JOURNAL OF NORTHERN STUDIES Vol. 7 • No. 1 • 2013, pp. 31–47

RAYNALD HARVEY LEMELIN & MICHEL S. BEAULIEU

The Technology Imperative of the Cree

Examining Adaptability and Livelihood in Northern Ontario, Canada

ABSTRACT In this article we discuss how the incorporation of selected technologies (i.e., outboard motor, snowmobile) in Northern Ontario profoundly and irrevocably transformed two Cree nations located in the Hudson Bay Lowlands. We demonstrate how this technological integration has provided two remote First Nations in Canada with the ability to adapt to biophysical and socio-cultural changes, thereby sustaining traditional livelihood and providing food security. Interviews conducted in 2006–2010 with the Weenusk First Nation at Peawanuck, and the Washaho First Nation at Fort Severn are used to contextualize the discussion and answer the following research questions: (a) Are a greater or smaller number of people in these two First Nations engaged in subsistence behaviour today than in the past?; (b) Are these harvesters more or less successful?; and (c) Are levels of subsistence consumption different? The findings indicate that while less people are generally participating in traditional subsistence activities, access to traditional foods due to technology remains, for the time being, the same. The sustainability of these activities on the long-term is examined in the conclusion.

KEYWORDS adaptability, food security, health, livelihood, technology, well-being, Ontario, Cree

"Technology is the metaphysics of our age; it is the way being appears to us" (Horowitz & Grant 1969: 3). By quoting Horowitz and Grant, Francis (2009) poignantly reminds us that technology has become over the course of the twentieth century the "most pervasive and dominant force in the modern world," and that for a generation of thinkers "it became for them an imperative" (Francis 2009: 1). Few would argue that, in the shaping of the modern north, technology and the accompanying industrialization have not had a profound impact on health and community well-being (see Coates & Powell 1989 and Morrison 1998 for a discussion on these topics). In one of the earliest such observations, Innis (1925) observed during a series of research trips to the Mackenzie basin in the early 1920s, the "impact of limited transportation technology on the cultural milieu" of the areas he visited. His conclusion, at the time though, was that limited transportation technology, which locals he argued could have cared less about anyway, "resulted in it being a region on the margin of the dominant centre of central Canada" (Innis 1925: 152).

Innis's perspectives—centred around a dichotomy between those who favoured the "moral imperative of technology" and by those who saw technology as a threat that would break "down communal ties that were important for the well-being of society and by undermining moral and spiritual values that had been the underpinning of Western civilization" (Francis 2009: 2). Coates and Morrison (1992), dealing specifically with the provincial norths, have argued that improvements in transportation like the jet plane "helped tie the Provincial Norths into the national transportation network in Canada" (Coates & Morrison 1992: 90). Yet, while Coates and Morrison (1992: 90) comment that technology such as the snowmobile "revolutionized winter freight transport to remote communities" and, after 1959, "personal transportation," it has still been tied to the concept that "northerners were no longer relegated to the conceptual sidelines of North American life."

In a similar light, American anthropologist Pelto (1973), in his landmark study on the Skolt Sami in Finland, suggests that the "snowmobile revolution" irrevocably transformed traditional livelihoods and altered socio-cultural practices. In the four decades since its first publication, however, few researchers have challenged this conclusion. Canadian researchers in particular have built upon this work, and that of Innis (1925), and frequently noted that the "snowmobile revolution" diminished "bush discipline" in Northern Canada by providing greater opportunity for displacement, resulted in the over-harvest of certain wildlife species, and in some cases lessened the need for economic interdependence and cooperative kinship (see Berkes *et al.* 1995). Arguing against the interpretation that aboriginal communities

are passive recipients of technology, this paper builds upon Bishop's (1984) contention that post-contact adaptations by the Cree in this instance, are the synthesis of the old and the new and are not necessarily radical departures from traditional practices resulting in discontinuities with the past. The paper demonstrates how the selective integration of certain technologies like the outboard motor (decades ahead of the snowmobile) and the snowmobile, profoundly and irrevocably transformed Cree livelihood, yet also provided the tools for communities and individuals to adapt to biophysical and socio-cultural changes, thereby ensuring the viability of traditional livelihood and cultural food security. In-order to better understand these transformations, three research questions guided the study:

a. Are a greater or smaller number of people in these two First Nations engaged in subsistence behaviour today than in the past?
b. Are these harvesters more or less successful?
c. Are levels of subsistence consumption different? How does the consumption of different foods affect food security issues in the community?

In the next section, we provide an overview of climate change and community health while also describing the methodological approach used in the study. This is followed by a description of the two communities, a discussion pertaining to the findings, and the conclusion.

Climate Change and Community Health

According to a scientific report produced by Arctic Climate Impact Assessment (ACIA), warming temperatures will increase the vulnerability of many Northern communities to invasive species, permafrost melting, and other environmental changes. As Knotsch and Lamouche (2010: 1) recently reported: "Changes in climate and weather events in the Arctic and their subsequent effects on the biological systems of the region have impacts on food security and economic well-being." More than 70 per cent of northern aboriginal[1] adults reported harvesting natural resources through hunting and fishing and of those more than 96 per cent do so for subsistence purposes (see Furgal & Seguin 2006 for further details). The ability to adapt and "overcome changes in access to or availability of country food resources [...] is significantly influenced by an individual's access to economic resources and technology" (Furgal & Seguin 2006: 1968). The ability to invest in new "equipment for hunting and traveling (e.g., snow machine, four-wheel all-terrain vehicle, flat bottom or larger boat)," satellite phones and navigational tools such as GPS, increases the capability of an individual to access

often unpredictable landscapes while still providing healthy foods to family and community members (Furgal & Seguin 2006).

