboon*** was said to be turning to ***ziigwan*** when the ice on the lakes began to melt and break up. Rather than sharp edges delineating seasons, there were periods of transitions from one season to another. A season changed more quickly in a year when there were quick changes in the ambient environment. People knew that a season was changing by being aware of the changes in the biogeophysical environment. Anishinaabe perception of temporal dynamics was rooted in frequent journeys within the land.

The seasons provided guidance as to when different activities should be undertaken. A place that denoted the location of a camping site, for instance, was often named on the basis of the season. For instance, a summer camping site was different in location from a winter camping site. Summer sites were often related to blueberry picking or the harvesting of manomin (*Zizania aquatica*). Winter camping sites were usually related to the trapping of fur-bearing animals. The season called ***Miinokamin*** referred to the time when the berries were beginning to emerge and ripen. As a person learned what occurred during a season, they were made aware of the appropriate activities for different time periods. Seasons did not mark linear time. Anishinaabe seasons marked the changes in the biogeophysical cycles of the land and linked those to the activities that were carried out during those different time periods.

While changes in the biogeophysical environment signaled a change in season, they were also marked through ceremonies such as feasting. As people journeyed in the land, they began to obtain a sense when a season was changing from one to another. As the elders put it, a person then held a feast to recognize and respect the spirits of the season past and the season that was beginning. For instance, as ***ziigwan*** turned into ***miinokamin***, a feast to celebrate the first fruits was held. This feast showed respect to the plant beings who shared with the Anishinaabe berry-picking season. Another example was the feast held as ***tagwaagin*** turned into ***oshkibiboon***. This feast marked the time when beings were becoming less active on the land. Some healers, at this time, put away their ceremonial regalia related to healing sweats. Instead, this was the season when stories could be told. Seasons provided one representation of what a dynamic social-ecological environment from an Anishinaabe perspective might look like.

Anishinaabe Moons. The yearly cycle was also marked by the names given to the different moons. The names given for the moons are provided in **Figure VI-7**. This figure was derived from a poster created by The Manitoba Association of Native Languages entitled ***Giizisoo Mazana'igan***. The moons were written out on a piece of paper and the community researcher worked with Ella Dawn Green and Walter Redsky to check the names utilized by Iskatewizaagegan people. This was checked again by Phyllis Jack with two other elders. As the poster was derived from a community near to Iskatewizaagegan, it was found that the names used in the two communities were the same.

The names of the moons provided another way in which the Anishinaabe elders marked the temporal dynamics of the biogeophysical environment. The moons provided a further differentiation of time and were linked to both the changing biophysical environment and livelihood activities. ***Migizi giizis***, translated as "bald eagle moon," marked the time when the bald eagles returned. ***Maangwag giizis*** denoted the time when loons returned and began to nest. Other moons, such as ***Miinikaa giizis***, 'Blueberrying moon' and ***Manoominike giizis***, 'Ricing moon,' marked the time period when different livelihood activities were undertaken. Other names for the moons referred to the time when certain ceremonies were undertaken, such as ***Manitoo giizis***, 'Creator's moon'. The moons also marked the time when different feasts would occur. Moons, as with seasons, provided a social-ecological environment that marked the occurrence of the timing for certain activities. These linguistic markings of temporal dynamics provided an institution in which yearly, patterned change could be remembered.

Rarámuri *Livelihood Cycle*. The Rarámuri people of Mexico also remembered their landscape in terms of the activities they undertook at different periods of the year. One of the principal organizing factors of time for the Rarámuri was related to the cycle of corn. As explained by Martín Chavez, the Rarámuri trace their origin to the emergence of corn into the world. Periods of time were marked by ceremonies that indicated the time at which practices should be undertaken so that corn might prosper. A very complex and extended time of ceremonies was held in the spring. This ceremony has been described in great detail by many other authors (Bonfiglioli 1995).

The annual cycle began with the ceremonies, which, in **Figure VI-8**, are called "collective restoration ceremonies." These ceremonies were held prior to the planting of corn, so that an appropriate social-ecological environment could be prepared in which corn could develop. Preparing an environment for corn required the purification of both the Rarámuri and the place where corn would be planted. This was referred to as 'curación,' in Spanish that could be glossed as 'healing' in English. This process allowed for the yearly restoration of right relationships necessary for the arrival of rain and the subsequent development and maturation of corn. After these ceremonies had been undertaken, the cornfields were prepared and the corn seeded. Initial development of corn depended upon the soil moisture left from winter snows. The Rarámuri believed that this was all that they could do to ensure that corn developed and matured (See Salmón 1999; 2000).

It was then up to rain to come and create a favourable environment for corn development. As the rains began to arrive, it was then time to burn the ***kumerachi*** and plant the beans. Taking care of the fields through weeding occurred over the summer months. Beans were harvested prior to the corn harvest. As the time of the corn harvest approached, there were other ceremonies, or feasts, which occurred to thank the Creator for corn. The corn harvest lasted through the fall.

A significant contribution to Rarámuri livelihood was cash obtained through migrant labour. However, the time periods of migration to obtain cash were structured within the temporal dynamics of the corn cycle. People came back to the community for the collective restoration ceremonies and the planting of corn. The period that followed these activities was when people migrated to obtain cash. Portions of a family stayed in the community and procured food through the harvest of non-timber forest products. Others obtained some cash by making and selling crafts like pine needle baskets. However, many of the men and some of the women migrated to obtain cash labour. Some went to the apple orchards of Chihuahua while others went to work as domestic labour in the city of Chihuahua. Many people only undertook those jobs on a temporary basis and returned for the corn harvest ceremonies and the harvest of the corn. After the corn harvest, people again migrated to look for work during the months of December, January, February and March. Many of the men migrated to the greenhouse vegetable installations in Sonora and Sinoloa. The cycle began again when the people returned for the collective restoration ceremonies.

In a Rarámuri perspective, time was linked to the ceremonies that marked the temporal dynamics of the corn cycle. This was interwoven with the activities, including migrant labour, that were necessary for the maintenance of a Rarámuri way of life. Remembering a Rarámuri way of life included more than cognitive knowledge. In **Figure VI-8** there are four different components that formed part of the process of remembering. The innermost component expressed the basis of life for the Rarámuri that is ***Oname***, 'the creator'. The procurement of a livelihood depended upon the individual and collective relationships with the creator. The continuation of cyclic, or patterned, change depended upon the maintenance of those relationships through ceremonies and livelihood practice. Deviations from the expected pattern indicated a problem with individual or collective relationships with the creator. This required the mediation of the ***Owiruame***, 'the healer.' On a yearly basis, the healer was required to restore the relationships between the people and the creator. This was undertaken through a cycle of ceremonial activities and special ceremonies when needed. Institutions, such as ***Korima***, which emphasized the sharing of goods and labour, provided a base of values. When such values were not followed, changes in the social-ecological environment could result. The temporal dynamics of social-ecological environments were perceived as linked to the behaviour and actions of humans (See Salmón 1999; 2000). For the Rarámuri and Anishinaabe elders, there was no separation of the social from the ecological environments. Environments could only be social-ecological settings out of which practices, learning and creativity could emerge.

The spatial dynamics of remembering

After the first field season with Iskatewizaagegan elders, two workshops were held to review the research on habitat descriptions and plant names. At both of these workshops, the comment was made by elders that the research team should spend more time on the history of the people living on the land. This was seen as more pertinent to the question of how Anishinaabe people knew the land than biogeophysical descriptions of the land. It was also suggested that the knowledge as portrayed by biogeophysical description seemed incomplete. They felt that this approach did not capture how they perceived the land. While the scope of this project did not allow us to begin an oral history process, we did decide to look at other ways the land might be known. In order to do this, we began by mapping a sample of place-names.

Iskatewizaagegan Place-Names (Toponyms). Toponyms are important because they form another dimension of spatial and temporal perception. In this case, we only undertook toponymic mapping with two elders in two short sessions. The toponyms presented in **Figures VI-9** and **VI-10** do no represent a full list of toponyms of Iskatewizaagegan. The community researcher undertook two sessions of place-name mapping. One was undertaken with the late Dan Greene while another was done with Walter Redsky. In **Figure VI-9** a compilation map of the place-names provided by both elders is presented along with the English translations in **Figure VI-10**. Place-names were most often attached to prominent features of the physical landscape. Lakes, ponds, rivers, creeks, islands, points, rocks, and many other features often received names. Some names referred to a physical feature of the landscape, such as ***Gitchinayaashing*** that describes that place as a big point. Other place-names associated a feature with a being, event or activity that occurred at that place. For instance, ***Waabozo minayam*** was translated by the elder as "Rabbit Point." ***Aagimakobawatig*** was a place where black ash grows beside a rapid. A lake where a type of plant grows in the water was called ***Gaanikooshkooshkaag Zaagaigan***. ***Ogishkibwaakaaning*** described a place where wild potatoes (*Helianthus tuberosus*) grew, while ***Gitigaani minis*** referred to an island where gardening occurred. Place-names also referred to stories told about a place. ***Animoshi minis***, 'dog island', was named from a story about the sound of dogs howling being heard on the island. Likewise, ***Pitikonigaming*** was the name of a portage that came from a story where a person heard the sound of horses galloping.

Rarámuri Place-Names (Toponyms). As stated in the previous section, this work does not present a full list of toponyms for the ejido of Basíhuare. This should be considered as only a small sample that indicates the type of places that are named. Students recorded toponyms during a class fieldtrip. The teacher would take the students on a transect walk and record the location by G.P.S. and the name of the location as they moved along a path. Other names were obtained during interviews with the community researcher and elder community members during site visits and transect walks. **Figure VI-11** provides a compilation of place-names while **Figure VI-12** contains the English translations.

Rarámuri place naming followed a similar pattern to that of Anishinaabe place naming. As suggested by Rarámuri linguist Don Burgess (1989), places became named places (toponomy) due to the activities of a being or some event. Burgess (1989) also suggested that only "people places" are named. Rarámuri people often referred to these as 'ranchos' in Spanish. The name that was derived for a place often drew upon the physical or biological features associated with that place. For instance, the name ***Resochi Samiachi*** referred to a place where there was a wet cave. Likewise, the name ***Repogueachi*** was derived from the rock outcrops located at a rancho. Names derived from biological features were also found. For instance, ***Wilúrasi***, 'place of vultures,' and ***Rologóchi***, 'place of plantain,' were both names found in Basíhuare. A story may also be the source of a name, such as ***Malárali*** that was derived from a story about a spiritual animal.

Place-Names and Orientation. In order to understand place-names, it was important to remember that people were using these place-names on a daily basis to move around within a landscape. This sometimes led people to provide names that referred to a physical feature with no further specification. In **Figure VI-13**, there is an example of how naming was situated within an Anishinaabe context. An English translation is provided in **Figure VI-14**. When asked to name places, a person sometimes provided the names ***Koochiching***, ***Saagiing*** and ***Manoomin ziibi***. These were glossed as 'river inlet,' 'river outlet' and 'wild rice river'. On a Cartesian map, these places would not be considered as place-names for a gazette. However, when moving within a landscape, all of these names became places in relation to where a person is currently situated, or in relation to another named feature, such as a river. In this case, ***Koochiching*** was the location of a spring fishing camp, so it became a place that was known. Place-names demonstrated that, for Anishinaabe and the Rarámuri people, the landscape was not just an assemblage of biophysical features. A landscape was a collection of places that became known through personal experiences and remembered as stories and collective histories.

Place-names were not just utilized to mark known places, but could also act as reference points for orientation within a landscape. The Anishinaabe travelled using waterways, lakes, portages and winter trails, pathways along which either a canoe or a dog team could pass. As in the example above, physical features that provided orientation points were often known within the context of a trail. The word, which was used to describe the physical feature, might also have been considered a name. It became a named place in relation to movement along the trail. Point was both a description of a physical feature and a place-name. In a similar manner, biophysical features became place-names when they acted as reference points along a trail of movement. Sometimes a trail followed a path in which a river crossed through the narrows, where a campsite was found on the island with cedar. ***Gaazhiibatchiwang*** and ***Geezhikiminis*** became known places that were named for their physical and biological features. These places became reference points for remembering the path of a journey from one place to another. People also named anthropogenic features, such as portages and winter trails, as place-names. As with places, the portages and trails themselves became known in the context of a journey. They formed, and were formed by, the spatial movement along paths of journeying.

The Rarámuri were also constrained in terms of their travel. Due to the mountainous nature of their environment, travel consisted of moving up a watercourse (***tú komichi***) or down a watercourse (***kao komichi***). At times, trails crossed between watercourses and it was necessary to move up a slope (***riwiná***) or down a slope (***túana***). After moving up a slope, a trail could then follow a ridge. Prominent physical features, such as a mountain, ***Gawi***, which occurred along the trail, were sometimes given as a place-name. The mountain became a named place, and a reference point, along a known path of journeying, even though it was only named "mountain". Place-names most often referred to locations where the activities of beings, or events, had occurred. However, they also seemed to be applied to features that acted as reference points along paths of travel.

Paths and places of remembering

Remembering, for Anishinaabe and Rarámuri people with whom I worked, began with a person situated in a spatial and temporal context. This was different from a Cartesian perspective, where a person was assumed to be situated outside of a spatial and temporal location. Spatially, the Cartesian perspective was like the view from an airplane. Temporally, it could be considered as the perspective gained from a time series sequence of photos where time can be compressed into the present. An airplane allows a person to distinguish replicating patterns of biogeophysical structures (landforms) established by biogeophysical processes. These replicating patterns could then be turned into categories of habitat types, so that some categories could be grouped, while others were differentiated. Temporal pathways could then be established for each category of habitat type. Habitats could then be related and mapped in Cartesian space, described by biological, geological and physical structures and processes, and described by change over time. These spatial and temporal categories became containers for holding information and which could be mapped in Cartesian space and time. Memory became detached from a location in an environment to a category located outside the environment.

Anishinaabe and Rarámuri ways of remembering were akin to the experience of journeying within the land, a journey that is situated in both space and time. The practices, moons, seasons, and ceremonies that marked the passing of diurnal, yearly and life stages often structured the journey temporally. Spatially, the paths of travel linked places that could be revealed and described as they were encountered. Places changed in yearly and longer-term cycles. These changes were observed and remembered through frequent journeys. Places were known in relation to the paths of journey and reference points that orientated a person within the land. Memory was embedded in the land and the people. The spatial and temporal locations of things could never be forgotten as long as the journeys continued.

This perspective on memory was reflected in the way by which Rarámuri and Anishinaabe elders taught about plants and where to find them on the land. They did not prioritize categories of habitat so that the location of plants might be remembered; they described the location where they remembered having encountered a plant in the past. Such locations were described by recalling the journey along paths of travel and places that were encountered along that path. Stories about places turned locations into places of remembering and points of reference within the land. Anishinaabe and Rarámuri ways of remembering brought to mind events which occurred in the past, stories, place-names, physical features and biological features, not just landforms.

Figures VI-13 and **VI-15** provide an idealized schematic on the way in which this perspective remembers the spatial and temporal dynamics of the land. **Figures VI-14** and **VI-16** provide English translations. Campgrounds, trails, portages, cabins, planting areas, cultivated fields, ricing lakes, hills, mountains, habitat patches, rapids, stony slopes, springs, 'thunderbird nests,' homes of the 'little people' and many other biological, physical and cultural features came together to form different places on the landscape. It was the spatial and temporal dynamics that created places, places that were remembered as they were encountered along the paths of remembering. The land, the people and their histories became the interwoven social-ecological environment in which Rarámuri and Anishinaabe people undertook daily practices, learned and created new memories. These cultural landscapes that I recorded during my research were "freeze-frames" of the dynamic social-ecological systems in which the Anishinaabe and Rarámuri lived.

DISCUSSION: INSTITUTIONS OF KNOWLEDGE

This chapter began with a discussion of how Walter Redsky remembered where to find sage (*Artemisia frigida*). The chapter concludes with institutions of knowledge that emerge as the key mechanism for adaptive learning. Another story by Walter Redsky will set the stage for the chapter summary.

Walter Redsky's father grew up on the land trapping. In the middle of winter, Walter related, his father could travel to a place, thrust his hand through the snow and pull up the exact root he needed for a medicine. At any time of year, Walter told me, his father knew exactly where animals, plants and fish would be located. Things changed during the year and from year to year, but Walter believed that his father knew these things as he was always travelling on the land, undertaking ceremonies, and ensuring the survival of his family. This was Walter's way of telling me that he did not need to know that sage grew on a certain type of rock face. Sure, he could describe the rock face and many other things about the land. However, his father taught Walter that the land is not a stranger of abstract categories, but a place that could be known intimately through frequent experience on the land. Each place was unique, as it embodied an aspect of creation, biophysical characteristics, names, and histories. These teachings by Walter and other Anishinaabe and Rarámuri elders tell us something about adaptive learning and social-ecological resilience. Institutions of knowledge that tell a person how to remember the land are a key characteristic of adaptive learning.

At the outset of this chapter, I posed the question of how institutions of knowledge situate memory and creativity within social-ecological environments, which are temporally and spatially dynamic, so that learning becomes adaptive. This question followed up ideas from the resilience literature (Berkes, Folke and Colding 2003) that suggested that social memory and knowledge of ecosystem dynamics was key to adaptive capacity. The research demonstrated that Anishinaabe and Rarámuri elders had a sophisticated set of vocabulary to describe the spatial and temporal dynamics of the land. There was a rich perception of spatial and temporal dynamics, cognitive knowledge of the dynamics and a social memory that taught people about the dynamics. However, the Anishinaabe and Rarámuri elders also insisted that knowledge of the land emerged out of experience on the land. This insistence provided one of the key institutions of knowledge related to adaptive learning.

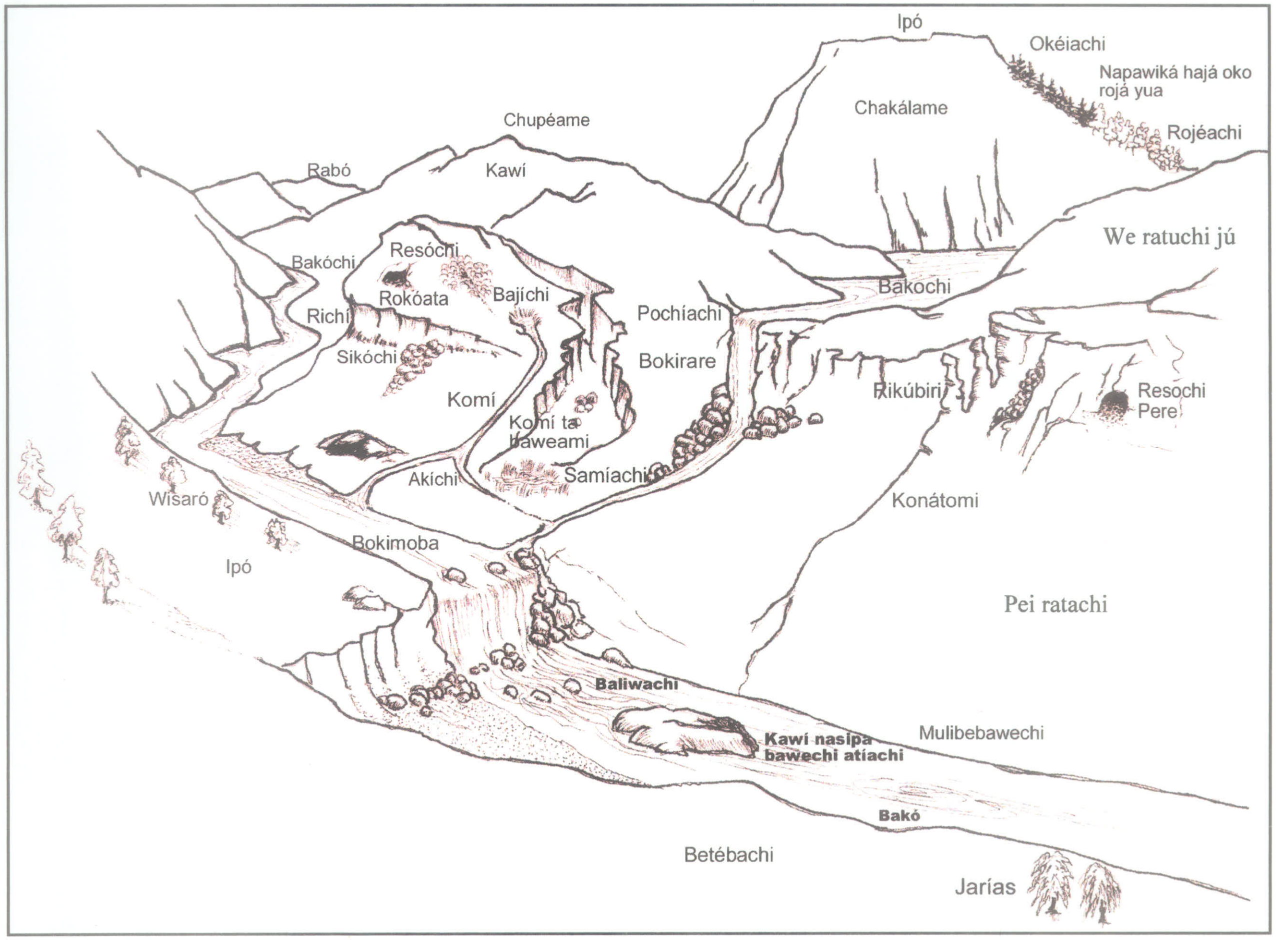
A review of the social-ecological literature and literature related to adaptive learning led to the following questions: What is an acceptable way for memories to be transmitted from one individual to another? How are memories learned? What is an acceptable way for individuals to develop their own competencies? How does individual creativity lead to authoritative and legitimate social memories? The findings that emerged from this research are that remembering, creativity and learning need to be situated in a social-ecological environment. The review of the literature led to a description of institutions of knowledge as that sub-set of institutions which frame the process of remembering, creativity and learning. They provide rules and values about how the process of adaptive learning should occur. The institution of knowledge that emerged from this research is that adaptive learning occurs within dynamic social-ecological environments. This is similar to other research among Canadian First Nations that has demonstrated that authoritative knowledge about the land is built through a long-term and direct relationship with a place and associated livelihood practices (Berkes 1999; Goulet 1998; Ingold 2000; Riddington 1988; 1990; Scott 1996; Tanner 1976). My research draws on this previous work. However, I consider the institution that some societies utilize so that iterative learning incorporates two-way feedbacks between the individual and the system into the development of institutions. Bringing these two ideas together, has not to my knowledge, been discussed in the literature.

Remembering, creativity and learning do not occur in the abstract. These activities emerge through individual action that is situated in a social-ecological environment. A person does not learn a classification of habitats in the abstract, but learns about habitats through experiences on the land. Places on the land are not just described as a category of habitat, but as a place with attributes of biogeophysical characteristics and history. These places become known as a person travels within the land. It is through journeying along the paths of travel and encountering the places of memory that memories are transmitted and new ones created. Persons develop their own competence iteratively and by trial-and-error as they become more familiar with the land, its biogeophysical characteristics, its temporal and spatial dynamics, its ceremonies and history. The basis of authoritative and legitimate social memories emerges from this feedback learning experience while journeying within the land.

Social memory includes this institution of knowledge that frames individual remembering, creativity and learning within a social-ecological environment, the land. Social memory, as discussed in the review of the literature, includes both the institutions which frame remembering, creativity and learning, and the palette of perceptions, memories, cognitive knowledge and technologies that can be drawn upon for remembering, creativity and learning. Institutions of knowledge allow authoritative and legitimate memories to be built through experience within the social-ecological environment.

Changes in the environment invoke remembering, creativity and learning. When these activities are based in individual experience on the land, this can lead to changes in social memory. As the elders rightly insist, social memory can change. This is the adaptive capacity that allows for survival. However, the abandonment of the institution of knowledge, which stresses that authority and legitimacy emerge out of experience within the land, will signal a more dramatic societal shift. Adaptive learning for social-ecological resilience, as suggested by this research, requires learning that is situated within a web of relationship of a place. This is one institution which allows social memory to frame creativity while allowing social memory to be adaptive in the face of a change. Social memory emerges from the interactions of a people with a place and becomes visible to us as cultural landscapes.

In this chapter I examined how the learning environment in some societies is perceived as a dynamic and holistic system. This is combined with an institution of knowledge that insists the direct experience within a dynamic system leads to authoritative memories over time. This close linkage between memory and dynamic systems is what provides a mechanism for learning to be adaptive. In Chapter VII, I turn to a specific type of knowledge, plant knowledge. The emphasis moves away from the system as a dynamic learning environment to a consideration of how individual learning becomes authoritative and can lead to institutional change and development. I summarize what I have learned about adaptive learning and social-ecological resilience in Chapter VIII, which concludes the dissertation.



FigureVI-1 An Idealized Schematic of Ralálmuli Biogeophysical Knowledge. A Sample of Terms.

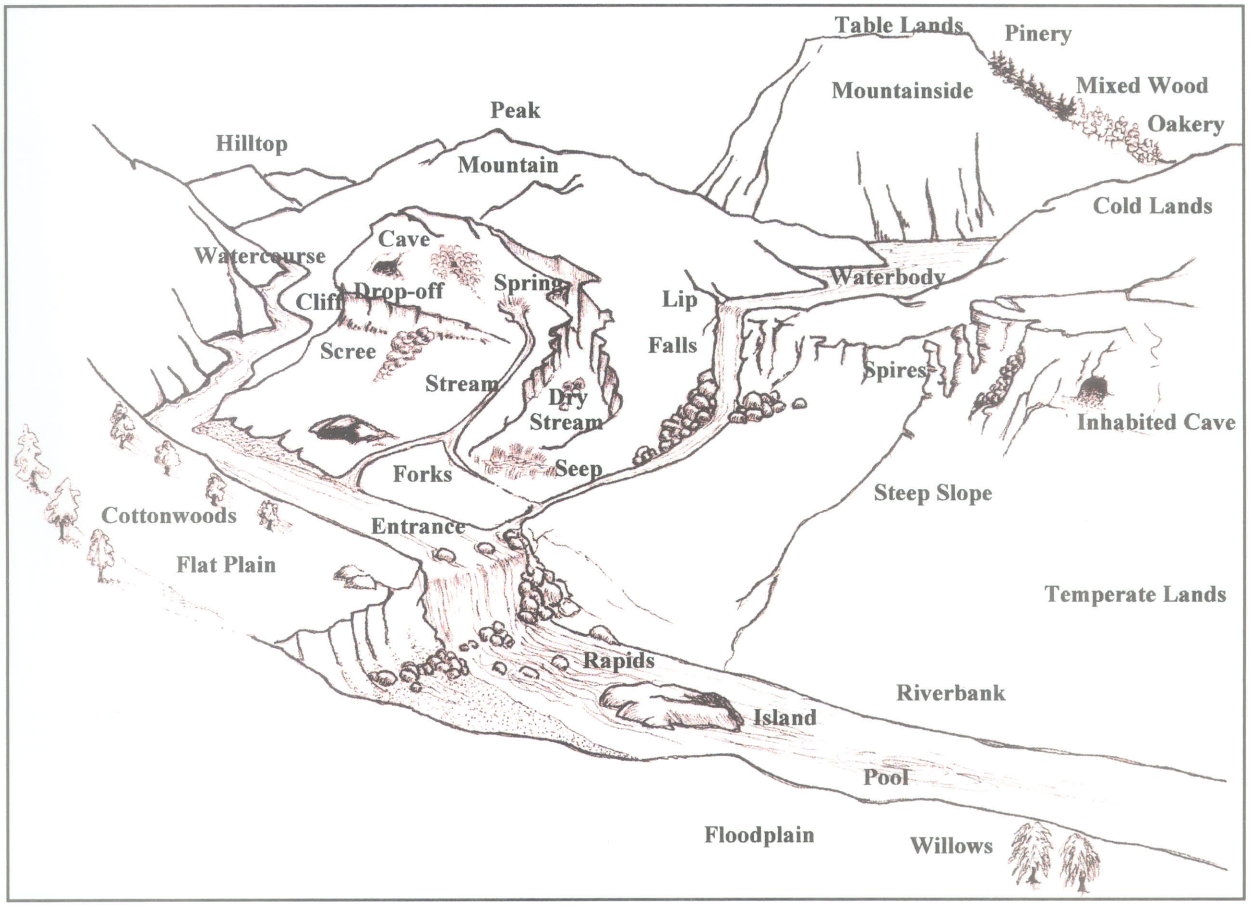


Figure VI-2 English Translation of Ralálmuli Biogeophysical Knowledge.

