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Northern Science and Research

Postsecondary Perspectives in the Northwest Territories

ABSTRACT The International Polar Year (IPY) provides an opportunity to reflect on Northern science and research. For all Canadians, science and research should contribute to living a good life. A good life includes successfully making sense of the world within local contexts, sharing this knowledge beyond the immediate community and reconciling it with knowledge held by outsiders. Northern science and research are inherent in Traditional Dene, Inuvialuit and Métis knowledge; and they continue to be reflected in Northern governance, economy, and cultures. Alongside Aboriginal sciences are Western sciences; these are primarily disciplinary in nature and formally structure postsecondary education globally. Postsecondary science and research education is still being introduced to the Northwest Territories (NWT). Over the last forty years the territorial government has developed the capacity for educational services, funding, institutions, and authority through the Department of Education, Culture and Employment. The delivery of Northern-based postsecondary education through Aurora College provides Northerners with the capacity to generate science and research in the North. What place do science and research have in the North? (North in this paper demarcates the socially constructed geopolitical territories north of the 60th parallel that we use cautiously as a structural term for the purposes of our narrative.) What kinds of investments need to be made and will Northerners be prepared to overcome barriers and take advantage of the opportunities?[1]

KEYWORDS Arctic science, International Polar Year (IPY), Arctic Council, post-secondary education, research, Northern Canada, Indigenous knowledge, history

Introduction

While much has changed in the North since the first International Polar Years (IPY) in 1882–1883, it remains a choice location for numerous researchers. If IPY (2007–2008) is an opportunity to advance sci-

ence and research, it is also a time for us to take stock, reflect and celebrate our achievements. The present moment in history is a perfect time to examine the relationship between science and education. Our discussion will look at research funding and we propose that there are great needs and little access to national funding in the north. Paradoxically, we will show that postsecondary science and research rely to a great extent on public funding. Furthermore, the North continues to be an attractive site for fieldwork for more reasons than the existing crumbling infrastructure, which has seen little investment since the 1970s. As a site for postsecondary learning and teaching our discussion explores some of the main challenges and opportunities facing research and science education, illustrated with specific examples from the Northwest Territories (NWT).[2]

The Arctic Human Development Report (AHDR) stated,

> [a]rctic societies have a well-deserved reputation for resilience in the face of change. But today they are facing an unprecedented combination of rapid and stressful changes involving environmental processes (e.g. the impacts of climate change), cultural developments (e.g. the erosion of indigenous languages), economic changes (e.g. the emergence of narrowly based mixed economies), industrial developments (e.g. the growing role of multinational corporations engaged in the extraction of natural resources), and political changes (e.g. the devolution of political authority). (Einarsson et al. (eds.) 2004: 10.)

This paper examines the role of Northern science and research, in particular how they contribute to living a good life in the NWT. We acknowledge there are major regional differences among circumpolar countries, even within regions of each country; there are also common experiences of being Northern. IPY is a massive focus on and investment in circumpolar research,[3] providing us with an opportunity to examine the role of Northern science and research, the resilience of Northern peoples and lands, as well as the nature of changes being experienced (to the extent they can be known). IPY is an opportunity not to be squandered.

Planning for IPY began at the Arctic Council and in circumpolar countries as early as 2004. In Canada, training and more broadly speaking, community outreach, were set as high priorities; however, some would argue that adequate investments were slow to materialize. The Arctic Council's legacy for IPY is to increase knowledge and understanding of Polar Regions. Ultimately long-term sustainability for Northern research requires understanding IPY's context as well as developing a long-term vision for Northern science and research. We would encourage comparative work in the future, to understand more fully the state of circumpolar science and

research, including the human and historical dimensions.[4]

On the topic of education, the Arctic Human Development Report (AHDR; Einarsson et al. (eds.) 2004) found that no comprehensive comparative assessment could be made for Northern education, "partly because there is very little circumpolar research in the field"; furthermore, "education policy is driven by values and interests. It is therefore important to know if some take precedence in curriculum development over others, and why" (Johansson et al. 2004: 169). Furthermore, there is no agreed upon Arctic Science Strategy, although there has been extensive cooperation in the Arctic Monitoring Assessment Program and in regional assessments (i.e. Arctic Climate Impact Assessment). In Northern Canada the three Northern Premiers stated (Yukon Government 2007: 9).

> Research infrastructure in the territories, as well as individual knowledge and know-how, needs to be strengthened. It is not sufficient to study the North from afar. Broadening our understanding of the North, and drawing upon traditional knowledge as well as modern science, will improve our collective ability to operate in an environment that is fragile to begin with, and undergoing serious and rapid change.

