

**Building Knowledge about Variability in the
Abundance and Distribution of Natural Resources:
A Case Study on Berry Harvesting from Northern Canada**

Brenda Parlee^{*}, Fikret Berkes^{*} and the Teetl'it Gwich'in Renewable Resources Council^{**}

^{*}Natural Resources Institute, University of Manitoba 70 Dysart Rd.
Winnipeg, MB, R3T2N2
parleeb@shaw.ca
berkes@ms.umanitoba.ca

^{**}Teetl'it Gwich'in Band Box 35 Fort McPherson, NT X0E 0J0
Box 78 Teetl'it Gwich'in Band Office, X0E 0J0

Abstract:

Local and traditional knowledge is disappearing at an alarming rate, however, there are examples in many parts of the world, including northern Canada, where new knowledge is being created. This case study on berry harvesting provides valuable insight into how knowledge is generated; specifically knowledge about variability in the abundance and distribution of a common pool resource. Knowledge is created when observations about changes are interpreted and shared from year to year within a family group, the community or across the region. When this knowledge is shared and interpreted over many generations, traditional knowledge is generated. It is argued that the success of berry harvesting in any given year, is dependent upon feedback between what is observed and interpreted and the decisions women make about where, when and with whom to harvest.

Keywords: adaptive management, traditional ecological knowledge, Dene, Teetl'it Gwich'in, cranberry, blueberry, cloudberry

1. Introduction

Understanding and dealing with ecological change are interconnected aspects of sustainable resource management. The dynamic interactions between knowledge building on the one hand and decision-making on the other, provides human beings with the capacity to deal with a range of complex systems problems (Johnson 1999; Berkes et al. 2000a; Berkes et al. 2003; Davidson-

Hunt and Berkes 2003). Among these problems is variability in the abundance and distribution of commons resources.

Resource abundance and distribution is a question most often dealt with by ecologists and ethnobiologists; how plants, animals and other biophysical elements manifest themselves and behave across spatial and temporal scales has been the basis for significant theoretical and empirical research. For many indigenous peoples, including Dene in the sub-arctic, dealing with variability in the abundance and distribution of species such as caribou and berries is part of a way of life (Smith 1998b; Parlee et al. 2004b). Successful harvesting, of such resources and the continued way of life of Dene people can be attributed in part to sophisticated systems of knowledge generation.

Knowledge generation has many faces. In the western academic tradition, it involves disciplinary hypothesis testing and peer review; for others, knowledge building is part of an intuitive or spiritual process that connects individuals with their families and the land around them (Ridington 1990; Smith 1998a). At a basic level, knowledge building can be defined as a process of empirical observation and individual and collective interpretation (Levi-Strauss 1962; Roots 1998). This process of knowledge building is not, however, a linear process; it is dependent upon constant feedbacks between what is observed and what is interpreted at different temporal and spatial scales (Levin 1992). Shared within a cultural group, individual observations and interpretations become embedded in social memory and over time, become the basis of traditional ecological knowledge.

Rules of use or institutions of knowledge building provide the framework in which individuals and groups of individuals operate; these rules in effect legitimize the individuals and processes by which observations and interpretations are made. Among indigenous societies, such rules of use may define who is an elder or an expert about a given area or a resource, as well as the criteria by which one develops this expertise (Berkes et al. 2003; Davidson-Hunt and Berkes 2003). These institutions also provide the guide by which systematic observation and interpretation and sharing of information - or monitoring – takes place. For example, the traditional ecological knowledge of the *Denesoline* guide caribou hunters in identifying

important signs and signals of population, body condition, as well as bifurcation points on the landscape which affect herd movements, however, it is their seasonal observations and interpretations of change in these indicators that enables them to deal with seasonal variation. (Parlee et al. 2004 (Forthcoming)).

Rules for knowledge generation do not, however, operate in a vacuum; they are interconnected together with other institutions related to resource use. Of particular interest are the interconnections between institutions of knowledge generation and those governing the harvesting of common pool resources.

A common-pool resource (CPR) is defined as “a natural or man-made resource system that is sufficiently large as to make it costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from its use” (Ostrom 1992; Ostrom and Dolsak 2003). Such resources tend not to be easily privatized or divisible into commodities over time and space; as such they require collective decision-making, cooperation and agreed upon rules of use (Berkes 1986, 1995). While some researchers have suggested that the sustainability of common-pool resources and the societies that depend on them to survive is attributable to the super-abundance of these resources (Hardin 1968), there is a growing body of literature which suggests that valued common-pool resources have been sustained over many generations as a result of common property institutions (Evans-Pritchard 1953; Berkes et al. 1989; McCay and Acheson 1989; Berkes 1995; Gadgil et al. 1998; Eerkens 1999; Ostrom and Dolsak 2003).

Although there has been limited research into how these institutions developed, much can be gleaned from the literature on human territoriality (Dyson-Hudson and Smith 1978).

Territoriality among hunter-gather societies is manifested in different rules of exclusion that limit unsustainable resource use. These rules may be viewed a long a continuum ranging from exclusive individual ownership to free-for-all systems of no ownership. Somewhere in between these two extremes are common-property institutions which enable multiple individuals or groups to benefit from the use of a finite resource (Berkes 1989; Eerkens 1999). Common property institutions are recognized as being both resource and culturally-specific; rules in use that are developed by Maori in New Zealand for managing coastal fisheries are somewhat

different than those related to the Cree fishery; rules around Gwich'in berry and medicinal plant harvesting will be different again.

Much interest in common property resource management is built around concepts of optimal foraging and the potential tragedy of the commons (Hardin 1968). In the case of fisheries, optimal foraging means maximizing catch rates while still allowing for the replenishment of the population (Berkes 1986; Guest 2003); optimal foraging in the case of berries is a much more simple equation in that productivity the species, is not negatively correlated with over-harvesting. In fact, the opposite may in fact be true; lack of harvesting activity can lead to under-productivity, particularly for blueberries.

The effectiveness of common property institutions differs depending on the social, cultural and ecological context. "Use of commons for long-term sustainable yields is relatively more likely in the case of people living in small groups with tight communal control over the resource base and over the resource base and social behaviour" (Berkes 1989). Resource abundance and distribution of the resources is recognized as an important determining factor in the rules of use that develop:

In general increased average density of critical resources makes a territorial system more economically defensible thus reducing defense costs. However, density of resources within a patch, combined with a high degree of unpredictability reduces the economic advantage of territoriality (Dyson-Hudson and Smith 1978).

While significant research has followed on this connection between resource abundance and distribution and the social organization of hunter-gather societies, there has been relatively limited focus on ecological variability and its implications for commons management.