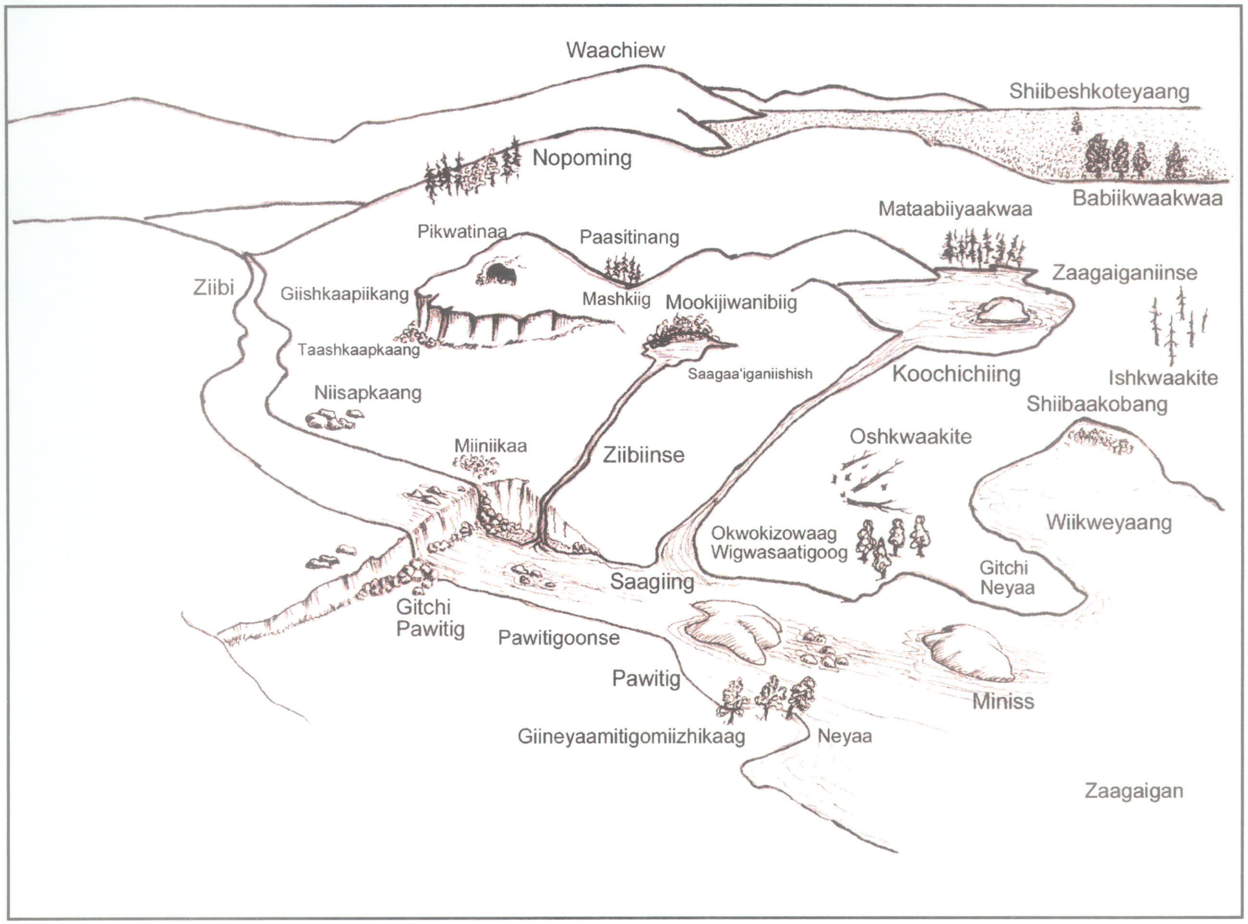


Figure VI-3 An Idealized Schematic of Anishinaabe Biogeophysical Knowledge. A Sample of Terms.

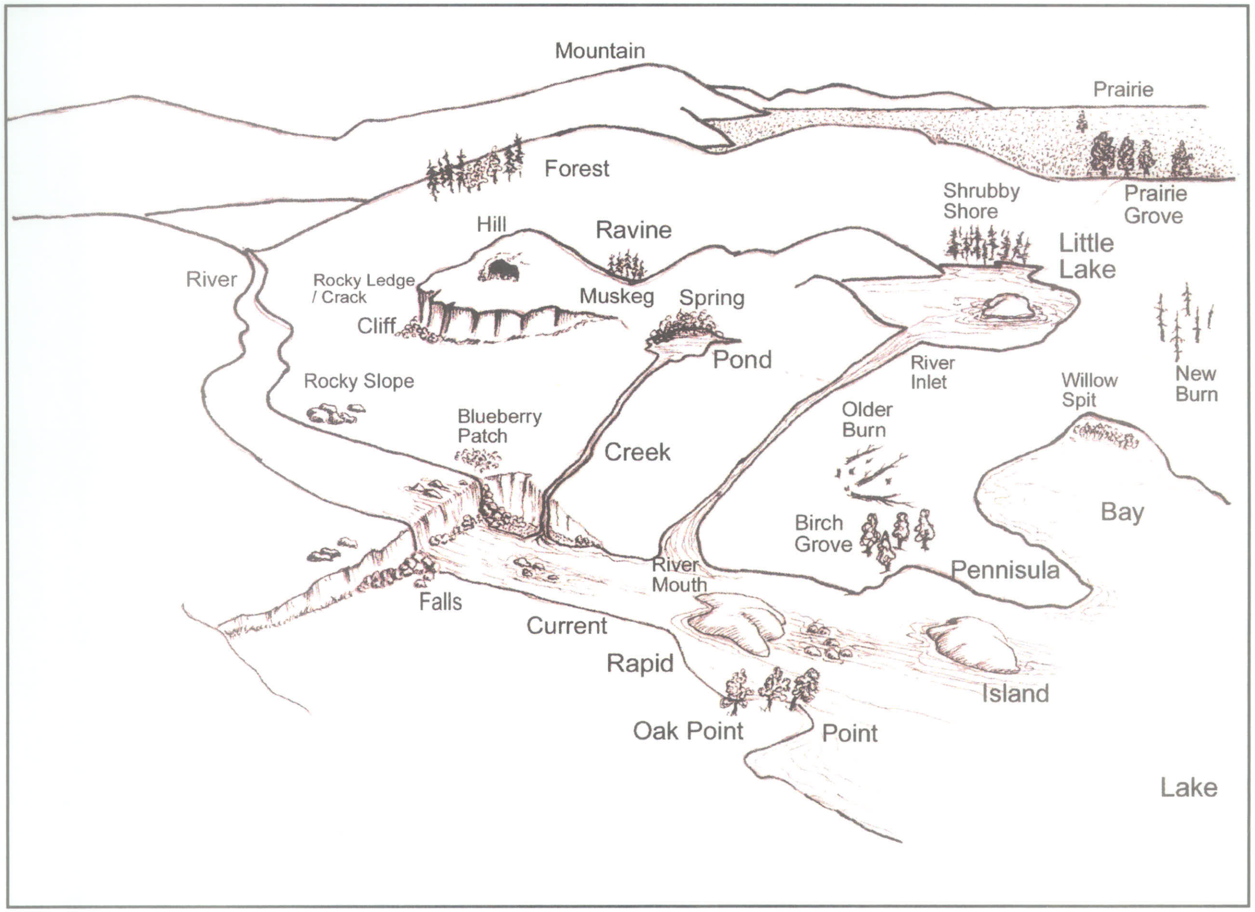


Figure VI-4 English Translation of Anishinaabe Biogeophysical Knowledge.

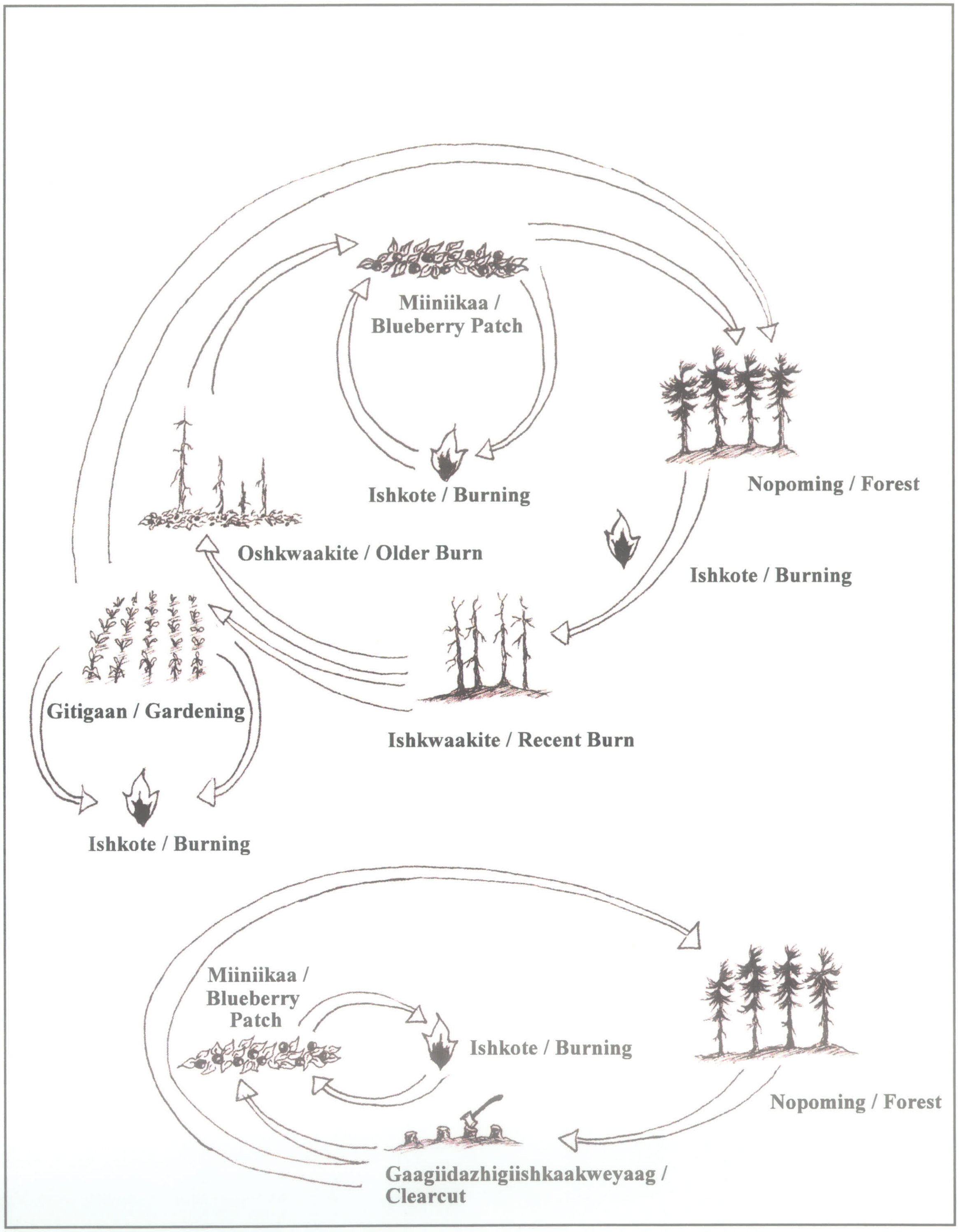


Figure VI-5 A Schematic of an Ojibway Perspective on Forest Disturbance Cycles. Arrows represent relative temporal scale of a cycle but not a temporal metric.

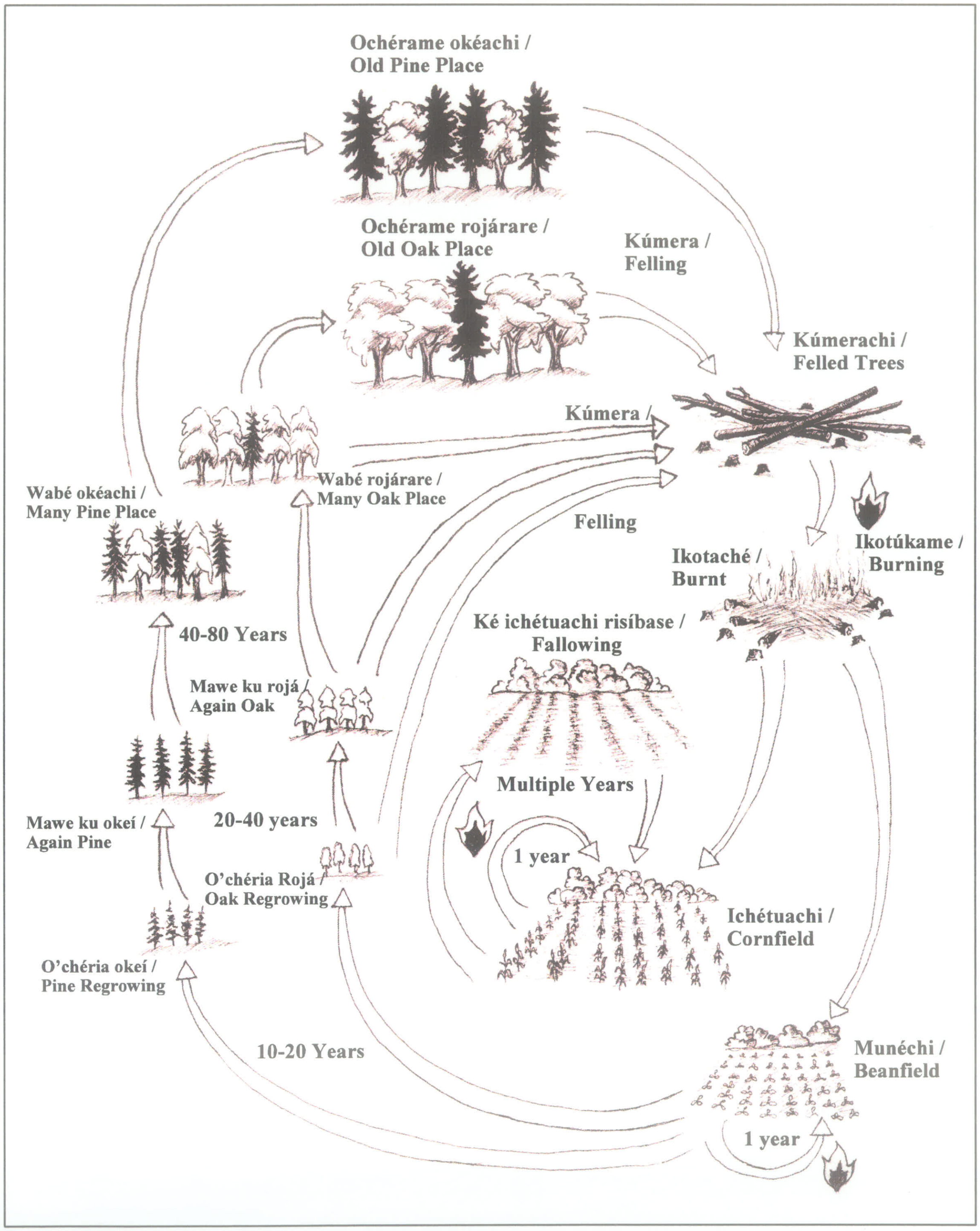


Figure VI-6 A Schematic of a Ralámuli Perspective on Forest Disturbance Cycles. Arrows represent relative temporal scale of a cycle but not a temporal metric.

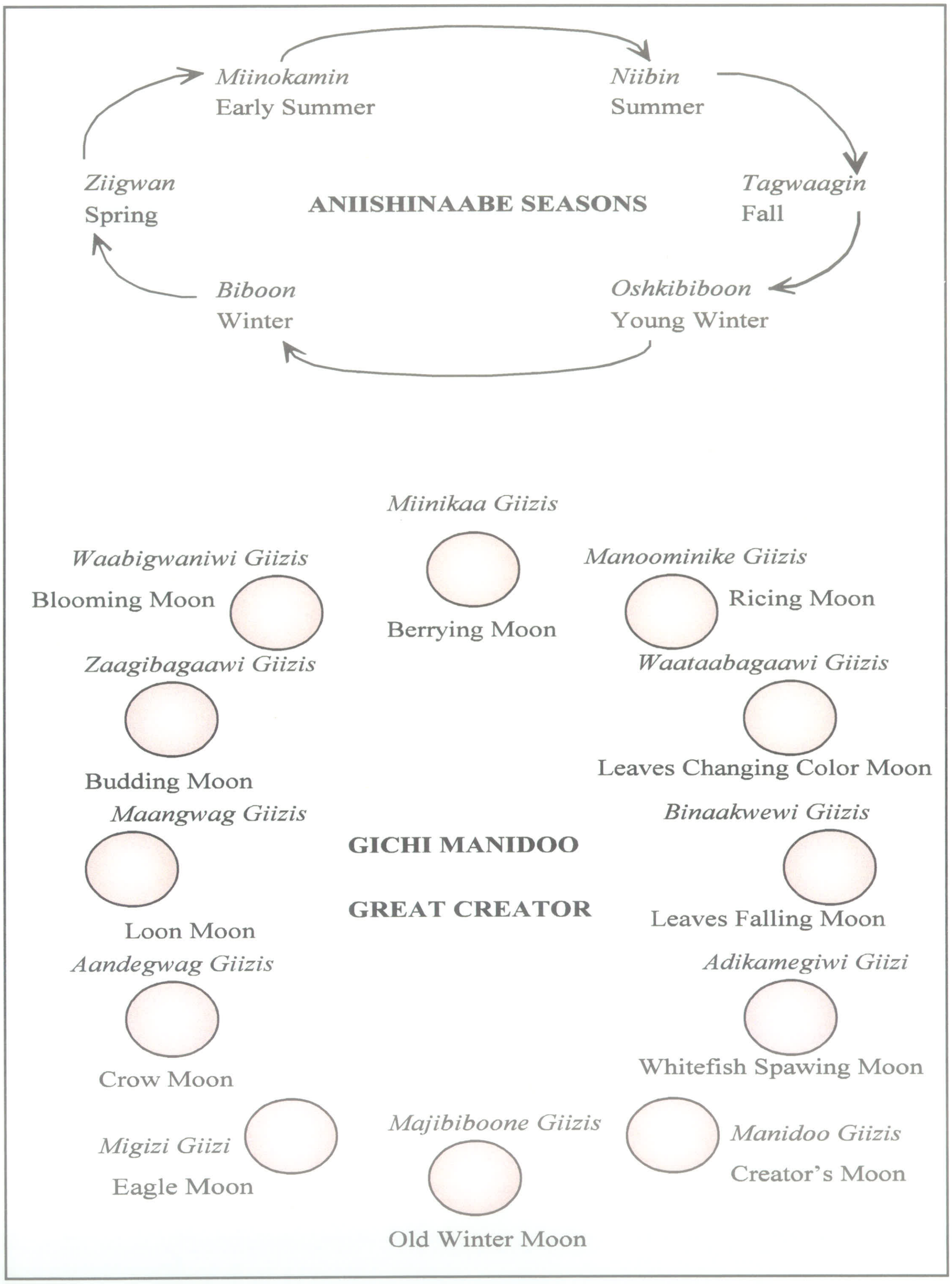


Figure VI-7 Anishinaabe Perspectives on Temporal Cycles. Seasons are Related to Changes in the Biological Environment whereas Lunar Cycles Provide a Fixed Metric.

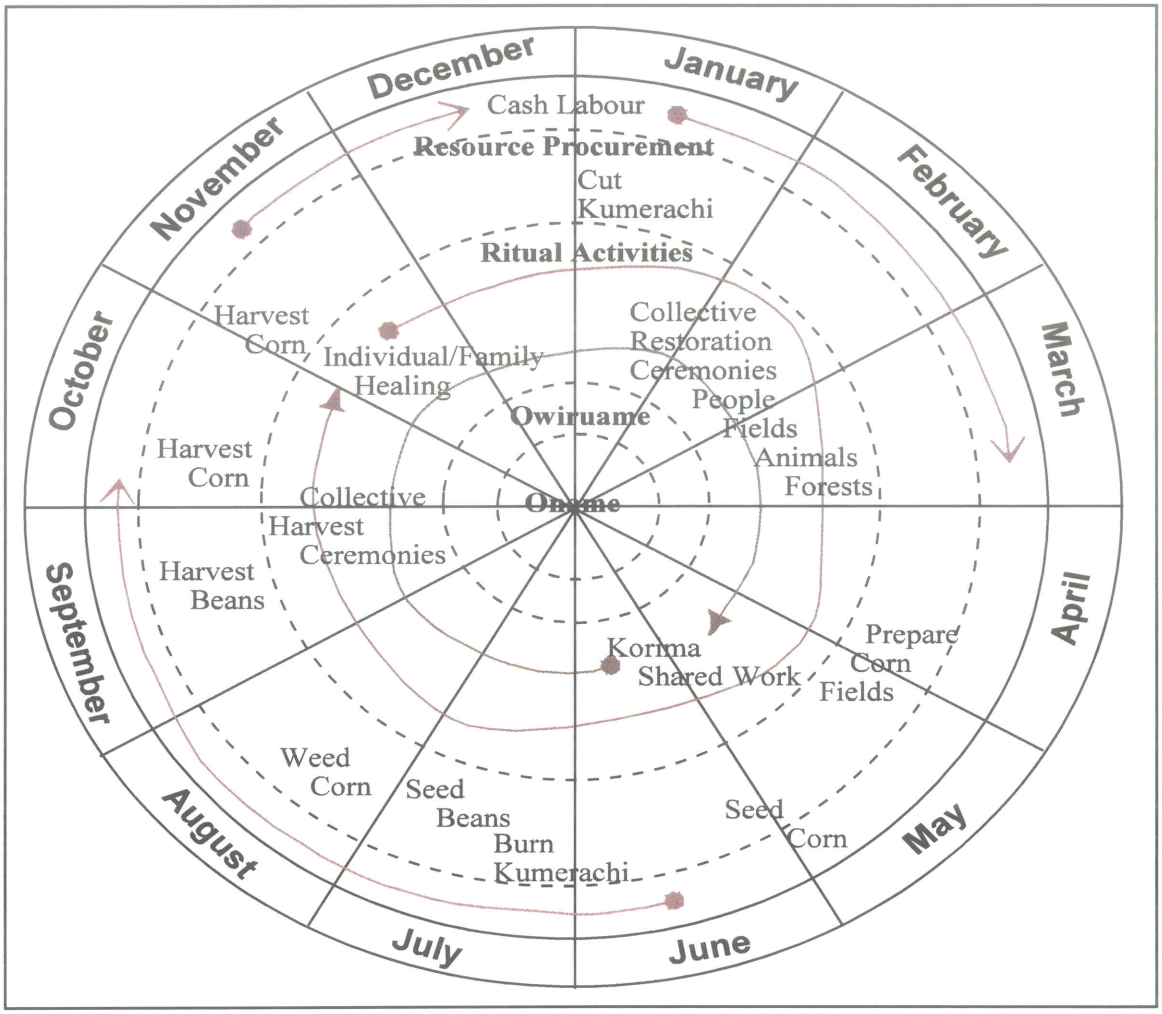


Figure VI-8 A Perspective on Social-Ecological Cycles. This Figure illustrates that a Ralámuli perspective on temporal cycles includes biological environment, livelihood tasks, ceremonies and institutions.

Figure VI-9 A Selected Sample of Places Names from Shoal Lake, Ontario, Canada. Sample Selected for Illustration Purposes.

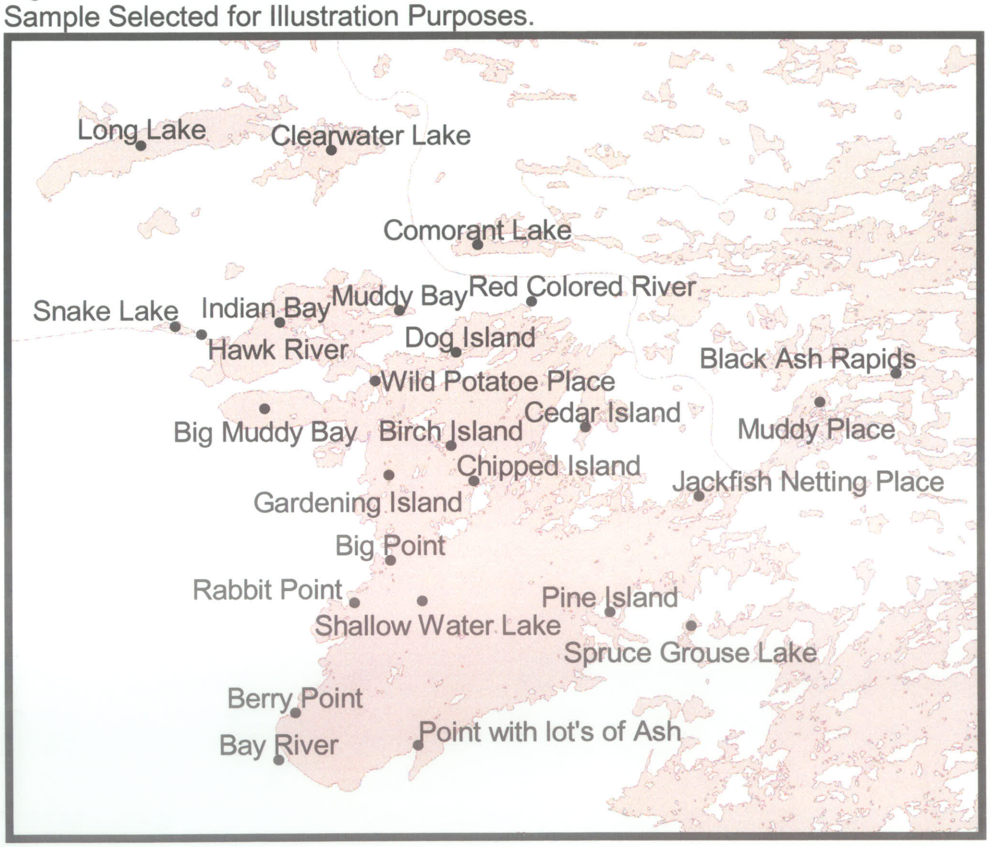


Figure VI-10 English Translation of A Selected Sample of Places Names from Shoal Lake, Ontario, Canada. Sample Selected for Illustration Purposes.

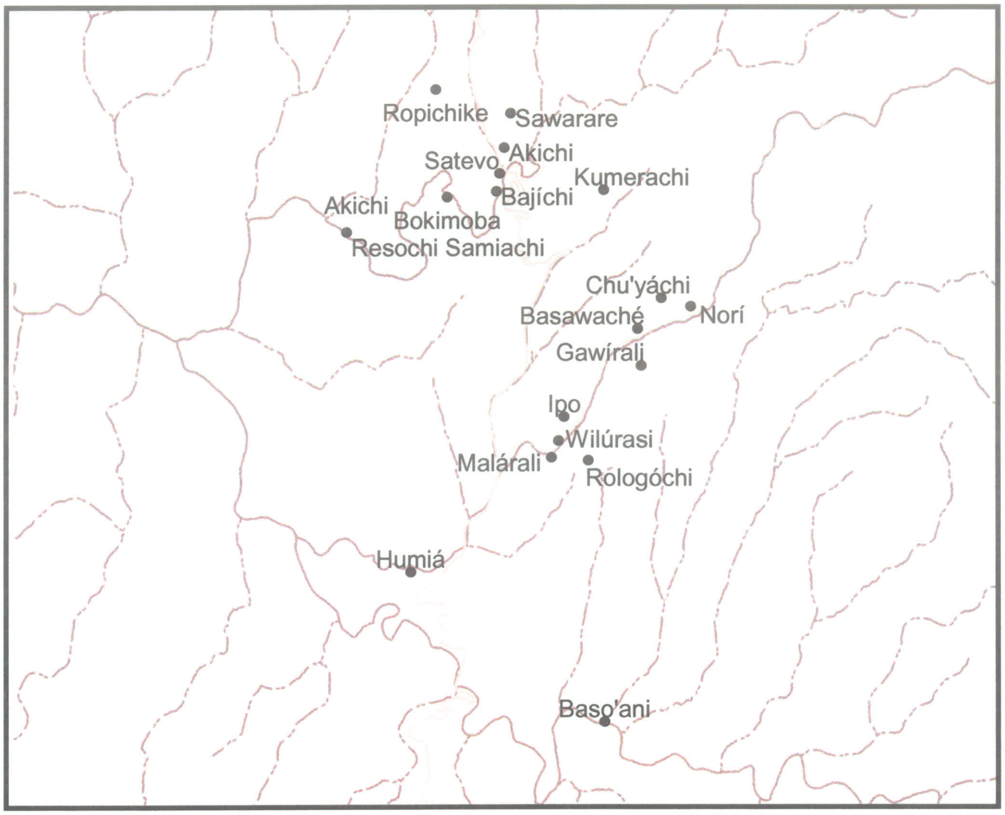


Figure VI-11 A Selected Sample of Place Names from Basihuare, Mexico. Sample Selected for Illustration Purposes.

