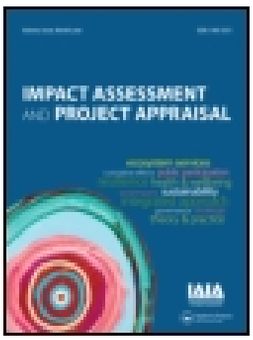

Impact Assessment and Project Appraisal

ISSN: 1461-5517 (Print) 1471-5465 (Online) Journal homepage: https://www.tandfonline.com/loi/tiap20

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Pierre Senécal & Dominique Égré

To cite this article: Pierre Senécal & Dominique Égré (1999) Human impacts of the La Grande hydroelectric complex on Cree communities in Québec, Impact Assessment and Project Appraisal, 17:4, 319-329, DOI: 10.3152/147154699781767648

To link to this article: https://doi.org/10.3152/147154699781767648

Published online: 20 Feb 2012.

Impact Assessment and Project Appraisal, volume 17, number 4, December 1999, pages 319–329, Beech Tree Publishing, 10 Watford Close, Guildford, Surrey GU1 2EP, UK.

Human impact

Human impacts of the La Grande hydroelectric complex on Cree communities in Québec

Pierre Senécal and Dominique Égré

This article gives an overview of the human impacts on the Cree communities generated by the construction and operation of the La Grande Hydroelectric Complex in Québec (Canada) and the agreements signed in its wake. It is based on a number of literature reviews of the follow-up studies which have assessed the human impacts incurred during the construction or operation phases. The article concludes that the biophysical impacts of the project have affected a minority of subsistence hunters living in four of the nine Cree communities. Both the Complex and the Agreement have clearly accelerated preexisting economic trends, as well as social change.

Keywords: human impact; hydroelectric; indigenous people

Pierre Senécal is with Hydro-Québec Groupe Production, Unit Hydraulique et Environment, 855 Ste-Catherine-est, 18th floor, Montreal, Québec, Canada H2L 4P5; Tel: +1 514 840 3000 x 4152; Fax: +1 514 840 5644; E-mail: Senecal.Pierre@hydro.qc.ca Dominique Égré is with Hydro-Quebec, Direction Environnement, 75 Ren-Lvesque-ouest, 18th Floor, Québec, Canada H2Z1A4; Tel: +1 514 289 221 x 5027; Fax: +1 514 289 4931; E-mail: Egre.Dominique@hydro.qc.ca.

The opinions expressed in this article are solely those of the authors, both of whom work for Hydro-Québec and have been involved in large hydro projects in other parts of the world. A previous version of this paper was published in French in *Recherches Amérindiennes au Québec*, XXVIII(1), 1998, pages 89–103.

SOME 25 YEARS AGO, in Québec, construction began on the vast La Grande Hydroelectric Complex, better known as the James Bay Project. The Complex's total capacity is about 15,300 MW, close to 50% of Hydro-Québec's installed capacity. Construction took place in two phases: phase 1 (1971–1985) with a capacity of 10,300 MW and phase 2 (1978–1996) with a capacity of 5,000 MW. Other hydroelectric projects are presently being considered on the James Bay territory. They exclude the Grande-Baleine Complex, a different project which would have affected a river basin flowing into Hudson Bay, north of James Bay.

This article[1] gives an overview of the human impacts of the project and of agreements signed in its wake with the Cree, Inuit and Naskapi nations. It focuses on the Cree population, which has been affected the most by the hydroelectric complex. Subsistence activities of an Inuit village (Kujjuak, previously Fort Chimo) experienced some changes as a result of a reduction in the water flow of the Koksoak river. It is not known or is unclear whether the Naskapi, a small nation living in a single village, have been exposed to biophysical impacts related to the project. It should, however, be emphasized that all the Inuit and Naskapi villages have been affected by the agreements signed in the wake of the project, which generated impacts similar to those experienced by the Cree.

Human impacts of the James Bay project were at the forefront of the intense debate on the Grande-Baleine project in the early 90s. In the heat of this debate, which has probably influenced to some degree the perception of hydroelectricity worldwide, its