In the case of community health and well-being, increased rates of obesity have been linked to decreased opportunity for engaging in harvesting activities (Young & Katzmarzyk 2007) and a lack of access to country foods can also affect people's mental health by decreasing social ties (through the sharing of food) and decreasing an individual's confidence about her or his traditional knowledge (see Waldram *et al*. 2006). However, previous studies examining the impacts of technology on indigenous communities have tended to overlook or disregard the limitations of previous studies, whether they be ethnographic or surveys, and largely discount the resilience of aboriginal communities. In particular, by failing to acknowledge the sociopolitical context and discounting the incorporation of technology into livelihood and well-being, researchers often perpetuate the notions that culture is static and non-adaptive, thereby essentially denying indigenous peoples of agency (Bernard & Pelto (eds.) 1987).

Although often overlooked, the physical nature of harvesting activities also plays an important part in providing exercise and outdoor activity. Further, the general well-being of individuals is also impacted by their participation in food harvesting and collection activities. For example, the act of hunting or gathering requires a collective way of harvesting, processing, distributing and preparing foods, reflecting values of cooperation and sharing. Harvesting activities strengthen social connections between family and community members. From this perspective, the incorporation of these technologies by the Weenusk First Nation at Peawanuck and the Washaho Cree Nation at Fort Severn, two Cree communities located in the Canadian sub-Arctic, is simply a series of adjustments in livelihood to various environmental and social changes.

In order to examine the various impacts (both positive and negative) of outboard motors and snowmobiles in Cree society we use a combination of bio-history (Krech 1984; Ray 1999), environmental sociology (Bell 2004; Gould & Lewis 2009), and an ethnographic approach consisting of participant observations and 22 semi-structured interviews conducted with 12 harvesters and 10 Elders in Weenusk between 2007 and 2010 was undertaken. Of the 24 participants in Washaho (19 Elders, 5 younger harvesters), all were defined as still active in *pimachiowin* (traditional Cree livelihood). As stated earlier, the following research questions were asked:

a. Are a greater or smaller number of people in these two First Nations engaged in subsistence behaviour today than in the past?
b. Are these harvesters more or less successful?
c. Are levels of subsistence consumption different? How does the consumption of different foods affect food security issues in the community?

The analysis for this study was conducted through a deliberate coding approach highlighting any discussion regarding mechanization and/or technology. The interviewees are cited anonymously to protect their identity.

Weenusk and Washaho. Historical Backgrounds

The peoples of Weenusk and Washao are the *omaske.ko.w* Cree (meaning muskeg or swamp people in the Cree language). They have lived in the Hudson Bay Lowlands for countless generations. Although the Cree's traditional territory extended throughout the Hudson and James Bay Lowlands of Quebec, Ontario, and Manitoba, subsistence activities were often focused on in coastal and waterway areas and guided by seasonal patterns of fishing, hunting, and trapping. Fish, such as whitefish and sturgeons, were collected along major waterways in the spring and fall seasons, while river estuaries provided hunting (shorebirds, migratory birds), fishing, and foraging grounds in the spring and summer seasons (see Ohmagari & Berkes 1997). In the fall and winter, Cree families returned inland towards their traditional hunting grounds to hunt caribou and moose, ice-fish, and trap furbearing animals (see Lytwyn 2002).