This paper describes the interconnections between ecological variability and commons resource management. As a first step, the paper describes some of key ecological elements and processes that Gwich'in women monitor or "check" to understand and deal with variability in the abundance and distribution of cloudbberries, blueberries and cranberries. The women describe this as 'watching over the berries to be healthy' or in Teetl'it Gwich'in - *Srii tri'i gwineendaii eenjit jak k'andehtr'inahtii*.

3. Methodology

Our research on knowledge of ecological variability and Teetl'it Gwich'in berry harvesting practices was part of a larger study aimed at documenting local and traditional knowledge about non-timber forest resources in the Gwich'in Settlement Region. The research was conducted according to a collaborative ethnographic methodology; all research activities were carried out under the guidance of three Gwich'in organizations - the Gwich'in Renewable Resources Board, the Gwich'in Social and Cultural Institute and the Teetl'it Gwich'in Renewable Resources Council.

Traditional ecological knowledge, more specifically Teetl'it Gwich'in knowledge about ecological variability, was documented through four interrelated methods. First, a series of open-ended semi-directed interviews were carried out with elder Teetl'it Gwich'in women in the community of Fort McPherson. Through this process, the researchers were able to understand more about the life histories and experiences of individual harvesters with respect to berry harvesting. Themes and issues related to berry harvesting practices and the ecological factors affecting the abundance and distribution of cranberries, cloudbberries and blueberries were identified; these themes became the basis for a series of semi-directed interviews (See Table 1). These semi-directed interviews were carried out in June-August 2003 with 45 women and others identified as berry harvesters including women and men from ages 16-85. An additional series of interviews related to access and information sharing rules related to berry harvesting were carried out to better understand this

A participatory mapping workshop was held in June 2003; mapping of approximately 70 key harvesting areas was done at both a 1:50 000 and 1:250 000 scales by 35 community members. The mapping provided insight into the spatial distribution of berry patches relative to other landscape features and culturally significant sites such as cabins and historical including the best locations for picking cranberries, blueberries and cloudberries.

4. Gwich'in Study Area and Ethnography

4.1 Teetl'it Gwich'in

The Teetl'it Gwich'in (Dene), historically known as Loucheux, are one of ten Gwich'in groups that live in current day Alaska, Yukon and the Northwest Territories (Heime et al. 2001). Since the 1950s, the Teetl'it Gwich'in have lived in a permanent settlement at Fort McPherson; traditionally they are known as the 'people of upper Peel watershed'. Like other Dene groups in the Canadian sub-arctic, the Teetl'it Gwich'in way of life is fundamentally interconnected with the seasonal availability of natural resources including caribou, fish and berries.

The importance of berries and boreal forest plants to northern Dene groups has been well documented in the ethnobiology and ethnobotany literature (Turner and Davis 1993; Marles 2000). Dene use of berries and medicinal plants was documented as early as the 1800s by Mackenzie (1801), however, little research had been done on the value of this species to the Gwich'in until recently (Andre and Fehr 2001; Murray and Boxall 2002). The most detailed ethnographic account of the Teetl'it Gwich'in was published by Slobodin (1962) who lived with several Teetl'it Gwich'in trappers and their families in 1938-39. Much can be learned about the social organization of the Teetl'it Gwich'in from his work, in particular the importance of extended family groups. Slobodin (1964) also had this to say about wealth ranking and the accumulation of property:

Although the rudiments of social stratification are reported by Peel River and other Kutchin, for pre-contact Yukon Kutchin and Han, they do not appear to have existed in Peel River society. Rather there was, and is ranking in terms of gradation in wealth. The accumulation of property and its distribution in potlatches, feasts, and aid to the less fortunate are involved, but other achievements

and also certain no-acquisitive qualities are prerequisite to high rank. To achieve high rank, a person must display certain “hard” qualities: shrewdness, willingness, and a touch of ruthlessness; and also “soft” qualities: generosity and a concern for the common wealth...the mere possession of property without these qualities does not win high rank. (1964: 45)

Slobodin’s (1964) work provides insight into the lack of emphasis place on individual property in traditional Teetl’it Gwich’in society, however, his work provides little detail about the role of women, nor about the social organization associated with harvesting berries and other plants. Nelson (1986) published research on the Alaskan Kutchin (Gwich’in) suggests that berries and plants, other than spruce, willow and birch, may never have been important to the Gwich’in; he cites McKennan (1965) and his work with the Chandalar Gwich’in. However, anthropologists of that period may have been too quick to disregard the work of women in that society (Kritsch 2002). Turner and Davis (1993) for example, suggest that berries and other edible plants were critical to the diet of many Aboriginal communities in Northwestern Canada, particularly when other resources were scarce. While the nutritional value of these plants may account for only 5% of the total traditional diet of the Dene (Kuhnlein and Turner 1991), the activity of berry harvesting is an important social and cultural activity for many Dene women with many complex social, cultural and ecological dimensions. (Parlee et al. 2004a).

5. Results

5.1 A System of Knowledge Generation: Observation and Interpreting Variability in the Abundance and Distribution of Berries

The Teetl’it Gwich’in have an understanding of their environment that reflects many generations of living on the land; a key aspect of this knowledge relates to understanding and dealing with ecological variability. Teetl’it Gwich’in knowledge about variability in the abundance and distribution of berries and other plant species was the focus of the current study.

Many different species of berries and medicinal plants are harvested by the Teetl’it Gwich’in (Table 3). The species most commonly harvested are the cranberry (*Vaccinium vitis-idaea*), blueberry (*Vaccinium uliginosum*) and cloudberry (*Rubus chamaemorus*). Gwich’in women

identified these species as having important medicinal and nutritional value (Parlee et al. 2004); individual interest, physical health benefits, and social interaction, cultural continuity and spiritual connectedness to the land are some of the factors that compel Gwich'in women to harvest significant stores of berries each year. The current research estimated harvest yield of cranberries, blueberries and cloudbberries at 4000 litres / year, however this calculation may be conservative; previous research estimated the harvest yield of berries by the Teetl'it work at over 10 000 litres / year (Murray and Boxall, 2000). This yield of berries is not static; the areas where women harvest and the actual yield of berries harvested varies each year in response to a host of social and ecological factors (Parlee et al 2004).

The results of the study suggest that the Teetl'it Gwich'in have developed a body of knowledge about the abundance and distribution of berries that extends over 400 km². As a foundation, harvesters hold traditional knowledge about their environment that has been passed on from their mothers, grandmothers and great grandmothers. Many of the women interviewed said that they pick berries where their grandmothers or mothers used to pick; some people have been picking blueberries and cranberries in the same patches for more than three generations.