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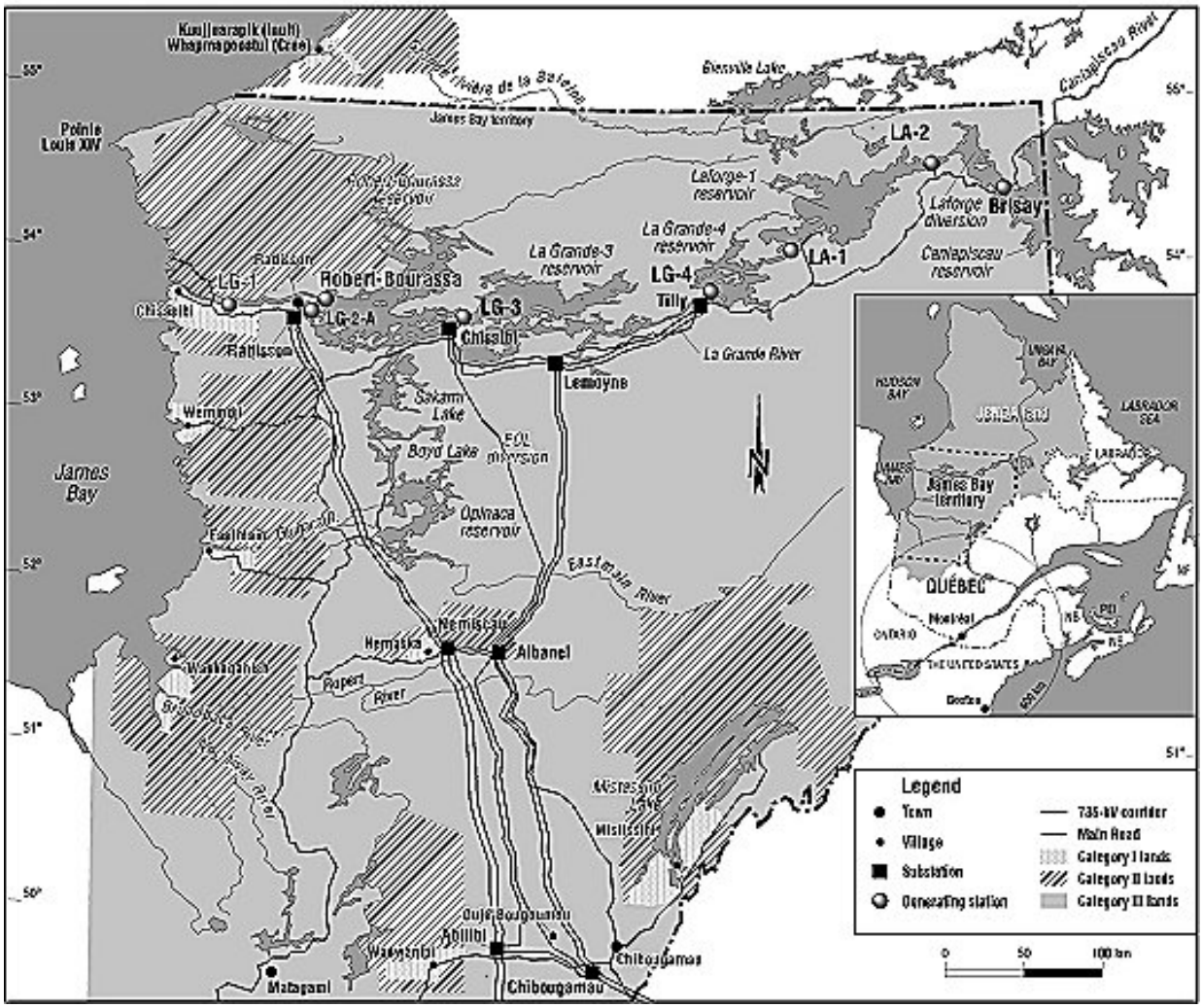

Figure 1. James Bay territory

human impacts have often been portrayed as catastrophic. Unfortunately, the results of the many follow-up assessments which have been carried out on these impacts (often by researchers with no link whatsoever with the promoters) have generally been overlooked in that debate. Our purpose is to give a more balanced view of what actually happened, based on the results of all the follow-up studies which were conducted and as devoid as possible of any ideological bias.

This article is subdivided into three sections. The first recalls the geographic and historical contexts of the James Bay project. It also defines what is meant by human impacts in this article. Finally, it gives an overview of the types of follow-up studies which have been carried out in the James Bay territory and of the way they were summarized.

The second section describes the impacts which have affected traditional subsistence activities mostly based on hunting, trapping and fishing. These activities have been carried out for thousands of years on traplines, the large hunting territories, extending over hundreds of square kilometers, exploited on a family basis, at a distance from the villages, which can vary from a few kilometers to 1,000 by road.

The third section draws a global picture of the impacts which have affected the villages themselves, established in the 1940s, where most of the community members now live on a permanent or semi-permanent basis, and have lived since their creation.

Background

Geographic and historical background

The James Bay territory lies between the 48th and 55th North parallels and covers 350,000 km2 (135,000 sq miles), an area the size of Germany or about two thirds of France (see map). The territory, which includes all or part of the drainage basins of six large rivers, is home to some 11,000 Cree Indians, belonging to eight communities scattered across the region and the community of Whapmagoostui located just outside its northern boundary.

The basin of the La Grande hydroelectric complex is contained within this territory. Covering nearly 177,000 km^2 (66,000 sq mi), it includes the drainage basin of the La Grande River and waters diverted from the basins of the Caniapiscau River to the East and of the Eastman River to the South. The project involved the construction of nine generating stations (among

other infrastructures such as roads and power lines) and required the creation of seven reservoirs covering a total area 13,577 km² (6,130 sq mi), including 11,505 km² (4,444 sq mi) of land surface that was flooded.

The announcement of the project started a long legal dispute with the Crees. It culminated on November 11, 1975 with the signing of the James Bay and Northern Quebec Agreement (JBNQA). The first treaty signed with aboriginal nations in Canada for over a century, its provisions cover 30 chapters. The Crees and the Inuit gained financial compensation, lands and a range of rights in areas such as local government, harvesting of wildlife resources, economic development, administration of justice, health, social services, education and environmental protection.

Several amendments to the JBNQA and new agreements have also been signed since 1975. They mostly dealt with remedial or compensatory measures related to additions and changes to the La Grande Complex.

Definitions and methodological background

In accordance with Hydro-Québec's standard practice, human impacts are defined here in their broadest sense, which includes:

impacts on prehistoric and historic heritage;
impacts on land use and landscapes;
economic impacts; and
social impacts (in the ethnological or sociological sense).

Impacts on archeological heritage and landscapes will not be described in this article, since the former have been covered in a number of reports and the latter have rarely been dealt with in studies on the La Grande Complex.

This overview is based primarily on a review of the large number of studies on the human impacts of the La Grande Complex conducted since the mid 1970s. Most of them involved fieldwork or the collection and analysis of statistical data. Our most important sources were literature reviews or global analyses which Professors Richard Salisbury (1986) and Jean-Jacques Simard (1996), as well as the Centre for Human Sciences Research and Analysis (ssDcc, 1992–1996) carried out. The latter systematically synthesized the most significant studies on the human impacts of Phase 1, most of which involved fieldwork. These studies were conducted by university researchers or private consultants working independently or for various organizations (government, aboriginal groups or Hydro-Québec). These researchers or consultants used a vast range of survey techniques or assessment methods.