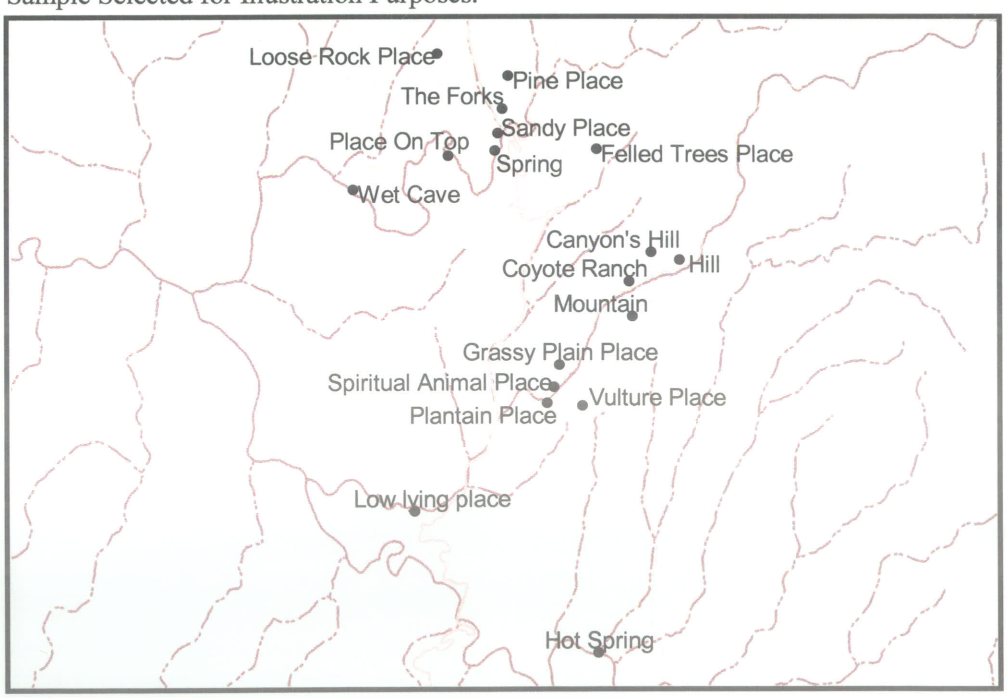


Figure VI-12 English Translation of A Selected Sample of Place Names from Basihuare, Mexico. Sample Selected for Illustration Purposes.

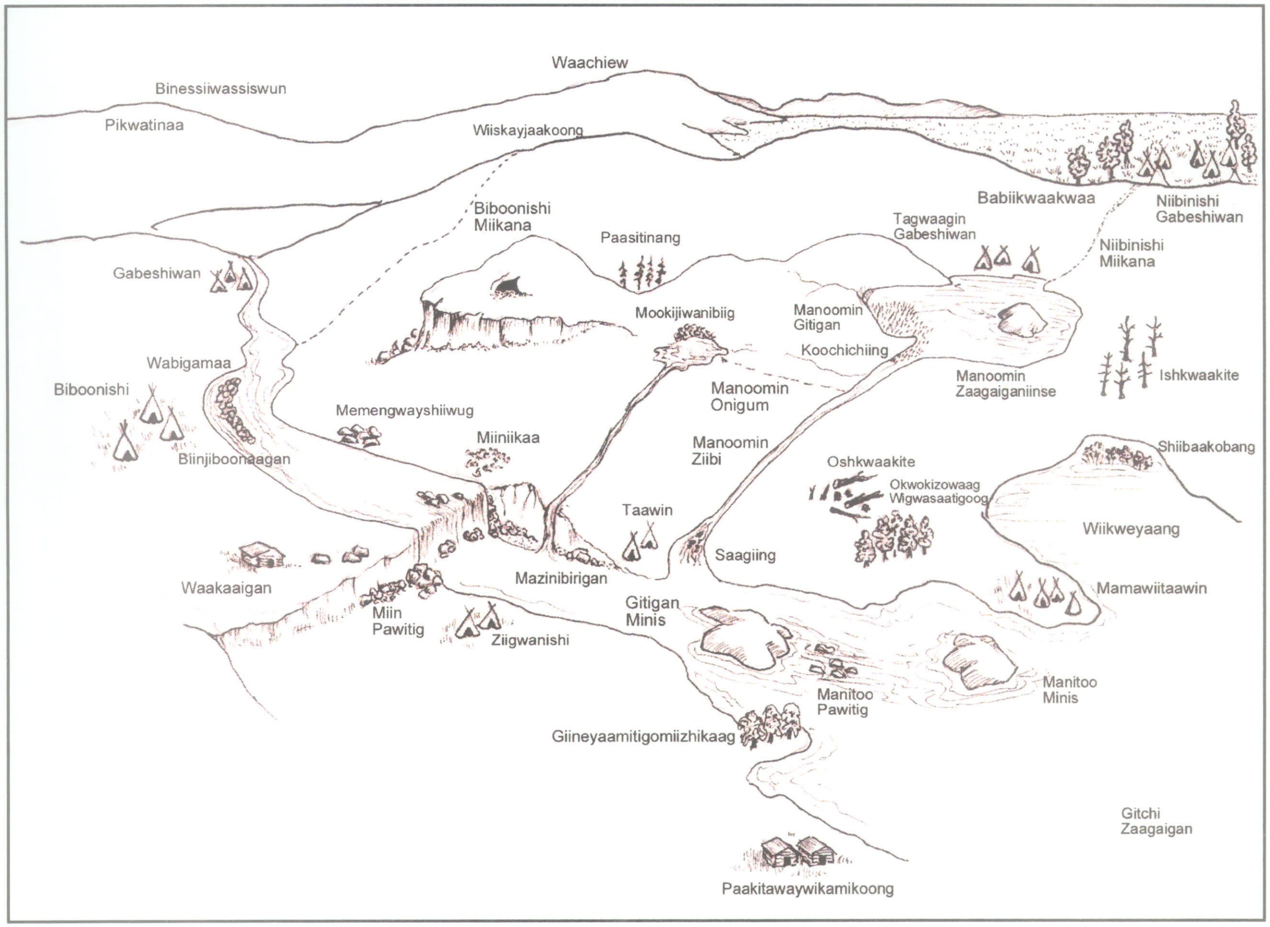


Figure VI-13 An Idealized Schematic of An Anishinaabe Cultural Landscape. Cultural Landscapes are a Mixture of Biogeophysical, Artifactual and Known (Named or unnamed) Features. A Sample of Terms.

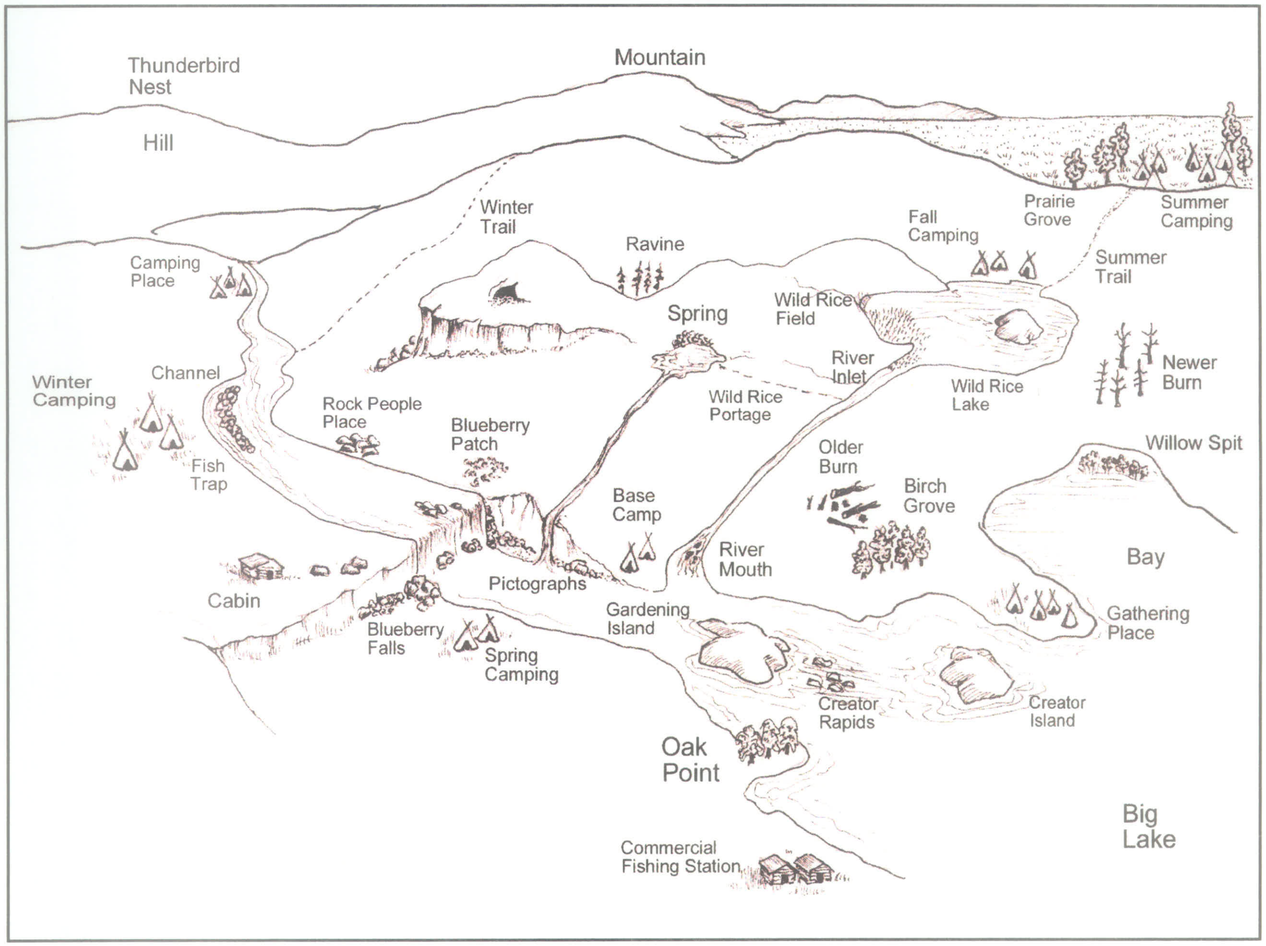


Figure VI-14 English Translation of An Anishinaabe Cultural Landscape.

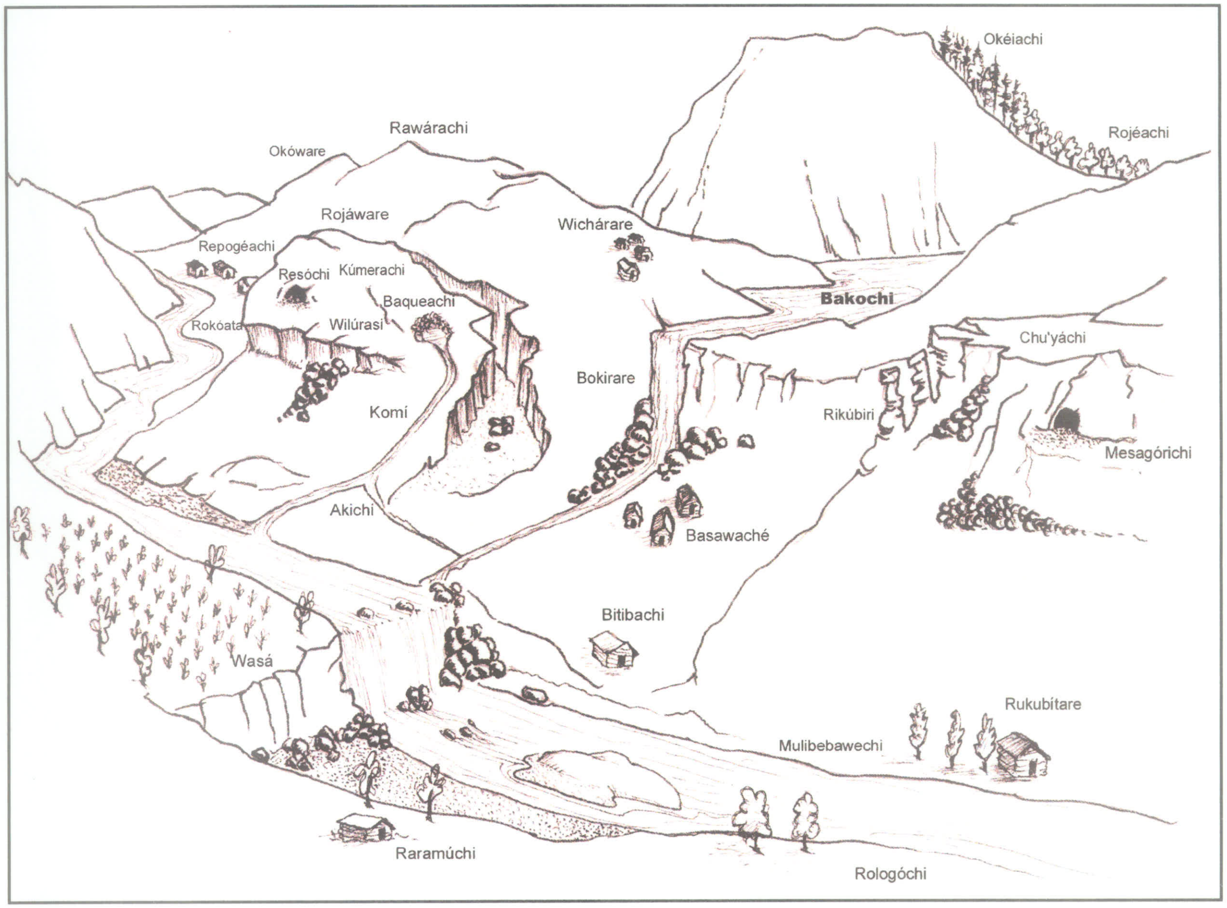


Figure VI-15 An Idealized Schematic of a Ralámuli Cultural Landscape. Cultural Landscapes are a Mixture of Biogeophysical, Artifactual and Known (Named or unnamed) Features. A Sample of Terms.

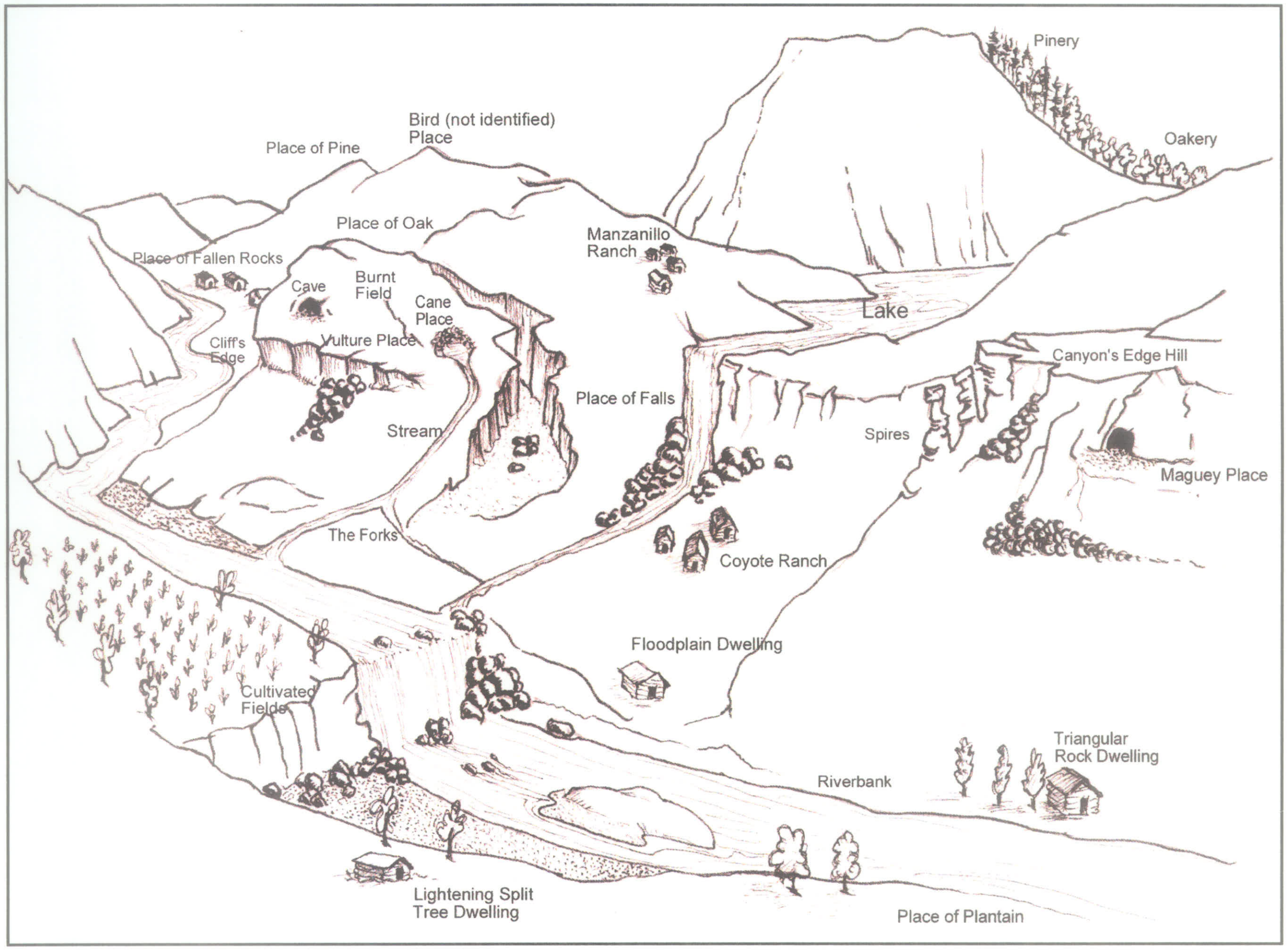


Figure VI-16 English Translation of Ralámuli Cultural Landscape.

Plate 9. Steve Mandamin on Stall Island where his ancestors transplanted Manitoba Maple (*Acer negundo*) from Manitoba in the 1800s.

Plate 10. Crowduck Lake where Shoal Lake people planted manomin (*Zizania aquatica*) after being removed from lakes they planted in what became Whiteshell Provincial Park in Manitoba.

CHAPTER VII

ETHNOBOTANY: PLANTS, DREAMS AND ELDERS

INTRODUCTION

Wiigwasaatig is the name given to the birch tree (*Betula papyrifera*) by the Anishinaabe of Iskatewizaagegan. ***Wiigwas***, the bark of the birch tree could be used to make a ***wiigwium***, the name given to a conical birch bark covered dwelling. ***Wiigwas*** could also be used to cover a ***waganagun***, which is an arched dwelling, to any number of types of containers to hold things. It became apparent during my research, however, that knowing the name of the tree and the structures was an extremely different matter than actually making one of the structures.

In the summer of 2001 I worked with Brennan Wapioke, Tracy Ruta, Dan Green, Ella Dawn Green, Jimmy Redsky and Walter Redsky to learn how to make a ***waganagun***. The learning began when I asked Robin Greene to lead a ceremony to begin the work of our project for the summer of 2001. The ceremony started by laying out the food for the feast and the gifts that I had brought for the elders from my field work in Mexico. As is usual in this type of ceremony, Robin led by opening with a pipe and smudging. Prayers were held for the work that had been undertaken and the work that we planned to undertake in the coming year. After I had presented tobacco and the gifts that I had brought for the elders, I requested that the elders teach us the proper way to work with birch bark. Ella Dawn mentioned that holding the ceremony was the appropriate way to begin learning how to work with birch bark. She brought to mind the birch that would be called upon to offer bark for the dwelling. The ceremony ended after discussing where the right type and quantity of birch bark could be found for baskets and a dwelling.

Learning to work with birch bark required procuring the necessary materials before beginning. The first few days consisted of going to various spots known to the elders where different plants could be harvested. One of the first things taught was that tobacco should be offered as a gift to the being from whom something was being asked. A being who made itself present for harvesting was seen to be offering a gift; reciprocity, through the gifting of something in return, was seen as the appropriate response. Trips were made to harvest ***otibis*** from the ***sesegaanaatig*** (*Picea mariana*). ***Otibis*** were the rootlets utilized for sewing and could be harvested from ***sesegaanaatig*** or ***mashkiigwaatig*** (*Larix laricina*).

In places, where either of these trees grow in moss, the rootlets could be easily harvested by lifting the moss. Once harvested, the rootlets were brought back to Ella Dawn's house where we had set up a place to work. The elders showed us how to peel the rootlets, split them in half and soak them in water in order that they remain supple until we were ready to sew. Other trips were made to find dried logs of ***Giizhig*** (*Thuja occidentalis*) so that they could be peeled, split and turned into slats used in the birch dwelling. Straight shoots of ***wiigob*** (*Salix* spp.) or ***miskwabimag*** (*Cornus sericea*) were sought as rims for birch containers. These proved difficult to find as the preferred shoots were first year shoots that have not branched. One-year-old shoots were easier to peel and split. However, this required that the plant be pruned yearly to stimulate new growth rather than branching. Finally, after all these materials had been collected it was time to look for the birch bark.

Choosing the bark from a tree depended upon the structure that was to be made. Structures that needed more flexibility required using a younger tree with thinner bark. Older trees were chosen for dwelling structures, as the bark was thicker and stronger. The structures we were to build were dwellings made from bark sheets; thus it was not necessary that the bark be flexible. The timing of bark harvest was also critical. We had chosen to work with birch in early July as it was at this time of the year, as Walter had explained, that was the time when the bark loosened from the tree. The elders decided on gathering thin bark from some birch trees recently knocked down, while the thick bark required a long trip down the lake. The elders carefully demonstrated how a knife, for thin bark, or a hatchet for thick bark, could be used to split the outer bark. If done at the right time of year, the bark peels itself off the tree in complete sheets. As Ella Dawn thought we might need some cedar to sew the dwelling, she showed how cedar bark is peeled in strips rather than sheets. If the bark was harvested from the trees in the right way the tree did not die and could still be seen to be growing. This depended upon harvesting the bark correctly as well as choosing the right tree. Once all materials had been gathered, it was then time to start learning how to construct the baskets and dwellings.

The following day Ella Dawn sent some of the youth to gather birch saplings, as she had decided we would make a ***waganagun*** instead of a ***wiigium***. She then showed how to cut the birch to create a folded corner basket and use a ***migoos*** (awl) to make holes for sewing. A ***namung*** (wooden needle), or simply the rootlet itself was then used to close the corners of the basket. The following day work in earnest began on the dwelling. Birch saplings were bent into shape, cedar logs were split and carved to create wooden slats, and birch sheets were sewn together. While work was in progress, the elders would talk about how their parents used to make dwellings out of birch. They themselves had only rarely made dwellings out of birch, as canvas tarps had replaced birch as the covering for dwellings when the elders were young.

After a week of work, a birch covered dwelling began to take shape, and it became evident why canvas replaced bark coverings. Ella Dawn at this point reminded us that we should obtain some cloth and tobacco and return to where the birch had been harvested. She suggested this since the birch had given us a gift and we, in turn, should return a gift to the birch. If this teaching was not followed, Ella Dawn felt there would be consequences to having harvested the birch. Learning to work with birch bark clearly emphasized how social memory is drawn upon to undertake and learn an activity. Social memory, as will be discussed, includes the cognitive memories of classification, nomenclature, institutions, technologies and techniques. However, social memory also includes the institutions of knowledge which frame the social-ecological environment in which memories are practiced, adapted and transmitted.

This chapter explores Anishinaabe knowledge of plants. It begins with a standard ethnobotanical examination of plant classification and nomenclature. The chapter then turns to an examination of how the elders' memories of plants became authoritative. This includes a consideration of knowledge transmission from one person to another, elders to youth, people of similar age and between people from different societies. How does a person learn about plants in a way that their knowledge can become authoritative? The chapter ends by discussing how an institution of knowledge can authorize individual creativity so that new memories can lead to the institutional development within societies.

The chapter draws upon the theory that is presented in Chapter II while the methodologies, which were utilized in the research, are reported on in Chapter III. Chapter IV provides a historical review of the social-ecological system out of which Anishinaabe plant memories have emerged. I would like to acknowledge the elders, the late Dan Green, Ella Dawn Green, Robin Greene, Jimmy Redsky and Walter Redsky along with community researcher Brennan Wapioke. They taught me what I was able to learn in such a short time about plants and dreams.

PLANTS

Iskatewizaagegan plant classification

This research began by investigating Anishinaabe classification and nomenclature of plants. However, as the work progressed elders made it clear that they were not comfortable with the idea of hierarchical plant classification. As Walter Redsky told the research team "Each plant is an individual whom I know through my dreams. It would be disrespectful to classify plants." Further discussions with other elders on this topic brought me to the realization that they perceived plants as individuals. As individuals, a plant could only be known through a relationship with that plant through personal experience, dreams and visions. Elders resisted the idea of formal methods to test their knowledge about classification. This is consistent with the only other known work on Algonquian classification by Mary Black (Black 1977). She suggested that the Algonquian people with whom she worked placed very little importance on the classification of plants. Other domains of knowledge were considered much more important than classification (Black 1977). A great deal of the ethnobotanical literature has considered hierarchical classification to be a universal and privileged cognitive domain of plant knowledge (Berlin 1992). Other ethnobotanists have considered that classification at a basic rank is found in all societies. However, they also consider that other domains of knowledge, such as the material, also influence classification system (Hunn 1976; 1977; 1982; Hunn and French 1984; Turner 1974; 1987; 1988; 1989). Other voices, from ecological anthropology, concur that classification is not purely formal but embedded in sociocultural values and processes (Ellen 1982; 1993; Ingold 2000). This may explain why I found what I would call a system of plant taxonomy (classification, identification and nomenclature) even though elders would not agree that they classify plants. After I present what I learned regarding plant classification I explore this contradiction through an examination of authority and dreams.

Iskatewizaagegan plant classification was similar to that suggested for other North American Indigenous Peoples. As Johnson (1999) reports for northwestern North America, the Gitxsan plant classification system was a shallow hierarchy with the presence of major plant groups, generics and a few specifics. The rank of folk generics exhibits high correspondence to scientific taxa. When moving to higher order ranks, such as life forms, or lower order ranks, such as folk varieties, there was more complexity and difference from scientific classifications. Atran (1990) and Berlin (1992) have argued that higher order ranks such as intermediate groups, life forms and kingdoms should be non-transitive and mutually exclusive. In other words, a lower order rank should only be a member of one higher order taxa. There should not be alternative axis of classification to form taxa. If there are alternative orderings of plants, these should not be considered as part of the classificatory structure according to Berlin (1992). However, Turner (1987; 1988; 1989) and Hunn (1976; 1977; 1982) argue that mid-level and general plant categories are influenced by utilitarian factors and should be considered as part of a classification system.

Folk Generics. In **Table VII-1** the Iskatewizaagegan generics are presented. The system of writing utilized in the table conforms to the double vowel system developed by Algonquian linguists. This table only presents plants which elders recognized, for which they provided an Anishinaabe name, and which were verified during a workshop. There were also many other plants that were recognized as useful for medicines, but for which elders did not have a name. A sample of plants which were known but not named are included in **Table VII-2** and **Appendix VII-1** and **VII-2**. **Table VII-1** also provides other Ojibway plant names. These names were obtained from the book *Plants Used by the Great Lake Ojibwa* (Meeker et. al. 1993). In this book the authors compiled the plants recorded by the main Ojibway ethnobotanies (Densmore 1928; Gilmore 1933; Hoffman 1891; Reagan 1928; Smith 1923). These names were then presented to elders in the northern Great Lakes States who provided verification, if possible, of the names. John Nichols, an Ojibway linguist now located at the University of Minnesota, then transcribed the verified names into current Ojibway orthography utilizing the double vowel system. However, it should be noted that some of the names presented in this column retain earlier versions of Ojibway orthography. The table also provides the relationship between the verified Ojibway name and the scientific species.

The Iskatewizaagegan generics presented in **Table VII-1** show a high degree of one-to-one correspondence between the generics and scientific species. In one case, ***aajitaamowaano***, different elders applied the name to different species. The only other case in which elders disagreed was related to pronunciation of ***obweminaatig*** versus ***paweminaatig***. This was attributed to the different geographic origins of their families. There are a number of cases that have been included in this table in which the rank of the term is not clear. ***Agwisiimaan*** included pumpkins and squashes (*Cucurbita pepo*) and watermelons (*Citrullus colocynthis*). Elders recognized a difference between pumpkins, squash and watermelon but referred to them all by the same name. This also occurred for ***aasaakamig***, which referred to mosses.

Elders recognized differences between mosses when asked, but did not assign names to the different taxa. Other examples will be discussed below in the section on plant groups. Also included in the table were examples of coordinate naming where the name of a plant was borrowed for an independent taxon. ***Waabemaanomin*** [Lit. white maanomin; white rice] and ***mishtetimomaanomin*** [Lit. horse maanomin; oats] were not considered to be related to ***maanomin*** (*Zizania aquatica*) but a modification of the name maanomin was used to distinguish these taxa. White rice was not grown in the area but oats were grown to feed horses. An example of folk varieties was provided by the case of blueberries (*Vaccinium* spp.). The terms ***makatemiin*** and ***shaabwaatemiin*** referred to specific types of berries found within the ***miin*** taxon (*Vaccinium angustifolium*).

It can be seen in **Table VII-1** that there was a basic rank of Iskatwewizaagegan nomenclature that was not related to utilitarian or ecological factors but which provided a general-purpose classification for plants. ***Agiimaatig*** (*Fraxinus nigra*), ***giizhig*** (*Thuja occidentalis*), ***oshkiizhigobag*** (*Rubus pubescens*), ***shiiwiigiibik*** (*Osmorhiza longistylis*) were examples of basic rank taxa that were classified due to perceptual salience and not other factors, such as utilitarian. However, it can also be seen in this table that there were some complications when the analysis moved from the basic rank to higher order groupings of plants

In comparing the names provided in this research with those collected in the late 1800's and early 1900's by previous ethnobotanies there was also a surprising degree of similarity. All of the previous ethnobotanical studies were undertaken with Ojibway people of Wisconsin, Michigan and Minnesota. In the case of Densmore's (1928) study, some of the results came from work undertaken with Ojibway in the Rainy River area which lies 200 km southeast of Shoal Lake. At first glance, some of the names did not appear to be the same, although this may be due to issues related to nomenclature or orthography. For instance, the Iskatewizaagegan name for balsam fir (*Abies balsamea*) was ***pigewaatig***. One of the names recorded by Meeker et. al. (1993) was ***bigiwaandag***. These two names were, upon analysis, the same name and referred to the same taxon. As will be explained in more detail in the section on nomenclature, there were many ways to refer to taxa in Anishinaabe.