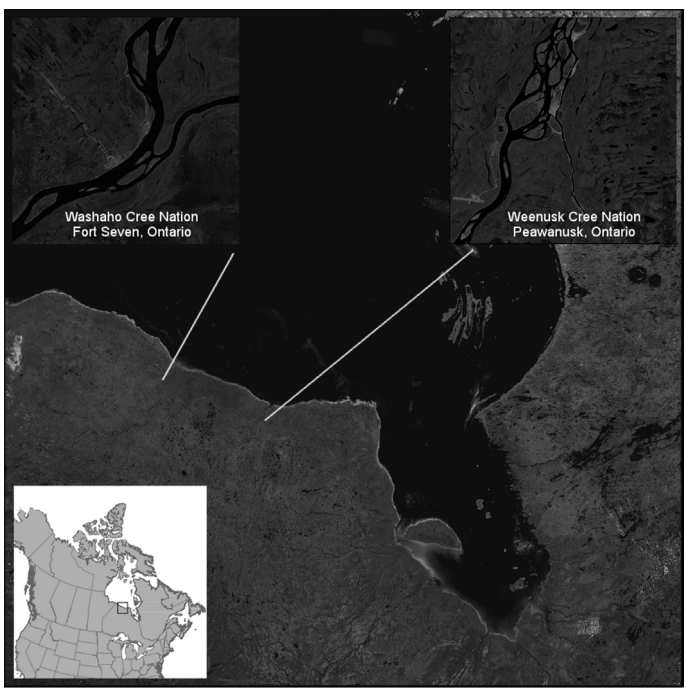

Fig 1. Map of Washaho and Weenusk

European contact with the coastal Cree occurred relatively early. In fact, it was a solitary Cree hunter in 1610 that welcomed Henry Hudson to *Wînipekw* (the large muddy waters), the large body that would eventually bear the European explorer's name (Mancall 2009). In many instances, contact with Europeans provided the *Wiinibeyk Iiyuu* (coasters or Coastal Cree) with the opportunities to incorporate equipment and tools made available through the fur trade quite quickly (George & Preston 1987). With the establishment of trading posts in the region beginning in the eighteenth century, more frequent and prolonged contact began and some of the Cree families were encouraged to become more sedentary and increasingly dependent on manufactured goods (Graham 1988). The "home guard" Cree, as they became known to Europeans, became the "middle-men" of the lowland trade (Beardy 1996; Bird 2005; Lytwyn 2002).

Consistent dealings with federal officials occurred as various Nations began ratifying Treaty 9 and its addendums between 1905 and 1930, while dealings with provincial officials began to occur after the Second World War (see Beaulieu & Southcott 2010; Long 2010). The 1950s and 1960s can be defined as the "military era" when infrastructures, the wage economy and mechanization (typified by outboard motors and snowmobiles) appeared and more localized lifestyles through permanent dwellings were encouraged (Graham 1988; Lemelin & McIntyre 2011). This era was followed by the conservation and protection period in the 1970s and early 1980s (highlighted by the establishment of Polar Bear Provincial Park in 1970) to the mixed economy of the modern era (Lemelin *et al*. 2010*b*).

While steamships were actively used throughout Northern Canada during the late nineteenth and early twentieth century, the first transportation revolution occurred with the introduction of canoes and skiffs powered by outboard motors. The mass production of outboard motors introduced in the North American market in the 1920s, and in the Canadian sub-Arctic in the 1930s provided an opportunity for Northerners to incorporate this technology into traditional lifestyles (Hunn 2002; Montevecchi *et al*. 2007; Piper 2009). Whereas few individuals initially had the capital to purchase outboard motors, by the 1960s almost everyone in Weenusk and Washaho had one (interview with Cree Elder from Weenusk, 2007). Since Cree families could now travel tremendous distances both inland and along the coastlines, the outboard motors provided various opportunities to access new hunting and fishing territories, attend cultural activities in other coastal communities, and in some cases seek employment opportunities throughout the spring, summer and fall seasons.

Initially, Bombardier snowmachines were large and heavy enclosed tracked vehicles that were very expensive, and were used mostly by gov-

ernment and church officials. It would take several decades before snowmobiles (smaller tracked winter-vehicles made by Bombardier) and other snowmachines, were made especially for the winter conditions of Northern Canada. As Piper explains, the introduction of the snowmobile in the 1960s facilitated winter travel, since fishers instead of relocating in winter camps, could now live at home and visit their fishing areas on a daily basis (Piper 2009). While the snowmobile gradually became more popular in the Canadian north, some individuals preferring the versatility, safety, and efficiency of dog teams in the deep snows of the taiga or out on the coastal ice of the Hudson Bay, resisted this type of technology (interview with Cree Elder from Weenusk, 2007). Indeed, it was not until the late 1970s that the snowmobile became the preferred mode of transportation in Weenusk and Washaho (interview with Cree Elder from Weenusk, 2007). However, according to elders in both communities, by the mid-1980s everyone had one (see Table 1 below).

The two small Cree nations of Washaho (pop. 400) and Weenusk (pop. 250) (Statistics Canada 2009) are only accessible by plane, boat, and winter road (temporary roads that allow for transportation across rivers and muskeg when they freeze each winter) (see Fig. 1). Modern employment opportunities in government, health, education and tourism in both communities are complemented by traditional activities such as wood-cutting, hunting, fishing and trapping. The effectiveness of the mixed economy in Weenusk and Washaho has been praised by researchers and reporters who claim that Weenusk is a First Nation that successfully blends the old (traditional harvesting practices and sharing) with the new (cooperatives and tourism) (Lemelin *et al*. 2010*a*; Tsuji & Nieborer 1999).

Table 1. Chronology of technology.

Era	Early 1900s	1930–1950	1960–1970	1980s	1990–present
Subject	Treaty era	Military era	Protection era	Modern era	Mixed-economy
Marine travels	Canoes and/ or rowboats	Trap skiffs/ outboard motors	Wooden speed-boats/outboard motors	Fibreglass speed-boats/outboard motors	Fibreglass speed-boats/larger outboard motors
Land travels	Snowshoes, dog sled	Bombardier	Ski-doo	Various models	Liquide, multipiston, large machines
Monetary cost of technology	Low	High	Moderate	Moderate	High

Adapted from Montevecchi *et al.*, 2007

Being Well out on the Land

Among Canada's aboriginal peoples, cultural identity is often linked to key natural resources. For the Cree, the harvesting of caribou, moose, geese and various fish is an important element of cultural identity, which in turn reinforces personal and community pride and feelings of well-being (Lemelin *et al*. 2010*a*). The loss of biodiversity impacts the Cree to a greater degree because of their increased contact with, and reliance upon, the natural environment. This loss will have effects on, among other issues, the harvesting of foods (i.e., hunting and fishing rights), the use of natural resources (ecotourism, and others), the collection of traditional medicines, access to and control over traditional territories, as well as the storage and transmission of traditional knowledge, culture and information regarding these issues (Lemelin *et al*. 2010*a*).