How can Northern science and research infrastructure be strengthened? In addition to support and key investments, the way in which Northern science is conducted must change. Through "A Northern Vision," the territorial Premiers discuss the importance of bringing traditional knowledge and Western science together, to improve educational opportunities for Northerners, and to work in partnership with Canada and private organizations, including industry, to achieve their vision.

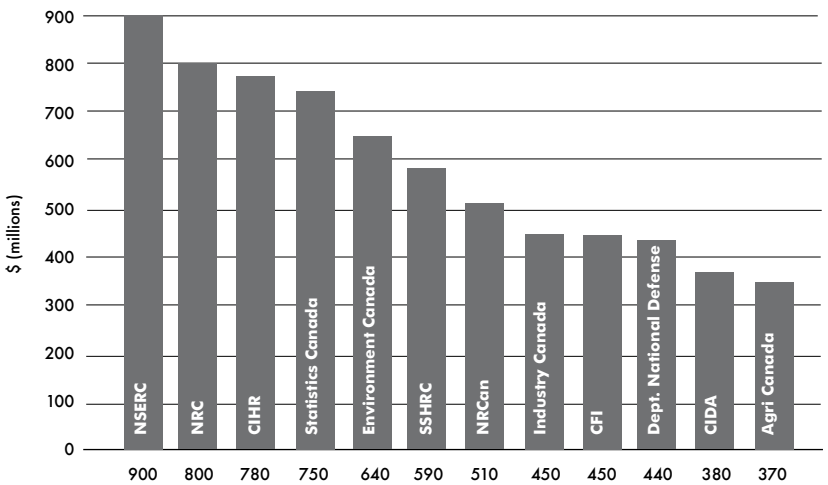
Investments in Northern Science and Research

The Conference Board of Canada (2007: 81) observed that there is a "direct relationship between investments in education, educational attainment and economic growth." Northern economic growth is dependent on educational investments from other jurisdictions.[5] Northern economic growth is fueled by labor demands for natural resource extraction and the export of raw resources. The Conference Board of Canada's logic would require additional analysis for it to make sense in the Northern regions of Canada, even though a national perspective is reasonable.

There are two ways in which science and research funding flows. It can flow directly to the North, through departmental agreements or partnerships. Or it can be applied to Northern issues led by researchers and scientists in southern Canada and elsewhere. The funding of international re-

searchers will not be discussed. Instead, we focus our attention on funding within Canada (see Fig. 1). Public health-related research gets the largest part of research funds, in excess of ~$1.2 billion, or about 17%, followed by industrial investments at ~$900 million, or about 13% (Canada 2007b). The majority of these funds are spent at universities, teaching hospitals, and industries based in Southern Canada. Statistics are not kept for the NWT or the other two territories, or combined for such measures as business enterprise expenditure on research and development (BERD). While Canada has increased its funding over the last decade of higher-education research and development (over $9.9 billion in 2005), the North sees only indirect benefits from these increases in the form of Northern Research Chairs based in southern institutions. Other initiatives, for example the floating science lab

Fig. 1. Major government Canadian funding agencies for science and research. Funding amounts are for 2005, in millions of dollars.



known as Arcticnet (IPY investments are listed as $24.2 million), attract most of the dollars with little spent on Northern postsecondary infrastructure.

The Canadian Foundation for Innovation (CFI 2007: 2) indicates that they have invested 3 billion dollars in over 4,000 projects at universities, colleges, non-profit research institutes and hospitals in municipalities across Canada. CFI expects this amount to be $11 billion dollars by 2010. CFI (2007: 4) supports research capacity through the college research development fund with contributions capped at $800,000.00. With over $15.6 million invested nationally since 1999, the fund has yet to be accessed by Aurora College and it will only be relevant after a science program has been established (besides

Nursing) to encourage opportunities for innovative research with industry.

Canada (2007b: 10) reported that the government "supports R&D [research and development] and RSA [related scientific activities] through a number of departments and agencies. Some departments and agencies perform most of their R&D internally (National Research Council, Natural Resources Canada), and others mainly provide research funds to universities (National Science and Engineering Research Council [NSERC], Canadian Institute of Health Research [CIHR], Social Science and Humanities Research Council [SSHRC], and CFI) or to the business sector (Industry Canada)." The North is excluded from this funding because there is no university located there. NSERC and SSHRC have attempted to address these issues internally through program changes and pilot projects, for example the College and Community Innovation Pilot project,[6] as well as working collaboratively with Northern jurisdictions.

Northern Science and Research: A Good Life?