In other cases it appeared that an error may have been made in the original ethnobotanical work. Densmore (1928) referred to Canada mint (*Mentha arvensis*) as ***namepin***. However, Iskatewizaagegan people were confident that ***namepin*** referred to wild ginger (*Asarum canadense*). This was also reflected in the words for wild ginger recorded by Meeker et al. (1993) that also utilized ***namepin***. It was likely that Densmore (1928) was not correct in this case, and a few others, such as the name for skunk currant (*Ribes glandulosum*) that she gave as ***waaboozojiibik***. It seemed more likely that ***waabozogiibik*** referred to wild sarsaparilla (*Aralia nudicaulis*) as the name embeds the name for the root, also used as a medicine. Canada mint also provided an example of how names may not be consistent from one region to another. There was no correspondence between the name given by Iskatewizaagegan elders and those provided by Meeker et. al. (1993). It was actually expected that more difference would be found due to the geographic and temporal distance from the words recorded in previous ethnobotanical research.

Major Plant Groups. The existence of higher order groupings of plants was thought to be a way to order increasing amounts of information. There had been some evidence that suggested that the human mind could only manage, more or less, 500 categories at a given rank (Hunn 1994). This was reflected in scientific classification that had to manage an exploding number of taxa as a universal system of classification was sought (Atran 1990). In Atran's (1990) and Berlin's (1992) models of ethnobiological classification higher ranks needed to be transitive and mutually exclusive. In other words, a higher rank taxon included a set of taxa at a lower rank. There should be no overlap between the taxa at a given rank. This then created a hierarchy of classification. Atran (1990) and Berlin (1992) argued that this general-purpose classification is based upon morphological characters. Such a system existed independently of the instrumental or symbolic meanings attached to that category. Hunn (1976; 1982), Turner (1989) and Ellen (1993) provided a counter argument to this perspective. They contended that a basic rank may be independent of instrumental and symbolic knowledge but that higher order groups were often created based upon these characteristics. It was not clear that all of the higher order groupings in this research meet the conditions for higher order ranks stipulated by Atran (1990) and Berlin (1992). For this reason the term "major plant groups" was utilized following Johnson (1999) and Turner (1987).

In **Table VII-3** it should be noted that no name is provided which corresponds to plant at the scientific rank of kingdom. The term ***awesii***, [animal], or ***awesiiyag*** [animals], was understood as a term that referred to animals in general. There was no corresponding term which the elders felt could be given for plants in general. As there was no term to be translated from the English term plant into Anishinaabe, it was not possible to ask the question, "is this type of thing a plant?" However there was a notion that certain kinds of living things were not animals. This type of response has often been treated as representing an unnamed category of plant at the kingdom rank (Johnson 1999). This research was not conclusive in that regard.

Although categories at the rank of kingdom were not well developed, there were often categories that existed at the life form rank (Berlin 1992). The terms related to life forms are presented in **Table VII-3**. They were: ***aasaakamig***, 'moss/lichen;' ***ginebigowazhin***, 'fern;' ***mitig***, 'tree;' ***mushkosii***, 'grass;' and ***ozhushkweto***, 'fungus.' We were not able to derive equivalent terms for shrubs or herbs. These terms were seen as mutually exclusive and transitive. A kind of thing was either ***aasaakamig*** or ***mitig***; it could not be both. This held true for the other terms. Some of these life forms contained categories at the intermediate rank, and the folk generic rank, while others contained categories which were unnamed or unrecognized. For instance, ***aasaakamig*** ('moss/lichen') included the named generic ***mashkiigokamig*** (Sphagnums) as well as unnamed categories for things such as lichens. ***Mitig*** ('trees') included groups such as ***shingwak*** ('pines') and ***shingobiig*** ('short-needled conifers'), which in turn included a number of generics. The existence of life form categories supported the idea of a cognitive structure for general-purpose classification. It also demonstrated that this cognitive structure was often a combination of named and unnamed categories along with more full, or more empty, categories at higher order ranks. At best it would be considered a shallow and uneven hierarchical classification.

Table VII-3 also demonstrates where the appearance of higher order taxa, which did not easily satisfy the conditions stipulated by Atran (1990) and Berlin (1992) for higher ranks, began to appear. There was a group of plants grouped under the term ***manitoo***. These plants were those considered to be ***manaamiichim***, literally translated as "be careful eating." They were known as powerful plants that should not be touched. The group included ***manitoominan***, translated as "Creator's berries," and ***manitoo o caatag***, translated as "creator's taproot." The former included two scientific taxa (*Actea rubra* and *Clintonia borealis*) while the latter included one taxon (*Circuta maculata*). *Circuta maculata* was one of the deadliest plants of the local flora while the berries of both *A. rubra* and *C. borealis* were considered to be poisonous. ***Mashkiigo*** plants were a group of plants found in muskeg. This habitat was often a wet, mossy area of black spruce and sphagnum moss which overlaid earth instead of water. Finally, there was a group of plants that were grouped under the term ***wiingushk***. This was a group of plants that included the folk generics ***wiingushk*** (*Artemisia fragilis*) and ***mushkosii wiingushk*** (*Hierochloe odorata*). The existence of these groups did not confound the existence of a general-purpose classification by Iskatewizaagegan people. They do, however, point to the interaction of different domains of knowledge that influenced the cognitive structure of plant classification. In this case, we see that major groups emerged based on morphological (poisonous), ecological (muskeg habitat) and instrumental (smudging) characteristics.

Polysemy. Evidence of polysemy is also evident in the result presented in **Table VII-3.** Polysemy is a phenomenon that is well recognized in the ethnobotanical literature (Berlin 1992). It refers to the existence of a prototypical member of a taxon that is utilized to construct a contrasting set at the same rank. The name of the prototypical taxon is often the same as the name of the more inclusive generic. The names of other taxon are often modifications of that name or may remain as unnamed taxon. The terms ***agwisiinaanan*** ('curcubits'), ***miinan*** ('blueberries'), ***shingwak*** ('pines'), ***shingobiig*** ('short-needled confiers') and ***wiigobig*** ('willows') all satisfy the conditions described by Berlin (1992) for polysemy.

Agwisiinaanan ('curcubits') was not a clear case as there was no clear prototypical member although elders did distinguish between things like squash, pumpkin and cucumber. It was a generic but contained many categories that were unnamed in the contrasting set. The other three terms were more clearly polysemous generics. ***Miinan*** (*Vaccinium angustifolium*) was the prototypical category of the ***miin*** generic which included ***makatemiin***, ***shaabwaatemiin*** and ***pingomiinan*** (*V. myrtilloides*). ***Shingwak*** was the pine generic that included ***shingwak*** (*Pinus strobus*), ***gaazhoosh kwenigwegozid shingwak*** (*P. resinosa*) and ***okigaandag*** (*P. banksiana*). ***Shingobiig*** could be glossed as 'short-needled conifers.' It was a contrasting set of generics that included ***minaeg*** (*Picea glauca*), ***pigewaatig*** (*Abies balsamea*) and ***sesegaanaatig*** (*Picea mariana*) whereas other taxon such as ***giizhig*** (*Thuja occidentalis*) and ***gaagagiwaandag*** (*Juniperus communis*) were excluded. Elders, when referring to *Picea mariana* in general conversation, often utilized the name shingobiig. For instance, Ella Dawn Greene would ask us to collect some ***shingobiig***. The community researcher would then go and collect *Picea mariana* boughs. This suggested that *Picea mariana* might be the prototypical member for that generic. ***Wiigobiig*** was a contrasting set of generics that included many species of *Salix*, 'willow', most of which were recognized, though unnamed, and ***miskwabimag*** (*C. sericea*). This was a grouping noted by Johnson (1999) for the Gitksan of northwestern British Columbia. ***Miskwabimag*** was also often referred to as red willow in English. Unnamed taxon of ***wiigobiig*** existed as elders distinguished between scientific taxon of willow when we were looking for willow to make basket rims. However, in this research I was not able to determine whether a prototypical member of ***wiiigobiig*** existed. This research supports other research that has shown the existence of polysemy within ethnobotanical classification systems.

Iskatewizaagegan plant nomenclature

Johnson (1999) and Turner (1987; 1988) argue that there are many major groups of plants that do not satisfy the conditions for general-purpose plant classification. In nomenclature we began to see the interaction between cognitive memory and institutions of knowledge. Memory is based on the cognitive structure of a classification system of categories and ranks. The institutions that guided how a category could be named, on the other hand, structured nomenclature. In scientific botany taxonomists have developed a highly structured system of rules and institutions for nomenclature that authorize both categories and the names to be applied to a category. At the time of my research, Anishinaabe people, as will be discussed in the next section, had their own institutions for authorizing plant memories. One significant difference was that a plant was remembered by Anishinaabe people within a context of practice. Plants (categories) and names for categories (nomenclature) were taught in the context of daily livelihood practice and the institutions of knowledge. These cognitive memories were brought into an environment and did not exist independently of an environment. While a cognitive memory could be reproduced as an independent system of classification, the elders did not teach about plants independent of context.

The nomenclature utilized for major plant groups began to show how plants were situated within social-ecological environments. For instance, the ***manitoo*** group discussed above brought together a set of taxa on the basis of a symbolic taboo. The name warned people of the 'powerful' or poisonous nature of those plants. The ***mashkiigo*** group brought together a set of taxa found in a particular habitat. The name informed people as to where they might find those plants. In similar fashion, the ***Wingushk*** group brought together a set of plants. This name informed people that they might be utilized for 'smudging' or purification ceremonies.

Institutions of knowledge, which situated cognitive memories into holistic environments, were also reflected in name variations. During the verification of names recorded through research it became apparent that there were slight variations between Iskatewizaagegan names and other ethnobotanies. However, there were also consistent differences. In order to clarify these differences, we recorded Iskatewizaagegan construction of plant vocabulary. The results are presented in **Table VII-4**. It became apparent that some plants could be grouped on the basis of what Johnson (1999) calls plant "partons," which in this thesis, will be referred to as plant structures. In **Table VII-**

5 the groups that paralleled some of those reported by Johnson (1999) are presented. For instance, a plant name could be constructed in such a way as to specify the boughs by using the word ending ***-aandag***. In the case of ***giizhigaandag*** this was done to specify the cedar bough while the word ***giizhig*** was utilized for the plant itself. The word ***okigaandag*** would literally be translated as "Jackpine bough" but was also used to refer to the whole plant itself.

This pattern repeated itself for ***-aatig***, which literally seemed to be translated as "stick," but referred to the hard or stiff nature of the supporting structure. Black ash (*Fraxinus nigra*) could be called ***agiimak*** or ***agiimaatig*** just as paper birch (*Betula papyrifera*) might be called ***wiigwas*** or ***wiigwasaatig***. ***Wiigwas*** also specifically referred to the birch bark. Likewise, the word ending ***-bagoon*** could be part of the construction of a category name. Wild strawberries (*Fragaria* spp.) were named ***oteiminabag(-oon)*** in this research. Densmore (1928) recorded the name, using current Anishinaabe orthography as ***oteiminabik***. In this research the word provided by the elder referred to the leafy nature of the strawberry taxon. In the case of Densmore (1928) it referred to the roots of the same taxon.

This pattern could also be seen with the term ***min(-an)***. This term was literally translated as "berry," and the strawberry taxon could also be denoted as ***oteiminan***. Another interesting variation was the group of 'berry-stick.' These are the shrubby trees that provide fruit and medicine from their bark. There was no confusion, for Iskatewizaagegan people, when pin cherry was called ***obweminan*** or ***obweminaatig***. It simply reflected the way the category was brought into a specific situation. In the former, the word emphasized a situation in which the fruit was being talked about as a food, while in the latter; it was the bark as medicine that was of interest.

The social-ecological environment into which cognitive memories were situated can also be emphasized through an extended discussion of strawberry. During the period of my research, at least three terms for strawberry were in use, along with singular, plural and other variants. Examples of the possible names for strawberry (*Fragaria* spp.) were ***oteiminabag(-oon)***, ***oteiminabik***, ***oteiminabins***, ***oteimin(-an)***. In **Table VII-6** the translations of the names are provided along with the general use category and plant structures that were in use. The use category, and the plants structures utilized, represented a combination of knowledge collected during the current research, combined with information collected in previous ethnobotanies. The choice of the word for wild strawberry depended upon the way in which the plant was being utilized. A name would never be spoken unless there was a specific context for its utterance. When I asked for the name of a strawberry plant I was told ***oteiminabag(-oon)***. However, Densmore (1928), who was focusing on medicinal uses of plants, was told ***oteiminabik***. A particular set of circumstances influenced the construction of the name to be utilized in reference to the strawberry category at the time of its utterance.

The importance of context in relation to the name utilized also became apparent during verification workshops. Long discussions occurred between the elders as to the name that should be utilized independent of a social-ecological environment. The institution of knowledge insisted that plants were named only as brought into a present situation; not as an abstract entity. When a name for a plant was required independent of a context—name to use for a specimen which can move into many different contexts—elders had to create a new rule for naming. It was decided that for the shrubby berry plants they should use the suffix ***-minaatig***, for herbaceous type plants they should use ***-bagoon***, if a berry plant didn't fit comfortably into either of these categories they could just use ***-min***.

The relationships between cognitive memory, plant category, and social-ecological environment of naming has led some authors to suggest that these words may indicate groupings of plants (Johnson 1999). There were, for instance, certain plants that were useful for boughs. All of those plants could take a name modified by the word ending for 'bough'. However, in different contexts the same plant might have taken the word ending for 'stick' or 'root.' It was not the category that was changing but the time and place in which the cognitive memory was being remembered or taught. Different situations led to different constructions of the name without changing the category itself. The word endings ***-aandag***, ***-aatig***, ***-bag***, ***-bik***, ***-min*** and ***-minaatig*** did indicate a relationship amongst these plants in a given context. For example, ***-minaatig*** was used for a set of plants whose bark could be used for medicine. In the context of talking about a plants used for medicine the construction of the name would include ***-minaatig***. This did not, however, mean that there was a cognitive category for that group. Rather, the nomenclature was expressing an institution of knowledge that insisted names emerged from an environment in which a plant was being remembered.

Plant nomenclature not only specified information in word endings but also in the words utilized to construct the names themselves. Iskatewizaagegan nomenclature often imparted useful ecological, symbolic or instrumental knowledge. ***Agiimak*** expressed that the wood of this tree was useful for making snowshoes due to the shared root for both the tree and a snowshoe. Other examples are shown in the translations provided in **Table VII-6**. ***Baabiigobagoon*** reminded a person that this herbaceous plant could cause the skin to blister. ***Waabozogiibik*** told a person that this was a plant that rabbits liked to eat as well as indicating that the root was the medicinal part of the plant. There was a good deal of information contained in the words used in Anishinaabe nomenclature. As a result of an institution of knowledge, which stressed the linkage between context and naming, elders placed more emphasis on how people learned the cognitive memories of plants than the names themselves.

Cognitive plant memories and social-ecological environments

My research on Anishinaabe classification of plants revealed that there was a cognitive structure of plant classification. This structure was most evident at the folk generic rank where categories of plants were recognized. At the same time Anishinaabe nomenclature demonstrated the importance placed on the social-ecological environment in which cognitive memories are remembered. Names were always remembered and taught through specific activities. This allowed people to realize that there was not a contradiction between nomenclature and category. Nomenclature revealed an aspect of the specific situation in which a category was being remembered. This reflected the priority given by Anishinaabe elders to the institution of knowledge that situated cognitive memory within the practice of an activity. Research also revealed another institution of knowledge: the elders. Elders were able to provide authoritative and legitimate names when the context of nomenclature shifted into a room at the elders' centre during verification workshops. Elders were able to structure social-ecological learning environments so that a change in cognitive memory was possible. These institutions of knowledge, which created authoritative and legitimate innovation in nomenclature, form the topic to which I now turn.

DREAMS AND ELDERS

"Out of nothing he made rock, water, fire, and wind. Into each one he breathed the breath of life. On each he bestowed with his breath a different essence and nature. Each substance had its own power which became its soul-spirit.

From these four substances Kitche Manitou created the physical world of sun, stars, moon, and earth.

To the sun Kitche Manitou gave the powers of light and heat. To the earth he gave growth and healing; to waters purity and renewal; to the wind music and the breath of life itself.

On earth Kitche Manitou formed mountains, valleys, plains, islands, lakes, bays, and rivers. Everything was in its place; everything was beautiful.

Then Kitche Manitou made the plant beings. These were four kinds: flowers, grasses, trees, and vegetables. To each he gave a spirit of life, growth, healing and beauty. Each he placed where it would be the most beneficial, and lend to earth the greatest beauty and harmony and order.

After plants, Kitche Manitou created animal beings conferring on each special powers and natures. There were two-leggeds, four-leggeds, wingeds, and swimmers.

Last of all he made man. Though last in the order of creation, least in the order of dependence, and weakest in the bodily powers, man had the greatest gift - the power to dream.

Kitche Manitou then made The Great Laws of nature for the well being and harmony of all things and all creatures. The Great Laws governed the place and movement of sun, moon, earth and stars, governed the powers of wind, water, fire, and rock; governed the rhythm and continuity of life, birth, growth, and decay. All things lived and worked by these laws.

Kitche Manitou had brought into existence his vision."

Basil Johnson (1976:12-13)

The Anishinaabe elders with whom I worked insisted that their authority to teach on plants emerged from their dreams and experience, not from an Anishinaabe system of plant classification. Each plant had a spirit as well as a name. If a person followed the teachings of the Anishinaabe during their journeys within the land, the spirit of a plant would reveal itself. If a plant spirit was offended, it would then withdraw and no longer reveal itself to that person or collectively to the Anishinaabe. A person could not teach if the plant did not reveal itself in the situation where a person wanted to teach a novice about a plant. While learning on the land was one of the key institutions of knowledge, as discussed in Chapter Six, this alone was not enough. If a plant was offended, it would no longer reveal itself in dreams for healing or during journeys on the land. It was also important that a person be taught how to journey in the land through the guidance of knowledgeable people.

Elders were Anishinaabe people who had followed the Anishinaabe teachings and journeyed within the land for a long time. This had allowed them access, through their dreams, to plant spirits for healing and/or plant spirits would reveal themselves when journeying on the land. The combination of dreaming and learning through practices undertaken at a particular place was what made their cognitive plant memories authoritative. Worldview and institutions were part of the social-ecological environment in which plant memories were practiced and taught. The authority of elders emerged from their dreams of plant spirits and their experience on the land. Authority and legitimate memories were rooted in dreams and the experience of the land, not on paper as Jimmy Redsky always insisted.

Three conversations have been reproduced here, in which elders taught about the way a person became a competent and authoritative teacher of plant memories. These statements were obtained through conversations held with elders during the summer of 2001. These conversations only captured a snapshot of what the elders expressed in detail during trips to the bush, through the undertaking of activities and in workshops. The first story, entitled learning respect, was told by Robin Greene and emphasized that learning was a process of revelation. The revelation deepened as a person matured in their experience with the people with whom, and the place in which, they journeyed (**Box 1**). The next story is called learning plants. It came from a conversation with Brennan Wapioke, Ella Dawn Green, Jimmy Redsky and Walter Redsky. This conversation was held in Anishinaabe and translated by Brennan Wapioke (**Box 2**). Walter Redsky offered the final story when he taught about the harvesting of birch bark. This teaching was told in Anishinaabe and translated by Brennan Wapioke (**Box 3**). Editing has only been undertaken to improve readability.

BOX 1. Learning Respect

A conversation held with Robin Green (RG) and Iain Davidson-Hunt(IDH)
Iskatewizaagegan #39 Independent First Nation
June 2000

A long time ago, all tribes, in whatever territory they started to have communities, there they found the tobacco in their territories. And that tobacco came about to be something very sacred to us as a, more or less, I would say, if you wanted to understand it, like money. If you want something you got to pay for it, its as simple as that. In our belief, if you want to know something, we have to offer tobacco first. And that varies to ... sometimes you have to have a ceremony and sometimes you can very much do it on your own. And this tobacco I am talking about, the real tobacco, is very strong stuff, its something that you don't smoke everyday kind of thing, it is very strong, stronger than cigar, the way I have noticed it. It goes to show that as you begin to understand, sometimes you say why type of thing. It just goes to show you that you cannot really abuse that to get a big supply of it. The teaching is that you only take what you need to use and that's the way it was always followed. Otherwise it begins to abuse of these things ... something what we call consequence catch up to you. So it is told that a strong message flows through the tobacco to the creator or to any spirit that you want to contact. For that reason we always believe tobacco comes first before you do something. Like when I go out to pick plants, I place my tobacco and talk to the plants to say that I want you to, whatever the plant may be, to cure me, of whatever ailment I may have. And so I take that and that's the way I use it and that's the way it works. If I just place tobacco and start picking I didn't really clarify why did I pick that. So...more likely at times...some people are not aware of that... because in our view and in our belief, everything is alive, regardless of what it is, anything in the environment, everything is alive and that is what we are told to look at. That's how I don't abuse the environment.

It is all a matter of understanding it. Why you have to do that. When you talk about respect that is where the why is the answer. Respect ... you respecting what you are about to do and what you are about to take.

Learning respect requires that you separate knowledge from being very gifted. A gifted person very much knows the medicines and what those plants are. But whereas, when you look at it the other way, you have to study to know what that plant is. That's the difference. So...when you go about it in that way...that's the very important thing to be aware of...Through the vision quest or through the dreams that's where this person already knows yeah that medicine I can use for certain things and so forth. So that is already where the knowledge is. In other words, there are certain people in our Nation who are gifted to know that. It's not everybody. And uh...if I was to go to university and study all these things and get lucky to get my degree there is no value in that though I am educated, the value is of that person identified to have it. A gifted person has learned that you only harvest what you need. That is another way to show respect.

When I am teaching a person I look at how much they can understand. Take a look at it this way ... I can only give you a quarter of this tobacco ... because there are things that I know I can't really, maybe, not of use to me but I can keep that information and that is all. The tobacco is my responsibility and even if I don't need it I need to think if you are ready to receive it. I don't own it but whether I should release it is another question. I have learned that teaching people who are not ready to learn can do more harm than good. That is what I have to be very careful about.
Again, it just goes back to that tobacco that you offered did I accept it properly in the way to ask for these things that I am talking about. Did I take some of that tobacco and put it on the ground or whatever, that's my responsibility, whatever I say, just like that legal term, hold against you, or it will be held against you.

A lot of this has to do with communication. In a communication you will get in some form the answer that you are looking for spiritually. And .... sometimes that as we talk together here ... it doesn't say that I am limiting myself to tell you what I have to tell you .. But we are limited to certain things that we talk about that we can only learn from. Just like a school system ... you are taught one subject ... and if you tend to think you know ... you go on to another one. That's principally the way things are in our spirituality. It's the perception also by whomever it is asking that question or wanting to know.

Asking to be taught and teaching requires thinking carefully otherwise there could be consequences. It could be anything ... maybe you won't understand it when it happens, you will be having a rough time or bad luck or may not have a job and having difficulties struggling personally. Then when you think back ... why did that happen to me .... maybe I did somebody wrong or did something wrong and that is a hard way to learn, very difficult, and that is one of the consequences. You know I'll be as a young boy growing up foolishly and all that stuff, without thinking or without knowing I might be abusing an animal. Ok, that animal is badly abused and reacts spiritually ... later on in my life it catches up to me and I remember the animal who I had abused so many years and know it has caught up to me and I am going through a rough time. I might be affected directly and getting sick or my family.

BOX 2. Anishinaabe Iekawin - Learning Plants

A conversation held with Ella Dawn Green (EG), Jimmy Redsky (JR), Walter Redsky (WR) and Iain Davidson-Hunt (IDH)
Iskatewizaagegan #39 Independent First Nation
July, 2000

EG - I guess the way I started learning plants is my aunties, they used to take me out in the bush to show me what kind of plants there are and what kind of plants that we can use for medicine. My mom too, she used to take me out on the lake along the shoreline, and she used to tell me all kind of plants which I can't remember, she named them, but I don't remember the names of them. And that was passed on and a lot of these medicines that they showed me and how they are used for, they used to tell me that I would be carrying on to the next generation. And it was so important to them for me to learn all this and to keep in mind which plants I am supposed to pick, and there are some poisonous plants that I can't touch. And then some of them I received through dreams. Like, I would dream about something, you know. Especially an old lady or an old man would be in my dreams telling me all kinds of things. But after talking to me, like, you know it would be a bird or a four-legged, you know those animals that run around and around, that's how they turn when they leave. Dreams, visions...visions would be like seeing a bear coming to me and telling me what the purpose of a plants is, you know, giving me that plant...That is how I learned to make medicines for anyone. Another thing I learned, when they have shaking tents, the people in there, the spirits, when they give you medicine, and you are supposed to keep that medicine it is for you, eh, for you to heal, I keep that too because it has already been given to me through shaking tents. That's how I received all these things that I carry, that I carry on, from my aunties, my mom and dad, through dreams and through shaking tents. And there are people too that come to you. Sometimes you are sick, they see you are not feeling well, and then they pass that medicine on, they give you that medicine, or they tell you about these plants to go and pick. And that's yours now because it was given to you by that person who felt sorry for you...so you can get healed from medicine. So I keep that too, I take it because it was already passed on by another elder. And that's how I remember all these things and I keep them and I use them when people come to me. And I do the same thing, especially for young people, when they come to me, for healing or anything like that, then I pass that thing on to them, I give it to them. I tell them and I show them what to do. I take them out in the bush and show them where that plant is because I won't be taking that with me. I like to leave it with the young people. That's what I do. I think that's how the teaching of our elders, a long time ago, that's how they did these things. It was passed on, passed on, generation to generation, whoever keeps it will take care of it and learn more about it. You never stop learning...right to the end My time right now is my time to show them, if they come to me with tobacco or with gifts, then I teach them. I show them what the plants are, so they will know and they can use it. I know when I was being taught all this, I never touched nothing, I never even bothered to do anything, until just recently, it all came back...I started feeling that it was very important for me to carry that, and practice it and go on and do that healing for others

WR - In order to learn, how much interest you have in wanting to learn has a lot to do with it. And yeah, sometimes in order to learn you have to go out fasting. You have to be careful when you are fasting, see that you don't make a silly move. You will be glad that the spirit has come to you in person to tell you these things. So you have to be careful what kind of a move, what kind of a question, what things you are looking for. For example, one time there was three people who went out fasting and the spirit came to them. I come here to grant you your wish. What is your wish that you ... what is it that you want to learn from me. This is why I say that you have to be careful that you don't make a silly move or a silly question. See that you don't, the spirit will give you what you want. When you fast four days, four nights, the spirit does not live by water or eat bread alone. In order to talk to the spirit, this is why you fast, all that food and water is gone and you become a spirit. And this is the way that you communicate with the spirit. And the spirit will ask you what you want. You have to be careful. What kind of a wish you make. This person in the legend, years back, teachings, what would you like from me? I'll give it to you. He made the silly move of asking the great spirit, the creator, that I want to live forever. He made his wish. Yes if that is what you want, I'll give it to you...you will never die. See that rock over there - I'll turn you into a rock and you will never die. So...this is why I say that you have to be careful what you wish for, what you want from the great spirit. Another one, two ladies, two young girls were outside and they were laying down on the grass and looking at the stars. They too were fasting so they looked at the stars .... the stars had human form like. Which star would you like. I like that one on the left, I'll take the one on the right. The stars came in and got them and disappeared. And they are up there in the stars now. So this is why I say you have to be careful, what kind of move you make, because the spirits will give it to you.

EG - There was one that my mom and dad used to tell me. There was a young boy who always went to get water at night. Waiting for their grandson to come back.. Getting the water out of the icehole and holding the pail on his right arm and he would stay there for hours. Mom asked why he did that and he said that he wished that he would be up there in the moon. The next day he was looking up and disappeared and ended up in the moon.

BOX 3. Harvesting Birch bark

A Conversation with Walter Redsky and Ella Dawn Green
July, 2000

WR - I used to go with my dad to Gull Bay to get birch bark. He'd climb the tree and make a cut around then with the knife he'd make a verticle incision down. This is called ***pakwaniiyag*** when the birch just peels off easy. On the other hand this one is already too hard to peel, it is called ***asiniiyag***. You wouldn't be able to peel a big piece just strips.

Well anyway when I used to go with my dad to get birch bark he'd start from the top, cut around and then cut downward. He just climbed up he never used anything to get up the tree. Yeah, he carefully made the cut down to about here, he then put his hands underneath the birch bark to separate it from the tree. He'd move down a bit more and do the same thing. He did this until the birch bark started to fold back inwards. He'd then carefully cut downward until it would just start to peel off onto the ground. However big a piece he wanted that is where he'd make the cut around the tree. That's what I remembered my dad doing. It worked.