Because we have mostly based this article on global analyses and literature reviews, we do not refer the reader to all the original studies which were summarized in the context of these reviews. Many of these studies were highly specific, describing, for example, how at some stage of the project navigation in an estuary was affected. For this reason, the reader will not find in this article any mention of researchers such as Feit, Berkes and many others, often working at McGill University at the time of the project, who carried out many of these studies. However, we do refer the reader directly to some studies with a broader outlook, which focused on a key issue or which have emerged as a turning point in the history of this literature.

Cree authorities and environmental groups have pointed out that no impact study was conducted before the work started, but a major environmental research program was launched prior to commencement to determine the region's characteristics

Literature overview

Prior to the La Grande project, very few studies, physical, biological or human, had been undertaken on the James Bay territory. Cree authorities and environmental groups have often pointed out that no impact study was conducted before the work started. Environmental impact assessment (EIA) legislation, however, was not passed until several years after commencement. Moreover, a major environmental research program to determine the characteristics of the region was launched before the work began. At the same time, the project initiated one of the world's first social impact studies, conducted by Richard Salisbury (1972).

Some impacts, on land use especially, have been studied in much more detail than others. The predominance of land-use studies is a result of a variety of factors, such as the influence of development anthropology (which has often stressed the physical and economic problems faced by subsistence activities) and the need for practical solutions to the problems encountered. For a long time, land-use studies emphasizing physical and technical aspects overshadowed the assessment of social and cultural impacts. At the present time, however, most human impacts have been described at least in a qualitative, basic way. To our knowledge, no other hydroelectric project in the North (or elsewhere) has been the subject of so many follow-up studies on human impacts.

Impacts of hydraulic modifications

The impacts of the Complex and the JBNQA on the harvesting of wildlife resources can be attributed to several causes. We will first describe the direct

Table 1. Traplines affected by reservoirs of the La Grande Complex (Phase 1)

Cree community	Number of traplines	Traplines affected	%	Areas affected	% hunting territory
Whapmagoostui (Great Whale)	17	0	0.0	0.00	0.00
Chisasibi	38	18	47.4	5,638.88	8.74
Wemindji	20	6	40.0	872.48	3.15
Eastmain	15	4	26.7	906.93	5.80
Mistissini	96	1	1.0	2,159.72	1.62
Waskaganish (Fort Rupert)	34	0	0.0	0.00	0.00
Nemaska	7	0	0.0	0.00	0.00
Waswanipi	50	0	0.0	0.00	0.00
Total	277	29	10.5	9,578.01	2.73

Note: Traplines as delineated in 1977
Source: Urbanex (1995)

impacts of river system modifications on hunting territories. It should be pointed out that impacts on hunting territories and subsistence activities have often been found to be combined with road-access impacts, which will be presented later. Lastly, all these impacts must be placed in the context of the implementation of the Income Security Program (ISP), which will be described later.

Hunting territories

The reservoirs created by Phases 1 and 2 of the La Grande Complex cover nearly 16,000 km^2 and affected the hunting grounds of four of the nine present-day Cree communities (see Table 1). The traplines most affected were those of Chisasibi, at the mouth of the La Grande River. The four reservoirs impounded in Phase 1 affected 18 of its 38 traplines.[2] These reservoirs flooded 8.7% of all the hunting territories of this community, that is, approximately 5,600 km^2. The Phase 2 reservoirs flooded an additional 984 km^2, affecting 11 of Chisasibi's traplines, one of which had not been affected by the Phase 1 reservoirs. With this additional flooding, 10% of Chisasibi's total hunting grounds are now impounded.

In addition, the average annual flow of the La Grande River doubled, changing the hydrological conditions of the river and its estuary as well as its freshwater extension along the east coast of James Bay in winter. For the Chisasibi Crees, these changes made fishing more difficult in the estuary and hindered river access to coastal wildlife resources.

Two access roads built for the project, however, facilitated resource harvesting in those same areas. Road access to the north shore of the La Grande River was made possible by the construction in 1979 of a bridge spanning the site of LG-1 dam (now completed) and of a road to James Bay that runs along the north shore. Another road, also built in the context of the project, provides access to the bay, south of the La Grande River mouth.

The Cree communities of Eastmain and Wemindji were affected by the creation of the Opinaca reservoir and the Eastmain–Opinaca–La Grande (EOL) diversion: ten of the 35 traplines belonging to these two communities were partially flooded. As a result, Eastmain lost 5.8% of its hunting grounds and Wemindji 3.1%. Eastmain was also affected by a 90% reduction in the flow of the Eastmain River, resulting from the diversion of the Eastmain and Opinaca Rivers. Only one trapline belonging to the community of Mistissini was affected by the creation of the Caniapiscau Reservoir, which flooded 1.6% of the hunting grounds.

Flooding by reservoirs is not the only type of impact that can be quantified. Other traplines or the same ones, in some cases, were disturbed by changes in the flow of the main rivers, the installation of transmission lines and the construction of roads. The number of traplines and additional areas that were disturbed by the various sources of impacts in Phase 1 was recently reassessed with the help of a GIS (geographical information survey).

Based on this method of calculation,[2] the total number of traplines affected by these various sources of impacts for all villages climbs from 35 to 124 out of a total of 277. The total surface area affected increases by a relatively small amount (by about 1,723 km^2 out of a total of 12,272 km^2) when all these sources of impacts are considered. However, the implications of this increase are undoubtedly significant, mainly from a perceptual point of view. Many traplines were affected only marginally, but a greater number of hunters and families (than that estimated previously) were able to witness effects, which may have contributed to the perception that the impacts were generalized throughout the territory.