For Dene, Inuvialuit, Métis, and all NWT residents, science and research should contribute to living a "good life" (Paci & Villebrun 2005). The ideal good life is more than the accumulation of externalities (Tsetta et al. 2005). To paraphrase Westlund (2006: 68), the dominant financial view of living the good life includes competing for and winning resources, making "enough" money to afford to buy our way in and out of price situations. From an economic perspective, IPY is a massive injection of resources (funding and attention) for the scientific community. In Canada alone there are 44 Canadian lead projects, in addition to international lead. Many of these projects examine the most pressing scientific questions of our day: the relationship of the Arctic to contaminants and climate change. There is also a human dimension to many of the approved projects, and hence there are great expectations for the benefits from this work collectively; that the resulting data and analysis will contribute to living a "good life."

In addition to an economic dimension, living a good life has other considerations. From an ecological perspective, it is sustainable: balanced energy cycles with species interactions that are robust. This perspective requires acknowledgment and respect for interconnectedness. Carelessness or rapid change can lead to vulnerability, ecosystem flips and extirpations. The reason we raise the ecological and the economic perspectives is to stress the importance our values have when we reflect what is after all a good life and how we seek to achieve this state of being individually and collectively. Anielski (2007: 21) asks: "Is there discord between the values espoused by our modern democratic, capitalist and free market system and the values

that reside in our hearts about what constitutes 'a good life'?" Our answers are important to the kinds of research and postsecondary education we establish. Neilsen (1998: 270) notes:

> We live and work in the texts of the world, but in educational research, just as in education itself, such living inside the texts we create allows us to ignore the ways in which these texts weave themselves into the larger ecology of interdependencies and relations among people, ideas, and the particular tasks of living on the planet. But [...] ignoring the consequences of our ecological assumptions about our work in education may, in fact, threaten the very sustainability we claim to be working towards. An ecological awareness reminds us of the tensions inherent in our unstable interdependence.

For Northerners living a good life begins by satisfying internal values, successfully making sense of (and a place in) the world within cultural (this includes economic), social, political and ecological contexts; as well as sharing this knowledge beyond the immediate community and reconciling it with knowledge held by others. To what extent has science contributed to a good life in the NWT? While it has enabled major natural resource development, transportation, communication, it has also radically changed the North. Great fortunes have been amassed and lost: for example, uranium from Port Radium fed the Manhattan project and devastated a generation of families in the Sahtu. Indigenous knowledge is mostly marginalized or worse; Aboriginal languages, governance, economies and cultures have resisted scientific disciplines in their own right. In contrast, Western scientific knowledge has dominated formal education in most countries (see Box 1).

In the past, science revolutionized, liberated, and thus also dominated the way Western societies constructed postsecondary education. Ideas such as mechanical, rational, and atomistic thinking evolved out of the Enlightenment. Said (1994) points out that imperialism and empire have also had their influences and their far-reaching impacts have swept aside, in many ways, Indigenous knowledge systems. The forces of empire and colonialism replaced limitations and old fears with the realities of modernity; however, we have a new set of fears: mass hysteria, alienation, and environmental degradation. Western sciences are no longer acultural, conveyed unexamined from the cultural contexts that bore them; they are no longer insular, albeit some institutions remain ivory towers. Most universities embrace diversity, and cultural contexts and breakthroughs from ecology, feminism, social history, as well as a host of ethno-sciences are included in this mix (Nazerea (ed.) 1999).

Is it correct to conceive of scientific research as an enterprise? Any type of knowledge, new knowledge, acknowledgement of old knowledge,

Box 1. The 4 program foundations for junior and senior secondary science curriculum. Government of the Northwest territories (GNWT).

Foundation 1: Science, Technology and Society (STS) – ***Students will*** develop an understanding of the nature of science and technology, the relationships between science and technology, and the social and environmental contexts of science and technology.

Foundation 2: Knowledge – ***Students will*** construct knowledge and understandings of concepts in life science, physical science and Earth and space science, and apply these understandings to interpret, integrate and extend their knowledge.

Foundation 3: Skills – ***Students will*** develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively and for making informed decisions.