EG - Sometime they made cradle boards with birch bark - this is the outside. When they use birch bark it's not good to make a cradle board with birch bark. The baby doesn't feel comfortable and it cries all the time. The baby doesn't grow healthy. If you make the cradle board improperly this is the outside layer you need to use. You need to be extra careful of how you make the cradle board, and also when making the cradle wrap. The Anishinaabeg were very careful how they made things. That's all I can talk about for now. So that in the future the teaching doesn't get lost. It's important to follow the right procedures when you follow the Anishinaabe way. That's all I can say for now.

WR - See this birch bark, it's already been harvested. These other trees, balsam, spruce and ash, if you take the bark they die. If you take the birch bark in the proper way the tree will live. Someone must have made a ***maanomin*** pan from this piece that was harvested, the bark is already growing back.

WR - If you're going to make something, like a birch bark canoe, you choose a birch bark tree that has it's branches arched like this. Look at this tree it doesn't look like that. If there was a tree with arched branches back then it must have been cut down and used for a canoe. And this is the tree that is used when they make birch bark baskets, boxes and other things like that. Any tree that you use, poplar, whatever, you look for the arched branches. What kind of tree you are looking for you can't miss it. Also when you're going to use roots for sewing you look for a spruce, you dig out the roots then pull them out. The roots are long. Then you soak them and split them in half. It works really good when you split it.

Whatever you are going to make with birch bark the outside of the bark is on the outside and the inside of the bark on the inside of the thing you are making. Now when I see the younger generation they use the outside for the inside. They're doing it the wrong way. What I mean is that when you make a birch bark basket the outside of the bark always goes on the outside of whatever you are making. Just like if you want to make a ***maanomin*** pan, this is the outside and this goes on the inside. There's a reason why everything was made the way you had to make it. If you don't follow this Law that the creator gave the Anishinaabe when you make a birch bark basket or house, if you don't believe these Laws and you do them backwards, you will not find the birch bark that you need when you want to make other things. It is always important that you place tobacco before harvesting birch bark.

Anishinaabe worldview and institutions identified the source of memory as the ability to build awareness of the land through the guidance of the elders. An elder became authoritative as she built her ability to access the memories of the social-ecological environment, the land. This emerged through experience on the land and following the Anishinaabe teachings. These teachings included respect, taking only what you need, taking responsibility for your actions and being aware of the consequences of your actions. As a person became more competent in following these teachings through experience on the land they built authority to speak about cognitive plant memories. They became more aware of the plants that revealed themselves through dreams, visions and daily practices.

Once elders became authoritative they then were required to play a dual role. On the one hand, they were responsible to create learning environments for younger people. This was often within the context of their family but specialized learning occurred across family lines. Elders worked with younger people to interpret visions and dreams. They led ceremonies where young people learned respect for other people and beings. Trips to harvest plants and hunt provided a time to transfer cognitive plant memories as well as teach about the proper ways to undertake activities. The focus was on building a learner's competence and attentiveness to their present space-time location through Anishinaabe teachings. This was one of the key institutions of knowledge for Anishinaabe people. A learner built his own cognitive memories within a learning context framed by elders. This allowed them to adjust cognitive memories to current situations. As elders were authoritative this allowed new cognitive memories to be created in response to changes occurring in the place where they lived. Adaptation was built into the learning process. This was the learning process whether it was an elder who noticed a change through the practice of her daily activities on the land. Or a youth who observed that the knowledge being transmitted from an elder no longer seemed relevant to her currant situation. Elders sanctioned the creativity of youth; the creativity of elders was sanctioned by their dreams. Dreams and elders ensured that creativity resonated with social-ecological dynamics while ensuring that there was a linkage between past, present and future.

DISCUSSION: INSTITUTIONS OF KNOWLEDGE

This chapter began with a story about adaptive learning. People, who had no idea as to how to work with birch bark, were taught by Anishinaabe elders by going out on the land to collect materials and then crafting their own baskets and a dwelling along with the elders. Research revealed that elders were a key institution of knowledge linking cognitive plant memories and adaptive learning. The elders framed a learning experience in which learners could build their own cognitive plant memories through the practice of building a birch bark shelter. The framing of the learning environment began with a ceremony whereby these learners asked the elders to teach them about working with birch bark. The elders then took the learners to the bush and taught them where to find plants, the names of plants, and how to prepare the plants. Teaching the learners how to work with birch bark in order to make a shelter followed this. Finally, the teaching ended by insisting that the learners return to the spot where birch bark was harvested with a gift of tobacco and cloth. Learning, by observing and doing, was not just a platform for the transmission of cognitive plant memories. Rather, a learning environment, which included cognitive plant memories, technologies, techniques and institutions, was framed by elders so that individuals were able to build their own competence.

As reviewed in the literature, learning of cognitive plant memories has often been presented as the transmission of memories from one mind to another. This research has demonstrated that the Anishinaabe people had a system of classification, nomenclature and utility for plants. However, Anishinaabe nomenclature reflected an institution of knowledge, one that insisted that all memory was embedded within the web of social-ecological relationships of a place. A name for a plant category was constructed within a specific situation and not prior to its utterance but on the basis of socio-cultural patterns and norms. Authoritative and legitimate memories about plants were not seen to reside in the system of classification, nor in the names themselves, but in the ability to communicate through dreams with a plant. Elders emphasized that the authority for their plant memories came through their dreams. It was also due to this authority that an elder could provide experiences that allowed a person with similar dreams to learn about plants.

The question asked at the outset of this chapter was how institutions of knowledge framed social-ecological learning environments so that learning became adaptive. This research has focused on two institutions of knowledge that made Anishinaabe learning adaptive. The first (see Chapter VI) was that the Anishinaabe elders insisted that learning occur through dreams and the experiences gained on the land. A person learned by building her memories within a social-ecological environment. This allowed a person to adjust memories in response to changes in his particular situation. The second institution of knowledge was that social-ecological learning environments were to be framed by knowledgeable people: elders (this chapter). Adaptive learning brought together the individual building of memories through observation and practice with the transmission of memory from an elder to a learner. The first institution ensured that learning led to adaptation in individual memories as a learner built an awareness to changes occurring in their contemporary milieu. The second provided the individual with access to the palette of memories—cognitive plant memories, technologies, techniques and institutions—of an elder, from which the learner could learn. However, elders not only framed learning but also became an institution in, and of themselves, so that creativity could be sanctioned by those considered to be the holders of authoritative and legitimate social memories.

The creativity of a learner could be authorized and become legitimate if it emerged from a learning process guided by an elder. However, there was also innovation that emerged from an elders' awareness of changes in his environment. Since authority resides in the land itself, an elder was authoritative through her dreams and experience of the land. An elder who had followed the Anishinaabe teachings, and who had a wealth of experience on the land, could create new and legitimate memories, technologies, techniques and institutions. This was the way in which social memory both framed creativity and was changed by the creativity that it framed. Adaptive learning was the process by which an individual built awareness of the web of relationships of a place by drawing on the palette of social memory; however, through creativity the individual could lead to changes in the palette of social memory. Adaptive capacity emerged from the institutions of knowledge that insisted that authoritative memories were situated in places, and that knowledgeable people framed creativity. Learning became adaptive when authoritative and legitimate memories emerged from a learner's dreams and experiences of a social-ecological environment. The continuity between past, present and future was maintained when elders provided the frame, and palate, for the environments of adaptive learning.

The research presented in this chapter supports findings from other anthropological and ethnobotanical literature. The idea of the linkages between the developmental environment of an individual and practice is similar, for instance, to Bourdieu's concept of *habitus* (Bourdieu 1977; 1990). The system of plant classification described is similar to many other ethnobotanies found in the literature (Berlin 1992; Turner 1974). In terms of the examination of Anishinaabe ethnobotany this is one of the first detailed collection of original data in the Lake of the Woods region since Densmore (1928). It supports much of Densmore's original work with some minor exceptions. Other Anishinaabe recent Anishinaabe ethnobotanies are few but include work done by Kenny (2000) at Lac Seul. Much ethnography of boreal First Nations people support this research regarding authority, knowledge and elders (Goulet 1998; Riddington 1988; 1990; Scott 1996; Tanner 1976). This research, however, moves beyond the cognitive approach of much ethnobotany and toward a more dynamic consideration of knowledge.

The literature of social-ecological resilience (Berkes, Colding and Folke 2003; Berkes and Folke 1998) allows us to move beyond questions of knowledge transmission to a consideration of adaptive learning. This is the first research, to my knowledge, that has looked at the linkages between individual creativity and institutions that can lead to authoritative change in social memory. This suggests that resilience is based upon the existence of institutions that can allow knowledge to adapt without losing the linkages between the past, present and future. In the next chapter, Chapter VIII, I turn to a summary of my research presented in this dissertation. In that chapter, I attempt to bring together the importance of learning on the land with learning from elders in a model of social-ecological resilience.

TABLE VII-1. Iskatewizaagegan (Anishinaabe) Generics. Includes Alternate Nomenclature, Folk Varieties, Common English Names and Latin Nomenclature.

Iskatewizaagegan Generic Alternate Nomenclature Folk varieties	Other Ojibway Generics	English Name	Latin Binomial
Aajitaamowaano	Ajidamoowaanow	Foxtail Barley	*Hordeum jubatum* L.
Aajitaamowaano		Rusty Woodsia	*Woodsia ilvensis* (L.) R. Br.
Aasaakamig		'Moss'	Sphagnaceae + Dicranaceae + Hylocomiaceae + Hypnaceae + Brachytheciaceae
Agiimaatig	Aagimaak; Wiisagaak	Black Ash	*Fraxinus nigra* Marsh.
Agiimak			
Agwisiimaan		Pumpkin + Squash +Watermelon	*Cucurbita pepo* L. + *Citrullus colocynthis* (L.) Schrad.
Amikominaatig		Black Gooseberry / Bristly Black Currant	*Ribes lacustre* (Pers.) Poiret.
Aniib	Aniib	American Elm	*Ulmus americana* L.
Aniibiminaatig	Aniibimin	Highbush Cranberry	*Viburnum trilobum* Marsh.
Aniibimin			
Aniimoziitens		Little Prickly Pear Cactus	*Opuntia fragilis* (Nutt.) Haw.
Azaati	Azaadi (i)	Trembling Aspen	*Populus tremuloides* Michx.
Baabiigobag	Animikiibag	Poison Ivy	*Rhus radicans* L.
Gaagagiwaandag	Giizhigaandagizi / Ogaawalinzh	Common Juniper	*Juniperus communis* L.
Gaagagiwaandagminan			
Gaagigebag	Gaagigebag	Prince's-pine ; Pipsissewa	*Chimaphila umbellata* (L.) Bart.
Gaatecaasiing	Aandegobagoons; Namepin; Namewashkoon	Canada Mint	*Mentha arvensis* L.
Giizhig	Giizhik; Gizhikens; Giizhikaandag	Eastern White Cedar	*Thuja occidentalis* L.
Giizhigaandag			
Ginebigowazhin		'Fern'	*Matteuccia* sp. + *Polypodium* sp. + other fern species.
Gitcheaniibiish		Ostrich Fern	*Matteuccia struthiopteris* (L.) Todaro.
Gitchegaamewashcon	Anaakan; Anaakanashk; (Gi)chigamiiwashk	Great Bulrush	*Schoenoplectus acutus* (Muhl. ex Bigelow) A. + D. Löve

Gaazhoosh Kwenigwegozid Shingwaak	Apakwanagemag, Bapakwanagemag; Zhingobiins; Zhingwaak	Red Pine; Norway Pine	*Pinus resinosa* Ait.
Maananoos	Maananoons	Ironwood; Hop-Hornbeam	*Ostrya virginiana* (Mill.) K. Koch
Maandamin		Corn	*Zea mays* L.
Maanizati	Man´asa´di	Balsam Poplar	*Populus balsamifera* L.
Maanomin	Manoomin	Wild Rice	*Zizania aquatica* L.
Maanominaatig			
Waabemaanomin		White Rice	
Mishtetimomaanomin		Oats	
Manitoominaatig		Red Baneberry and Blue-bead Lily	*Actaea rubra* (Ait.) Willd. and *Clintonia borealis* (Ait.)Raf.
Manitoomin			
Maanitoo o caatag	Wanúkons´ Abagwasî´gans	Water Hemlock	*Cicuta maculata* L.
Makominaatig		Wild Black Currant	*Ribes americanum* Miller
Makomin			
Makwaminaatig	Adjimag	Showy Mountain Ash	*Sorbus decora* (Sarg.) C.K. Schneid
Makwamin			
Mashkiigobag	Mashkiigobag; Mashkiikaang niibiish; Waabashkikiibag	Labrador Tea	*Ledum groenlandicum* Oeder
Mashkiigokamig		Sphagnum Moss	*Sphagnum* spp.
Mashkiigomin	Mashkiigiminagaawanzh; Mashkiigimin (-an)	Bog Cranberry	*Vaccinium oxycoccos* L.
Mashkiigwaatig	Mashkiigwaatig	Tamarack; Larch	*Larix laricina* (Du Roi) K. Koch
Mashkiigwandag			
Mazaanishk	Mazaan; Mazaanaatig	Stinging Nettle	*Urtica dioica* L.
Maazhii Miitigomizh		Poison Oak	*Toxicodendron* sp.
Miin		Blueberry	
Miin		Low-bush Blueberry; Narrow-leaved Blueberry	*Vaccinium angustifolium* Ait.
Miinaatig			
Makatemiin		Black Blueberry	
Shaabwaatemiin		Transparent Blueberry	
Pingomiinaatig		Velvetleaf Blueberry; High-bush	*Vaccinium myrtilloides* Michx.

		Blueberry	
Miishichiiminaatig	Waaboozojiibik; Micidji´minaga´wû	Skunk Currant	*Ribes glandulosum* Graver
Miishichiimin			
Miitigomish	Mitigomizh	Bur Oak	*Quercus macrocarpa* Michx.
Minaeg	Gaawaandag; Gaawaandagwaatig; Mina´ig; Wadab; Zesegaandag	White Spruce; Highland Spruce	*Picea glauca* (Moench) Voss
Minesiwaatig	Agin, (-iig); Mine´saga´wûnj	Scarlet Hawthorn	*Crataegus coccinea* L.
Miskominaatig	Miskominagaawanzh; Miskomin	Wild Red Raspberry	*Rubus idaeus* L. var. *strigosus* (Michx.) Maxim.
Miskomin			
Miskwabimag		Red Osier Dogwood	*Cornus sericea* L. (syn. *C. stolonifera* Michx.)
Mushkosii Wiingushk		Sweet Grass	*Hierochloe odorata* (L.) Beauv.
Nabaagshkoon		Water Sedge	*Carex aquatilis* Wahl.
Namepin	Namepin	Wild Ginger	*Asarum canadense* L.
Nayngaaminaatig	Sewa´komin	Sandcherry	*Prunus pumila* L.
Nayngaamin			
Niibaayaandag	Ne´bagandag	Canada Yew; Ground Hemlock	*Taxus canadensis* Marsh.
Obiiweshkgaanag	Apakway; Apakweshk; Apakweshkway; Nabagashk	Cattail	*Typha latifolia* L.
Obweminaatig	Bawa´iminaan; Gozigwaakomin	Pincherry	*Prunus pensylvanica* L.f.
Paweminaatig			
Oginii		Tomato	*Lycopersicon esculentum* Miller
Oginiiwaabigwunaatig		Prickly Rose	*Rosa acicularis* Lindley.
Oginiiwaabigwun			
Ogishkiibwaak	A´skibwan´	Jerusalem artichoke	*Helianthus tuberosus* L.
Okigaandag	Okikaandag	Jack Pine	*Pinus banksiana* Lamb.
Okigaandagoosag			
Okiitebagoon	Nbiish-waawaasgone; Oga´damûn; Odite´abûg	Small yellow pond-lily and White waterlily	*Nuphar variegatum* Engelm. and *Nymphaea tetragona* Georgi.
Opin		Potato	*Solanum tuberosum* L.
Oshkiizhigobag	Skižgu-min	Dewberry	*Rubus pubescens* Raf.
Oshkiizhigomin			
Osisewayminaatig	asa/isaweminagaawanzh	Chokecherry	*Prunus virginiana* L. var. *virginiana*
Osisewaymin			

Oteiminabag	Ode´iminidjiibik; Ode´imin (-an);	Woodland Strawberry and Wild Strawberry	*Fragaria vesca* L. and *F. virginiana* Duchesne
Oteimin			
Oteiminabik			
Ozhaabominaatig	Zhaaboomin (-ag); Zhaaboominagaawanzh	Northern Gooseberry; Bristly Wild Gooseberry	*Ribes hirtellum* L. (syn. *Ribes oxyacanthoides* L.)
Ozhaabomin			
Ozigwaakominaatig	Gozigwaakominagaawanzh; gozigwaakomin (-an); Ozagadigom	Saskatoon Berry	*Amelanchier alnifolia* (Nutt.) Nutt. ex M. Roemer and *Amelanchier* spp.
Ozigwaakomin			
Ozhuskweto		Fungus	?
Paagesanaatig	Bagesaanaatig (-oog)	Canada Plum Tree	*Prunus nigra* Ait.
Paagesan			
Pagaaniimizh	Bagaanimizh	Beaked-hazelnut	*Corylus cornuta* Marsh.
Pagaan			
Pigewaatig	Aninaandag (-oog); Iniwaandag (-oog); Bigiwaandag (-oog); Zhingob (-iig); Zhingobaandag (-oog); Zhingob Bigiwaandag	Balsam Fir	*Abies balsamea* (L.) P. Mill.
Pigewandag			
Shiiwiigiibik	Ozagadigom	Long-styled Sweet Cicely	*Osmorhiza longistylis* (Torr.) DC.
Sagataagan		Tinder Fungus	*Inonotus obliquus* (Ach. ex Pers.) Pil.
Sesegaanaatig	Gaagaagiwanzh; Zesegaandag; Zhingob; Zhingob gaawaandag	Black Spruce	*Picea mariana* (Mill.) BSP
Sesegaandag			
Shaashaagomin	Ode´iminijiibik; Zhakaagomin; Zhaashaagomin	Bunchberry	*Cornus canadensis* L.
Shiigaagomizh	Bagwaji-zhi/agaagawinzh (-iig); Mashkode-zhi/agaagawanzh (-iig)	Pink-flowered Onion	*Allium stellatum* Fraser
Shingwaak	Zhingwaak	White Pine	*Pinus strobus* L.
Siizibaakwetaatig		Manitoba Maple; Box Elder	*Acer negundo* L.
Waabozogiibik	Bebaamaabiig; Okaadaak; Waaboozojiibik	Wild Sarsaparilla	*Aralia nudicaulis* L.
Paagemo			
Wiigwasaatig	Wiigwaas (-an) (-ag);	Paper Birch	*Betula papyrifera* Marsh.

	Wiigwaasaatig; Wiigwaasi-mitig; Wiigwaasimizh		
Wiigwas			
Wiigob	Oziisigobimizh	Bebb Willow + Willows	*Salix bebbiana* Sarg. + *Salix* spp.
Wiike	Wiikenh; Nabagashk; Mashkosii-zhaabozigan	Sweet Flag	*Acorus* americanus (Raf.) Raf.
Wiimbushk	Ozaawashkojiibik	Spotted Touch-me-not	*Impatiens capensis* Meerb.
Wiingushk	Bizhikii-wiingashk; Bizhikii-wiingwashk	Sage	*Artemisia frigida* Willd. + *Artemisia* spp.
Wiingwushk			
Wiinsibag (-oons)	Wiinisiibag; Wiinisiibagoons; Wiinisiibagad	Wintergreen; Teaberry	*Gaultheria procumbens* L.

Table Notes.

1. Scientific Nomenclature follows treatment by Marles (2000) where possible. If plant not included in Marles (2000), then Farrar (1995), Soper and Heimburger (1982), Newmaster (1998) or Gleason and Cronquist (1991) followed in the preceding order.
2. Other Ojibway Generics compiled from Densmore (1974) and Meeker (1993).
3. I have used the singular form of plant names unless Elders thought the name should be plural. See vocabulary table and plant parton table for other ways in which names may be utilized.

TABLE VII-2. A Sample of plants that were utilized but not named by Iskatewizaagegan Elders.

English Name	Scientific Name	Use
Great Burdock	*Arctium lappa* L.	Medicinal
Lady's Slipper	*Cypripedium* spp.	Ornamental
Puffball Fungus	*Lycoperdon* spp.	Medicinal
Rock Polypody	*Polypodium virginianum* L.	Medicinal
Wintergreens	*Pyrola* spp.	Medicinal
Common Mullein	*Verbascum thapsus* L.	Medicinal

TABLE VII-3. Iskatewizaagegan Major Plant Groups. Includes Folk Generics and Varieties.

Iskatewizaagegan Plant Group	Meaning	Folk Generics and Folk Varieties Included
Aasaakamig	Bryophytes	'Mosses' 'Lichens' Mashkiigokamig - 'Sphagnum Mosses' in Muskeg
Agwisiinaanan	'Curcubits'	*Cucurbita pepo* L. *Citrullus colocynthis* (L.) Schrad.
Ginebigowazhin	'Ferns'	Gitcheaniibiish Other Ferns
Manitoo-	'Creators' Plants' (berries) (berry stick) (taproot)	 Manitoomin(-an)(-aatig) *A. rubra* and *C. borealis* Manitoo o caatag *C. maculata L.*
Mashkiigo-	'Muskeg Plants' 'Muskeg Leafy Plants' 'Muskeg Moss' 'Muskeg Berries' 'Muskeg Tree'	 Mashkiigobagoon Mashkiigokamig Mashkiigominan Mashkiigowaatig
Miinan	'Blueberries'	Miin(-an) *V. angustifolium* Makatemiin Shaabwaatemiin Pingomiin(-an) *V. myrtilloides*
Mashkiki	'Medicine'	A being involved in healing processes, including plants
Mushkosii	'Grass'	Mushkosii Wiingushk Hay
Ozhushkweto	'Fungus'	'Mushrooms' 'Conks'
Shingobiig	'Conifers' excluding pines	Minaeg Pigewaatig Sesegaanaatig
Shingwaak	'Pine'	Shingwaak Gaazhooshkwenigwe Gozid Shingwaak Okigaandag
Wiigobiig	'Willows'	Grey-barked Willow White-barked Willow Atoop - Red/Green barked Willow Miskwabimag
Wiingushk	'Smudging Plants'	Wiingushk - 'Sage' (Artemisia sp.) Mushkosii Wiingushk - 'Sweet Grass'

TABLE VII-4. Vocabulary Related to Iskatewizaagegan Plant Nomenclature.

Aniishinaabe Term	English Gloss
-aandag	Word ending which specifies bough
-aandagoog	Plural of -aandag
-aatig	Word ending which suggests woody or stiff stalked plant. Can be used to refer to stick, stem or stalk but infers whole plant including roots, stems, leaves and flowers.
-aatigoog	plural of -aatig
-aatigoos	Sapling or young woody plant
-aatigoosag	Saplings or young woody plants
Aniibish	Leaf
Aniibishun	Leaves
-bag	Word ending which suggests leafy or herbaceous types of plants. Sometimes used to mean leaf but refers more to the leafy nature of a plant and infers whole plant including roots, stem, leaves and flower.
-bagoon	Plural of -bag
Caatag	Taproot - compared to being similar to carrot root
Gaanag	Flat leaf blade
Mashkiig	Muskeg
Min	Berry - Refers to fleshy berries like raspberry (Miskominan) and seeds like corn (Mandamin) or wild rice (Maanomin). Compare to Miin(-an) which specifically refers to blueberries (*Vaccinium* sp.)
Minan	Berries
Mushkossii	Grass
Odub	Root
Odubik	Roots
Ogiib	Root
Ogiibik	Roots
Oginii	'Rosehip'
Okandamin	Literally - bone of fruit. Refers to the stone pit of a fruit
Omish	Used to refer to edible flesh of a nut (oak nut flesh) or edible bulb (wild onion); fleshy edible things covered with papery layer
Opin	Tuber- compared to being similar to potato which is called opin
Otabiig	Roots
Otabins	Root
Otabis	Root prepared for sewing, from otapiige = sewing - previously only roots used for sewing
Pagaan	Nut
Paagesan	Fruit
Paagesanag	Fruits
Piigegiisug	Rotted wood
Sagaanjiigesii	Literally - latching on. Refers to burs and thistles
Sagaanjiigesiiwug	Plural of Sagaanjiigesii
Waabiigwen	Flower
Waabiigweneen	Flowers
Waanagek	Bark
Washcon	Word used to refer to grass
Wiingushk	Smudging
Wiigwas	Birch Bark

TABLE VII-5. Plant Nomenclature based on Plant Structures.

Plant Character -singular(plural)	Explanation of Term	English Gloss	Example of Plants Included
-aandag(-oog)	Literally translated as 'bough(-s)'	'Bough'	Gaagagiwaandag Giizhigaandag Mashkiigowaandag Okigaandag
-aatig	This can be translated as 'stick'. The term refers to nature of the supporting structure, stem, as woody, or stiff. This term can be used to name a variety of 'life-forms'	'Stiff-stemmed plant'	Agiimaatig Mashkiigowaatig Minesiwaatig Siizibaakwetaatig Wigwasaatig
-bag(-oon)	The term can be translated as leaves but actually refers to the whole nature of the plant as leafy. Although the nature of the plant is leafy the term includes leaves, roots, stems, and flowers.	'Herbs'	Baabiigobagoon Gaagigebagoon Mashkiigobagoon Okiitebagoon Oshkiizhigobagoon Oteiminabagoon
-bik	This term is used to refer to the roots of a plant. From Odubik or Ogiibik which are literally translated as 'roots'.	'Roots'	Oteiminabik Shiiwiigiibik
-min(-an)	This term refers to berries. The term includes both fleshy berries such as a chokecherry or raspberry but also dry berries such as wild rice seed and a corn kernel.	'Berries'	Amikominan Maanomin Mashkiigominan Obweminan Oshkiizhigominan Ozigwaakominan Oteiminan Shaashaagominan
-minaatig	The term can be translated as 'berry stick'. It refers to the nature of the plant of having berries while also having a woody, or stiff-stalked stem. This is not related to life-form as includes both small trees, shrubs and in one case a grass.	'Stiff-stemmed berry plants'	Amikominaatig Gaagagiwaandagminan Maanominaatig Makominaatig Makwaminaatig Miinaatig Miishichiiminaatig Miskominaatig Nayngaaminaatig Obweminaatig Osisewayminaatig Ozhaabominaatig Ozigwaakominaatig

TABLE VII-6. English Translations of Iskatewizaagegan Plant Nomenclature, Documented Plant Uses and Plant Structures Utilized.