It is difficult to assess whether the impacts of flooding resulted in a drop in the number of hunters carrying on their traditional activities. During the years that followed the impounding, Cree trappers did not redraw the boundaries of their traplines to compensate those trappers whose lands had been partially flooded. The trappers affected were instead invited by other tallymen, in accordance with Cree tradition, to use the territories that had not been affected by flooding or

that had remained viable for hunting or fishing.[3]

No drop in the number of hunters and trappers was in fact noted in the most severely affected villages: statistics of the ISP for Hunters and Trappers show that trends observed in these communities are similar to those observed in unaffected villages. The importance of 'bush food' (game and fish) in the Cree diet compared to food imported from the South, before and after the project, is unknown and would be very difficult to assess anyway, given the rapid changes in subsistence activities, eating habits and the availability of these foods in the villages.

Land-use patterns

First it should be recalled that only some of the residents in four of the nine Cree communities were affected: in fact, about three-fourths of the residents no longer engage in subsistence activities on an ongoing basis (for reasons unrelated to the project). Only a fraction of the fourth of the residents who are continuing such pursuits were therefore significantly affected.

As we have just seen, the reservoir impounding resulted in the flooding of hunting grounds and consequently in the loss of game. In addition, reservoir drawdowns are not compatible with the survival of traditionally valued riparian species such as beaver, even in the case of traplines that were only slightly flooded (ssDcc, 1982). Drawdowns also tend to make snowmobile travel difficult on the reservoirs.

Moreover, impacts occurred on traplines crossed by rivers whose flows were altered. In the case of reduced flow, these impacts have been partly attenuated by weirs that maintain the water levels. A number of valued fishing sites disappeared on these rivers, and fish from the rivers with reduced flow are said not to taste as good. Reduced flow has also given rise to problems for canoe and snowmobile travel, especially in the estuaries.

Various mitigation measures, such as navigation maps, selective clearing, boat launches, docking areas and snowmobile trails have facilitated summer and winter use of the reservoirs (LG-2 in particular) as a means to reach traplines located along the shores or in the vicinity. In both summer and winter, the reservoirs (combined with roads) facilitate access to thousands of square kilometers of territory that was formerly more difficult and costly to reach, and could only be accessed at certain times of the year. However, the low productivity of shore habitats for species such as beaver and the high mercury levels in several species of fish (although yield is high) have limited the use of the reservoirs. They also have prompted trappers to focus their activities on the unaffected areas of their traplines..

The substantial increase in mercury content in reservoir fish, from three to five times higher (depending on the species) than in natural lakes, was observed in the early 1980s. The contamination of fish-eating species increased the difficulties faced by subsistence activities on heavily flooded traplines already experiencing a loss of terrestrial and riparian fauna: the fishing of some valued species has been compromised for a period that could range from 20 to 30 years.

Biophysical impacts gave rise to changes in habitats of wildlife, and variations in availability of traditionally harvested species: this forced some hunters and fishermen to alter their harvesting strategies during the construction work

In 1986, Hydro-Québec signed the Mercury Agreement with the Québec Government and the Grand Council of the Crees. The main objective of this agreement was to develop remedial measures that took into account the importance of fish in the Cree diet and the way of life. These measures have substantially reduced exposure to the mercury observed in the early 1980s.[4] For the Cree population as a whole, mercury concentrations, as measured in hair samples, have dropped and stabilized at levels that present no health hazards. A major research program on the social impact of this problem was initiated in the early 1990s as part of the Mercury Agreement.[5]

Researchers have brought to light other impacts on subsistence activities as a result of the project, but also of other factors, such as the boycott on fur, and various JBNQA-related programs designed to improve the conditions for pursuit of traditional activities. The biophysical impacts gave rise, in a number of areas, to changes in the habitats frequented by wildlife, and variations in the availability of traditionally harvested species.

These impacts forced some hunters and fishermen living in the most severely affected villages to alter their wildlife resource harvesting strategies for the duration of the construction work. The Phase 1 construction schedule in fact extended over more than 15 years, forcing these hunters and fishermen regularly to change their strategies. Phase 2 considerably prolonged this impact in some areas.

Some families may have been forced to use other hunting territories or other sectors of their own territories at a somewhat higher cost.[6] The loss of areas formerly used for trapping or hunting also contributed (along with other factors unrelated to the project) to a reorganization of the groups of hunters who exploited the affected traplines. Moreover, the tallymen claim that they were unfairly treated, because the JBNQA negotiators made no provisions for any compensation for the loss of their traplines.[7] Various measures implemented by a joint organization called SOTRAC (Société des travaux de correction du Complexe La Grande) mitigated some land-use impacts or partially offset the loss of certain areas. For example, the

construction of ponds along the coast has facilitated waterfowl hunting.

Lastly, there are some signs that indicate that the loss of hunting grounds led to cultural and psychological difficulties among tallymen and their families who strongly identified with their traplines:

> a perception that the project resulted in ecological consequences that are likely permanently to jeopardize the quality of the biophysical[8] or even the social[9] environment;
> a feeling of guilt because of their inability to pass the land of their ancestors down to future generations and ensure the protection of animals lost during the flooding;
> a feeling of loss for the flooded land, the scene of family events and the burial place of their ancestors.

The older tallymen do not hesitate to describe the old days as a golden era — when life was hard but humans lived in complete harmony with nature, itself defined as an incarnation of divinity and as the heritage left by God to the Crees. The impacts are therefore perceived as having a spiritual dimension.