Foundation 4: Attitudes – ***Students will be encouraged to*** develop attitudes that support the responsible acquisition and application of scientific and technological knowledge to the mutual benefit of self, society and the environment.

repackaging knowledge, verification of knowledge, etc., has a distinct feature, but they all share the goal of learning and improving our quality of life. The *professionalization* of research, the production and communication of knowledge, the recruitment and education of research and science professionals, each involves investments and returns. The nature of science and research, both being *in situ* and also *ex situ*, in particular their production and consumption, is central to our discussion. Postsecondary science and research education is still being introduced to the NWT.[7] Over the last forty years the territorial government developed the capacity for educational services, funding, institutions, and investing the authority through the Ministry of Education, Culture and Employment (ECE).[8] The exclusive delivery of Northern-based postsecondary education takes place at Aurora College. There is a primary campus and head office located in Fort Smith (Thebacha), and there are two regional campuses in Yellowknife and Inuvik, and learning centers in 23 rural and remote communities. Not all campuses offer the same programs and there is regional division of services and support that will not be examined in detail, but has a significant influence on Northern science and research capacity, or lack thereof. Much of the circumpolar North was "explored" and "settled" as Northern science and technology evolved, in particular to allow large-scale industrial development and extraction of natural resources and therefore settlement (Bravo & Sörlin 2002, Paci & Villebrun 2005).

Throughout the circumpolar region, natural resource discoveries led to development of most of the current infrastructure. In Northern Canada, rather than the growth of cities and settlement, the pattern of natural resource extraction resulted in the development of frontier industry

towns (bush camps), the underdevelopment of science and education infrastructure. Apart from polar field stations, very little has been spent on educational institutions. While Canadians claim to be a Northern nation, Northern underdevelopment must be the most poorly appreciated aspect of our identity (Bravo in press). Rather than dwell on underdevelopment, it is enough to say that we are facing a significant challenge.

Linking Northern Science and Research with Postsecondary Education

There is a link between national level science and research funding of government and/or university scientists (and their graduate students), which funds relevant and important Northern research. This is problematic for the territorial North, which on the whole does not gain access to this money. Furthermore, without a tax base or other revenue common among the provinces, and a dominant feature in other circumpolar jurisdictions, the Canadian North is in a precarious position. National funding in the sciences builds capacity to study the North. Moreover, prestigious Northern programs, for example the Northern Contaminants Program and Arcticnet, to name two, fund Northern research conducted primarily by southern institutions. It is not that these programs, including IPY, or the national funding agencies, or southern-based scientists, are unconcerned about postsecondary education. However, most lack an appreciation of the link and lack thereof between their research and Northern postsecondary education. Individuals and their institutions do not have the authority or jurisdiction to build territorial postsecondary capacity. IPY, in particular, highlights this problem, because half of the principle investigators (n=22) are southern-based academics with graduate and doctoral cohorts working in the North. The University of British Columbia (3 projects worth $9.3M), Laval (4 projects worth $3.9M), Manitoba (2 projects worth $6.5M), and Toronto (2 projects worth $4.2M) are the four main institutes.

According to the Canadian Education Statistics Council (2003: 109), "formal education, either at the 'typical' age of study, or later, as an adult learner, is a key to providing people with the opportunities to develop the knowledge and skills needed in the knowledge economy." Southern-based academic institutions continue to build their Northern expertise and IPY is facilitating this. Meanwhile, Northern academics/researchers and scientists are managing 13% of IPY projects (accounting for $7.4M). This is a huge improvement in comparison with 1882, when there were only international scientists at two field stations (Fort Rae and Fort Conger).

The linkage of Northern postsecondary education with science and research would benefit the current postsecondary institutions, which are

currently sites for adult education, vocational training, and very specialized and limited undergraduate studies. In our opinion, traditional knowledge has a prominent role to play. The role of adult education might cause some to argue that such linkages would be a waste of time. Dennison & Gallagher (1989: 11) provide a cautionary note regarding postsecondary and adult education.

> Became increasingly popularized as a collective label that would incorporate all education after secondary school: universities, degree-granting colleges, specialized institutions which admitted students beyond school age, and the new institutions which most commonly referred to themselves as community colleges. The place of adult education in this new alignment of institutions remained ambiguous because at this state in the development of Canadian education, it really did not fit.

The problem today is in practice, Northern science and research are not conducted at/by Aurora College. College instructors have relatively small class sizes (<12), but heavy teaching loads (>5 courses/semester) and no release time to pursue research. The separation of research from teaching has the obvious impact of disengaging college faculty, in all programs including those teaching in Adult Basic Education, Carpentry, and the more academic programs. Instructors are not learning and expanding the present state of knowledge, which is a major disconnect because for the most part they are practicing state of the art teaching, in particular to bring traditional know-ledge into the classroom, or their classes out on the land. Research is effectively muzzled at the college, evident in libraries that are underdeveloped at the three campuses, nothing more than book shelves in the community learning centers (if at all). Besides the nursing labs, science labs are almost non-existent. Efforts are being made to establish complete computer labs in many locations on campus and off (for example in Behchokǫ̃), which should add to faculty and student capacity to pursue original research. However, the general attitude seems to be that it is teaching and not research that is going on in the NWT. Reasearch is conducted under a science license issued by the Aurora Research Institute (ARI); however, private industry, southern universities, professional consultants, and public government departments mostly conduct research. Most of this research is government funded, but some, in particular mineral exploration, is privately funded and there are other examples, as is evident in the recent example from W. Garfield Weston Foundation.[9]