Iskatewizaagegan Generic	English Translation	Documented Uses	Documented Plant Structures Utilized
Aajitaamowaano	'Squirrel Tail'	Medicinal	Leaf or frond
Agiimaatig / Agiimak	Lit. Agiim = 'Snowshoe'. 'Snowshoe stick'	Medicinal, Technological, Ritual	Branch wood, sapling, outer bark, inner bark, emerging buds
Agwisiimaan	Word refers to squashes and watermelon.	Food	Fruit
Amikominaatig	Lit. Amik = 'Beaver'. 'Beaver berry stick'	Food, Medicinal	Berry, bark, twig, leaf,
Aniib	Word refers to this plant.	Shade, Medicinal	Whole tree, root bark
Aniibiminaatig / Aniibimin	Lit. 'Aniib berry stick' / 'Aniib berry'	Food, Medicinal	Berry, stem, root, inner bark
Aniimoziitens	Lit. Aniimo = 'Dog'; Ziitens = 'Feet'. 'Dog feet'		
Azaati		Medicinal, Technological	Emerging buds, wood, outer bark, inner bark, root, ash, cambium,
Baabiigobagoon	Lit. Baabiigo = 'Blistering'. 'Blistering leafy plant'	Poisonous	
Gaagagiwaandag / Gaagagiwaandagminan		Medicinal, Technological, Ritual	Needle, cone/berry, inner bark, debarked stem, bough, root
Gaagigebagoon	Lit. Gaagige = 'Everlasting'. 'Everlasting leafy plant'	Medicinal	Root, whole plant
Gaatecaasiing	Lit. 'Cool tasting' or 'Refreshing'	Food, Medicinal, Technological	Leaf, stem, flower, whole plant
Gaazhoosh Kwenigwegozid Shingwaak	Lit. Gaazhoosh = 'Smooth'; Kwenigwegozid = 'Bark'. 'Smooth-barked pine'	Medicinal, Technological	Wood, needle,
Giizhig / Giizhigaandag	Word refers to this plant.	Medicinal, Ritual	Bough, leaf
Ginebigowazhin	Lit. Ginebig = 'Snake'. 'Snake Plant'		
Gitcheaniibiish	Lit. Gitche = 'Big'; Aniibiish = 'Leaf'. 'Big leaf'	Food, Medicinal	Immature leaf frond, root
Gitchegaamewashcon	Lit. Gitche = 'Big'; Gaamewashcon = 'Water grass'. 'Big water grass'	Food, Medicinal, Technological	Immature shoots and leaf base, stem pith, leaf
Maananoos	Word refers to this plant.	Medicinal	Outer Bark, branch (wood + bark), heart wood, wood

Maandamin	Word refers to this plant.	Food	Seed
Maanomin / Maanominaatig	Word refers to this plant.	Food	Seed
Manitoominaatig / Manitoominan	Lit. Manitoo = 'Creator'. 'Creators' stick' / 'Creators' berries'	Poisonous	
Maanitoo o caatag	Lit. 'Creators' tap-root'	Poisonous	
Makominaatig / Makomin (-an)	Lit. Mako = ' Bear'. 'Bears' berry stick' / 'Bears' berry (-ies)	Food, Medicinal	Berry, stem bark, root bark, root, young leaf, whole stem
Makwaminaatig (-oon?) / Makwamin (-an)	Lit. Makwa = 'Bear'. 'Bear berry stick' / 'Bear berry (-ies)'	Food, Ritual	Berry, outer bark, inner bark, peeled branch, root, stem
Maanizati		Medicinal	Emerging buds
Maazhii Miitigomizh	Lit. Maazhii = 'Poison'. 'Poison Oak'		
Mashkiigobagoon /	Lit. Mashkiigo = 'Muskeg'. 'Muskeg leafy plant'	Food, Medicinal, Ritual	Leaf
Mashkiigomin (-an)	Lit. 'Muskeg berry (-ies)'	Food, Medicinal, Technological	Berry, whole plant
Mashkiigwaatig / Mashkiigwandag	Lit. 'Muskeg stick' / 'Muskeg bough'	Medicinal, Technological	Wood, branch, inner bark, outer bark
Mazaanishk	Lit. Mazaan = 'maanomin threshing dust'. Word used to refer to anything which makes you itchy	Food, Medicinal, Technological	Immature leaf, stem, stem fibre, root,
Miin (-an) / Miinaatig (-oog)	Miin used to refer to *V. angustifolium* and in general to a major plant grouping. 'Berry (-ies)' / 'Berry stick'		
Miin (-an) / Miinaatig (-oog)		Food, Medicinal, Technological, Ritual	Berry, leaf, flower, stem, root, whole plant
Makatemiin(-an)	Lit. Makate = 'Black'. 'Black berry (-ies)		
Shaabwaatemiin(-an)	Lit. Shaabwaate = 'Translucent'. 'Translucent berry (-ies)'		
Pingomiinaatig	Lit. Pingo = 'Ashy' or 'Dusty'. 'Ashy berry (-ies)' or 'Dusty berry (-ies)'		

Miishichiiminaatig / Miishichiimin (-an)	Lit. Miishichii = 'Hairy' or 'Fuzzy'. 'Hairy (fuzzy) berry stick' / 'Hairy berry (-ies)'	Food, Medicinal	Berry, stem, root, bark,
Miitigomish	Lit. Miitig = Tree. Omizh = Edible nut-flesh or bulb covered in papery layer 'Edible nut-flesh tree'	Food, Medicinal, Technological, Ornamental	Acorn, bark, wood, whole tree, inner bark
Minaeg	?	Medicinal, Technological	Twig, inner bark, outer bark, root, needle, bough
Minesiwaatig	From Mines = Hawthorn Berry	Food, Medicinal, Technological	Bark, berry, thorn, root
Miskoninaatig / Miskomin (-an)	Lit. Misko = 'Red'. 'Red berry stick' / 'Red berry(-ies)'	Food, Medicinal	Berry, immature leaf, root, root bark, peeled young stem,
Miskwabimag		Technological	Young stem
Mushkosii Wiingushk	Lit. Mushkosii = 'Grass'; Wiingushk = 'Smudging'. 'Grass smudging'	Ritual	Above ground whole plant
Nabaagshkoon	?	Medicinal	Root
Namepin	Lit. Name = Sturgeon; pin from opin? 'Sturgeon tuber'	Food, Medicinal	Root
Nayngaaminaatig / Nayngaamin (-an)	?	Food	Fruit
Niibaayaandag	Lit. Niibaay = the process of day turning to night, or, the time in English called twilight 'Twilight bough'	Medicinal	bough
Obiiweshkgaanag	Lit. Obiiweshk = 'Fluffy'; Gaanag = 'Flat leaf' or 'Leaf blade'. 'Fluffy flat leaf'	Food, Medicinal, Technological, Ritual	Immature leaf base, rhizome, immature flowering stalk, immature shoots, mature seed head,
Obweminaatig / Paweminaatig	?	Food, Medicinal, Technological	Fruit, leaf, root, inner bark, bark
Oginii	'Rosehip' but name used for tomato.	Food	Fruit
Oginiiwaabigwunaatig /Oginiiwaabigwun (-in)	Lit. Oginii - now translated as tomato but probably referred to the rose hip. The name of the rose hip probably borrowed for tomato. Waabigwun = 'Flower'. 'Tomato (Rose-hip) flower stick'		

Ogishkiibwaak	?	Food	Tuber
Okigaandag (-oog) / Okigaandagoosag	?	Medicinal, Technological	Wood, bark, inner bark
Okiitebagoon	Lit. Okiite - refers to a spreading out shape. Bagoon = leafy plants. 'Spreading leafy plants'	Food, Medicinal	Rhizome
Opin	Lit. 'tuber' but name used for potato.	Food	Tuber
Oshkiizhigobagoon / Oshkiizhigomin (-an)	Lit. Oshkiizhigo = eye. 'Eye leafy plants' / 'Eye berry (-ies)	Food, Medicinal	Berry, root
Osisewayminaatig / Osisewaymin (-an)		Food, Medicinal, Technological	Fruit, leaf, young stem, bark, root, branch
Oteiminabagoon / Oteimin (-an) / Oteiminabik	Lit. Otei = heart. 'Heart berry leafy plant' / 'Heart berry (-ies)' / 'Heart berry root'	Food, Medicinal	Berry, leaf, root, stolons, root ash, whole plant
Ozhaabominaatig / Ozhaabomin (-an)	?	Food, Medicinal, Technological	Berry, stem, root, thorn
Ozhushkweto	?	Technological, Ritual	Conk, Tinder Fungus
Ozigwaakominaatig / Ozigwaakomin (-an)	?	Food, Medicinal, Technological	Berry, stem, bud, wood, root, bark
Paagesanaatig (-oog) / Paagesan (-ag)	Lit. Paagesan = 'Plum fruit'. Paagesan has also come to mean fruit in general. 'Plum Fruit stick' / 'Plum Fruit (-s)'	Food, Medicinal	Fruit, stem, bark, root
Pagaaniimizh / Pagaan	Lit. Pagaan = 'Nut' Omizh = Edible nut-flesh or bulb covered in papery layer. 'Edible Nut'	Food, Medicinal, Technological, Ritual	Nut, twig, root, inner bark, outer bark,
Pigewaatig / Pigewaandag	?	Medicine, Technological	Twig, needle, outer bark, inner bark, root, sap
Shiiwiigiibik	Lit. Shiiwii = 'Sweet'. 'Sweet root'	Medicine	Root
Sesegaanaatig / Sesegaandag	?	Medicinal, Technological	Twig, inner bark, outer bark, root, needle, bough
Shaashaagomin (-an)	Lit. Shaashaago = 'Chewing'. 'Chewing berry (-ies)'	Food (emergency), Medicinal	Berry, root
Shiigaagomizh	Lit. Shiigaag = 'Skunk'. 'Skunk bulb'	Food, Medicinal	Bulb
Shingwaak	Word refers to this plant and plant group.	Medicinal, Technological	Sapling stem, wood, sap, needle,

Siizibaakwetaatig	Lit. Siizibaakwetaatig = 'Sugar'. 'Sugar stick'	Food	Sap
Waabozogiibik	Lit. Waabozogiibik = 'Rabbit'. 'Rabbit Root'	Medicinal	Root, leaf, fruiting stalk, whole plant
Wiigwasaatig	Lit. Wiigwas = 'Birch bark'. 'Birch bark tree'	Food, Medicinal, Technological, Ritual	Bark, sap, twig, bud, wood, branch
Wiigob (-iig)	Word refers to 'Willow' plant group and some generics within the group.	Technological, Medicinal, Ritual	Stem, twig, wood, outer bark, inner bark, inner root bark, outer root bark
Wiike	Word refers to this plant.	Medicinal, Ritual	Rhizome
Wiimbushk	Lit. 'Hollow stem'	Medicinal	Stem juice, leaf,
Wiingushk	Lit. 'Smudging'	Medicinal, Technological, Ritual	Stem, leaf, flower, whole plant above ground
Wiinsibag (-oons)	Lit. Wiinsi = this taste of leaves, or 'Wintergreen'. 'Wintergreen leafy plant'	Food, Medicinal	Leaf, berry, whole plant

Table Notes.

1. Uses following Marles' (2000) broad category of Food, Technological, Medicinal and Ritual. Decorative has been added for plants noted as visually pleasing but for which no specific use has been attributed.
2. Uses and Plant structues utilized compiled from Densmore (1974), Marles (2000) and Meeker (1993) and from my research.
3. Medicinal uses indicated by Iskatewizaagegan are not specific as per research protocol. Uses are those which are published in the public domain. Most medicinal and spiritual uses recorded require compound mixtures of plants. Plants should not be used medicinally or ritually without guidance from an elder.

Plate 11. The late Dan Green looking for just the right wiigobiig (*Salix* spp.) to make basket rims.

Plate 12. Jimmy Redsky teaching Tracy Ruta how to harvest birch bark.

CHAPTER VIII

CONCLUSION

> "A formidable barrier to research is the scientists' lack of credence in folk specialists. This manifests itself in a reluctance to allow the informant to lead the researcher along unfamiliar lines of logic and into areas of research that the native chooses. Scientists resist the loss of control of the questioning paradigm and fear leaving the base line of the "reality" that control signifies. Concerns about research time also inhibit emic analysis, since restraints on field stays often mean that researchers are reluctant to trade assured results from their project design for possible "finds" from informants" (Posey 1998:105).

This dissertation began as an exploration of the ways in which Anishinaabe and Rarámuri people perceived ecological dynamics. The starting point was observations emerging from the resilience literature (Folke et al. 1998; Berkes, Folke and Colding 2003). It was suggested in this literature that traditional ecological knowledge and an understanding of ecological dynamics may have the potential to build practices that enhance social-ecological resilience. Traditional ecological knowledge provided a linkage between ecological and social systems. The literature also suggested that creativity framed by an evolving social memory, in tune with ecological dynamics, would build the adaptive capacity of social and ecological systems. These two propositions formed the core around which the research and subsequent writing of this dissertation was built. These propositions were important as social-ecological resilience depended upon a concept linking social and ecological systems. Furthermore, one of the defining characteristics of resilience was "the ability to build and increase the capacity for learning and adaptation" (www.resalliance.org). Social-ecological resilience required a conceptual model describing the dynamics of adaptive learning for integrated systems. A conceptual model was explored through the research undertaken on six questions:

- What theories can be drawn upon to understand the process of adaptive learning for social-ecological resilience?

- What research models and methodologies can contribute to adaptive learning and social-ecological resilience?
- What are the historical processes that have influenced the social-ecological learning environment of Anishinaabe people?
- What are the historical processes that have influenced the social-ecological learning environment of Rarámuri people?
- How do institutions of knowledge situate memory and creativity within social-ecological environments so that learning becomes adaptive?
- How do institutions of knowledge frame social-ecological learning environments so that learning becomes adaptive?

There were two de-limitations placed upon the research undertaken for this dissertation. The boundaries of the research emerged from the model of social-ecological resilience presented by Berkes, Folke and Colding (2003). The first boundary was related to focus of the research. The research focused on the knowledge of people who directly utilize natural resources, as opposed to urban people. The people with whom the research was undertaken could be referred to as "resource users" and whose livelihood and identity were closely related to those resources. The second limitation was related to scale. The research focused on the knowledge of resource users related to their local ecosystem, as opposed to large-scale systems such as the Great Lakes or the Baltic Sea. Thus the focus of the research could be characterized as small-scale systems or community-based natural resources management.

REFLECTIONS ON RESEARCH FINDINGS

Literature of adaptive learning and social-ecological resilience

The adaptive learning literature suggested that a learner is situated within a social-ecological environment. A learner brings their memories into the mundane practices of daily life. Memories, in this case, are the cognitive structures, perceptions, information, practices, technologies, techniques, relational networks, institutions and worldviews of a individual learner. Memory is both what is inside the individual's head as well as the legacy of the social memory upon which the learner can draw. Social memory includes the range of memories upon which a learner can draw and the institutions of knowledge which frame the creativity of a learner. Creativity is considered to be an innovation of individual learning that resolves the dissonance that can emerge between memory and the environment. Framed creativity is learning which draws upon the palette of social memory while being structured by the institutions of knowledge. The literature of adaptive learning proposes two institutions of knowledge, in the sense of meta-rules regarding knowledge. One situates creativity within the environment and the other suggests knowledgeable mentors structure learning environments.

The literature of resilience provides an analysis of the dynamics of social-ecological systems. These systems are characterized as a nested set of adaptive-renewal cycles that undergo cyclic change. In the adaptive learning literature the social-ecological system is the environment in which individual learners are situated. The dynamics of the adaptive-renewal cycle generates dissonance between memory and the environment. It is this dissonance that is resolved through creativity as new memories are sought. Panarchy is the term utilized to describe the nested set of adaptive-renewal cycles. Higher scale cycles frame the lower scale cycles while at certain periods a change in a lower scale cycle can cascade upward. The adaptive learning literature describes this as the period in which dissonance between memory and the environment has become so great that individual creativity can lead to changes in social memory. Social memory is also introduced by the resilience literature as both the palette and the frame of creativity.

These two sets of literature can be brought together. Some of the resilience literature concentrates on describing the dynamics of social-ecological systems, but does not provide a discussion of the process of adaptive learning. How does social memory evolve in tune with ecosystem dynamics so that it can frame creativity and lead to adaptive capacity in complex, dynamic and holistic systems? The question remains as to how social memory becomes adaptive. Adaptive learning suggests that creativity emerges from individual learners, situated within an environment, who attempt to resolve dissonance between memory and their learning environment. If this is combined with a dynamic social-ecological system then the dynamics of the system result in creativity. Although individuals built their own memories they draw upon the palette of social memory within learning environments framed by knowledgeable people. Adaptive capacity of within these systems emerges when institutions of knowledge are present that allow authority to emerge out of the individual experience of the land and mentoring of knowledgeable people.

Cooperative methodologies for social-ecological resilience

The adaptive learning model suggests that authoritative memories emerge from within holistic learning environments. This presents a challenge to research paradigms that treat places and people as external objects from which knowledge can be extracted, knowledge that can then be placed into a social-ecological environment with different institutions of knowledge and authority. This is one of the main reasons that the Anishinaabe people with whom I worked were nervous about working with university researchers. This nervousness does not emerge just because there are different knowledge systems coming into contact. Field and laboratory disciplines that place an emphasis on experiential learning through mentorship share many characteristics of the adaptive learning model presented in this research. The problem emerges due to differential positions of power which means that university based research often extracts knowledge from local communities rather than work with them as partners in solving problems. The solution is a long process of negotiation and a protocol that guides the research. This approach to resolving the power differential worked better in Canada than in Mexico.

One of the main problems with the cooperative research methodology is that it depends upon temporary mechanisms that delegate power and authority amongst community members, scientists and practitioners. This works well for research teams that focus on specific problems and places. Place specific research organizations which have a mixture of community members, scientists and practitioners on the executive boards, funding boards and day to day operations would lead to research which is more cooperative. The difficulty is that research priorities and goals are still set by centralizing institutions of research, and the objectives of research do not deal directly with the goals and priorities of the community. Adaptive management, which depends upon the design of management experiments, will also have to struggle with how management objectives, goals and priorities could be set through a more even delegation of power and authority. Cooperative research, which can produce knowledge relevant to community challenges and problems, requires more work at delegating power and authority at the stage where research and management objectives, goals and priorities are negotiated. Problem definition, which is place specific, has also been recognized as a challenge by the literature of sustainability science and resilience (Kates et al. 2000; Walker et al. 2002).

An interesting innovation in field methodologies also emerged during the course of the research. Adaptive learning systems, such as the Anishinaabe and Rarámuri, insisted that learning should occur within structured social-ecological learning environments. The methodology was originally designed to take elders to pre-selected field sites. Elders insisted that they should choose the sites after they were informed what the researchers wanted to learn. For instance, the first time that I wanted to go look at a birch patch for harvesting birch bark I chose it on the basis of the Forest Resource Inventory. However, after listening to my request Walter Redsky chose a spot that he thought would be more appropriate to learn about birch harvesting. This process, as I learned, followed the basic structure of Anishinaabe and Rarámuri epistemologies.

A person approaches someone from who they would like to learn with a request for that person to teach about a particular topic. That person then decides upon a teaching plan and the teaching is carried out. It is in this way that a knowledgeable person structures a learning environment for a person who would like to learn. Teaching is done in the context of an activity on the land. The learner is taught to be aware of the path of travel, time of year, the stories associated with the activity, the plants utilized during the activity, the bodily movements necessary to carry out the activity, the ceremonies which should be undertaken prior to and after the activity and many other subtle details. Researchers can learn many things from knowledgeable Anishinaabe and Rarámuri people but it takes time to realize that you are being taught. I was not told what is done in order to be adaptive but shown what I must be aware of in order that I become adaptive as I matured. It was then my responsibility to translate those teachings into a form that could be presented as part of a Ph.D. dissertation.

Historical processes, adaptive learning and social-ecological resilience

Chapters IV and V were included after Anishinaabe elders insisted that the research did not give enough attention to the history of Iskatewizaagegan people. A focus on history is also consistent with the literature of adaptive learning and social-ecological resilience. The resilience literature suggests that there is a nested set of adaptive-renewal cycles. Larger scale cycles correspond to longer periods of time and more physical space. Historical processes such as colonization, fur trade, mission establishment, logging industry and centralized government resource management were larger scale adaptive-renewal cycles present in Canada and/or Mexico. The social memory and social-ecological environment of adaptive learning are related to these historical processes. The perceptions, cognitive memories, technologies, techniques, institutions and lands of indigenous people often lead to their portrayal as a people without history (Wolf 1982). What some elders in this research referred to as the "Invisible Indian" perspective. These two chapters emphasize that the Anishinaabe and Rarámuri peoples and lands have had a long history of interaction with historical processes.

These chapters are not meant to suggest that the past provides a benchmark for a return to a "preferred" way of indigenous life. As the second law of thermodynamics tells us time's arrow only moves in one direction. The goal is not the restoration of the cultural landscapes of the 1800's. However, the knowledge of indigenous people provides a source of information for innovation and the emergence of new technologies, institutions and cultural landscapes that could contribute to the well being of their contemporary indigenous societies. Chapters IV and V provide a glimpse into the resilience of indigenous societies during a period of rapid change.

Memory, creativity and social-ecological environments

Chapter VI provided the results of the research undertaken with Anishinaabe and Rarámuri people on their perception of the temporal and spatial dynamics of the land. The research demonstrated that both the Anishinaabe and the Rarámuri people had a sophisticated set of vocabulary to describe the biogeophyscial structures and processes of the land. The research also demonstrated, however, that the elders did not place authority into the biogeophysical descriptions of the land but rather into the experience of the land as a social-ecological environment within which people journey.

Memory of the land included the biogeophysical descriptions and knowledge of the cycles. However, cycles were not just remembered as biological cycles. The memory of cycles was interwoven with the ceremonies and livelihood activities that occurred in relation to the cycles. The temporal dynamics were taught as the rhythms of the social-ecological environment. Likewise, the spatial dynamics were not just abstract habitat categories distributed across the landscapes. The land was a place that was known by the path and places of journeying. A person orientated herself within the land by learning the history of the land. This included paths of travel with known reference points as well as places which were named or where significant activities had taken place. Adaptive learning occurred as a person became aware of the subtle details of her environment, monitored changes in those details, created innovative solutions to changes and adjusted behaviour in response.

Institutions of knowledge are considered to be that sub-set of social-memory that guides learning. The institution of knowledge emerging from this research is that adaptive learning is situated within a social-ecological environment. People build their memories through daily activities carried out from within a familiar place. Creativity emerges when memory becomes dissonant with a contemporary context. The dynamics of the social-ecological environment result in creativity. However, an individual is also taught about the cycles of their environment. Participating in ceremonies and activities, which mark changes in the yearly cycle, is one way in which a person becomes aware of the cyclical changes in the environment. A person who has a deep experience of the land becomes authoritative to speak about the land through their dreams and experience. They become aware of the cyclic rhythms of the land over large time periods and the appropriate response to such changes. They are also able to recognize changes that require novel responses and innovations. While they can draw on their knowledge of the past for innovative solutions they also may encourage and support innovations from other sectors of the society such as youth or young adults. Elders can be a source of change, a brake to change or the supporters of change initiated by others. The one rule is that a person's ideas for change should emerge out of her direct experience of learning within a dynamic and holistic environment. This chapter describes a mechanism for how innovation can emerge out of a dynamic social-ecological environment. It does not provide a mechanism for how an innovation can lead to changes in the rules and practices of a society.

Memory, creativity and social-ecological learning environments

Chapter VII focused on the question of how holistic learning environments were framed by institutions of knowledge. This question was examined through the presentation of Iskatewizaagegan plant classification, nomenclature and a discussion of how elders thought plant knowledge should be learned. The research demonstrated that the Anishinaabe people had a system of classification, nomenclature and utility for plants. However, Anishinaabe nomenclature reflected the institution of knowledge that insisted all memory was situated within a specific context. When a plant memory was brought into a social-ecological environment, the name for the class was constructed in reference to the environment. Authoritative and legitimate memories about plants were not seen to reside in the system of classification nor the names but in the ability to communicate with the plant. Elders emphasized that it was through their dreams that they gained authority for their plant memories. However, due to their own authority an elder could then frame learning experiences for others to learn.

The question asked at the outset of this chapter was how institutions of knowledge framed social-ecological learning environments so that learning became adaptive. This research has focused on two institutions of knowledge that make Anishinaabe learning adaptive. The first, Anishinaabe elders insisted that a social-ecological environment should frame learning. Learning based on direct experience is highly valued. This institution provides a mechanism in which innovation is emergent from individual experience of the dynamics of the land. However, what is the mechanism by which individual innovations are weeded out so that only some are accepted by society and lead to changes in techniques, technologies, practices and institutions and finally the behaviour of other individuals?

The second mechanism that is described by this research might be summarized as the institution of mentoring. The first mechanism ensures that innovation emerges out of an individual's awareness of the dynamics of the social-ecological system. The second mechanism, mentoring, provides a process by which individual innovations can lead to changes in the practices of society.

The creativity of a learner can be authorized and become legitimate if it emerges from following a process of practice on the land and mentoring by an elder. Adaptive innovations emerge from the individual's awareness of changes in the environment. Since authority resides in the land itself an elder is authoritative through her dreams and experience of the land. An elder who follows the Anishinaabe teachings, and has a wealth of experience on the land, can create new and legitimate memories, technologies, techniques, practices and institutions. Likewise, among the Rarámuri, knowledgeable people were also considered authoritative about the lands they journeyed. While I did not deal directly with the Rarámuri in Chapter VII, other research confirms this basic pattern for the Rarámuri (Salmón 1999; 2000). Not all innovations are treated equally. Other members of Anishinaabe and Rarámuri society consider innovations, which emerge from people who have followed a way of learning over a period of time, more seriously. This provides a mechanism which weeds out innovations and favours those that might have beneficial adaptive consequences. This same mechanism provides the means by which an innovation might be accepted by a social group and lead to changes in the practices and institutions of a society.

There are two caveats that must be raised in regards to this model of adaptive learning. This research demonstrates how a mechanism, institution of knowledge, can link innovation to an individual's awareness of the social-ecological environment. It also suggests a second mechanism by which an individual innovation can be considered authoritative and legitimate by other members of a society. This favours the opportunity of such innovations to lead to changes in the practices and institutions of a society. However, while such innovations may have a better chance of success in leading to changes in the practices and rules of a society than other innovations there will also be differential acceptance of an innovation by different sectors of a society. An innovation that emerges from an individual's awareness of the social-ecological environment may require changes in practices and institutions. Such changes might negatively affect the interests of individuals and social groups within a society. This research did not trace the pathway of an innovation as it is wrenched and warped by the distribution of power within a society. Other research has shown how innovations lead to alternative versions of the practices and institutions of a society held by individuals and groups within the society. It is through political processes by which these alternative versions can lead to societal changes in practices and rules (Keesing 1976).

Anishinaabe and Rarámuri societies utilize mechanisms that favour changes based upon innovations of knowledgeable people. As individual innovation is linked to awareness of changes in the environment there will be an accumulation of authoritative and legitimate innovations that reflect social-ecological dynamics. As these alternative versions accumulate in the society this can lead to a change in the practices and institutions of a society that then leads to change in the behaviour of individuals.

The second caveat that should be raised is that individual innovation is not always creating solutions to problems that have been observed in the social-ecological environment. Humans are not always adaptive pragmatists and engaged in choosing beneficial solutions to problems. Innovations are just as likely to be based upon the interests of individuals and groups within a society while spun out as fantasies and explanations of problems. It is important to keep in mind that the model of adaptive learning suggests that individual innovations emerge out of the dynamics of a social-ecological system. The political dynamics of social-ecological systems will be one factor that influences the ability of individual innovations to lead to changes in the practices and institutions of a society.

This research has demonstrated that a model of adaptive learning is based upon a mechanism that favours individual innovation to emerge out of intimate awareness of changes in a social-ecological system (ontology). It has also suggested that a process of learning (epistemology) based upon experience of the land and mentoring provides a mechanism to favour some creativity over others in changing the practices and institutions of a society. It has also been noted that more work needs to be done in tracing how individual innovations move from alternative versions of practices and institutions to changes in a society.

CONTRIBUTIONS TO LITERATURE

Methodological contributions

The methodology in this research attempted to develop a model that would delegate power and authority equitably amongst a research team. The model that emerged was the formation of advisory teams and research teams which included people from the community and the university. A key finding was that the advisory team had to work together to define the question or problem that would be researched. The model worked on the premise that different approaches would be drawn upon to understand the problem and the potential solutions. Elders, band councilors, community researchers, professors, students and other participants would share their perspectives and research results within workshops. Elders could build their own knowledge in a way that would be authoritative while scientists could build their knowledge so that it could be authoritative. Rather than incorporating knowledge of one system into another this model focused on building authoritative knowledge, relevant to both systems, so that a specific goal could be met or a problem resolved. To ensure that sharing was equitable this model utilized research protocols that specified distribution of resources, intellectual property rights and review of research results. This builds upon other efforts to find ways to undertake cooperative, place-specific and problem centric research with communities (Kates et al. 2001; Latour 1993; 1998; Walker et al. 2002)

Theoretical Contributions

The social-ecological resilience literature had noted the importance of adaptive capacity. It had been suggested that a model of framed creativity was what led to adaptive capacity of social-ecological systems. Creativity emerged from individual action and innovation that was framed by social memory; a social memory, which evolved in tune with ecosystem dynamics, was the process by which adaptive capacity was built within integrated systems. However, the literature did not propose a process by which social memory became adaptive.

This research has proposed a modification of the conceptual model of adaptive capacity in complex systems. The research has proposed two mechanisms, institutions of knowledge, that lead to adaptive learning for social-ecological resilience. The first mechanism identified the authoritative and legitimate source of innovation as individuals who monitored places and resources as members of a social-ecological system. Creativity emerged from the dissonance that resulted when an individual's memory was no longer appropriate for his contemporary situation. Creativity resulted in new memories that were more appropriate. The larger the dissonance between memory and the contemporary social-ecological system, the greater the potential for changes in the social memory as more and more individuals became aware of the dissonance. The authority and legitimacy of individual innovations builds not from abstract models but as other individuals became aware of the appropriateness of the innovation during their experiences and journeys on the land.

The model of adaptive learning also proposed that mentoring was a key mechanism. This institution of knowledge insisted that social memories be transmitted from a knowledgeable person to a learner through the practice of the memory in the social-ecological environment. An individual built her own competence within the context of practice under the tutelage of the knowledgeable person, and who thereby gained authority. This began through observation and progressed to the learner undertaking an activity more and more on his own. This process of adaptive learning often occurred through the shared experiences of the family. However, specialized learning, such as healing, required that a young person have a dream and search out a knowledgeable person, or people, who would teach them. This allowed an individual to adjust what they learned to the contemporary environment as they built their own competence. The elder provided the authority to allow for adjustments when necessary or to correct adjustments that resulted from a lack of competency. Dreams and elders allowed creativity to emerge from social-ecological learning environments that was authoritative and could become part of the social memory.

The model of adaptive learning that was developed through this research suggests that adaptive capacity emerges from two key mechanisms or institutions of knowledge. By situating a learner into practical experiences it ensured that authoritative memories were built through an awareness of the social-ecological environment. This was why Anishinaabe and Rarámuri people often deferred to a person who had deep familiarity with a place or set of resources. The mechanism that required an individual to learn through the mentoring of a knowledgeable person ensured that social memory provided continuity between the past, present and future. This allowed for the transmission of social memory while allowing for individual innovations to emerge through the dynamics of the integrated system. Adaptive learning provides a model for social-ecological resilience, which allows creativity to respond to changes in the evironment, while ensuring a linkage between the past, present and future.