Roads built for the project

To build the Complex, a major road network was required. The 625 km highway between Matagami and La Grande 2 links the Complex with the road system in southern Québec. Another 665 km East–West road provides access from the main highway to facilities further east, to LG-1 generating station, the village of Chisasibi and James Bay, about 90 km to the west. Secondary roads have also been built, for logging purposes in the southern part of the territory and to reach reservoir dykes in the northern part.

Subsistence activities

The new roads significantly affected several coastal communities. Chisasibi was linked with the rest of the road system built for the Complex at the very start of the project. Wemindji and Eastmain, the other coastal communities affected by the Complex, were first connected to this road system by winter roads or snowmobile trails and, since 1995, by a permanent road (Roche, 1997). As the Cree communities became less isolated, the cost of shipping and the price of goods formerly brought in by boat or air dropped substantially, and there was considerably more cultural and economic exchange with cities in the South and with other Cree villages. Of all the Cree villages in Québec, only Whapmagoostui or Great Whale and Waskaganish have not yet been linked to any road system (however, a road to Waskaganish will be built in 1999).

The road system also facilitated wildlife harvesting. It is now much quicker to access remote areas by road than by canoe and much less expensive than by air. Consequently, roads combined with the reservoirs have become the best access routes leading to hunting, fishing and trapping territories.[10] Whereas camps used to be located at the best sites for harvesting wildlife resources (generally near lakes and rivers), they are now most often set up near roads and reservoirs. Since access to remote areas has improved, harvesting of wildlife is more evenly distributed throughout the territory.

Before the construction of these roads, remote territories were under-exploited because of the high cost of air travel (or the long time needed to access them by canoe) and hunting pressures increased in areas near the villages.[11] Chisasibi (then called Fort George) was particularly affected as conflicts broke out with the tallymen responsible for traplines along the coast or near the village. Contrary to custom, the tallymen were no longer always asked for authorization to trap or hunt big game on their traplines.

The road system and use of snowmobiles also enabled the Crees to travel back and forth between their camps and the village more often. It is now easier for trappers to get supplies when necessary and to send fish and game back to the village regularly. Supplying game or fish to the villages is important for dietary reasons and also as a way of saving money, in view of the transportation charges for food brought in from the South. Residents in many villages can now get to their relatives' and friends' camps on weekends, thereby making it easier during winter (when traplines are mostly exploited) to maintain family ties which might have suffered with such a large part of the population settling down in the villages.

Moreover, wage-earners often help fund some of the subsistence activities while benefiting from some of the catches. This type of exchange has therefore led to a sort of cultural and economic integration between those involved in traditional pursuits and salaried workers. Roads have also made the development of exchanges between most villages considerably easier. On the other hand, the use of trucks, combined with snowmobiles and motorboats is costly for hunters, especially when more than one type of transportation is required, as is often the case. Finally, a radio communication system has made road traveling and hunting activities much safer.

Salaried Cree workers living permanently in

Roads have made the development of exchanges between villages considerably easier, but the use of trucks, combined with snowmobiles and motorboats is costly for hunters, especially when more than one form of transportation is required

villages hunt and fish in accessible areas near the roads, partially for recreational purposes. This practice has been called 'corridor hunting' because it is done along a narrow strip on either side of the main roads, the only area accessible to a casual hunter who travels about in a truck and has little time to hunt. The rest of the territory is less accessible to this type of hunter (except for snowmobile owners during the winter). Nevertheless, groups organize hunting trips by air into remote areas, from time to time. In some villages, goose hunters are now regularly dropped along the coast by helicopters.

Corridor hunting can also result in conflicts with tallymen, especially if it involves trapping fur-bearing animals, activities that are still traditionally reserved for hunters registered in the ISP and that must be co-ordinated by the tallymen. These conflicts have forced band councils to intervene and various measures have been taken to reinforce the traditional authority of the tallymen. The new roads have made it easier to access hunting territories belonging to other villages, thus giving rise to occasional tension between communities.

Recreational hunting and fishing

Sport hunting and fishing have been practiced much more intensively by visitors from the South since the road was opened to non-aboriginal communities in 1986, mainly in the southern part of the James Bay territory and, more and more, east of the La Grande 2 facilities. The number of non-aboriginal users rapidly increased and Hydro-Québec (in conjunction with other organizations) set up a program to monitor such use, with the particular aim of assessing its impact on wildlife.

Nearly 11,000 vehicles were registered in 1991 at the entrance to the 'James Bay highway' and nearly 27,000 visitors were recorded. In 1997, the number of registered vehicles had increased to 90,000 and the number of visitors to 150,000. Hydro-Québec's several hundred operations employees and subcontractors living in the area on a more or less ongoing basis also take part in fishing (44% of the total) and hunting (10%) activities (Hydro-Québec, 1993).

These activities have significant potential for the development of businesses (and jobs) such as outfitters for hunting and fishing, which are often owned or managed by Cree authorities. However, in such a vast territory that is so hard to supervise, sport hunting and fishing by people from the south can also prove to be a source of conflict with the Crees. In the northern part of the territory, fishing as a livelihood and sport fishing often do not focus on the same species. In the southern part of the territory, in areas accessible to sport fishermen which are simultaneously used by Cree communities, fishing as a livelihood and sport fishing focus more on the same species. Nevertheless, despite the lack of knowledge about the evolution of certain species, the Québec Ministry of Recreation, Hunting and Fishing stated in 1991 that there were no particular problems regarding the current state of wildlife resources in the James Bay region.

Sport hunters and fishermen seem generally to comply with the JBNQA's regulations regarding exclusive Cree rights to certain parts of the territory or certain species. The few infringements noted (0.08% of the estimated total catch) are mainly a result of sportsmen from outside the region and seem to result primarily from a lack of information. Moreover, fishermen and hunters from the South report little conflict with the Crees during their chance meetings; 90% of them even describe these encounters as rather pleasant.