Does it matter where research funding comes from? One result is that research generated by these different actors is at best patchy and disconnected. An example of this disjointedness is apparent in the multiple stake-

holders' attempt to develop a cumulative effects monitoring framework for the Great Slave Geological Province. While being one of the most studied areas in the NWT, due in part to the longstanding and extensive gold and now diamond mining activities, the research on the North Slave region is still so fragmented that no one can answer if there was in fact a decline in 2006 of caribou and if so what was causing it.

In addition to knowledge silos creating barriers to sharing information and the real problem of disciplinary compartmentalization of knowledge, there are public and private science and research labs and offices. Besides the fact that these are understaffed knowledge domains quickly develop in a way that retards cooperation and collaboration and fosters, privacy and competition. Without a postsecondary institution in the North, "knowledge workers" including research scientists and lab technicians must be imported. At the present time, there is no incentive for collaboration between knowledge holders/producers or a unified plan (science strategy). Until Northern postsecondary institutions produce competent Northern researchers/scientists, the region will continue to export students for training and import trained workers. If as a region and as a country, we agree that it is essential to ensure full and active engagement of the North in science and research, we need to improve current partnerships, educational opportunities and collaboration.

Before we move on, one last point is that sharing knowledge in the communities where it is originally gathered (or in directly impacted communities) has not led to increased capacity. This problem will only be addressed when the capacity is developed in the communities, so that they can collaborate, lead, and critique knowledge and inform decision makers with sound science. The North as a de facto client or object of research is problematic and when devolution of authority and responsibility from the federal to the territorial government occurs, much of the publicly funded research will need to find a new home and approach, hopefully in the North.

Northern Identity, Northern Research?

According to Coates & Morrison (2005: 25), Canada's newest Northern university, University of Northern British Columbia (UNBC),

> represented a declaration of regional self-confidence. Northerners when launching the institution, seemed determined to assure themselves of a 'complete' society, one that had the capacity to conduct research on regional themes, teach students from the North, attend the intellectual and educational needs of First Nations people, and represent Northern British Columbia to the world.

Regional self-confidence aside, there are some basic ingredients that went into creating the university in Prince George, ingredients that can be found in other Northern jurisdictions. For example, the population base for Northern British Columbia is in excess of 200,000 people. From a postsecondary perspective, the cities and towns north of Hope were served by four well-established regional community colleges before a university was established. While population size is an essential ingredient, the fact that people recognized the expanded opportunities from establishing a university was also essential. The UNBC values, also at the heart of our paper, include conducting research on regional themes, teaching Northern students, and attending to the intellectual and educational needs of Indigenous peoples. As is the case for all jurisdictions where universities have developed, a set of shared and unique characteristics influenced their establishment.

Northern engagement in the knowledge-based economy is a key concern to which we now turn our attention. According to the Government of Canada (2007a: 63), "the Council of Canadian Academies has identified Canadian S&T [Science and Technology] strengths and opportunities in areas

Box 2. Postsecondary student perspective.

Students attending secondary school in the NWT follow a departmentally approved Alberta/NWT science curriculum. Along with grade 9 and 10 core science, students in grade 11 and 12 complete courses in Chemistry, Biology and Physics. This model ensures that NWT graduates have the prerequisites to pursue postsecondary science programs anywhere in Canada. The curriculum provides students with building blocks for a future in science and research, but there are no opportunities, apart from Nursing, Teaching and a diploma in Natural Resources Technology, to pursue postsecondary science education in the NWT. To achieve an academic degree that will lead to employment in the sciences, students must attend Southern institutions. In comparison, learning basic research skills in the North is possible; however, Northern students compete with Southern trained researchers, many of whom have a graduate education. The completion rates of university degrees are relatively low for NWT students, while the total number of postsecondary graduates is misleading (11% of males and 15% of females in 2005), because many move to the NWT, and specifically Yellowknife, because of the demand for skilled/trained labor (Government of the Northwest Territories 2006c). In 2004, 22% of the 498 students enrolled in universities outside the NWT are enrolled in science programs (Government of the Northwest Territories 2006a). The only science program offered in the NWT is a Bachelor of Science in Nursing. Rather than being a research-oriented degree, the nursing program prepares Northerners to be professionally trained. For high school graduates, the option to take a general science degree, or engineering, or the natural sciences in their first years of postsecondary studies requires transition to a Southern university. Several options should be explored, such as offering a general Bachelor of Science in the NWT, the first two years of science, science access, and/or graduate studies. Would student enrollment, retention and graduation increase, would students save money and achieve a higher degree of satisfaction from their postsecondary experience? The goals of training and mentoring Northerners for Northern work includes science and research work that needs to be done in the North. It makes sense to encourage the training of Northern professionals in degree programs; however, more research is needed to answer questions about the costs and benefits of Northern or Southern-based education.