My grandmother used to pick berries a way up the Peel. She always used this place because of her grandmother. The trail to that place is worn into the ground. These places, you really have to walk a long ways to get there but it is worth it. (Meeting - AV 02 20 03)

This traditional knowledge is not considered to be historical but continues to develop each season through observation and interpretation. While some harvesters go out and check on their berry patches in early spring and summer, the vast majority of observations and interpretations are made during the harvesting season (July – September) around the community of Fort McPherson - along the edges of the Peel River and Dempster Highway from the Yukon border to Tsiigehtchic (Fig. 1). Observations and interpretations made by friends and relatives as far way as Aklavik and Inuvik and Dawson City, Whitehorse and Old Crow in the Yukon are also shared with the Teetl'it Gwich'in from time to time consequently extending the geographical scope of their knowledge about seasonal abundance and distribution.

Empirical observation is arguably the foundation of this knowledge building process; observations are not made arbitrarily however, but are tied to indicators of abundance and distribution. While some of these indicators, such as those associated with human disturbance (e.g. seismic lines) may have developed in recent years (since 1950s), other indicators related to natural ecological cycles, patterns and or events are conceivably generations old. Results revealed indicators at three interrelated ecological scales.: cycles in the productivity of specific species, landscape and microclimate patterns in habitat and cycles and events at an ecological scale. Seasonal monitoring or ‘checking’ of these indicators enable Teetl’it Gwich’in women to understand and deal variability in their harvesting of this valued resource.

5.1.1 Knowledge of Species-Specific Characteristics and Cycles

Many of the indicators used by the Gwich’in for understanding and dealing with variability in the abundance and distribution of berries are species-specific. Natural seasonal availability is a fundamental consideration in the Gwich’in region; the short summer season associated with the northern latitude severely limits growth and productivity when compared to more southern climates. Within this short season, harvesters watch for well-known signs of flowering, berry growth and ripening to identify when each species will be ready; cloudberry are predictably available in mid July, followed by blueberries in late July and cranberries in mid August.

Density and productivity cycles for each species are also key factors in where and in what years to harvest. Blueberries and cranberries are known to grow in relatively dense patches which increases the potential daily harvest yield of each harvester. Such density also limits the need for harvesters to “run around”, as described by Gladys Alexie, as is the case with the individual cloudberry plants or stems which tend to be scattered across the landscape. Natural productivity cycles for these species is also recognized as a factor. Although there are sometimes many cloudberry plants including plants with blossoms, they do not necessarily produce berries. According to several harvesters, there is a 5- 7 year productivity cycle. Harvesters were not aware of any productivity cycle for cranberries; patches that develop will tend to last for many generations. While there may be a physiological cycle associated with blueberries, harvesters generally talked about the rise and fall of blueberry patch productivity as related to habitat factors, particularly succession of invasive willow.

5.1.2 Knowledge of Landscape and Habitat Patterns

Landscape patterns and cycles are also key considerations in Gwich'in harvesting of these three species. Cloudberry are commonly harvested in alpine areas along the Dempster Highway and along the Peel River in the Richardson and Ogilvie Mountains (Fig. 1); the best cloudberry, according to harvesters, are to be found in the wet areas (valleys) where there are small trees or black spruce. Blueberry are also commonly harvested along the Dempster Highway; the best patches however, were seen to be those at the edges of bogs or other disturbed areas such as roads or seismic lines. The most cranberry patches were identified in the delta region, north of Fort McPherson and were associated with larger trees (white spruce) and fishing camps such as those along Rat River.

Habitat succession is recognized as a key factor in the abundance and distribution of cloudberry and blueberry. Both species are associated with the early stages of succession or alpine open areas when other species, such as willow or spruce don't grow more than 3 or four feet high. Harvesters were most conscious of the vulnerability of blueberry patches to succession describing how invasive willows tend to take over if the harvesters are not careful to clear away the brush each season. Competing species of willow are not a concern in the case of cranberry; good patches of cranberry only become established in the later stages of succession long after willow have been out-competed by white spruce and birch.

5.1.3 Knowledge of Large – Scale Ecological Change

The abundance and distribution of all three berries also varies significantly across the Gwich'in region, as a result of external factors; the most significant factor being the weather. According to harvesters, "the weather is the main thing that affects the berries." (Bertha Francis 02 20 03).

Ideal weather conditions for berry harvesting begins with a heavy snowfall before December and constant cold temperatures throughout winter to maintain snow cover. A slow warming in spring allowing for good drainage of melting snow into the ground is also important according to harvesters; if it gets warm too quickly, the water runs away. Rain in spring and summer is also important and warm temperatures between 10 °C and 25 °C are key for the berries to grow. "If it is too hot or too cold, the berries will not grow" (EC 06 04 03).

Extreme weather events are a recent concern to many harvesters; late frosts or cold temperatures in spring, extremely hot temperatures in summer and drought are events occurring in the last five years that have severely affect these species, particularly the cloudberry. Cloudberries are “soft” according to harvesters – which makes them more susceptible to extremes than the heartier or “hard” cranberry. Harvest yield in 2002 and 2003 can be used as an indication of how extreme weather events contribute to variability in the abundance and distribution of berries in the Gwich’in region. According to harvesters, 2003 was an extremely good year for picking berries; there was sufficient snowfall and moisture in the spring and warmer temperatures in the summer to produce many berries of a good size. Berry picking in 1998 and 1999 was very good also (RF, 10 15 03). In 2002, however, a late frost and a very hot dry summer resulted in virtually no berries across the region as a result of many extreme weather events. Although women have witnessed significant variability, 2002 was said to be an extremely bad year.

Fire is not a process that Gwich’in associate with good berry harvesting. Forest fires are largely considered to be destructive events because of the long period of time it takes for the land and plants to regenerate. “Once there has been a fire, we no longer go there” according to harvesters, “it takes a very long time for the berries to come back”. For example, areas along the Peel River that were affected by wild fires between 10 and 20 years ago, are still sparse of new vegetation and appear to have been “dried out”.

Spring flooding is a process in the Gwich’in region that affects berry harvesting. Flooding, which raises the water levels of all the small ponds creeks and rivers in the region is good for the berries because it raises the moisture levels as well as feeds nutrients to areas that are otherwise “dried out”. Extreme flooding of the Peel River, which occurs on a 25-year cycle can, however, be destructive. Berry patches, cabin sites and other culturally important sites have been eroded by ice jams, washed away by high water, or be covered by mud and debris.

Anthropogenic change or development represents another aspect of variability in the abundance and distribution of berry patches in the Gwich’in region. Linear disturbances including roads and seismic lines have significantly affected harvesting practices. While there are some concerns about dust, contaminants and hidden fuel spills, harvesting of blueberries and

cloudberries off the Dempster Highway is common practice among the vast majority of Gwich'in women; blueberry picking is also common on old seismic lines. Some women are opposed to picking berries off the road and seismic lines, preferring to boat up or down the Peel River and hike to patches in the mountains.