While the traditional harvest of waterfowl, caribou, moose and certain fish remains significant in the Washaho and Weenusk Cree nations, challenges to healthy lifestyles at the biophysical and social levels are also occurring. As one younger harvester from Weenusk commented: "Limited access to caribou, seal, fish, berries and other 'country foods' leads to greater reliance on imported store-bought foods" (interview with Cree harvester from Weenusk, 2008). Indeed, since access to market food items is reliant upon shipment via air or sea, these modes of transportations, significantly increase the price and increases food insecurity in the Canadian north (Ford & Pearce 2010; Prowse *et al*. 2009).

Throughout much of the Arctic, the significance of traditional livelihood, and the subsequent sharing and distribution of wild foods acquired from these activities in this region, have been documented by researchers, government officials, and community members (Berkes *et al*. 1995; George *et al*. 1992; George *et al*. 1995). Some studies have argued that, through traditional livelihood and the use of traditional knowledge, some contemporary health problems in North American indigenous populations could be solved while at the same time increasing food security (Milburn 2004). For the Cree people of Northern Ontario, food security can be defined as:

> (i) food availability: sufficient quantities of food available on a consistent basis; (ii) food access: sufficient resources to obtain appropriate foods for a nutritious diet; and, (iii) food use: appropriate use based on knowledge of basic nutrition and care; adequate water and sanitation must also be considered in relation to northern environments, and their connection to socio-cultural practices. (World Health Organization 2011.)

Beyond the use of technology, the act of hunting or being "out on the land" in a modern context, requires collaborative efforts before, during and after the "hunt" (interview with Cree harvester from Wenusk, 2008).

Findings. Navigating the Technological "Imperatives"

Today, the snowmobile, motor-powered freighter canoe, and all-terrain-vehicle (ATV) are essential tools for harvesting, gathering berries, and collecting firewood in the northern aboriginal communities of Ontario and Northern Canada. It is these tools that assist in the provision of traditional country foods, which contribute greatly to the overall quality of life and sustenance of Northerners, while also providing the necessary mechanism to adapt to the rapid changes occurring in the circumpolar north (Weller *et al*. 2005).

The Kayahna Region Land Utilization and Occupancy Study (Kayahna Tribal Area Council 1985) conducted by the Kayahna Tribal Area Council in the early 1980s, for instance, reveals an entrenching of claims to traditional land areas and land use in the twentieth century that correlates with available data on land use patterns from the pre-contact and fur trade eras. For the families of Washaho (Weenusk did not participate in the survey), a 100 per cent participation rate was achieved. What the findings from the Kayahna study illustrate is that traditional livelihood activities like trappings throughout the Hudson Bay Lowlands have been widely transformed through mechanization.

From sharing vehicles and gas, to sharing feathers and hides from the fall harvest, many interviewees explained that reciprocity remains a central element of Cree society:

> I will buy nets because I don't sew. But I will buy them and they're expensive, but I need gas and I want to go check my nets. But in return I have these real tanned hides. And it's sort of like ... I think it bounces back, you know, where you get what you get from the land and how you turn it into use, especially with the people who have low income. Like sometimes my husband will take somebody that wants to hunt and yet can't afford gas or doesn't have a snow machine. You give them a snow machine, but in return they will help. Like they'll shoot caribou and they'll help loading it up and take whatever they get. In the end, it all turns out, you know? (Interview with Cree Elder from Weenusk, 2008.)

While participation in traditional harvesting activities remains high in both communities, mechanization has drastically reduced distances, or at least the time to travel great distances, and also reduced the time spent on observing natural occurrences and changes, and significantly increased costs (Shephard & Rode 1996). As one participant from Washaho (2009) explains:

> My first snowmobile was $595. It's sure not that price today. It's about $5,000 for a snow machine now. Anyway, the fuel prices are not cheap. [...] You have those snow machines and people are out of gas, and we're paying $2.45 a litre up here. Who can afford to go up hunting? You really have to count your pennies to do any activities. If you want to be a trapper, you need at least $10,000, you know? $5,000 for the snow machine and gas, the necessities is another $2,000 just to get there.

Increased mechanization, many participants noted, has also resulted in decreased physical activity. "People don't go on foot anymore. If they are trav-

Table 2. Impacts from technology on livelihood.