where Canada can leverage our research strengths to achieve economic and social advantage." The four areas identified are: environment and science and technology, natural resource and energy, health and related life sciences and technologies, information and communication technologies. Northern Canada offers unique opportunities in all four areas. Northern postsecondary education will contribute in two ways: by increasing the numbers of Northern graduates and by stimulating development of postsecondary infrastructure for access to the subject areas.

Canada suggested that a milestone to gauge the fulfillment of our learning potential is by ranking as "one of the top three countries in mathematics, science, and reading achievements." If Northerners are to participate in this goal, we will need to pay considerable attention to how we can increase our capabilities in these areas. Northern participation depends to a great extent on improvements in teaching and learning as well as research in the areas that will benefit the North. If these national goals are to make sense in the North, we must recognize that identity formation synergistically interacts with the development and deployment of knowledge resources and goals.

A significant annual investment of public funds is made to Aurora College – we would expect the college would be a valuable resource for knowledge production and training in the NWT.[10] Goals are set out in the two strategic plans, one established by the college (2006a) and the other by the Department (2006b). Ultimately the expression of the College's mission is the curriculum. In reviewing the calendar for 2007–2008 the challenges and opportunities Northern science students and researchers face are apparent

Fig. 2. Postsecondary full-time student enrollments NWT 1991–2005 (Government of the Northwest Territories 2006a).

	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97
Total	950	1010	1320	1460	1630	1610
Dene	200	200	340	390	460	460
Inuit	70	80	140	170	220	150
Metis	120	130	150	180	180	170
Non-Aboriginal	560	600	690	720	770	830
Southern Aboriginal	n/a	n/a	n/a	n/a	n/a	n/a
Not Declared	n/a	n/a	n/a	n/a	n/a	n/a

Source: Education, Culture and Employment, February 2006. 2001 Postsecondary Indicators Report.
Note: Data represents a head count. ***2001 Postsecondary Indicators Report* used uncorrected data for 1999/00.

(see Box 2). The College's mission of excellence in Northern education and research are not actively supported. While we would expect to find courses in research methods together with adult education and development studies, but they are not to be found. The kinds of opportunities (including funding) to engage both faculty and students in Northern science are not obvious. We would expect to find a specialized reflective research agenda in tandem with educational options that reflect Northern realities. This is not, however, occurring at Aurora College or ARI, although they are doing some innovative and exciting work that is not always talked about as research.

In 2004–2005, the largest cohort of Aurora College students was enrolled in career development followed by academic studies (including career access programs and adult literacy and basic education). Since 2000, enrollments in career development and diploma programs have increased. University partnership enrollments have been stagnant. Most students enrolled in courses that might lead to a science degree, or develop the skills to do research, do not attend Aurora College. Relatively few college faculty are conducting basic research and they are not given release time from teaching to conduct research or to attract research money. Unfortunately, most of the College faculty are not eligible to tap into the national funds. At the present time Aurora College lacks the capacity to develop real long lasting research.

As previously noted, there are a number of options for increasing science and research education in the North. Northern students are taking courses in Southern universities and they are enrolling in on-line postsec-

1997/98	1998/99	1999/00**	2000/01	2001/02	2002/03	2003/04	2004/5
1560	1520	1459	1325	1399	1484	1459	1501
470	410	423	366	390	418	405	448
130	150	128	146	127	115	148	138
180	180	152	116	118	119	113	124
780	780	756	697	763	808	768	764
n/a	n/a	n/a	n/a	1	24	23	27
n/a	n/a	n/a	n/a	0	0	2	0

ondary programs. Postsecondary statistics provided by the Government of the Northwest Territories (2006a: 13) paint an encouraging picture: in 2006 there were 1,501 students (see Fig. 2). NWT postsecondary students received $15.1 million in financial assistance (on average each student receives $10,050.00) and 132 students received the Canada Millennium Bursary. Similar to enrollments at Aurora College, where women form the majority of the student body (66.5%), women are the majority of students attending Southern colleges and institutes (57.5%) and Southern and international universities (61.8%). Aboriginal students, as a percentage of all postsecondary students from the NWT, accounted for 47.3%. Over the last 14 years the annual number of Aboriginal students attending postsecondary programs more than doubled (791 students in 2004 compared to 387 in 1991). In the last seven years of data there has been an overall decline in student enrollment. According to the Government of the Northwest Territories (1999: 131), there were 769 full-time equivalent students attending Aurora College in 1999 – a number that had dropped to 610 in 2006 (Dent 2006). This drop occurred despite an increase in population in the territory (approximately 2,000 people) and an increase in high school completion rates, which doubled for Aboriginal Northerners within this time frame (Government of the Northwest Territories 2006a).