This knowledge about ecological variability is fundamental to the success of Teetl'it Gwich'in in resource harvesting; while a strong foundation of traditional knowledge guide the women in identifying key ecological elements and processes, that knowledge continues to develop every year as harvesters 'check' their berry patches - making empirical observations and interpretations about species characteristics and cycles, landscape patterns and ecological processes.

5.2 Rules in Use for Berry Harvesting in the Gwich'in Region

Each year, Teetl'it Gwich'in women from Fort McPherson engage in harvesting of cloudberries, blueberries and cranberries; successful harvesting however, is dependent on their capacity to understand deal with variability in the abundance and distribution of those species.

Over time, harvester observations and interpretations about ecological variability become embedded in the social memory of the community providing a diachronic foundation on which to make decisions. Such knowledge is not, however, created in a vacuum; rules related to resource access, information sharing and harvest sharing guide harvesters in their seasonal harvesting activities; conversely knowledge about ecological variability informs how these rules are applied under different harvest conditions (Tables x).

5.2.1 Property Rights for Resource Access

Rules that limit or determine who has access to good areas for berry picking have developed in man parts of the Gwich'in region. However, rules that have developed for cranberry patches are distinct from those in place for blueberries and cloudberries.

Extended family ownership regimes have developed around cranberry patches, particularly cranberry patches near cabin sites in the Peel River delta and along Rat River. In the case of cloudberries, few access rules appear to be in use; areas along the Dempster highway are

considered 'open' to anyone interested in picking there. Blueberry patches along the roads near the community are also considered to be open access, however, access to blueberry patches near cabins along the Peel River is more limited to extended family groups. As described by harvesters, "you can only go those areas if you are invited".

When comparing these access rules to the nature of the resource, there appears to be significant correspondence between the ecological predictability of the species (i.e. density / heartiness) and whether patches are considered to have property value. For example, there are more property rights associated with cranberries, which are the most densely distributed and heartiest of the three berries, than cloudberries, which are unpredictable by comparison. Blueberry patches are somewhat more predictable than cloudberries, however, given the susceptibility of patches to the succession of willow, they are considered to be somewhat unpredictable over time.

Access rules undoubtedly developed to limit the number of people who could harvest in one area, thereby increasing potential optimal yields for each individual harvester. Access rules may also have developed to ensure good stewardship of the patches and the surrounding environment including cultural sites, such as cabins, fishing. Blueberries, which tend to proliferate in disturbed sites, cut lines, or areas eroded by marshes, are described as needing the most care. Those who use the areas often need to cut back willows and other brush in order to maintain trails and limit competition, otherwise, as described by Ernest Vittrkewa, "the willows just take over".

5.2.2 Rules related to Sharing Information

Knowledge about berry patches that the locations of many berry patches has been passed on through shared experience. Women remember going to pick berries with the grandmother, or mother. "We always pick up there because of our Mom; we have been picking there our whole lives (Alice and Shirley Vittrkewa, Oct. 15, 2003). In order to ensure they have enough berries, harvesters will first visit places where they know there have been berries before; if conditions are poor in this local area, harvesters will rely on information and communication with other family members and friends in the community or in other parts of the region. Specific observations about conditions from year to year, and from patch to patch are generally communicated

informally between family and friends. It is generally the younger women who are sent out to check where the berries are “good” before older, less mobile women venture out on the land.

I find out from other people if the berries are good! I ask, Christine, “how’s it growing”? When we women go for berries, they usually say, the “berries are good” or “there’s lots”. If they say, “there is not much”, no one bothers to go out there (Elizabeth Colin, July 4, 2003)

Informal and opportunistic communication among and between family groups and friends is one of the main ways information is shared; it is also highly effective and efficient. In some cases, word of mouth communication about a “great” berry patches can turn a party of three women and two children into a party of over 20 women and children less than an hour later (Fig. 2).

The urgent arrival of so many women in one harvesting location largely a phenomenon associated with blueberry patches; “you have to get there before the bears do”. In other cases, berries have to be picked quickly due to unpredictable weather, such as that in 2002.

Blueberries – I went a long way for nothing. I found lots of blueberries [it one spot where she was looking for cloudberry]. I found lots of blueberries but it was damp and it was getting late so I left it thinking that I was going to come back to it – to pick because to me it was too good... then the next day, it started raining. I think it rained for a couple of days; do you remember? After that I went back and all the berries were gone. They had dropped in the rain. Rain and a bit of snow made them drop early; the rain plus the heat that we had. So it [the blueberries] was only in certain places – shaded where I found cloudberry and blueberries but that’s what happened (May Andre, April 7, 2003)

These information networks are key to ensuring that women are able to find berries, particularly in poor years such as 2002.

Rat River was the only place there were berries last year. I picked up there for a while. I wanted to go back but I did not have time. I knew I would not have time so I called my daughter (on the two-way radio) and told her – “Go check over there by Rat River for berries”. I told her the

exact place. So we went over there and she got so many berries – bags and bags of cranberries. (Bertha Francis, June 2003)

Similar rules have developed around transportation. Although some people walk to picking areas near the community, most people rely on one member of their group to have a truck or boat to drive them to places further a field. Elder Elizabeth Colin explains some the history of transportation with respect to berry picking as well as her strategies for “getting rides” today.

I like going for berries. But when you don't have a vehicle to go any place, its very hard. Sometimes a bunch of us get together and we get gas money and we ask someone to take us for berries out on the highway but there are also some berry patches along the Peel River and up the Peel and down the Peel too. We don't go for berries much by boat anymore....when I was small, we didn't even have a kicker [a boat with outboard motor]. All I remember is that when we had to go somewhere we had to paddle... we paddled and we didn't think anything of it – to paddle to get berries. That was the way life was back then. (Elizabeth Colin, March 21, 2003)

Through these information sharing networks, Teetl'it Gwich'in harvesters are able to deal with seasonal variability in the abundance and distribution of berries through increasing or decreasing the geographic extent of their picking area. When berries are abundant around the community, the total of harvest may be less than 200 km², as in 2003. In years of greater scarcity, women will seek out information and travel to visit friends and family in surrounding communities, thereby increasing the geographic extent of their harvesting area.

5.2.3 “Giving Them Away”: Rules for Sharing the Harvest

Rules for sharing berries are also based on a complex network of relationships both in the community and with friends and family in other parts of the Gwich'in Settlement Region, the Northwest Territories and the Yukon.

“Giving away berries” is a very important tradition in the community, particularly to elders or others who are unable to get out on the land due to illness or other conditions. Sharing berries within the immediate family is also very important.