Some Crees, however, complain that the southern hunters and fishermen lack respect for the harvested game, a serious offence in the eyes of traditional hunters. According to their reports, some animals are slaughtered without being cut up, counter to Cree traditional value, and areas used for butchering (such as boat ramps or roadsides) are not cleaned up. Acts of vandalism are blamed on non-aboriginal users of the territory. In 1997, a special program was set up to convince caribou hunters, the worst offenders, to hunt in a more ethical way, and game warden patrols were increased.

Impacts on communities

Large amounts of compensation were paid to the Crees, Inuit and Naskapis after the signing of the James Bay and Northern Québec Agreement and subsequent agreements. By the end of the 1980s, total compensation had reached Can$505 million (not including the cost of government programs or capital spending on public infrastructures). The 1992 Opimiscow agreement with the Crees raised this amount by several tens of millions of dollars. The JBNQA and other agreements also resulted, for the first time in Canadian history, in the creation of aboriginal political structures very similar to governments (such as the Cree Regional Administration and Makivik for the Inuit), which play a large role in the management of health, education and housing programs (among other responsibilities). Northern Québec was subdivided in three categories of lands involving varying degrees of property and hunting or fishing rights for aboriginal communities.

Income security program

All the impacts on forest subsistence activities must be situated within the context of the ISP, created in 1975 and probably unique in the world. This program is designed to preserve the traditional way of life by providing assistance, including financial aid, to families or individuals who hunt on a more or less ongoing basis (at least 120 days a year). In 1971, 600 families only were regularly involved in hunting, fishing and trapping activities. In the first half of the 1980s, the

Table 2. Beneficiaries of the income security program for Cree hunters and trappers

Year	Number of beneficiaries	Number of beneficiary units	Average payment per unit ($)
1976–1977	4,046	979	4,719
1980–1981	3,043	874	6,880
1984–1985	3,710	1,205	9,491
1988–1989	3,372	1,217	9,979
1992–1993	2,994	1,225	12,146
1996–1997	2,595	1,190	11,749

Source: Cree Hunters and Trappers Income Security Board

number of program beneficiary units increased to approximately 1,200.

All studies conducted show that the ISP program, which applies to the entire Cree population, has made it possible to preserve a way of life that appeared to be threatened, or at least slow down its decline, which started before the project was launched. Some signs, noted in aboriginal villages not benefiting from such a program, seem to imply that as a result of lack of adequate support, traditional activities are less dynamic, despite grant programs such as air transportation subsidies for remote traplines. Between 1978 and 1995, the number of people benefiting from the program fluctuated between 2,595 and 4,046, out of a total population of approximately 11,000 in 1995 (see Table 2). The popularity of the program largely reflects the persistence and strength of the values connected with the traditional way of life.

A declining trend, however, may be noted from year to year since 1984. In 1994–1995, for example, beneficiaries accounted for only 24.1% of the Cree population, down from one third at the end of the 1980s. Some of the new generation, raised in the villages and more educated, are apparently less attracted to a way of life based on hunting, fishing and trapping. In addition, these activities seem to be becoming more of an occupation than a way of life: they are practised less and less by families and more by individuals. Lastly, people in the 18–30 age bracket (generally with little education) and those over 50 are present in a greater proportion among ISP beneficiaries, compared with the Cree population as a whole.

The program has helped shift the focus of bush life from trapping back to its original objective prior to the first exchanges with Europeans, namely, subsistence hunting and fishing. In fact, life in the bush — now directly subsidized by the Québec Government rather than supported by the sale of furs — increasingly aims to feed the trapper's immediate and extended family. Income from the sale of furs accounts for only a small proportion (less than 2%) of the overall income generated by traditional activities.

Participation in the ISP also seems to be inversely proportional to the number of jobs available. The program's popularity therefore partially reflects, when other sources of income (such as temporary jobs) run dry, the precariousness of a social stratum made up of youth, the elderly or the less educated, for whom the ISP acts as a type of social safety net.

Because of the income derived from the ISP, almost all hunters and trappers now use improved technology, such as small trucks and snowmobiles. Such equipment, which in some cases had already made its appearance before the JBNQA was signed, has made travel faster over longer distances while making it easier to transport game and fish. Moreover, the hunter is no longer forced to change campsites periodically to be near his source of subsistence and his traps. He can now build a permanent, more comfortable camp.

Nevertheless, some observers feel that the program has transformed the traditional hunter into a 'harvest manager', and was instrumental in changing the very meaning of traditional activities. The dispenser of resources is no longer the 'Master of the Animals' leading the game to the gun or net, but rather the Administration that issues ISP cheques from hundreds of kilometers away in Québec City (La Rusic, 1979).

Occupational structures

Traditional pursuits no longer carry the same weight in terms of income as before. Although hunters' incomes more than tripled between 1971 and 1981, according to Salisbury (1986), their percentage of overall income in the Cree communities dropped from 61% to 43%, while salary income rose from 23% to 52%. This gap seems to have widened over the past 15 years: Simard (1996) explain that, starting in 1981, salaried employees generally earned nearly twice as much money as regular hunters (by a multiplier of 1.7) and the gap widened slightly in 1989 (1.9 multiplier).

Moreover, Simard (1996) estimated that the average annual income for a family of five engaged primarily in subsistence activities amounted to Can$28,000 in 1989. The average annual income for an equivalent family living mainly from salaried employment amounted to Can$47,800, which would put the income of the first family into the lower middle class in Canada (even taking into account the higher cost of living in the North).

This sharp increase in total income indicates a consolidation of the job market and is clearly one of the most significant impacts of the agreements signed in the wake of the project. Previously, employment was precarious and seasonal. A considerable proportion of jobs are now permanent and much better paid. These jobs, usually provided by one of the many organizations created in the wake of the Agreement (or by the Band Councils), are mainly concentrated in the public-service sector, which has developed locally and regionally with the transfer of government services.