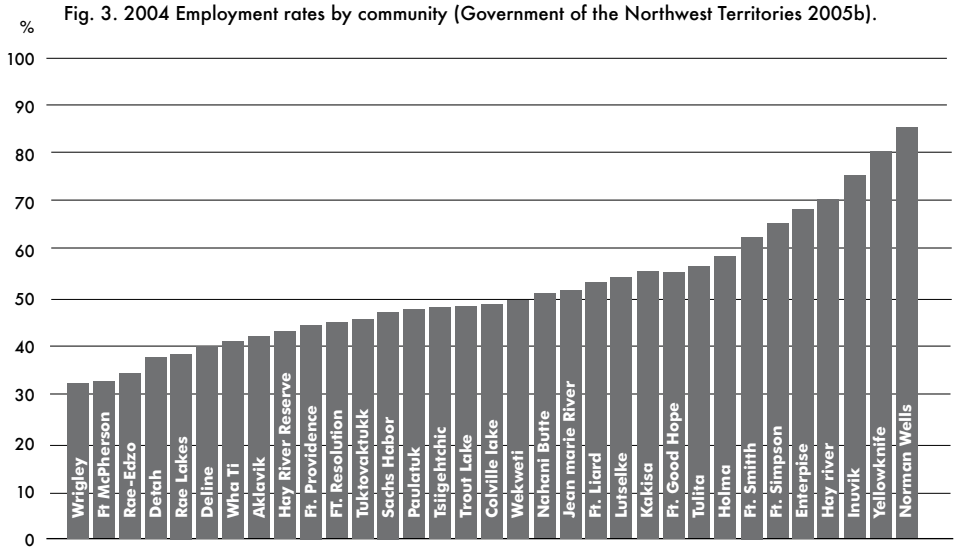
During this same period, enrolment in Southern universities increased, as did Northern employment. According to the *Annual Labor Force Report* (Government of the Northwest territories 2005b), on average 23,900 persons were in the labor force, representing an overall participation rate of 76.1%. The participation rate has remained relatively steady since 2001. In 2005, there were some 1,300 persons unemployed in the NWT, a decrease of 600 persons from 2001. The overall NWT unemployment rate stood at 5.4% for 2005, a decrease from the 8.6% unemployment rate in 2001. In 2005, the employment rate for Aboriginal and non-Aboriginal persons stood at 55.1% and 83.4%, respectively. Differences in rates are significant. Aboriginal unemployment stood at 11.3%, while the non-Aboriginal rate was only 1.9%. The highest levels of unemployment are in the smaller communities and ranges considerably (see Fig. 3).

Aboriginal governments have increased control over primary education, training and employment, all of which contribute to a positive trend in Aboriginal labor force participation. Future comparative research should focus on investments by Aboriginal governments in development of postsecondary education. In the NWT there have been investments in a number of training programs, and despite being underrepresented and occupying low entry-level jobs, significant increases have been made in the mining sector for Aboriginal workers. Aboriginal miners now comprise 39% of all

employees in the NWT diamond industry (Government of the Northwest Territories 2005c).[11] These figures stand in stark contrast to Aboriginal labor force participation rates a decade earlier: 10% of all full time positions in the mining industry were Aboriginal (NWT & Nunavut Chamber of Mines n.d.: 14). Several conclusions can be drawn from these figures and we note that a strong economy and training to support Aboriginal participation has made a difference. It has also made it difficult for Aurora College to recruit students and faculty for science and research. At the same time, a direct correlation exists between increased non-renewable resource development and expansion of trades-related programming. In 1995–1996, approximately 10% of skills-based courses offered at the College related directly to the mining sector. Ten years later approximately 40% of the programs offered related directly to this sector.

When comparing labor force participation rates and College enrollment figures, it is obvious that the current structure does a good job training

Fig. 3. 2004 Employment rates by community (Government of the Northwest Territories 2005b).



Northerners for some sectors of the economy. Also, we can read the financing of Northern students in Southern institutions as indicative of both supply and demand for postsecondary programs. An important question for the future is when this investment will be seen as undermining the Northern capacity? This question will not be answered here and in order to get back to understanding the link of research and science, we turn to examine science licensing.