Taken together these two mechanisms of the adaptive learning model begin to address the question posed at the beginning of this dissertation of how social memory can evolve in tune with ecosystem dynamics. A review of the anthropological literature revealed that two mechanisms are necessary to explain the emergence of innovation in the practices and innovations of a society. First, a mechanism must be present which can generate a stream of customs, beliefs and practices that can lead to innovation. Second, a mechanism is needed by which a society can favour those innovations that are adaptive over those which are not (Keesing 1976).

This research proposed a number of new directions for understanding these mechanisms of human adaptation. First, by drawing upon the model of resilience the adaptive learning model considers individual innovation to emerge from the dynamics of the social-ecological system. In the anthropological model innovation is considered to emerge when humans adapt to changes in the biophysical environment. The adaptive learning model considers innovation to emerge from an individual's awareness of the dynamics of a complex system of which she is a part. The dynamics of the social-ecological system and the individual awareness of the dynamics drive the stream of innovation that can lead to societal change. The source of innovation is neither the biophysical nor the social but the dynamics of the integrated system.

Second, mentoring provides a mechanism by which individual innovations can be weeded out before leading to societal change. While this may be a conservative mechanism it also ensures that non-adaptive innovations do not move beyond an individual or group. Mentoring ensures that an individual is aware of the many subtle details of a social-ecological system and has been made aware of the social memory of the society. Individual innovations that are seen as authoritative and legitimate emerge from people who are intimate with the dynamics of the system and have been tutored over a long time period. However, since authority is also decentralized in this model, these alternative versions will not directly lead to changes in the practices and institutions of a society. The two mechanisms of the adaptive learning model have suggested how a stream of innovation can emerge from the dynamics of social-ecological systems and weed out non-adaptive innovations. However, the research has also pointed out that in a decentralized model of adaptive learning individual authority and legitimacy does not necessarily mean that alternative versions of practices and institutions will lead to societal change. The political dynamics of the pathway of individual innovation to social change in practices and institutions requires further investigation to understand social-ecological resilience.

Concluding Remarks

This research challenges current policy approaches to natural resources research and management that attempts to incorporate indigenous knowledge into centralized research and management paradigms. Adaptive learning situates authority into a person's experience of the land and learning from other experienced people. There is a linkage between memories and the land that cannot be severed. When the linkage is severed then the memories are no longer authoritative. A divide has emerged between adaptive learning and centralized paradigms of resource management. Neither sees the other as authoritative. The policy shift, which is suggested through this research, is that adaptive learning should be brought into research and management paradigms. This will require that research and management teams be formed with an equitable distribution of power and authority. One of the first tasks of these teams will be to establish goals and objectives for the activities of the team. Rather than one group incorporating the memories of another group into their models, the group has to engage in extended conversations to create new models and possible solutions. These models, and solutions, would have to be authoritative within local communities or they will not be accepted. People, both within social-ecological systems and between scales of systems, have to be engaged in the production of knowledge and not simply be the source of data for other peoples' processes of knowledge production. Due to the tensions between place-specific and centralizing institutions of knowledge, this may require the emergence of place-specific organization that can produce knowledge relevant for community-based natural resources and environmental management. Adaptive learning and social-ecological resilience will require more than documenting others' knowledge. It will require the emergence of institutions where indigenous peoples can once again write their histories into the landscape; creating the cultural landscapes which so many of us our interested in conserving.

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B.64/e Escabitchewan District Reports
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B. 273/a Dinorwic Post Journal
B.273/d Dinorwic Manager's District Reports
B. 287/d Grassy Narrows Manager's District Reports
B.498/a Grassy Narrows Post Journal
D.25 Eagle Lake Inspection Reports

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MG1-A10 Boundary Commission

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Acts related to the prevention of forest fires in Ontario.

41 Victoria, c.23 (1878)
52 Victoria, c.46 (1889)
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3 Edward VII, c.19 Division VI. (1903)
3-4 George V, c.64 (1913)
7 George V, c.54 (1917)
14 George V, c.71 (1924)
17 George V, c.25 (1927)
20 George V, c.60 (1930)
10 George VI, c.32 (1946)
7-8 Elizabeth II, c.38 (1959)

Acts related to the establishment of Manitoba

The Temporary Government of Rupert's Land Act, 1869, 32-33 Victoria, c.3 (Canada)
The Manitoba Act, 1870, 33 Victoria, c.3 (Canada)

SEMARNAP (Mexican Ministry of Natural Resources, Agriculture and Fisheries)

Leyes Forestal (Forest Laws); 1948, 1960, 1986, 1992 and 1997.
Ley General Del Equilibrio Ecologico y La Proteccion al Ambiente (General Law for the Ecological Equilibrium and Environmental Protection); 1994.

Kenora Public Library

Rat Portage Miner
Kenora Miner and News

APPENDICES

Appendix III-1

University of XXXX

XXXX First Nation Institution

RE: Proposed Research Project
XXXX

The purpose of this letter is to explore your interest in undertaking a cooperative research project between XXXX and XXXX with the University of XXXX.

The XXXX has received funding from the XXXX to undertake the proposed research. The XXXX is a Canadian Centre of Excellence for XXXX and is based at the University of XXXX. It is supported by contributions from the Federal Government of Canada, the XXXX Industry and provincial resource management agencies. The XXXX student involved in the research is also supported by a Social Sciences and Humanities Research Council grant. The research forms a part of a larger project on XXXX.

The purpose of the study is to build a model of cooperative research between First Nation communities and scientists to investigate XXXX. The research will include an investigation of plant knowledge and could include the following topics: XXXX names of plants; historic and contemporary uses of plants; technologies of plant harvesting; ecological knowledge of plants; rules/institutions of plant harvesting; transmission of knowledge between generations; changes in harvesting practices; and, environmental changes which have impacted harvesting.

The research will be designed in cooperation with XXXX First Nation Institute so that the research is relevant to its goals. The research process will begin with a workshop where community leaders, university researchers and other interested participants will choose a community researcher, elder advisor and five people considered to be knowledgeable about plants. A second workshop will be held to decide upon the specific topics of research, develop research agreements and protocols, and allow community research participants to decide if they would like to participate in the research. The research will also contribute to the work of the XXXX First Nation Institute in documenting the knowledge of XXXX people and producing a CD-ROM for educational purposes and negotiations with other governments.

Individual community members who participate in the research will be required for five days each year for two years. They will be provided with an honorarium at the rate of XXXX per day. Payment for the elder who will advise the project will be discussed with the XXXX First Nation Institute. Elders will be asked to participate in field interviews and follow-up interviews in their homes, or other locations in the community. Any participant will be allowed to withdraw from the research at any time with no penalty. Participants will be allowed to choose whether they would like the information they provide to remain anonymous, or whether they would like public recognition for such information.

The project will also train a youth from the community in the skills of identifying and collecting plants in the bush, interviewing elders, understanding forest resource inventories and entering information into a computer. It is hoped that this will aid in transmitting knowledge of the elders to the next generation. We are able to support the community researcher at the rate of XXXX per month for four months over 2 years.

We are also working with the XXXX First Nation Institute at the current time to develop other proposals which can use our research funding as leverage to attract funding from other sources.

If you have any questions or concerns, you may contact:

XXXX
University of XXXX

If you would like to participate in this research process, we would ask that you sign a band council resolution indicating that you would like to work with XXXX, University of XXXX, to develop the project.

Appendix III-2

INTERNAL BAND COUNCIL RESOLUTION
Number yy/##

WHEREAS, the First Nation Government of XXXX is committed to developing the technical capacity for the benefit of the social, economic and educational enhancement for the preservation of the well-being of the people of XXXX;

WHEREAS, the First Nation Government of XXXX approves the partnership between University of XXXX and the XXXX First Nation Institute to document our peoples knowledge of the forest ecology of the XXXX watershed:

BE IT THEREFORE RESOLVED THAT the Chief and Council support the XXXX First Nation Institute to work with the University of XXXX to develop the research project: XXXX.

Signed by Chief and Council

Appendix III-3

An Example of a Workshop Held with an Advisory Committee to Discuss Research Project and Obtain Informed Consent from Participating Individuals within Community

WORKSHOP 1

Purpose: To explain to selected group of elders and community representatives the purposes of the project.

Objectives:

Outline the project and solicit input from community members.

Select a group of five elders knowledgeable about plants.

Select a community researcher.

WORKSHOP 2

Purpose: To draft protocol and agreement between community and research team.

Objectives: Work with a small group of elders and community representatives to draft research protocol and agreement.

Submit research protocol and agreement to band council for approval through band council resolution.

WORKSHOP 1

Purpose of the Project:	To record and document the names, uses and other knowledge about plants of the Ojibway people.
	Understand the ecological knowledge(how things are related in time and space) of Ojibway people.
	To determine if there is a way to link forest inventories with Ojibway knowledge to foster economic development.
Use of Information Collected:	Create knowledge legacy for Shoal Lake people.
	Use in production of a CD-ROM.
	Inform Watershed Committee of how Ojibway people use the bush.
	Build knowledge which can be passed on to younger generations through school programs.
	Use for basis of interpretive and educational tourism.
	Use as basis for examining economic development options.
	Professional publications and thesis (Researchers will need to publish some of the results).
	Popular publications along with community participants as co-authors.

Who would you recommend as a person knowledgeable about the bush, where plants can be found, and the uses of plants?

Who would you recommend as a youth who would be good to work on this project?

An example of type of information that will be gathered:

1. Seasonal Cycle or Lunar Calendar.

   Main activities during different moons.
   Where activities occurred on the land.
   Names for places where activities occurred.

2. Ojibway names of trees and other plants. (Eg. Birch, Jack Pine, Red Pine, White Pine, Black Spruce, Cedar, Oak, Poplar.)

3. Are certain places recognized due to the types of trees that grow in that place?

4. Do plants grow wherever, or do they have a place that they like to grow? (Example of plant along with habitat eg. Marshes, grasslands, burned areas, etc.)

5. Do some plants like to grow with specific trees? Examples?

6. Do you remember going to harvest birch bark with your parents? Do you remember if there were certain places that they liked to use to harvest bark for canoes? Baskets? Other?

7. Do some birch trees have better bark than others for canoes or baskets?

8. How would you describe a tree which provides good bark for canoes, baskets, etc?

9. Would a tree which provides good bark for canoes grow in groups of birch, or in areas where one birch tree is alone among other types of trees?

10. Could you show me on a map, or take me to a place, where birches grow? Could you take me to a place where you think good bark may be found?

11. Would you be willing to go into the bush and provide the Ojibway names of, uses for, and other information about plants found in birch, oak or cedar stands?

The above topics will form the content of the research project.

Are you comfortable with discussing the above topics?

Can you think of any topics that we have not included in the research, but that you think would be important to pass on to the younger generation?

After hearing about the project, would you be interested in participating in it?

Appendix III-4

RESEARCH PROTOCOL

FOR THE COOPERATIVE RESEARCH PROJECT

Linking Scientific and Harvester Knowledge to Assess the Value of Forest Patches in Northwestern Ontario: A Case Study of Traditional and Commercial Non-Timber Forest Products

SHOAL LAKE RESOURCE INSTITUTE,
ISKATEWIZAAGEGAN No. 39 INDEPENDENT FIRST NATION

AND

THE NATURAL RESOURCES INSTITUTE,
UNIVERSITY OF MANITOBA

MAY 30, 2000

This document outlines the protocol which will govern the research undertaken in the territory of **Iskatewizaagegan Independent First Nation** through a partnership between the **Natural Resources Institute**, University of Manitoba and the **Shoal Lake Resource Institute**, Iskatewizaagegan No. 39 Independent First Nation. The document will be brought into effect through the signing of a Band Council Resolution by Iskatewizaagegan Independent First Nation and a signed letter from the Principle Investigator of the research project.

Duration of Project.

The duration of the project will be of one year from June 1, 2000 to May 31, 2001. The project may be extended for a second year (June 1, 2001 to May 31, 2002), subsequent to a review of the project.

Preamble.

Iain Davidson-Hunt, a Doctoral Candidate at the University of Manitoba, and Ed Mandamin of the **Shoal Lake Resource Institute** (SLRI) have held on-going discussions during the year of 1999/2000 regarding the feasibility of forming a research partnership to investigate non-timber forest products and sustainable forest management.

The home department of Iain Davidson-Hunt is the **Natural Resources Institute**, based at the University of Manitoba, which has a dual mandate: (1) undertake interdisciplinary research to increase society's understanding of natural resources and their management; and, (2) train graduate students in the practices of applied research and resource management. One of the NRI's interests is to understand how resource management occurs at a local level and work with community-based resource management organizations.

The **Shoal Lake Resource Institute** is an initiative of Iskatewizaagegan No. 39 Independent First Nation to enhance the role of the community in the management of the Shoal Lake Watershed and improve the well-being of the Iskatewizaagegan people. The mandates of the SLRI relevant to the proposed project include: (1) document the knowledge legacy of Iskatewizaagegan people, safeguard this knowledge for future generations and facilitate the use of such knowledge in contemporary settings for the well-being of Iskatewizaagegan people; (2) train IIFN members in the use of computer technologies, such as GIS; (3) facilitate learning processes between elders and youth; and, (4) oversee and participate in western scientific research projects which build SLRI's knowledge of the Shoal Lake Watershed. The results of such initiatives are to be utilized for the purposes of: education curriculum, economic development, resource negotiations, management of the Shoal Lake Watershed, and the enhancement of the general well-being of Iskatewizaagegan people.

This project has been developed on the basis of the shared interest between the Natural Resources Institute and the Shoal Lake Resource Institute in fostering the community-based management of natural resources. The specific details of the research project are found in the attached proposal: "Linking Scientific and Harvester Knowledge to Assess the Value of Forest Patches in Northwestern Ontario: A Case Study of Traditional and Commercial Non-Timber Forest Products." The basic approach of the research is found in the diagrams attached to this protocol.

Summary of the Research Project.

There are two distinct components of the research project: western science; and local plant knowledge, ecosystems and institutions.

1) Western Science.

This component of the research will be the main focus of Tracy Ruta and form the basis for her Master of Natural Resources Management research and thesis. The general **objective** of her research is:

> ***to generate baseline data through accepted scientific methods which will examine the feasibility of utilizing an ecological land classification system to examine growth and bark values of birch and document the flora of other culturally important forest patches in the Shoal Lake Watershed.***

The broader **purpose** of the research responds to the interests of the NRI and the SLRI in exploring the feasibility of commercial non-timber forest products for community economic development. The results of the research will not be utilized to validate or invalidate knowledge of the people of Iskatewizaagegan but to add to the knowledge legacy cared for by the Shoal Lake Resource Institute. Additions to the Iskatewizaagegan No. 39 Independent First Nation knowledge legacy will include: commercial potential of non-timber forest products in the Shoal Lake Watershed; training in the methods of botanical investigation; understanding in the relationship between non-timber forest products and ecological land classification systems. Additions to the Natural Resources Institute's knowledge legacy will include greater awareness of indigenous resource stewardship and the role of local community-based resource management in promoting sustainable use of natural resources.

The **methodology** of the research will follow accepted scientific methods which include: bound research plots; measurements of trees and plants; and the collection of plants. Community members will accompany researchers during the establishment of the first plot and they will be shown the research methods to be utilized. A discussion of ways in which research methods can respect the ethics of local harvesters and meet demands of western science will be held. These suggestions will be incorporated into the research designs while ensuring that the methods meet western science standards.

The results of the research will be available for **review and comment** as noted below. Copies of written documents, plant vouchers and data sets will be archived at the Shoal Lake Resource Institute, the Natural Resources Institute (written documents and data sets) and the University of Manitoba Herbarium (plant vouchers).

2) Local Plant Knowledge, Ecosystems and Institutions.

This component of the research will be the main focus of Iain Davidson-Hunt, and form part of his doctoral research and dissertation.

The general **objective** of his research is:

> ***to investigate the linkages between ecosystems, institutions and local knowledge of plant harvesters utilizing qualitative interview methodologies.***

The broader **purpose** of this research responds to the interest of the NRI and SLRI to provide a documentary record of the knowledge which Iskatewizaagegan people are willing to share and the processes which lead to ecological and cultural resilience. The specific uses of the information collected will be to further: academic research (including student dissertations and publications); Shoal Lake watershed management; community economic development; transfer of knowledge between elders and youth; health programmes; cultural and ecological interpretive tourism and educational programmes; sustainable forest ecosystem management; written, oral and video documentation; and, development of an educational CD-ROM.

The **methodology** of the research will be based upon qualitative interviews with elders and other people knowledgeable about the plants of the Shoal Lake Watershed. The themes of the interviews will include:

- Ethnoecology
  -Ways in which people think about where plants are located across the landscape and how this changes over time
  -Ways in which plants are related to disturbances such as fire, windstorms, logging
  -Ways in which people think about how different plants are related to each other
  -Ways in which people know where plants are located
  -Different types of forest or landscape features that people recognize and/or name
  -Recognition of differences in soil, moisture regimes, etc. and linguistic terminology

- Ethnobotany
  -Ojibway Names of Trees/Plants and Scientific Names of

		Trees/Plants -Uses of Trees/Plants that people are willing to share -Historic or contemporary use of trees/plants for domestic or commercial use.
•	Institutions of Resource Harvesting	-Rules which guide the harvesting of plants -Customary systems of ownership and stewardship of places and resources -Ways in which respect is shown to plants when harvesting -Ways of monitoring plants -Ways to determine the sustainable harvest of plants -Other stories and beliefs about the relationship between plants and people -Activities people undertook to influence the abundance of a plant (burning, pruning and selective harvest)
•	Transfer of knowledge	-Ways in which people learned about plants in the past -Ways in which elders feel youth should learn about plants in the present
•	Archival Research	-Uses of plants found in botanical databases -Information about plants found in scientific, archival and ethnographic documents relevant to the Shoal Lake Watershed

The results of the research will be available for **review and comment** as noted in the protocol included below. Copies of written documents, plant vouchers and data sets will be deposited with the Shoal Lake Resource Institute.

Project Partners.

Natural Resources Institute, University of Manitoba
Shoal Lake Resource Institute, Iskatewizaagegan Independent First Nation
Chief and Council, Iskatewizaagegan Independent First Nation
Elders, Iskatewizaagegan Independent First Nation Band

The main partners of the research project are the NRI, SLRI - IIFN, Chief and Council - IIFN and Elders - IIFN. The other partners are mentioned as they have expressed interest in supporting the project through in-kind support of data, research advice and possibly other contributions on a case-by-case basis. It should be noted that secondary partners have not provided any financial contribution to the research partnership, but may have provided other forms of in-kind support.

Specific Project Protocols.

The Research Partnership.

The project is based on a partnership between Iain Davidson-Hunt, Fikret Berkes, Tracy Ruta and John Sinclair of the Natural Resources Institute and Ed Mandamin, Phyllis Jack and Brennan Wapioke of the Shoal Lake Resource Institute ("The Research Partnership"). Student researchers (Iain Davidson-Hunt, Ph.D. Candidate and Tracy Ruta, MNRM Candidate) will work in cooperation with Ed Mandamin, Phyllis Jack and Brennan Wapioke to plan research to occur during the project. The research partnership will be accountable to the university community through the Natural Resources Institute and to the IIFN through the Chief and Council and community elders.

Advisory Committee.

A project advisory committee will be formed and composed of:

Fikret Berkes, NRI; Iain Davidson-Hunt, NRI; John Sinclair, NRI; Tracy Ruta; Ed Mandamin, SLRI; Phyllis Jack, SLRI; Brennan Wapioke, SLRI; LaVerna Greene, C&C - IIFN; Randy Paishk, C&C - IIFN; Robin Greene - IIFN; Elladon Greene - IIFN; Basil Green - IIFN; Walter Redsky - IIFN.

This committee will meet to review the proposal and then on an ad hoc basis as needed.

Review of Research Proposals.

The Research proposal will be presented as a written document and through an oral presentation to the advisory committee of the project. Members of the advisory committee will be given the opportunity to ask questions and suggest changes to the research proposal.

Academic Committees.

An IIFN member of the advisory committee will be given the opportunity to attend academic committee meetings of the students undertaking the research and to provide comments on the first draft of the student's thesis.

Presentation of Research Results to Community, Advisory Committee and Project Partners.

Community — A community workshop will be held in January of 2001 and 2002 to present the results of the research to the advisory committee and other interested members of the community.

Advisory Committee	Ad hoc meetings of the Advisory committee will be called if specific problems arise during the course of the research project.
Project Partners	A workshop will be held for the project partners during January of 2001 and 2002 to present the results of the research. The material to be presented at such workshops will be reviewed and discussed by the Advisory Committee.

Informed Consent and Withdrawal.

People who are interviewed during the research will be asked to sign a form of consent, indicating that they are aware that the information they provide to the interviewer may be utilized for student dissertations, other publications and will be archived by the Shoal Lake Resource Institute. The consent form which will be utilized is attached to this protocol.

There will be no penalty if someone decides to withdraw from the research.

Recognition.

People who choose to be interviewed for the research project can indicate whether they prefer to be recognized as providing specific information or whether they prefer to remain anonymous.

Review of Written Reports, Theses, Academic Publications.

Written reports, thesis, dissertations, publications, and any other material for public release which is based on the activities undertaken for this research project will be submitted to the advisory committee for review.

In the case of data, results and conclusions of the western science component of the project, strong objections to the research findings, data or interpretation will be noted and published.

In the case of interview information, interpretations and conclusions documented during the study of local plant knowledge, ecosystems and institutions, it may be decided by the advisory committee that specific information content should not be released for public consumption. A specific example would be the medicinal knowledge of a plant which may hold commercial potential.

In both cases, strong objections will be noted and published if received within two months of the document being submitted to the SLRI.

Archiving and Distribution of Research Documentation.

All written documents (reports, theses, publications), audio tapes, videos and photos which result from the research project will be submitted to the Shoal Lake Resource Institute for storage.

Copies of photos will be provided to people who appear in the photo.

Interested community members will have free access to written documents from the SLRI or the NRI.

Plant vouchers will be deposited at the University of Manitoba herbarium and with the Shoal Lake Resource Institute.

All documentation collected during the research project will be available for use in the preparation of a CD-ROM by SLRI.

The research students will undertake to help in compiling any curriculum and educational materials based on the research for use by the Shoal Lake Resource Institute.

The research students will make themselves available during the time that they are undertaking research in the community to help with interpretive and teaching programs about plant use.

The research students will undertake to prepare their research results in a manner which can be conveyed to the community during workshops.

Activities of Community Researcher.

1. Develop skills to work as part of an interdisciplinary research team integrating scientific and traditional knowledge of sustainable forest management.
2. Learn techniques of botanical collections and identifications by assisting in field plot work and collection of plant specimens.
3. Learn art of informal, guided conversation interviewing technique by participating and translating during interview sessions.
4. Develop skills for the presentation of research data to community.

Honoraria / Compensation for Participating in Research.

Community Researcher	- $XXXX / hour spent in field and interviewing (Upset limit $XXXX per project year)

Elders Honoraria - $XXXX/ hour of interview
(upset limit of $XXXX per project year)

Administration of Funds.

The student researcher and SLRI will record the hourly participation of elders and the community researcher and will submit a summary of honoraria / compensation at the end of each month. Upon receipt of the summary and receipts the NRI will transfer funds to the band council for payment.

Sources of Funding.

Sustainable Forest Management Network.

The Sustainable Forest Management Network (SFMN), based at the University of Alberta, is one of Canada's 15 Network of Centres of Excellence. This is a Canadian government research initiative that is sponsored by the National Science and Engineering Research Council, the Social Science and Humanities Research Council, and the Medical Research Council. The SFMN also receives funding from corporations, provincial governments, universities and First Nation partners. The SFMN mandate is to fund university-based research carried out in cooperation with industry, resource management agencies, First Nations, and forest-based communities.

The overall goal of the SFMN is to develop knowledge, strategies and tools to ensure that Canada's boreal forests are effectively managed, such that biological diversity will be preserved and the resource base will be sustained for future generations. The primary objectives of the SFMN are:

- to provide integrated, multidisciplinary research to ensure the sustainability of Canada's boreal forests;
- to encourage research aimed at preserving the ecological functions and biodiversity inherent in Canada's forests;
- to conduct boreal forest research through strong partnerships and enhanced networking;
- to improve the nation's forest-based economy by developing new technologies, new knowledge and new strategies for the management and conservation of this valuable renewable resource;
- to train and educate highly qualified personnel in an interdisciplinary and cooperative atmosphere, involving interaction with members from the academic, forest industry, Aboriginal Peoples, and government sectors.

Further information about the SFMN can be found at:

<www.biology.ualberta/sfm.hp/sfm.web/index.htm>

or by contacting: Sustainable Forest Management Network
G-208, Biological Sciences Building
University of Alberta
Edmonton, Alberta
T6G 2E9
ph. 780-492-2479
fax. 780-492-8160

The SFMN has provided funding for the support of a community researcher, elders' per diems, support of a Master's student (Tracy Ruta), partial support of a Ph.D. student (Iain Davidson-Hunt), travel, and research materials.

Social Sciences and Humanities Research Council.

The Social Sciences and Humanities Research Council (SSHRC) is supported by the Government of Canada to oversee the funding of university-based research within the social sciences and humanities disciplines. Iain Davidson-Hunt, the Ph.D. student undertaking his research through this project, is supported in part by a SSHRC Doctoral Fellowship (752-97-0203) awarded in 1997. Iain Davidson-Hunt is also partially supported through a SSHRC research grant awarded to Dr. Fikret Berkes in 2000 to undertake research on the joint management of natural resources.

Appendix III-5

An Example of a Band Council Resolution that gives Permission for Research Project to Proceed.

INTERNAL BAND COUNCIL RESOLUTION
Number yy/##

Whereas the Chief and Council support cooperative efforts to build the knowledge legacy of XXXX First Nation in order to facilitate the effective participation in the management of the XXXX Watershed for the well-being of XXXX people;

Whereas the Chief and Council support cooperative research projects which build public awareness of First Nation community-based natural resources management;

Be it therefore resolved that XXXX of the University of XXXX have the permission of the Band Council to undertake a cooperative research project within the territories of and with the people of, XXXX First Nation in partnership with the XXXX First Nation Institute.

Be it further resolved that the research undertaken by students of the University of XXXX and members of the XXXX First Nation Institute be governed by the Research Protocol attached to this resolution.

Be it finally resolved that the research, and any writing from it, will be undertaken in a spirit of collaboration and mutual benefit. XXXX of the University of XXXX have permission to use information from their research in the preparation of their Thesis/Dissertation, academic research papers and conference presentations, subject to the attached Research Protocol. The XXXX First Nation Institute has permission to use information from the research for the purposes of education, resource negotiations, conference presentations, and any other uses for the benefit of the community subject, to the attached Research Protocol.

Chief and Council.

Appendix III-6

LETTER OF INFORMED CONSENT

Linking Scientific and Harvester Knowledge to Assess the Value of Forest Patches in
Northwestern Ontario: A Case Study of Traditional and Commercial Non-Timber Forest Products

I give permission to Iain Davidson-Hunt, of the University of Manitoba, and Ed Mandamin, Phyllis Jack and/or Brennan Wapioke, of the Shoal Lake Resource Institute to interview me about:

my knowledge of plants and other natural resources, including:

- ways in which people think about where plants are found in the forest;
- Anishinaabe names of plants that I am willing to share;
- Anishinaabe uses (domestic or commercial) of plants that I am willing to share;
- ways in which Anishinaabe people cared for plants and other resources; and
- ways in which I was taught (and teach others) about plants and other resources.

I understand that my participation is completely voluntary and that I may withdraw from the research at any time without penalty.

I agree that my interview will be audiotaped or videotaped and field notes will be taken. I understand that, until such time as the notes and tapes are transcribed, they will be kept secure. I agree that Iain Davidson-Hunt, Ed Mandamin, Phyllis Jack, and Brennan Wapioke will have access to these records.

I understand that I may be acknowledged as participantin and/or contributor to the final reports, tapes, collections, publications and any other form of presentation of the data. I also understand that, all materials collected during the research process will be stored by the Shoal Lake Resource Institute at Iskatewizaagegan and, if necessary, at an off-reserve location, as decided by the SLRI and band council.

I understand that I will be provided with a copy of any photo in which I appear.

I understand that my anonymity will not be protected, unless I request confidentiality.

I understand that I will have an opportunity to review any written documents containing information I provided during the research project. Objections I have to the conclusions reached by the researcher on the basis of information I have provided will be noted and published.

I agree to be compensated at the rate of $ XXXX / hour for participation in the research project.

( ) I agree to be identified as a contributor.
( ) I do not agree to be identified as a contributor.

( ) I give permission for Iain Davidson-Hunt to use the information obtained for the purpose of publishing, or for presentation at conferences and in lectures.
( ) I do not give permission for Iain Davidson-Hunt to use the information obtained for the purpose of publishing, or for presentation at conferences and in lectures.