This devolution of power, combined with the payment of indemnities and the effects of these two factors on the occupational structure in the form of better paying jobs, seem to have differentiated the

Rapid population growth has increased the need for housing and infrastructures, which has contributed to the expansion of the construction industry in the villages: growth in public services and construction have also boosted business activity

development of JBNQA communities from that of other aboriginal communities in remote or isolated regions of Québec not covered by the JBNQA. As Professor Jean-Jacques Simard (1996) pointed out however, this trend was already under way when the Agreement was signed. Even in the 1940s and 1950s, the first government programs and transfer payments resulted in a significant increase in income. The Agreement did quicken the pace or at the very least, gave it added impetus.

The very rapid population growth, approximately 25% in ten years, has increased the need for housing and infrastructures. This factor, combined with the economic impact of the contracts awarded by the James Bay Energy Corporation and Hydro-Québec to Crees companies, has contributed to the expansion of the construction industry within the villages. Growth in public services and construction in the villages have also boosted business activity. Interest gained from the indemnities paid under the Agreement has been invested in the start-up of many new businesses such as Air Creebec and the Cree Construction Company.

The presence of these companies greatly increased the value of contracts awarded to aboriginal companies during Phase 2 of the La Grande Complex (Can$272 million between 1987 and 1994) compared to Phase 1 (Can$3.8 million). Moreover, whereas the contracts awarded during Phase 1 were mainly related to forest clearing, those in Phase 2 were much more diversified: construction, maintenance or repair of roads and buildings, supply of services and so on. Work related to remedial measures also had significant economic spin-offs in the Cree villages, and contracts are awarded in the context of operation activities.

As we have seen, this development of salaried employment has given rise to increasingly marked differences between families living off salaried employment and households engaged in subsistence activities. This factor has resulted in the creation of social strata; some commentators even talk of social classes. According to Salisbury (1986), there also seems to be an educational gap growing between children of hunters and those of salaried workers.

The emergence of this social stratification system, already discernible in the early 1970s (when three-quarters of employment income was monopolized by one-third of families), seems to have increased with the signing of the agreements. According to ssDcc (1992–1996), at the top of the pyramid are families of politicians or management personnel, followed by families of salaried employees and, lastly, families of hunters registered in the ISP. At the bottom of the social scale, a certain percentage of the population seems to have access neither to salaried jobs nor to the ISP.

Social and psychological impacts

The Agreement led to the creation, to all intents and purposes, of a new level of government, controlled and managed by the Cree, and giving them a significant degree of political autonomy. These changes nevertheless led to the creation of an impressive number of consultation and decision-making organizations and mechanisms, in view of the relatively small number of Cree living in the James Bay territory. A large proportion of the population devotes much of its energy to operating these organizations. Several observers maintain that Cree society also went through a bureaucratic process that was superimposed on the old conflict-solving processes and networks of social solidarity. This evolution involves substantial social costs that are similar to those of advanced industrial societies:

> a certain youth sub-culture living on the fringe of society as well as a growing precariousness in their living conditions;
> tensions between local and central authorities, typical of modern political structures; and
> the various stresses faced by people torn between many responsibilities and cultural trends, which the Cree are nonetheless managing to integrate.[12]

The relocation of the town of Fort George from the island of the same name to its present site at Chisasibi — a move approved by the town citizens, who were consulted on the matter — was another major source of impacts. Like other similar projects around the world, the move was not without problems: despite a distinct improvement in the quality of life at the new location, several dozen people refused to relocate to Chisasibi and some are still living on the island. Elderly citizens who did move seem to have experienced a sense of loss, sometimes resulting (reportedly) in health problems or depression.

In a context of rapid demographic and social change, the ‘good old days’ of the elderly have sometimes come to symbolize an ideal world of strong family and community ties, and the erosion of these ties is seen as the source of numerous social problems. To alleviate these problems, get-togethers are held every summer at the old site of the town.

Construction of the La Grande Complex also led to the creation of a new village east of Chisasibi (Radisson, which is populated mainly by operations personnel) and of other residential compounds near

most of the La Grande power plants. Although Radisson is sometimes perceived as an intrusion of the 'white world', business relations developed rapidly between Radisson, Chisasibi and other aboriginal communities.

Conclusion

In a territory virtually untouched by the modern world, the La Grande Complex was bound to have large-scale effects. These effects have much in common (for instance, concerns about mercury) with those observed in other northern road and hydroelectric projects in Québec, as well as in the other Canadian provinces or even in Scandinavia (ssDcc, 1994).

The creation of vast reservoirs resulted in the disappearance of large areas used by groups of Cree hunters. In addition, the high mercury content in certain species of fish further reduced the quantity of wildlife resources that could be harvested on certain traplines. These factors, as well as the change in the flow of several rivers and the development of the road system, prompted the Cree to adopt new ways of traveling and harvesting wildlife resources. At the same time, however, the development of the road system substantially contributed to a more even distribution of wildlife harvesting throughout the territory.

Perceptions of impacts have also been an important factor influencing land use, probably as important as physical impacts and, to a significant extent, independent of them. Reservoirs and diverted rivers have been notoriously underused for fishing purposes, for example, even if a large range of species have not been affected by mercury. Debates on future projects have increased the importance of these perceptions. The James Bay Energy Corporation and the La Grande Complex Remedial Works Corporation have implemented many measures designed to mitigate or correct some of these impacts, while developing some of the resource potential.