I just give it away for nothing because it is important for me to do this... a long time ago people used to give berries away because it was a tradition, just like our culture (Dorothy Alexie, Oct. 15, 2003)

I share with people who can't get out on the land and pick berries... I don't sell them because I have a lot of grandchildren, I make cranberry sauce for them and cranberry juice. (Rebecca Francis, Oct. 15, 2003)

Different rules apply under different harvest conditions (See Figure 8). In years such as 2002 when there were few berries, some families received berries from outside of the community from Dawson, Aklavik, Whitehorse or elsewhere. Elder, Alice Blake, for example, received cranberries from her niece in Whitehorse in 2002. Elizabeth Colin (Oct. 16, 2003 said "she was lucky to get some berries from relatives in the Yukon". When berries are very abundant around Fort McPherson, women will in turn give them away to others who have none. Some women who are able to stock up on berries in very good picking years ration these out during years when the picking is not so good, however, sharing berries is still very important.

Last year 2002, there were hardly any berries that year. I was lucky that I still have some berries from the year before that. I sure rationed my berries then. I also gave some out to people who were sick and needed the berries for their health (Elizabeth Colin, Oct. 16, 2003)

Shopping for berries at the store is also common in years when there are no berries however, it is not the preferred option. As Dorothy Alexie (Oct. 16, 2003) said, "I had to buy cranberries from the store, but it doesn't taste like cranberries".

I trade berries for dry fish or dry meat... I trade berries for rabbits or tea, sugar or something like that I need; it's very important. (Rebecca Francis, Oct. 15, 2003)

The most common trading relationships may be those between women who cut fish and women who pick berries. Roles and responsibilities associated with fishing and berry harvesting are strongly integrated. Women who are the primary berry pickers and fish cutters sometimes share

their time between both of these activities. More often the work is shared between women of the same family group. This network of sharing is shown in Figure 3.

Rules for sharing the harvest of berries is the most direct way in which harvesters deal with variability in this valued natural resource. As with rules that limit access (Table 4), rules for sharing berries are more strictly enforced or become more specialized in times of scarcity. When there are few berries to be found around the community, harvesters generally share with those members of their families and the community that are in particular need, such as the ill and elderly, and at special family or community events. By contrast, during times of abundance, harvesters are less concerned with how and with whom berries are shared.

6. Discussion and Conclusions

The institutions or rules-in-use, governing commons resources have developed in many indigenous communities to prevent what Hardin (1968) described as the tragedy of the commons (Hardin 1968; Feeny et al. 1990). Over the last thirty years, the study of common property institutions, has provided tremendous insight into how these institutions function (Berkes 1989). For example, the Chisasibi Cree have rules about how much fish is to be harvested in different seasons, the size of fish as well as what kinds of nets are used (Berkes 1999). Many Amerindian hunter-trapper societies as well as indigenous populations in south-east Asia, have maintained resource biodiversity in sacred groves through specific beliefs, rules and rituals (Berkes and Folke 1998; Gadgil et al. 1998). The rules and norms developed by indigenous peoples who have lived through resource scarcity provide a particularly useful perspective on how to deal with uncertainty (Berkes and Folke 1998). For example, where resources are recognized as important, limiting, predictable and depletable and are under the control of the resource harvesters, those who depend on the resource more often than not, develop ways of managing those resources that amounts to a conservation ethic (Berkes 1989).

The contribution of the current study to general common property theory may be limited in that berries such as cloudberries, blueberries and cranberries are not susceptible to the same potential for over-harvesting and lack of regeneration as is the case with fisheries or forests. The research

supports previous arguments in the common property literature that open-systems of property rights tend to be associated with resources that are relatively unpredictable; closed access systems, by contrast, are associated with resources that are more predictable (Fratkin 1986).

This paper described three institutions in the Gwich'in region related to berry harvesting; rules for resource access, information sharing and sharing in the harvest undoubtedly developed to limit use of berry patches thereby increasing potential seasonal yields to individual harvesters and ensuring good stewardship. The extent to which these rules are enforced depends on ecological conditions (Tables 4, 5, 6). At a basic level, property rights appear to mirror the relative predictability of the species; cloudberry, which are scattered in distribution and sensitive to temperature and precipitations extremes, are associated with few property rights (Table 4). The heartier and more densely distributed cranberry, by contrast, tends to be associated with extended family groups property rights; when cranberries are scarce across the region, these rules become more strictly enforced by the family group. Rules related to information sharing also change depending on local and regional ecological conditions (Table 5) as do rules for sharing in the harvest (Table 6).

Ongoing knowledge generation about seasonal ecological conditions is therefore key to ensuring the relevance and legitimacy of rules-in-use. For Gwich'in harvesters, knowledge is generated by 'checking' the land or through empirical observations and interpretations of change at a species, landscape and ecological scale. When shared over space and time, these observations and interpretations become embedded in social memory, providing a map for harvesters seeking guidance on where and when to harvest. Dynamic interaction between knowledge generation and decision-making forms the foundation for further observations and interpretation (See Fig. 4)

This system (Fig. 4) can be viewed as a sophisticated approach to understanding and dealing with ecological change – specifically variability in the abundance and distribution of a commons resource. Although the Gwich'in berry harvesting practices are unique to their region of the boreal sub-arctic, this system shares characteristics with social learning and adaptive management approaches developed by other indigenous peoples in other regions of the world (Berkes et al. 2003).

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Fig. 1 - Gwich'in Settlement Region