( ) I give permission for the Shoal Lake Resource Institute to use the information obtained for the purpose of publishing, presentation at conferences, preparation of educational curriculum and for resource management negotiations.
( ) I do not give permission for the Shoal Lake Resource Institute to use the information obtained for the purpose of publishing, presentation at conferences, preparation of educational curriculum and for resource management negotiations.

____________________________ Date:____________________
Signed

____
Iain Davidson-Hunt, University of Manitoba

____
Shoal Lake Resource Institute Representative

Appendix III-7

Ojibway Ethnobotany of Northwestern Ontario
ISKATEWIZAAGEGAN

Voucher #______________ **Year**_________

Collected by: ____________________ **Date** _____________
Determined by:___________________ Date______________
Ethnobotany Verification by: __________________ Date____________________
Location of Collection (GPS Reading - UTM)
Easting _____________ Northing _____________ Altitude ____________

Site Characteristics
Slope (%) _______________ Aspect ____________ (Slope facing by cardinal direction)

Habitat (Riparian, Mixed-Wood, Mostly Poplar, Mixed Jack Pine/Spruce, Grassy Opening, etc.)

Sample Plot Identifier __________________(If classified using Ontario Ecological Methodology, if not provide information on next page)
Ecosite / Vegetation Type ______________________ Soil Type __________________

Lifeform: Grass Herb Bush Tree Vine

Plant Characteristics
(All lifeforms) Height___________ Diameter ____________(Tree >10cmdbh)
Colour of Flower ______________ Colour of Fruit _______________

Plant Habit(e.g. Upright, Trailing, Climbing, etc.)________________________________
Branching(Alternate, Opposite, Whorled) ______________________________________
Root System (Tap, Tubers, Rhizomes) ____
Other observations (Presence/Absence - sap, latex, juice - colour, etc.)

Flowering time __________________ Fruit time _________________

Plant Knowledge

Person who gave information ____
Ojibway Name of Plant ____
Translation ____
Scientific Name of Plant ____
Plant Family____

Other Names ____

Uses of Plant and Part of Plant Utilized

Preparation for specific uses

Description of Collection Site if not described as OELC Plot

Description of Soil Collection #, if soil sample collected (Sandy, Loamy, Clay, Mixed Gravel and Sand, etc)

Moisture Regime (Wet, Moist, Dry, etc)

List of Other Plants Found at the Collection Site

Data Related to Voucher Specimen
Current Research Project

Other Voucher #'s of Same Plant

Photo Record of Plant (#-year)

Audio/Video Records of Plant

Other Sources of Relevant Information

Other Descriptions of Plant - Pictures / Botanical Descriptions (Source)

Other Recorded Ojibway Names (Source)

Other Recorded Uses of Plant (Source)

Appendix VI-1

Aniishinaabe Ethnoecology: A Sample of Landscape Terminology. Biophysical and Cultural Terms, English Gloss, Ontario Ecological Inventory Equivalents and Associated Documentation.

Verified: Ella Dawn Greene, Walter Redsky, Brennan Wapioke; 24-1-02

Landform / Habitat Terms	English Gloss	Nearest Ecosite / Habitat Type / Life Zone	Photo Record	Video / Audio Record
Atiinaag	Hill			
Babiikwaakwaa	Patch of trees in open prairie			
Babiikwaakwaag	Place of patch of trees in open prairie			
Biboonishiiwinan	Winter camping			
Biinjiboonaagan	Fish trap			
Binesiiwassiswun	Thunderbird nest			
Daawaapakinigay	Channel			
Giinaywemitigomiizhikaag	Oak Point			
Giinaywewigwasikaag	Birch Point			
Giinaywe - point ikaag - place				
Giinaywe - any tree - ikaag	Any tree point			
Giishkaapiikaang Kaang - Rocky Place Piikaang - Rocky Area Giishkaa - Rock cracks	Cracks in rock wall -sage location		00- 53, 56, 57, 59	V001/04 (50-30)
Gaagiidazhigiishkaakweyaag	'Clearcut' Place where it was cut.			
Gitigaan	Garden		Have photo	
Gitigaan Minis	Garden Island			
Iskite	To burn			
Iskaate	burnt			
Iskaate Minis	Burnt Island			
Ishkwaakite	Burnt Trees -just recently burnt where trees still standing			
Kaaobiigiishkensikaag Kaaobii - narrows Giishkens - small cedars	Narrows -narrows between two points with cedar	V3		V001/04 (50-30)
Kaaobiikwaang (Kiiobwakwaag???)	Narrows with trees on points			
Kaazhimaanominikaag	Maanomin field			
Koochichiing	River inlet			
Kwaa	Grove of trees -used within word construction to refer to a bunch of clump of trees			
Maazinaapakinigun	Pictograph			
Mamawiitaawin	Multiple family dwelling place / Village			
Manitoo Minis	Spirit island			
Manitoo Minis	Spirit falls / rapids			
Mataabiiyaakwaa	Shrubby area at edge of water			

Mataabiiyaakwaag	Place of ...			
Mitaawang	Sand			
Mitaawangotina	Sand Ridge	ES 13 / V29		V001/03 (28-10) V001/06 (62-54)
Mashkiig	Muskeg	W21-23		
Mataabiiyaapkaang	Rocky slope going down to lake			
Memengwayshiiwug	Little rock people place			
Miikana	Trail			
Miiniikaa	Blueberry Patch		Have	
Oteiminaniikaa	Strawberry Patch		photos	
	Any berry patch			
Berry '-minaniikaa'				
Minis	Island			
Minisinaakwaa	Island of trees -refers to a clump of trees found within a swamp			V001/02 (60-41)
Minisinaakwaang	Place of island of trees			
Mitig(-oog)	Tree(-s)			
Mookichiiwanibiik	Spring			
Neyaa	Point			V001/02 (60-41)
Neyaakwaa	Point with trees			V001/02 (60-41)
Neyaakwaang	Place of point with trees			V001/02 (60-41)
Neyaapkaang	Rocky Point			
Nibiniishiiwinan	Summer camping			
Niisapkaang	Rocky Slope			
Nimishoomisaabik	Grandfather rock			
Ningkwaa'ikan	Burial place			
Nipaywinan	Camping place			
Nopoming	Forest / Bush			
Okwokizowaag	Patch / Grove of trees			
Okwokizowaag Wigwasaatigoog	Birch Grove		Have photos	
Okwokizowaag Geezhigoog	Cedar Grove		Have photos	
Okwokizowaag Agimakoog	Black Ash Grove		Have photos	
Okwokizowaag 'tree name')-oog)	Use to refer to any grove of tree by its plural name conjugation			
Onigum	Portage			
Oshkwaakite	Burnt tree place -2,3,4 years where new vegetation started to come in. Blueberry location		Have photos	
Paakita'waywikamikoon	Fishing station			
Paasitinang	Ravine -in boreal - ravine often black spruce with associated vegetation			

	- therefore both landform and assumed habitat			
Paawitig	Rapids			
Pikwatinaa	Hill			
Saagiing	River mouth			
Saaigan	Lake			
Shiibaakobang	Willow Spit			
Shiibeshkoteyaang	Prairie / Open Grassy Meadow Clear area that you can see across			
Shiibeyaa	Seeing through under Used to refer to -Parkland areas -fern covered areas where blueberries grow underneath			
Sigwanishiiwinan	Spring camping			
Taashkaapkaang	Cliff -sage location		00- 53, 56, 57, 59	V001/04 (50-30)
Taawin	Family dwelling place			
Takwaakishiiwinan	Summer Camping			
Totogan	Floating Bog	W13 / W14	00-86	
Waabigan	Clay			
Waabiganikaa	Place of clay			
Waachiew	Big hill / mountain			
Waakaa'igan	Cabin			
Wiikwechiishkiiwagaang	Shallow, muddy Bay -wild rice location	W7, W8		V001/04 50-30
Wiikweshkosewaagaang	Grassy Bay	W7, W8		V001/04 50-30
Wiikweyaang	Bay			
Zhiibaaminis	Narrows between two islands		Picture	
Zhiibaaminisiing	Narrows between a group of island -often found in front of a bay			
Kaazhiibaaminisiwong	Kaa = Go -wong - place where Go to the place where there are narrows between the islands			
Ziibi	River			

Appendix VII-1

List of Plants Recorded during Field Research Organized by Scientific Classification.

Kingdom Division Class Family	Latin Binomial	Iskatewizaagegan Plant Group Folk Generic Folk Variety	English Name Division Family Common Name
Fungus Kingdom		Ozhushkweto	
Ascomycota			Sac Fungi
Basidiomycota			Club Fungi
Coriolaceae			Conk Fungus
Hymenochaetaceae			Wood-infecting Fungus
			Tinder Fungus
	Inonotus obliquus (Ach. ex Pers.) Pil.	Sagataagan	Puffball Fungus
Lycoperdaceae			
Plantae			
Bryophyta		Aasaakamig	Moss
Dicranaceae			Hummock Moss Families
Hylocomiaceae, Hypnaceae,			Feather Moss
Brachytheciaceae			Peat Moss
Sphagnaceae			Peat Moss
	Sphagnum spp.	Mashkiigokamig	
Polypodiophyta		Ginebigowazhin	Fern
Aspleniaceae			Spleenwort
	Woodsia ilvensis (L.) R. Br.	Aajitaamowaano	Rusty Woodsia
Dryopteridaceae			Shield Fern
	Matteuccia struthiopteris (L.) Todaro.	Gitcheaniibiish	Ostrich Fern
Polypodiaceae			Polypody Fern
	Polypodium virginianum L.		Rock Polypody Fern
Pinophyta		Shinwak + Shingobiig + Unaffiliated Generics	Conifer
Cupressaceae			Cypress
	Juniperus communis L.	Gaagagiwaandag	Common Juniper
	Thuja occidentalis L.	Giizhig	Eastern White Cedar

Pinaceae			Pine
	Abies balsamea (L.) P. Mill.	Pigewaatig	Balsam Fir
	Larix laricina (Du Roi) K. Koch	Mashkiigwaatig	Tamarack; Larch
	Picea glauca (Moench) Voss	Minaeg	White Spruce Tree; Highland Spruce Tree
	Picea mariana (Mill.) BSP	Sesegaanaatig	Black Spruce Tree
	Pinus banksiana Lamb.	Okigaandag	Jack Pine
	Pinus strobus L.	Shingwaak	White Pine
	Pinus resinosa Ait.	Gaazhoosh Kwenigwegozid Shingwaak	Red Pine; Norway Pine
Taxaceae			Yew
	Taxus canadensis Marsh.	Niibaayaandag	Canada Yew; Ground Hemlock
Magnoliophyta			Flowering Plants
Magnoliopsida			Dicotyledons
Aceraceae			
	Acer negundo L.	Siizibaakwetaatig	Manitoba Maple; Box Elder
Anacardiaceae			Cashew
	Rhus radicans L.	Baabiigobagoon	Poison Ivy
Apiaceae			Celery
	Cicuta maculata L.	Maanitoo o caatag	Water Hemlock
	Osmorhiza longistylis (Torr.) DC.	Shiiwiigiibik	Long-styled Sweet Cicely
Araliaceae			Ginseng
	Aralia nudicaulis L.	Waabozogiibik	Wild Sarsaparilla
Aristolochiaceae			Birthwort
	Asarum canadense L.	Namepin	Wild Ginger
Ateraceae			Aster
	Achillea millefolium L.		Yarrow
	Artemisia frigida Willd. + *Artemisia* spp.	Wiingushk / Wiingwushk	Sage
	Helianthus tuberosus L.	Ogishkiibwaak	Jerusalem artichoke
Balsaminaceae			Touch-me-not
	Impatiens capensis Meerb.	Wiimbushk	Spotted Touch-me-not
Betulaceae			Birch
	Betula papyrifera Marsh.	Wiigwasaatig	Paper Birch

	Corylus cornuta Marsh.	Pagaaniimizh	Beaked-hazelnut
	Ostrya virginiana (Mill.) K. Koch	Maananoos	Ironwood; Hop-Hornbeam
Cactaceae			Cactus
	Opuntia fragilis (Nutt.) Haw.	Aniimoziitens	Little Prickly Pear Cactus
Caprifoliaceae			Honeysuckle
	Viburnum trilobum Marsh.	Aniibiminaatig	Highbush Cranberry
Cornaceae			Dogwood
	Cornus canadensis L.	Shaashaagomin	Bunchberry
	Cornus sericea L. syn. *C. stolonifera* Michx.	Miskwabimag	Red Osier Dogwood
Cucurbitaceae			Gourd
	Cucurbita pepo L.	Agwisiimaan	Pumpkin, Squash
	Citrullus colocynthis (L.) Schrad.	Agwisiimaan	Watermelon
Ericaceae			Heath
	Gaultheria procumbens L.	Wiinsibagoon	Wintergreen; Teaberry
	Ledum groenlandicum Oeder	Mashkiigobagoon	Labrador Tea
	Vaccinium angustifolium Ait.	Miinaatig	Low-bush Blueberry ; Narrow-leaved Blueberry
		Makatemin	Black Blueberry
		Shaabwaatemiin	Transparent Blueberry
	Vaccinium myrtilloides Michx.	Pingomiinaatig	Velvetleaf Blueberry; High-bush Blueberry
	Vaccinium oxycoccos L.	Mashkiigomin	Bog Cranberry
Fagaceae			Oak
	Quercus macrocarpa Michx.	Miitigomish	Bur Oak
Grossulariaceae			Currant
	Ribes americanum Miller	Makominaatig	Wild Black Currant
	Ribes glandulosum Graver	Miishichiiminaatig	Skunk Currant
	Ribes lacustre (Pers.) Poiret.	Amikominaatig	Black Gooseberry / Bristly Black Currant
	Ribes hirtellum L. syn. *Ribes oxyacanthoides* L.	Ozhaabominaatig	Northern Gooseberry Plant; Bristly Wild Gooseberry Plant
Lamiaceae			Mint
	Mentha arvensis L.	Gaatecaasiing	Canada Mint
Nymphaeaceae			Pond Lily

	Nuphar variegatum Engelm. and *Nymphaea tetragona* Georgi.	Okiitebagoon	Small yellow pond-lily and White waterlily
Oleaceae			Olive
	Fraxinus nigra Marsh.	Agiimaatig	Black Ash
Pyrolaceae			Pyrola
	Chimaphila umbellata (L.) Bart.	Gaagigebagoon	Pince's-pine; Pipsissewa
	Pyrola sp.		Wintergreens
Ranunculaceae			
	Actaea rubra (Ait.) Willd.	Manitoominaatig	Red Baneberry
Rosaceae			Rose
	Amelanchier alnifolia (Nutt.) Nutt. ex M. Roemer. And *Amelanchier* sp.	Ozigwaakominaatig	Saskatoon Berry
	Crataegus coccinea L.	Minesiwaatig	Scarlet Hawthorn
	Fragaria vesca L. and *F. virginiana* Duchesne.	Oteiminabagoon	Woodland and Wild Strawberry
	Prunus nigra Ait.	Paagesanaatig	Canada Plum
	Prunus pensylvanica L.f.	Obweminaatig / Paweminaatig	Pincherry
	Prunus pumila L.	Nayngaaminaatig	Sandcherry Tree
	Prunus virginiana L. var. *virginiana*	Osisewayminaatig	Chokecherry Tree
	Rosa acicularis Lindley.	Oginiiwaabigwunaatig	Prickly Rose
	Rubus idaeus L. var. *strigosus* (Michx.) Maxim.	Miskoninaatig	Wild Red Raspberry
	Rubus pubescens Raf.	Oshkiizhigobagoon	Dewberry plant
	Sorbus decora (Sarg.) C.K. Schneid	Makwaminaatig	Showy Mountain Ash
Salicaceae			Willow
	Populus balsamifera L.	Maanizati	Black Poplar
	Populus tremuloides Michx.	Azaati	Trembling Aspen
	Salix bebbiana Sarg. + *Salix* sp.	Wiigob	Bebb Willow + Willows
Solanaceae			Potato or Nightshade
	Lycopersicon esculentum Miller	Oginii	Tomato
	Solanum tuberosum L.	Opin	Potato
Ulmaceae			Elm
	Ulmus americana L.	Aniib	American Elm
Urticaceae			Stinging Nettle
	Urtica dioica L.	Mazaanishk	Stinging Nettle
Liliopsida			Monocotyledons
Acoraceae			Sweet Flag

	Acorus americanus (Raf.) Raf.	Wiike	Sweet Flag
Cyperaceae			Sedge
	Carex aquatilis Wahl.	Nabaagshkoon	Water Sedge
	Schoenoplectus acutus (Muhl. ex Bigelow) A. + D. Löve	Gitchegaamewashcon	Great Bulrush
Liliaceae			Lily
	Allium stellatum Fraser	Shiigaagomizh	Pink-flowered Onion
	Clintonia borealis (Ait.) Raf.	Manitoominaatig	Blue-bead Lily
Orchidaceae			Orchid
	Cypripedium spp.		Lady's Slippers
Poaceae			Grass
	Hierochloe odorata (L.) Beauv.	Mushkosii Wiingushk	Sweet Grass
	Hordeum jubatum L.	Aajitaamowaano	Foxtail Barley
	Zea mays L.	Maandamin	Corn
	Zizania aquatica L.	Maanomin	Wild Rice
Typhaceae			Cattail
	Typha latifolia L.	Obiiweshkgaanag	Cattail

Note: Scientific Taxonomy and Nomenclature follows treatment by Marles (2000) where possible. If plant not included in Marles (2000) then Farrar (1995), Soper and Heimburger (1982), Newmaster (1998) or Gleason and Cronquist (1991) followed in the preceding order.

Appendix VII-2

List of Information Records for Plants Recorded during Field Research.

Kingdom Division Class Family	Latin Binomial	Voucher Record	Data Form Record	Photo Record	Interview Record V = Video A = Audio	Elder Original Interview / Verification
Fungus Kingdom			67			WR/WR,EG
Ascomycota						
Basidiomycota						
Coriolaceae						
Hymenochaetaceae						
	Inonotus obliquus (Ach. ex Pers.) Pil.					
Lycoperdaceae						/WR,EG
Plantae						
Bryophyta			74			WR,EG/WR,EG
Dicranaceae						
Hylocomiaceae, Hypnaceae, Brachytheciaceae						
Sphagnaceae						
	Sphagnum spp.		74	01-167, 194, 203, 206		RG,EG,DG,WR/ EG,WR
Polypodiophyta			64			/WR,EG
Aspleniaceae						
	Woodsia ilvensis (L.) R. Br.		62	00-124, 00-125		WR/WR,EG
Dryopteridaceae						WR/WR,EG
	Matteuccia struthiopteris (L.) Todaro.	132	63	01-387		
Polypodiaceae						
	Polypodium virginianum L.		65	01-126		EG/WR,EG
Pinophyta						
Cupressaceae						
	Juniperus communis L.	2, 178	8, 9		V001/03 28-	DG,RG/WR,EG
	Thuja occidentalis L.	275	7	00-100, 01-T167, 01-01-T197	A00-03 T#2 4-5	WR/WR,EG

				01-T197	A00-03 T#2 27	
Pinaceae						
	Abies balsamea (L.) P. Mill.	3	5	00-T10, 00-T48, 01-T107, 01-T122, 01-T190	V001/01 23- A00-03 T#2 25-36, 36-44	DG/WR,EG
	Larix laricina (Du Roi) K. Koch		6		A00-03 T#2 17-, 44-56	WR/WR,EG
	Picea glauca (Moench) Voss		3, 4			
	Picea mariana (Mill.) BSP	6, 9, 96, 117	3, 4	00-T33-35, 00-T67, 00-T70, 00-T82, 00-T148, 00-106-111, 00-124, 01-200-204	V001/01 23- V001/03 10- A00-03 T#2 25-36	DG/WR,EG
	Pinus banksiana Lamb.		2	00-T5, 00-T6, 00-T24, 00-T25, 00-T26, 00-T59, 00-T70, 00-T75, 00-T82, 01-424, 01-426, 01-427, 01-445	V001/04 30- V001/04 53-	WR/WR,EG
	Pinus strobus L.	198	1	00-12S, 00-14S, 00-T84-86, 01-T129, 133, 191, 193, 204, 207, 219, 228	V001/06 62-54	DG/WR,EG
	Pinus resinosa Ait.		13			/WR,EG
Taxaceae						
	Taxus canadensis Marsh.		38	00-103		WR/WR
Magnoliophyta						
Magnoliopsida						
Aceraceae			69	01-375, 382, 386, 388, 389, 394, 396, 397	V002/01	SM/WR,EG
	Acer negundo L.					
Anacardiaceae						
	Rhus radicans L.		41	01-T182	A00-01 T#2 12-13	WR/WR,EG
Apiaceae						
	Cicuta maculata L.		49		V001/04 50-30	WR,DG/WR,EG
	Osmorhiza longistylis (Torr.) DC.	68, 212	70	01-401-412		JR/WR,EG
Araliaceae						

	Aralia nudicaulis L.	23, 50, 202	42	00-111, 01-T130		WR/WR,EG
Aristolochiaceae						
	Asarum canadense L.	140, 218	61	00-33, 00-36, 01-397, 01-401, 01-403, 01-T175, 01-T176		WR,JR/WR,EG
Asteraceae						
	Achillea millefolium L.	228	46	01-T216, 01-T236		WR
	Artemisia frigida Willd. + *Artemisia* spp.	126, 127, 130	51	00-54, 55, 57-59, 64, 65	V001/04 53-50	WR,DG/WR,EG
	Helianthus tuberosus L.	47, 48, 125, 131	50	00-49, 00-75, 00-76	V001/04 50-30 A00-03 T#2 0-10	WR/WR,EG
Balsaminaceae						
	Impatiens capensis Meerb.		68	00-45, 46	V001/06 47-39	EG/WR,EG
Betulaceae						
	Betula papyrifera Marsh.	263	14	00-06S, 13S, 15S, 17S, 18S, 20S, 25-27, 79-81, 115-118, 120, 121, 131, 01-132, 133, 190, 193, 245, 250-257, 297-344, 359-362, 437, 00-T1, 2, 7, 9, 12, 25, 26, 28, 29, 33, 34, 35, 39-41, 46, 01-T104-106, 112, 125, 132, 140, 170, 198, 228, 252, 266, 271-277, 279-287	V001/01 23-0	DG/WR,EG
	Corylus cornuta Marsh.	241	18	01-193	A00-01 T#2 5-6	WR,JR,DG,EG/ WR,EG
	Ostrya virginiana (Mill.) K. Koch	59	16	00-02S, 00-19S		WR/WR,EG
Cactaceae						
	Opuntia fragilis (Nutt.) Haw.		57	00-61	V001/04 50-30	DG,WR/WR,EG
Caprifoliaceae						
	Viburnum trilobum Marsh.		25	00-128, 00-129		RG/WR,EG
Cornaceae						
	Cornus canadensis L.	17, 122	56	00-148, 01-185		/WR,EG
	Cornus sericea L. syn. *C. stolonifera*		15			EG/WR,EG

	Michx.					
Cucurbitaceae						
	Cucurbita pepo L.		75			/WR,EG
	Citrullus colocynthis (L.) Schrad.		75			/WR,EG
Ericaceae						
	Gaultheria procumbens L.	1, 121	39	00-T076, 01-T260	V001/04 28- V001/03 28-10	RG,WR/WR,EG
	Ledum groenlandicum Oeder	225	43	00-62, 01-200, 01-202	V001/03 11 A00-01 T#2 12-13	WR/WR,EG
	Vaccinium angustifolium Ait.		27	00-T101, 01-T113, 203, 256, 257, 258	V001/06 62-54 V001/02 60-41 V001/03 28-10	DG,RG,WR,EG/ WR,EG
				00-110, 01-145, 151, 152, 153, 154, 171, 172, 173-184, 242, 243, 438-446		
	Vaccinium myrtilloides Michx.	159	27			DG,RG,WR,EG/ WR,EG
	Vaccinium oxycoccos L.	92	55	00-T37, 00-T38		WR
Fagaceae						
	Quercus macrocarpa Michx.	180	17	00-05S, 01-T140, 01-T145, 01-T148, 01-T149, 01-T183, 01-157, 01-158, 01-241, 01-248, 01-249, 01-294, 01-384, 01-390, 01-395	V001/01 23- V001/04 50-30	DG/WR,EG
Grossulariaceae						
	Ribes americanum Miller	147	33, 35	00-T87	V001/04 50-30	EG/WR,EG
	Ribes glandulosum Graver	29, 169	34	00-42, 01-207, 01-208		WR/WR,EG
	Ribes lacustre (Pers.) Poiret.		32		A00-01 T#2 8-9	WR/WR,EG
	Ribes hirtellum L. syn. *Ribes oxyacanthoides* L.	45, 164, 188, 254	31	00-T089		WR/WR,EG
Lamiaceae						
	Mentha arvensis L.	90, 93,102	48			WR/WR,EG
Nymphaeaceae						

	Nuphar variegatum Engelm. and *Nymphaea tetragona* Georgi.		44	00-70, 01-398, 01-399, 01, 400,	V001/04 50-30	JR,WR,DG/WR, EG
Oleaceae						
	Fraxinus nigra Marsh.		12	00-T045, 00-T046, 00-119, 00-121, 00-122, 00-123, 01-T167, 01-T178, 01-T190, 01-T191	V001/01 23-	DG/WR, EG
Pyrolaceae						
	Chimaphila umbellata (L.) Bart.	43, 272	40	01-T245	A00-01 T#2 14-15	WR/WR,EG
	Pyrola spp.					EG/WR,EG
Ranunculaceae						
	Actaea rubra (Ait.) Willd.	64, 142	36	00-44		WR,EG/WR,EG
Rosaceae						
	Amelanchier alnifolia (Nutt.) Nutt. ex M. Roemer and *Amelanchier* sp.	168, 281	24		V001/01 23-0	DG/WR,EG
	Crataegus coccinea L.	134	20		V001/01 23- V001/04 50-30	DG/WR,EG
	Fragaria vesca L. and *F. virginiana* Duchesne	245	28	01-T213, 01-T239	A00-01 T#2 5-6	WR/WR,EG
	Prunus nigra Ait.		19		A00-01 T#2 5-6	WR/WR,EG
	Prunus pensylvanica L.	42	23	01-295, 01-296		WR,EG/WR,EG
	Prunus pumila L.	128	26	00-66, 00-67	V001/04 59-53	WR,DG/WR,EG
	Prunus virginiana L. var. *virginiana*	52	22	00-52,		DG/WR,EG
	Rosa acicularis Lindley.		58			WR,EG/WR,EG
	Rubus idaeus L. var. *strigosus* (Michx.) Maxim.	44, 226	30	01-T248		WR/WR,EG
	Rubus pubescens Raf.	48, 52, 210, 274	29	00-04S, 00-T100, 01, T165		WR/WR,EG
	Sorbus decora (Sarg.) C.K. Schneid	41,80	21	00-50, 00-51, 00-T10, 00-T89, 00-T91	A00-01 T#2 10-11 V001/01 23-0	WR/WR,EG
Salicaceae						
	Populus balsamifera L.		11		V001/01 23-	DG/WR,EG
	Populus tremuloides Michx.		11	00-T002, 01-T131, 01-T159, 01-T161, 01-T171, 01-T200	V001/01 23-	DG/WR,EG

	Salix bebbiana Sarg. + *Salix* spp.	28, 86, 115, 118, 203	15	00-T063, 01-T242	V001/01 23-	DG/WR,EG
Solanaceae						
	Lycopersicon esculentum Miller		78			/WR,EG
	Solanum tuberosum L.		77			/WR,EG
Ulmaceae						
	Ulmus americana L.		10			WR / WR, EG
Urticaceae						
	Urtica dioica L.		45	00-73, 01-430, 01-431		WR/WR,EG
Liliopsida						
Acoraceae						
	Acorus americanus (Raf.) Raf.	141	60	00-28-35, 01-413-421		EG,JR/WR,EG
Cyperaceae						
	Carex aquatilis Wahl.		71			EG/WR,EG
	Schoenoplectus acutus (Muhl. ex Bigelow) A. + D. Löve		73	01-197		EG/WR,EG
Liliaceae						
	Allium stellatum Fraser	135, 69	50	00-71, 00-72, 01-209, 01-210, 01-211, 00-T20, 00-T21	V001/04 50-30	DG/WR,EG
	Clintonia borealis (Ait.)Raf.	223	37	00-41, 42, 106	V001/04 22-	EG/WR,EG
Orchidaceae						
	Cypripedium spp.		47			/WR,EG
Poaceae						
	Hierochloe odorata (L.) Beauv.					WR, EG
	Hordeum jubatum L.					/EG
	Zea mays L.		76			/WR,EG
	Zizania aquatica L.		59	00-69, 01-285, 01-286, 01-287, 01-288,01-292		WR,DG/WR,EG
Typhaceae						
	Typha latifolia L.		72	01-196-197, 01-212	V001/02 60-41	RG/WR,EG

Note: Scientific Taxonomy and Nomenclature follows treatment by Marles (2000) where possible. If plant not included in Marles (2000) then Farrar (1995), Soper and Heimburger (1982), Newmaster (1998) or Gleason and Cronquist (1991) followed in the preceding order.