These impacts affected communities that were already exposed to many other factors of social change. Bringing different values and ways of life, these other factors followed one another at a rapid pace starting in the mid-1940s and affected all the northern communities. Family allowance programs and other government benefits should be mentioned in this regard, as well as housing construction, compulsory schooling and the advent of television. The impacts of the hydroelectric complex and the JBNQA, combined with these factors, helped speed up the development of the Cree, Inuit and Naskapi societies.

The contribution of the Complex and the agreements to this process of acceleration,[13] which some experts had in fact anticipated, emerges at face value as the most significant social consequence of the project. Although it is often difficult to distinguish the impacts that can be attributed to each factor and even though certain impacts require better assessment, a number of experts (notably the late Dr Salisbury (1986, page 145)) have concluded that all these changes, and particularly those that arose from the various agreements, did benefit the Cree on the whole.

While significant impacts did occur in wildlife harvesting and in the related traditional social fabric, on the whole they affected a relatively small number of Cree hunters living in four of the nine villages. Many other impacts, often related to the JBNQA (and stemming more specifically from the introduction of new infrastructures or income growth), proved to be positive for the entire Cree population, not only for permanent residents of villages but also for hunters and trappers. The project and the agreements also helped speed up the pace of social change in the villages.

At the beginning of the 1980s, unemployment sharply increased as growth in the service sector and construction activities resulting from the JBNQA began to slow. The social problems related to high unemployment also appear to be worsening. Subsistence activities, essential to aboriginal identity and to the survival of part of the population, cannot grow indefinitely, considering the population increase, the limits of wildlife resources in the territory and the aspirations of younger generations.

Under these conditions, opening new areas of development compatible with the maintenance of traditional activities is the key factor influencing the future of aboriginal communities in northern Québec. In view of the remoteness of the territory and the limited diversification of its resources, few economic sectors offer sustainable development potential. The future of the territory, for this reason, will be largely dependent on the willingness of the stakeholders to engage in dialogue and search for common, or at least mutually acceptable, goals.

Notes

1. As this paper cites mainly the results of follow-up studies, readers should not look for signs of a general method for assessment of human impacts developed or promoted by Hydro-Québec as part of its draft-design studies.
2. Quantitative assessments of the number of trapping lots affected can be found in SEBJ (1987) and Urbanex (1995). The figures cited here are taken from the latter report and from a more recent reassessment carried by Hydro-Quebec: it contains more accurate and complex data, compiled by means of a geographical information system developed specially for this purpose. Both series of assessments were based on the trapping lot demarcation established in 1977 and which were in effect when the main hydraulic impacts occurred.
3. Trapline boundaries were drawn again in 1989 but the impacts of the La Grande complex, and the reservoirs in particular, do not seem to have had any influence on the new demarcation except, perhaps, in the case of one trapline belonging to the Chisasibi community (compare with ssDcc and LAS, 1993). As for the Cree's tradition of reciprocity and sharing, it is not limited to hunting on the traplines of other tallymen but also takes the form of sharing the costs and work involved in subsistence activities — an option that remains a possibility for those whose lots were flooded.
4. This problem is not limited to the areas affected by reservoir impounding, since high levels were also identified in the mid-1970s in some villages and in the early 1980s in all Cree villages, whether or not they had been affected by the reservoirs. Consequently, the measures developed to reduce these

levels were implemented in all Cree villages. According to the latest academic research, atmospheric emission of mercury is the leading source of mercury in reservoirs, largely through the burning of coal smelters and the incineration of domestic and industrial waste in southern areas, particularly in the United States.

5. Large-scale dissemination of study reports on the resulting economic, social and cultural impacts was opposed by Cree representatives.
6. It is very difficult to assess the economic repercussions of the biophysical impacts on subsistence activities. Recent efforts aimed at evaluating the economic repercussions of mercury have not proven very conclusive.
7. The tallymen affected were never compensated for the losses incurred, apparently because the JBNQA negotiators (both non-aboriginal and aboriginal) felt they did not have any ownership rights on hunting territories. This seems to have caused the tallymen considerable frustration which did not come to light until much later.
8. This perception of impacts is probably a result of the basically holistic view of ecological systems that has traditionally characterized the aboriginal outlook and that still exists today.
9. Some Crees link all the social problems they have experienced over the past 20 years, and more particularly the behavioral problems with the James Bay project. Others contest this assumption and attribute a substantial part of the responsibility, beyond the fast rise of revenues linked to the Agreement, to a problem-riddled internal evolution that calls for an 'awakening' and 'empowerment' by the Cree. A report by ssDcc (1994) seems to give some credit to this last assumption. It underlines that the studies establishing a cause-and-effect relationship between other northern hydroelectric projects and behavioral problems were rarely based on analyses comparing the evolution of the affected communities with unaffected communities, and therefore seem rather questionable from a methodological standpoint.
10. There are apparently still a number of constraints to navigation on certain reservoirs: debris (such as trees floating on the surface), underwater obstacles (tree trunks or boulders), strong waves on very windy days and so on.
11. According to some surveys, the traplines located farthest east of Chisasibi are still much less exploited. Obstacles to their use are now more a matter of economics than logistics.
12. A number of studies on the psychological well-being of the Cree were carried out in the late 1970s by Berry (1992, quoted by SSDcc, 1992–1996). According to their findings, stress resulting from the acculturation processes decreased over an eight-year period because the Cree managed, both collectively and individually, to take part in Euro-Canadian society while maintaining their identity. An assessment made in 1989 on the Cree's mental health seems to reveal, moreover, that psychological problems are no more acute in the villages most exposed to the impacts of the James Bay project (Laverdure and Lavallée, 1989).
13. This quickening of social change was also pointed out by the Cree. Moreover, this effect seems to have characterized the evolution of communities affected by other northern hydroelectric projects in North America and Europe. This topic was examined in depth in another report (ssDcc, 1991).

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