	DEGENERATIVE IMPACTS		GENERATIVE IMPACTS
Stressors	Description	Adaptors	Description
Dangerous	•Loss of machinery • Loss of life	Accommodating	• Overcoming spatial and temporal barriers
Dependence	• Dependence on external factors (gas, food) • High gas prices: $2.45 in 2007, $1.94 in 2009, limits the use of mechanized vehicles • Replacement parts which can also be costly have to be flown in	Agency	• "The ability to invest more in the required tools and equipment for hunting and traveling, or the access to other forms of transportation allows individuals to adapt more easily to changing environmental conditions." (Furgal & Seguin 2006: 1968.)
Disruptive	• Scares the animals • Creates pollution	Connections	• To the land, to culture, to ancestors
Disconnected	• People go to fast, don't notice the changes • Harvesters too dependent on GPS, don't notice the landscapes	Cooperation	• "Sometimes my husband will take somebody that wants to hunt and yet can't afford gas or doesn't have a snow machine. You give them a snow machine, but in return they will help. Like they'll shoot caribou and they'll help loading it up and take whatever they get. In the end, it all turns out." (Interview with Cree medical practioner, Weenusk 2008.)
Ecological exploitation	• Potential to over-harvest	Food security	• Meat in the freezer
Health	• People driving everywhere– decreasing physical activity • Pollution from the machine	Health	• "When we go hunting, it brings a good self-esteem if you're providing for your family and stuff like that. It's helpful. [...] Health and wellness are combined with the emotional."(Interview with Cree medical practioner, Weenusk 2008.)
Marginalization	• Elders and youth are the ones least likely able to afford the technologies	Safety	• Use of satellite phones, and social media to navigate changing landscapes

eling, they use the machines" (interview with Cree Elder from Washaho, 2009). Similarly, another interviewee reported:

> a long time ago we used dog teams and we could move around a lot and run. By using machines all the time there's more traveling and less moving. People aren't as active anymore. (Interview with Cree Elder from Weenusk, 2008.)

In addition, while land use intensity for hunting and fishing has increased since the introduction of the snowmobile and outboard motor, the efficiency and rapidity provided by mechanization and other technologies (including GPS and social media) is also disconnecting people from the land (Montevecchi *et al*. 2007). According to one Elder in Weenusk (2008), this has caused them to lose touch because "people like to get there fast, you know out there and back again. They go fast but don't see the changes." While transportation accidents and injuries were not specifically addressed by the interviewees and health professionals, they were noted during the first author's field seasons. Technological improvements in transportation and in fishing and hunting capabilities (e.g., longer ranging, faster vessels, automatic weapons) have helped to overcome traditional spatial (sedentary communities, commuting to traditional territories) and temporal barriers (i.e., seasonal or part-time harvest), by making certain traditional activities more effective or resilient to certain shocks and stressors. The generative outcomes from these technological innovations have been the continuity of food reciprocity, and in most cases, better health (see Table 2).

Improvements in technology also created breakpoints in wildlife exploitation that led to loss of traditional practices and in some cases, over-harvesting (Montevecchi *et al*. 2007). New technologies also represent significant initial investments and on-going cost for fuel (gas, oil) parts and repairs, thereby leading to increasing costs for the participation in traditional livelihoods and disenfranchising certain people from traditional activities, and a dependency on non-local goods. From this perspective technology results in "a loss of local autonomy through the growth of dependence on a worldwide system of resource allocation and political power" (Pelto 1973: 166).

However, to blame technology for disconnecting people from their livelihood simply because they are passive consumers, overlooks the fact that numerous policies (including transfer payments, compulsory school attendance) enacted by the federal government combined with sedentarization and village-life helped to make this way of living the norm. It also overlooks that the first technological revolution, the outboard motor, occurred several decades ahead of the so-called "snowmobile revolution." While Pelto (1973) highlighted the resource declines associated to the introduction of

the snowmobile, with the exception of a few scholars, little discussion is provided regarding resource declines and the introduction of the outboard motors in Northern Canada (Montevecchi *et al*. 2007).

In our overview of the first question, we found, much like Tester (2010) did, that the introduction of mechanized vehicles in the north, had profound social and ecological impacts. However, while focusing on the negative impacts brought about through the introduction of the snowmobile, researchers have overlooked the introduction of outboard motors several decades ahead of the snowmobile. Second, the Cree in many instances initially resisted the introduction of the snowmobile until the machines were engineered for the deeper snow conditions of the boreal forest and of course cheaper to purchase. This discussion suggests that the Cree were not simply passive consumers of technology, but would only introduce new technologies, when it was beneficial to them and to their traditional activities. Next we discuss how the findings provide insights into our research questions.

Discussion

The answer to our first question: are a greater or smaller number of people from these two communities engaged in subsistence behaviour? We noted that the outboard motor and snowmobile provided harvesters with greater opportunity to travel greater distances to harvest particular species of animals in shorter periods of time (i.e., over the week-end or during vacations). While sharing and bartering continues to ensure that most community members have access to some traditional foods, the costs associated to livelihood have made some of these activities prohibitive to elders, youth and some women. Therefore, while a majority of community members (approximately ¾ according to some sources) in both communities participate in such activities as fishing and the communal geese hunt, the exposure to these activities with elders and youth may be declining.