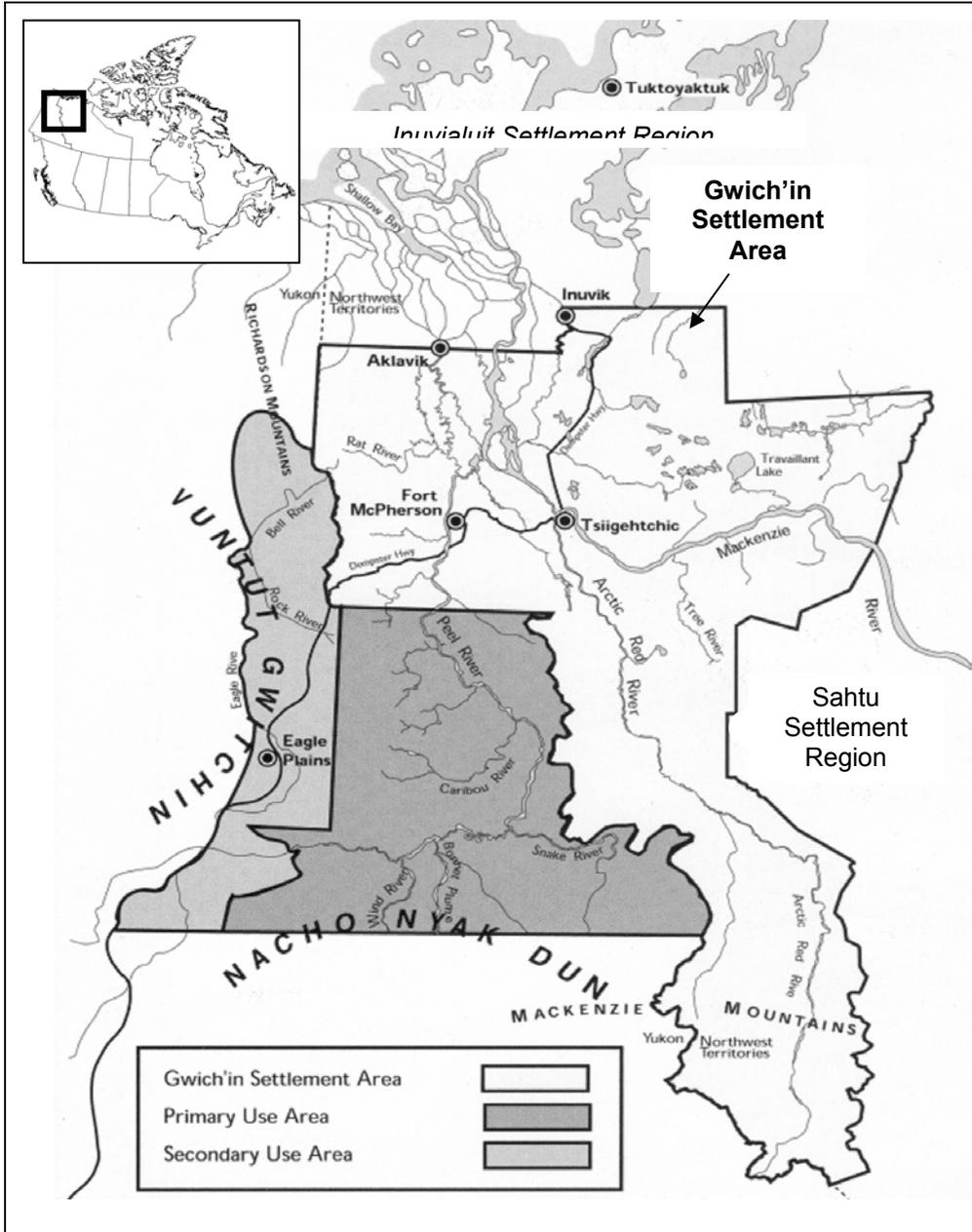


Fig. 2 - A Case of Information Sharing

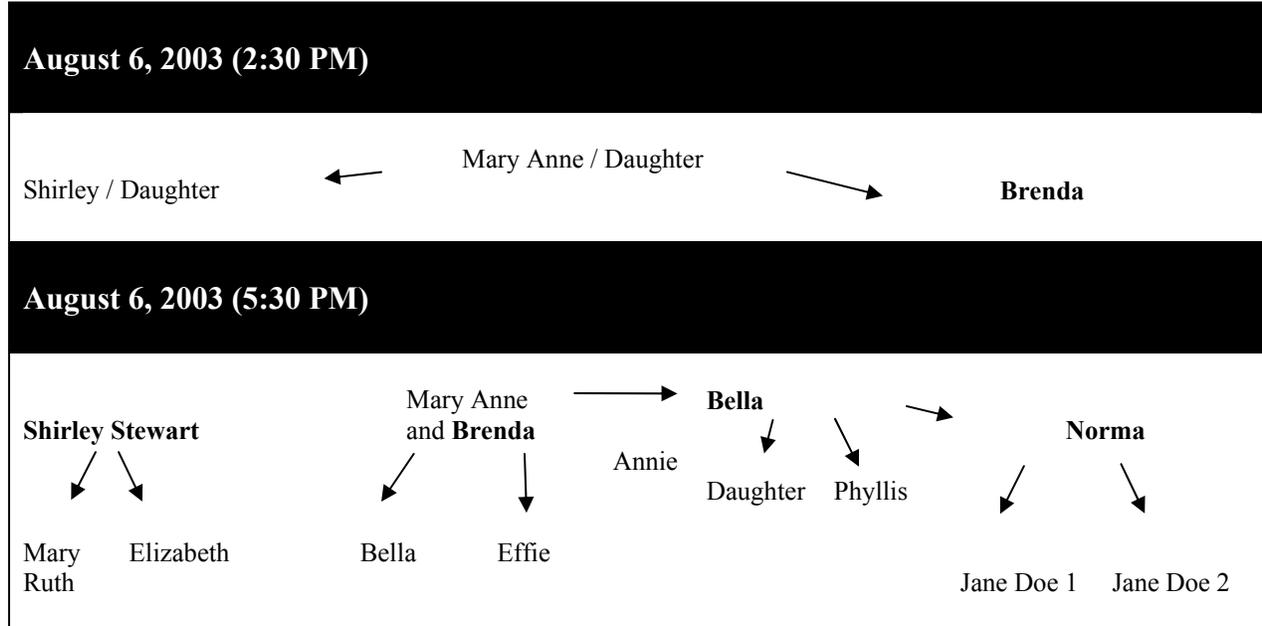


Fig. 3 – Institutions for Resource Sharing - Berries and Fish

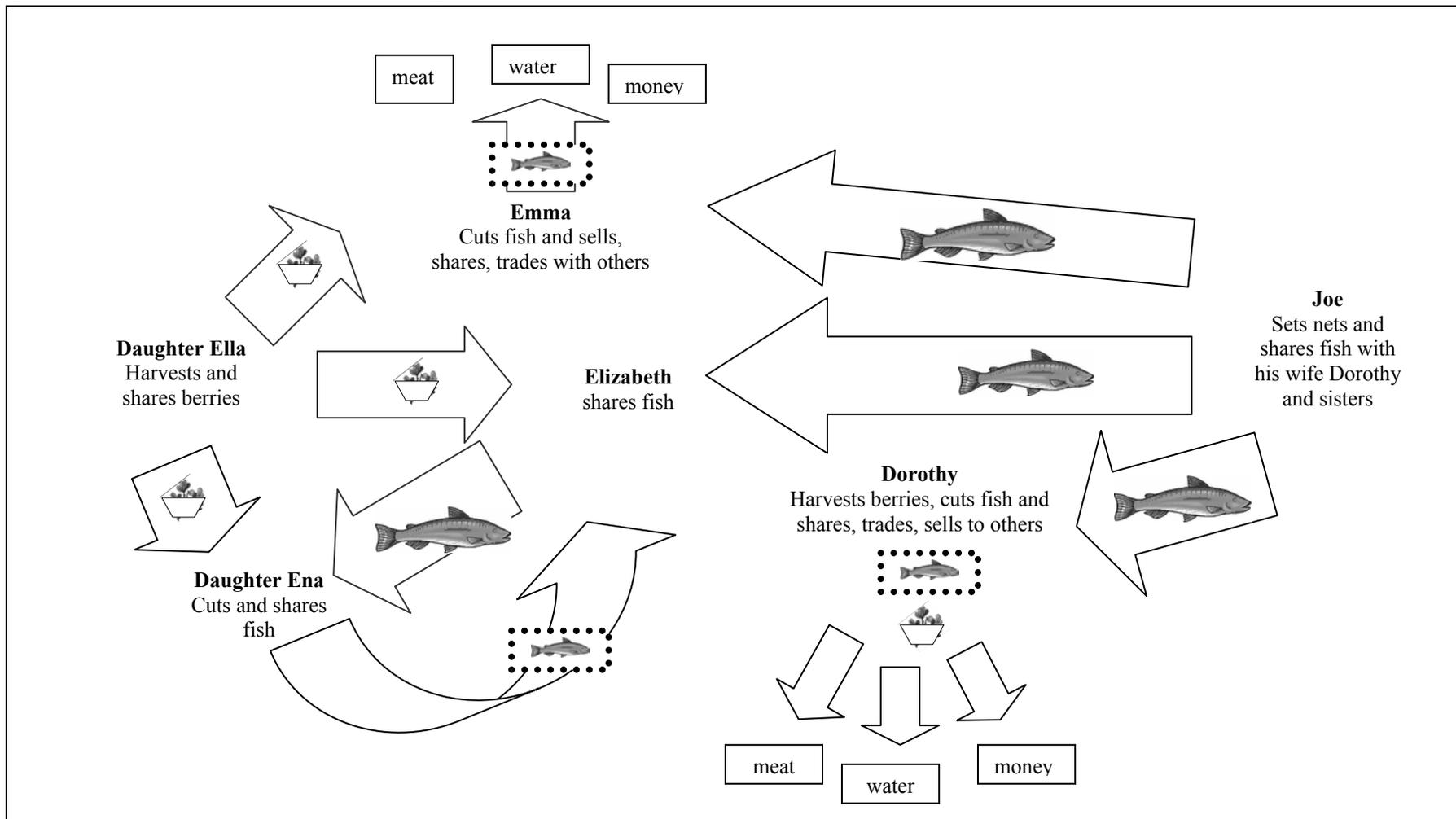


Fig. 4 – Knowledge Generation and Common Property Rules

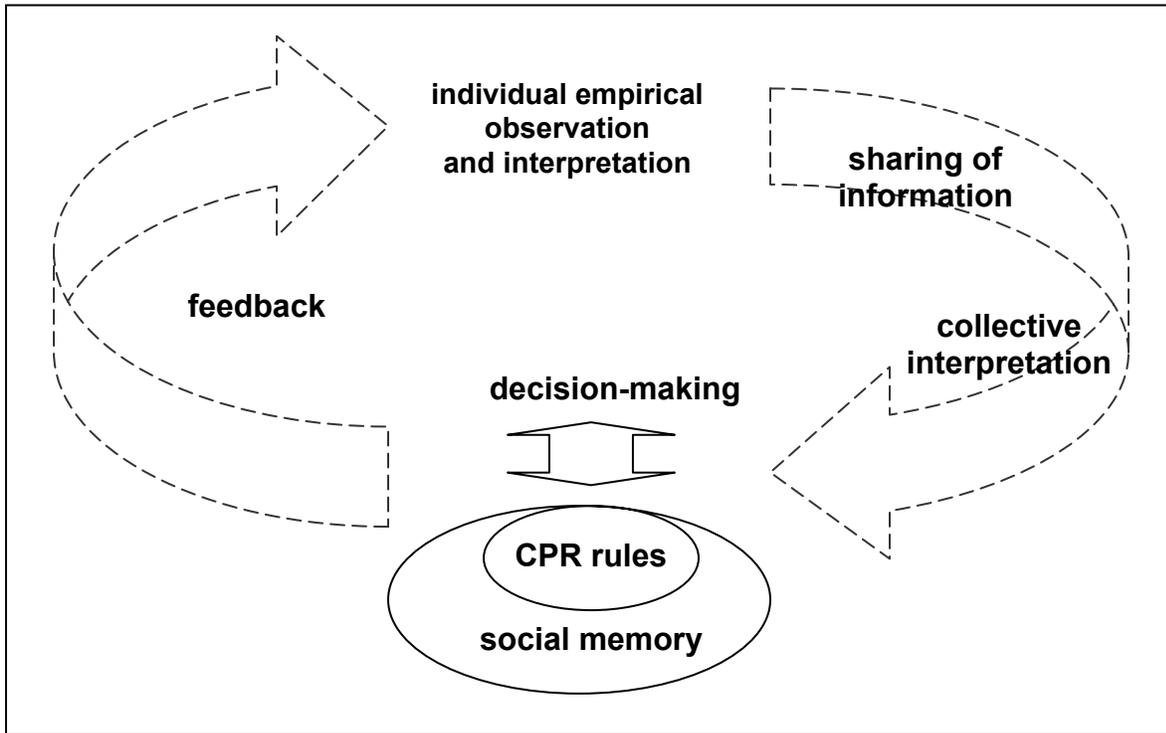


Table 1 – Guiding Questions for Interviews

Guiding Questions related to Social Values	
1	Why is berry picking important to you? (Why is berry picking not important?)
2	Where do you usually pick: a) cloudberries, b) blueberries, c) cranberries, d) other?
3	How many years have you been picking in these areas?
4	How did you learn that these places were good for berry picking? Who was picking in those areas before you?
5	When do you go picking in these areas?
6	Do you “check” the areas before the berries are ready? When? What do you check for?
7	How often do you visit these places? How many berries will you get? (ziplock bags) Would you like to pick more?
8	How will you get there? Who will go with you?
9	What will you do with the berries?
10	Do other people pick in these same areas? Why? Why not?
11	Do you think that your family and friends will continue picking there in the future?
12	Are you concerned about any changes in the land or community that will affect these berry picking areas? Should any of these areas be protected - for example by the Gwich’in Renewable Resources Board?