The answers to our second question: are harvesters more or less successful? suggest that the technology provides some opportunities to harvest some animals more efficiently, while in other cases, it also provides the opportunities to shift from one resource to another. For example, outboard motors and snowmobiles provide harvesters with opportunities to travel further and faster in less time. Thus, it is now possible to go hunting or fishing for the weekend, or during one's time-off from work, and still provide one's family and other members of the community with country food. Noted changes in migratory patterns in geese and caribou have been partially offset by increasing the harvest of other animals including moose (Peloquin & Berkes 2009; Sayles & Mulrennan 2010). Members have also adapted to these changes by incorporating GPS and satellite phones while on the land,

and exchanging information through social media and the Internet (Lemelin *et al*. 2010*a*). Access to the social media along with portable telephones suggested that some participants also create unique new challenges. Unfortunately, these challenges are beyond the scope of the present study.

In our third question we asked whether the levels of subsistence consumption are different? Participants noted that in spite of seasonal variations (earlier goose hunt), the Cree livelihood cycle in Northern Ontario persists. The one noted difference suggested by some elders is that moose is now the preferred species over caribou. Harvesters point out that one moose can feed an entire family for a month (depending on the size of the extended family), while it would take several caribous to feed a family during the same period. This rise in consumption of moose meat in the communities may also be due to accessibility, since moose can be hunted along waterways in the summer and fall months, while caribou are mostly hunted in the winter months with the aid of snowmobiles. Despite earlier spring goose hunts and fewer harvesters, the impacts on food security, for the time being, have not been profound, especially since the harvest has remained relatively the same (according to most participants), and most country foods are either smoked or stored in freezers throughout the year. What the following results suggest is that Cree livelihood and the culture of sharing in these communities is being transformed by climate change and globalization; these changes however, have not replaced all local traditions (Helander-Renvall 2010).

Conclusions

For the Cree, food security must be considered in relation to northern environments and the culture of sharing. Therefore, environmental changes that may reduce the amount of country foods consumed can result in increased likelihood of malnourishment and/or chronic conditions (obesity, diabetes, hypertension, etc.) through increased dependence on store-bought and generally highly processed foods. Such transformations will have profound socio-economic effects by further increasing the percentage of household budgets directed toward purchased food. Thus, the Cree relationship to traditional food must be recognized not only for its importance for physical health, but also for its connection to emotional, spiritual, social and cultural well-being.

Much like the Inuit and the Dene of Northern Canada and the Sami of Scandinavia, Cree livelihood has historically and continuously been challenged by socio-political changes, and the introduction of such technologies as the outboard motor and snowmobile. The Cree adapted to these changes by incorporating many of these new policies and technologies through

continuous activity on the land (Williams 2003). In contemporary Northern Canada, the "bush" for many Cree is a place of recreation and a place to reconnect to one's spirituality and one's ancestral ways; a place where food security and sharing is assured (George & Preston 1987). From this context, the technological revolution was in large part incorporated or even 'indigenized' into Cree livelihood (Carlson 2008; Sayles & Mulrennan 2010). Thereby, ensuring that livelihood, a fundamental component of healthy living, continued in Washaho and Weenusk. As noted elsewhere in the circumpolar north, similar adaptive trends can be seen where mechanized personal transportation is now required for all aspects of daily life (Das & Kolack 2008; Tester 2010). Further research is suggested regarding the increasing role of certain forms of technology as an adaptive mechanism to climate and social changes by indigenous communities. In addition, one aspect of technology that was not addressed in this article and which requires further investigation is who controlled the introduction of snowmobiles and other new technologies in the Canadian north. For example, did the Hudson Bay Company and certain government officials delay the technology for fear of environmental catastrophes (the disappearance of game and fur-bearing species) or did they encourage the use of these technologies to facilitate the incorporation of the Cree into Canadian society?

NOTES

[1] The legal definition of the term *aboriginal* from a Canadian perspective includes Indians, Inuit and Métis peoples. The term is used in the text when describing national studies or when discussing legal definitions. The term *indigenous people* is also used when referring to aboriginal people in an international context.

REFERENCES

Arctic Climate Impact Assessment (ACIA) (2005). *Scientific Report*, Cambridge: Cambridge University Press.

Beardy, F. (1996). *Voices from Hudson Bay. Cree Stories from York Factory*, Kingston & Montreal: McGill-Queen's University Press.

Beaulieu, M.S. & Southcott, C. (2010). *North of Superior. An Illustrated History of Northwestern Ontario*, Toronto: James Lorimer & Company.

Bell, M.M. (2004). *An Invitation to Environmental Sociology*, 2nd edition, Thousand Oaks, CA: Pine Forge Press.

Berkes, F., Hughes, A., George, P.J., Preston, R.J., Cummins, B.D. & Turner, J. (1995). "The persistence of aboriginal land use. Fish and wildlife harvest areas in the Hudson and James Bay lowland, Ontario,"*Arctic*, 48:1, pp. 81–93.

Bernard, R. & Pelto, P.J. (eds.) (1987). *Technology and Social Change*, 2nd edition, Prospect Heights: Waveland Press.

Bird, L. (2005). *Telling Our Stories. Omushkego Legends and Histories from Hudson Bay*, Toronto: Broadview Press.

Bishop, C.A. (1984). "The first century. Adaptive changes among the western James Bay Cree between the early seventeenth and early eighteenth centuries," in *The Sub-Arctic Fur Trade*, ed. S. Krech III, Vancouver: UBC Press, pp. 21–54.

Carlson, H.M. (2008). *Home Is the Hunter. The James Bay Cree and their Land*, Vancouver: UBC Press.

Coates, K. & Morrison, W. (1992). *The Forgotten North. A History of Canada's Provincial Norths*, Toronto: James Lorimer & Company.

Coates, K. & Powell, J. (1989). *The Modern North. People, Politics and the Rejection of Colonialism*, Toronto: James Lorimer & Company.

Das, M. & Kolack, S. (2008). *Technology, Values, and Society. Social Forces in Technological Change*, revised edition, New York: Peter Lang.

Ford, J.D. & Pearce, T. (2010). "What we know, do not know, and need to know about climate change vulnerability in the western Canadian Arctic. A systematic literature review," *Environmental Research Letters*, 5, pp. 1–9; doi:10.1088/1748-9326/5/1/014008.

Francis, R.D. (2009). *The Technological Imperative in Canada. An Intellectual History*, Vancouver: UBC Press.

Furgal, C.M. & Seguin, J. (2006). "Climate change, health and community adaptive capacity. Lessons from the Canadian North," *Environmental Health Perspectives*, 114:12, pp. 1964–1970.

George, P., Berkes, F. & Preston R.J. (1992). *Indigenous Land Use and Harvesting Among The Cree in Western James Bay. A Historical and Contemporary Analysis* (Research Program for Technology Assessment in Subarctic Ontario 5), Hamilton: University of McMaster, Dept. of Anthropology.

— (1995). "Aboriginal harvesting in the Moose River Basin. A historical and contemporary analysis," *Canadian Review of Sociology and Anthropology*, 32, pp. 69–90.

George, P.J. & Preston, R.J. (1987). "Going in between. The impact of European technology on the work patterns of the west main Cree of Northern Ontario," *The Journal of Economic History*, 47:20, pp. 447–460.

Gould, K.A. & Lewis, T.L. (2009). *Twenty Lessons in Environmental Sociology*, New York: Oxford University Press.

Graham, J.E. (1988). *The Weenusk Cree. A Preliminary Background Report of Locals, Locations and Relocations*, Hamilton, Canada: Program for Technology Assessment in Subarctic Ontario, McMaster University Research.

Helander-Renvall, E. (2010). "Globlization and traditional livelihoods," in *Globalization and the Circumpolar North*, eds. L. Heininen & C. Southcott, Fairbanks: University of Alaska Press, pp. 22–24.

Horowitz, G. & Grant, G. (1969). "A conversation on technology and man," *Journal of Canadian Studies*, 4:3, pp. 3–20.

Hunn P. (2002). *The Old Outboard Book*, 3rd edition, Toronto: International Marine/McGraw-Hill.

Innis, H. (1925). "A trip through the Mackenzie River Basin," *University of Toronto Monthly*, 25:4, pp. 151–153.

Kayahna Tribal Area Council (1985). *The Kayahna Region Land Utilization and Occupancy Study*, Toronto: University of Toronto Press & Kayahna Tribal Area Council.

Knotsch, C. & Lamouche, J. (2010). *Arctic Biodiversity and Inuit Health*, Ottawa: National Aboriginal Health Organization.

Krech, S. III (1984). *The Subarctic Fur Trade*, Vancouver: UBC Press.

Lemelin, R.H., Matthews, D., Mattina, C., McIntyre, N., Johnston, M., Koster, R. & the Weenusk First Nation at Peawanuck (2010*a*). "Climate change, well-being and resilience in the Weenusk First Nation at Peawanuck. The Moccasin Telegraph goes global," *Rural and Remote Health*, 10(2):1333 (special issue on human health at the ends of the earth), pp. 1–18.

Lemelin, R.H., McIntyre, N., Koster, R. & Johnston, M. (2010*b*). "Climate disruption and the changing dynamics of polar bear. Human interactions in northern Ontario. A case study of polar bear management in Polar Bear Provincial Park, Ontario, Canada," in *Tourism and Change in Polar Regions. Climate, Environments and Experiences*, eds. M. Hall & J. Saarinen, New York: Routledge, pp. 104–118.

Lemelin, R.H. & McIntyre, N. (2011). "Sub-Arctic human dimension. Resiliency and tourism in Ontario's Far North. The social ecological system of the Weenusk First Nation at Peawanuck," in *Polar Tourism. Human, Environmental and Governance Dimensions*, eds. P. Maher, E. Stewart & M. Lück, Elmsford: Cognizant Communication Corporation, pp. 206–220.

Long, J.S. (2010). *Treaty No. 9. Making the Agreement to Share the Land in Far Northern Ontario in 1905*, Montreal: McGill-Queen's University Press.

Lytwyn, V.P. (2002). *Muskekowuck Athinuwick. Original People of the Great Swampy Land*, Winnipeg: University of Manitoba Press.

Mancall, P.C. (2009). *Fatal Journey. The Final Expedition of Henry Hudson.* New York: Basic Books.

Milburn, M. (2004). "Indigenous nutrition. Using traditional food knowledge to solve contemporary health problems," *The American Indian Quarterly*, 28:3–4, pp. 411–434.