Table 1 (cont'd) – Guiding Questions for Interviews

Guiding Questions related to Ecological Values

- 13 What is the berry patch like where you go picking berries?
(Can you draw a map of what is in that area and how you get there)
Is it wet, dry, hilly, hummocks, mossy, sandy?
Is it near a lake, river, bog, creek?
Are there tall spruce trees, small spruce trees, willows, birch or alders there? What other plants are there?
- 14 How is the area affected by the weather?
- 15 Has this berry patch (or another you know) ever been affected by:
- River erosion
 - Flooding
 - Fire
 - Seismic lines / Cut lines
 - Roads
 - Wildlife (bears)
- What happened?
When did this happen?
- 16 Do you ever check this area in the spring, summer, fall or winter to find out what is happening?
- 17 What kinds of signs do you watch for to tell you the berries will be good?
- 18 Do you share the information with other people? How? With whom?
- 19 What will you do if there are no berries this year?
What did you do last year?
- 20 Do you have other information you would like to share?

Table 2 – Guiding Questions for Interviews on Abundance and Information Sharing

Guiding Questions related to Abundance and Sharing	
1	Do you remember berry picking when you were growing up? Were there times when you remember only surviving on berries or plants?
2	Do you remember years when there were few or no berries around?
3	How was the berry picking (a) this year (b) last year (c) 1999 d) previous years?
4	Did someone share berries with you when there were none around here? How much berries have you saved for your family? Did you share with others in the community? Did you sell or trade any of your berries?
5	Is sharing or trading berries important to you?
6	What did you do last year when there were no berries? Did you get berries from someone else or somewhere else?
7	Did other family members or friends in the community help you? Did you end up going further up the road or the river to find berries?
8	How many days did you go for berries or cut fish this year? Did someone else in your family go for berries or share it with you?
9	Do you have any other information you would like to share?

Table 3 – Berries and Other Plants harvested by the Tetlit Gwich'in

Tetlit Gwich'in	English	Latin
<i>Natl'at</i>	Cranberry / Lingonberry	<i>Vaccinium vitis-idaea</i>
<i>Jak na</i>	Dwarf Blueberry / Bog Bilberry	<i>Vaccinium caespitosum</i> <i>Vaccinium uliginosum</i>
<i>Nakàl</i>	Cloudberry	<i>Rubus chamaemorus</i>
<i>Nichih</i>	Rosehips	<i>Rosa acicularis</i>
<i>Ts'ìivii ch'ok</i>	Juniper Berries	<i>Juniperus communis</i>
<i>Deetree jàk</i>	Black Currant	<i>Ribes hudsonianum</i>
<i>Nee'uu</i>	Red Currant	<i>Ribes triste</i>
<i>Shis jak</i>	Red Bearberry	<i>Arctostaphylos rubra</i>
<i>Dineech'uh</i>	Crowberry	<i>Empetrum nigrum</i>

Table 4 – Species Specific Characteristics and Cycles

Species	Availability	Morphology / Density	Natural Productivity Cycles
Cloudberry	<ul style="list-style-type: none"> July 15- Aug. 15 	<ul style="list-style-type: none"> scattered (average picking area is 500-1 km.)² 	<ul style="list-style-type: none"> productivity of each plant follows a 5-7 year cycle
Blueberry	<ul style="list-style-type: none"> July 30– Aug. 30 	<ul style="list-style-type: none"> relatively dense (average picking area 100 – 200 m.) 	<ul style="list-style-type: none"> productivity is related to succession (can be as short as a few years or over one generation)
Cranberry	<ul style="list-style-type: none"> Aug 15 – Sept. 30 	<ul style="list-style-type: none"> dense (average picking area 10 m. – 100 m.) 	<ul style="list-style-type: none"> productivity is related to succession; once established cranberry patches can last for many any generations

Table 5 – Landscape Specific Indicators

Species	Associations	Microclimates	Cultural Landscape	Habitat Succession
Cloudberry	<ul style="list-style-type: none"> mossy ground associated with bog (wet areas) and small trees (black spruce) 	<ul style="list-style-type: none"> sensitive to temperature and precipitation extremes ripen quickly in and open areas ripen slower in closed areas (under willows) will last longer (not spoil) in mountain valleys where it is cooler 	<ul style="list-style-type: none"> commonly harvested along the Dempster highway between Fort McPherson and the Yukon border (e.g. flats above Midway Lake) 	<ul style="list-style-type: none"> patches are associated with early stages of succession where competing species of willow are limited
Blueberry	<ul style="list-style-type: none"> mossy ground associated with wet areas and small trees (black spruce) 	<ul style="list-style-type: none"> somewhat sensitive to temperature and precipitation extremes Ripen quickly in open areas near edge of bogs / other disturbed sites Ripen slower and last longer in closed areas 	<ul style="list-style-type: none"> Commonly harvested along the Dempster highway between Fort McPherson and Tsiigehtchic 	<ul style="list-style-type: none"> patches are associated with early stages of succession where competing species of willow are limited

		(under willows)		
Cranberry	<ul style="list-style-type: none"> found in the delta and in sandy / muddy areas associated with large trees (white spruce) 	<ul style="list-style-type: none"> somewhat insensitive to temperature and precipitation extremes Ripen quickly in open areas Ripen slower and last longer in closed areas (under willows) 	<ul style="list-style-type: none"> Commonly harvested near cabin sites along Peel River including in the Delta 	<ul style="list-style-type: none"> good patches develop during later stages of succession

Table 6 – Rules related to Access

Species	Location	Access Rules
Cloudberry <i>Rubus Chamaemorus</i>	Anywhere; mostly near road	Open access (few rules related to who can pick in these areas)
Cranberries (Lingonberry) <i>Vaccinium vitis idaea</i>	Near Family Camps	Limited Access: <ul style="list-style-type: none"> Extended family property rights
Blueberries <i>Vaccinium uliginosum</i>	Along the road and near family camps	Mixed access: <ul style="list-style-type: none"> Extended family property rights Open to those who can maintain access routes (i.e. cut down willows which take over in disturbed sites) Use of areas by bears is also a factor

Table 7 – Information Sharing Rules under Different Harvest Conditions

Harvest Conditions	Harvest	Local Sharing Arrangement	Regional Sharing Arrangement
Very poor year everywhere	No berries harvested by anyone;	Harvesters will communicate with local family and friends in an effort to find good berry patches;	People across the region will talk to one another about where they might find abundant berry patches;
Very poor year locally; good year elsewhere in the region	No berries harvested around Fort McPherson	Harvesters will communicate with local family and friends in an effort to find good berry	People from Fort McPherson will contact family and friends across the region to find good berry patches;

		patches;	
Good year everywhere	Lots of berries harvested by everyone	Harvesters may communicate about good berry patches with local family and friends;	Some people may communicate about good berry patches;
Good year locally but a poor year in other communities	Lots of berries harvested around Fort McPherson (See Fig. 3)	Some people may communicate about good berry patches with local family and friends;	People in other communities will make direct contact with family and friends from Fort McPherson to find good berry patches