Montevecchi, W.A., Chaffey, H. & Burke, C. (2007). "Hunting for security. Changes in the exploitation of marine birds in Newfoundland and Labrador," in *Resetting The Kitchen Table*, eds. C.C. Parrish, N.J. Turner & S.M. Solberg, Nova Scotia: Nova Science Publishers Inc., pp. 99–116.

Morrison, W.R. (1998). *True North. The Yukon and the Northwest Territories*, Toronto: Oxford University Press.

Ohmagari, K. & Berkes, F. (1997). "Transmission of indigenous knowledge and bush skills among the western James Bay Cree women of Subarctic Canada," *Human Ecology*, 25:2, pp. 197–222.

Peloquin, C. & Berkes, F. (2009). "Local knowledge, subsistence harvests and social-ecological complexity in James Bay," *Human Ecology*, 375, pp. 533–545.

Pelto, P.J. (1973). *The Snowmobile Revolution. Technology and Social Change in the Arctic*, Prospect Heights: Waveland Press Inc.

Piper, L. (2009). *The Industrial Transformation of Subarctic Canada*, Vancouver: UBC University Press.

Prowse, T.D., Furgal, C., Wrona, F.J. & Reist, J.D. (2009). "Implications of climate change for northern Canada. Freshwater, marine, and terrestrial ecosystems," *AMBIO*, 38:5, pp. 282–289.

Ray, A. (1999). "'Ould Betsy and her daughter.' Fur trade fisheries in Northern Ontario," in *Fishing Places, Fishing People. Traditions and Issues in Canada's Small-Scale Fisheries*, eds. D. Newell & R. E. Ommer, Toronto: University of Toronto Press, pp. 80–99.

Sayles, J.S. & Mulrennan, M.E. (2010). "Securing a future. Cree hunters' resistance and

flexibility to environmental changes, Wemindji, James Bay," *Ecology and Society*, 15:4; www.ecologyandsociety.org/vol15/iss4/art22/; access date 4 September 2013.

Shephard, R.S. & Rode, A. (1996). *The Health Consequences of 'Modernization.' Evidence from Circumpolar Peoples*, Cambridge: Cambridge University Press.

Statistics Canada (2009). "Statistical profile on the health of First Nations in Canada. Determinants of health, 1999 to 2003. Ottawa: Statistics Canada; 2009;" www.hc-sc.gc.ca/fniah-spnia/pubs/aborig-autoch/2009-stats-profil/01-high-sail-eng.php#high-sail; access date 20 March 2011.

Tester, F.J. (2010). "Mad dogs and (mostly) Englishmen. Colonial relations, commodities, and the fate of Inuit sled dogs," *Études/Inuit/Studies*, 34:2, pp. 129–147.

Tsuji, L. & Nieborer, E. (1999). "A question of sustainability in Cree harvesting practices. The seasons, technological and cultural changes in the Western James Bay region of Northern Ontario, Canada," *The Canadian Journal of Native Studies*, 19:1, pp. 169–192.

Waldram, J.B., Herring, D.A. & Young, T.K. (2006). *Aboriginal Health in Canada. Historical, Cultural, and Epidemiological, Perspectives*, 2nd edition, Toronto: University of Toronto Press.

Weller, G., Bush, E., Callaghan, T.V., Corell, R., Fox, S. & Furgal, C. (2005). "Summary and synthesis of the ACIA," in *Arctic Climate Impact Assessment*, Cambridge, Cambridge University Press, pp. 989–1020.

Williams, S.M. (2003). "Tradition and change in the Sub-Arctic. Sami reindeer herding in the modern era," *Scandinavian Studies*, 75, pp. 229–255.

World Health Organization (2011). "Food Security;" www.who.int/trade/glossary/story028/en/; access date 4 September 2013.

Young, T.K. & Katzmarzyk, T. (2007). "Physical activity of aboriginal people in Canada," *Applied Physiology, Nutrition, and Metabolism*, 32, pp. S148–S160.

AUTHORS

Raynald Harvey Lemelin is Associate Professor in the School of Outdoor Recreation, Parks and Tourism at Lakehead University, Thunder Bay, Canada and the Lakehead University Research Chair in Parks and Protected Areas. He has worked closely with several Cree First Nations in Northern Ontario. The following three publications highlight some of these projects: Lemelin *et al.* (2010), "Wabusk of the Omushkegouk. Cree-polar bears (Ursus maritimus) interactions in Northern Ontario;" Kakekaspan *et al.* (2013), "Developing a polar bear co-management strategy in Ontario through the Indigenous Stewardship Model;" Lemelin *et al.* (2013), "A dialogue and reflection on photohistory. Engaging indigenous communities in research through visual analysis."

harvey.lemelin@lakeheadu.ca

Michel S. Beaulieu is Associate Professor and Chair of the Department of History at Lakehead University, Canada. His research is wide-ranging, but generally deals with the historical political, economic, and social issues relating to northern and remote communities in Canada and the circumpolar north. Recent books include *Pulp Friction. Communities and the Forest Industry in a Global Perspective* (2012), *Labouring Finns. Transnational Politics in Finland, Canada, and the United States* (2011), and *Labour at the Lakehead. Ethnicity, Socialism, and Politics, 1900–35* (2011).

michel.beaulieu@lakeheadu.ca