There is an increase in the numbers of science licenses issued by ARI.[12] According to Aurora College (2006a: 15), licenses have steadily increased

from approximately 50 issued in 1997 to approximately 170 issued in 2005. In 2005–2006, the last years for which statistics are available, the majority of licenses were issued for the Inuvialuit and North Slave regions (61% of the total licenses for the year) and were focused on the physical sciences, geology and biology (79%). This does not include licenses issued for terrestrial wildlife research and archeology.[13] What is the relationship between the number of licenses issued and engagement of Northerners in research? To what extent are Northerners managing and/or participating in research, from conception to data gathering and analysis (presentation at conferences or in publications)? These are important future research questions. We know that relatively few Northerners are directly funded for research; however, there are quite a few who, as part of their jobs, are engaged in research that is never licensed by ARI, and are funded by sources other than those traditionally funded as academic or government research.

Statistics on postsecondary graduation rates do not exist for students attending schools outside the North or those students not tracked through Student Financial Assistance.[14] This latter group could be quite large and would include numerous employees completing postsecondary degrees and graduate programs through distance delivery (mostly web-based). We know that more of the students enrolled in the NWT are completing their postsecondary education (Government of the Northwest Territories 2006a). We also know that Canadian students graduating with postsecondary diplomas have highly developed skills and more postsecondary students are graduating than in a comparison with 17 Organization for Economic Co-operation and Development (OECD) countries (Conference Board of Canada 2007: 90). However, these statistics mask the regional issues faced in the North.

Shobe's (1998: 85) review of postsecondary students and programs in Northern Manitoba showed that, while the potential First Nations (Treaty) student body was increasing, the vast majority were not completing grade 9; while in contrast large amalgams of postsecondary graduates characterized Northern industrial centers. A similar situation exists in the NWT. In 1995, according to Government of the Northwest Territories (2006a: 53), 28% of all postsecondary full-time student enrolments were Dene, Métis or Inuvialuit attending Aurora College. In comparison, only 5% of all other Northern postsecondary students attended Aurora College. This statistic on its own tells us very little; however, when we look at university enrollments for that same year, 8% are Aboriginal compared to the non-Aboriginal category whose attendance was around 25%. Aurora College serves primarily Aboriginal students and Southern universities attract most of the non-Aboriginal Northern students. In 2004, there was a slight decrease in Aboriginal enrollments for all categories and a slight increase for university enrollments for

non-Aboriginal students. Most of the students taking courses in the south are taking business and commerce degrees as well as liberal arts. Approximately 100 Northern students were enrolled in science programs in 2004, and few are Aboriginal (ibid.). Enrollment provides a glimpse into the numbers of graduates who are potentially capable of conducting science and research. Such small numbers reveal the challenge to Northern science and research if we rely exclusively on Northerners trained down south.

Research Capacity and Good Governance

All governments require science and research capacity. Rarely are decisions made that require original research. Mostly, existing science and research are referred to in order for good decisions to be made. A skilled government bureaucracy must be able to analyze complex issues, provide decision-makers with sound advice, and implement legislation and policy effectively. However, sound decision-making based on science and the capacity to conduct original and secondary research is not always a priority for governments. Historically disenfranchised Aboriginal communities are learning that they can participate more fully in managing their own affairs by training (or sponsoring students through scholarships, to attend programs) their own people and hiring skilled workers (non-Aboriginal graduates): to participate more fully in a range of governance issues, in reforming modernity, and to decolonize (Erasmus et al. 2003). Everyday decisions related to natural resource management, transportation, public safety, community planning, cultural programs, human development, and the economy are made as a result of having the institutional capacity and access to science and research. Because of the rural and remote nature of the North, small Aboriginal populations, Southern institutions and professionals have largely served Northern research and science needs. Aboriginal nations are, however, increasingly assuming power through self-governance agreements, generating knowledge at the local and regional levels. The central goal of self-government is that it will increasingly lead to better decision-making and self-sufficiency. Considerable capacity building is needed to ensure this success.

Former Prime Minister Chrétien states in Canada's Innovation Strategy that we need to make investments in Canadians, and notes that the Canadian way is "building a partnership among citizens, entrepreneurs and governments that encourages new ideas and new approaches and that energetically seizes new opportunities." This strategy was followed by Prime Minister Martin's investments in a Northern Strategy (2004). Collectively these policies promised, among other things, to build "equal opportunity and economic innovation in a knowledge-based economy and society" in Northern Canada. More recently the GNWT Minister of ECE (Government of the

Northwest territories 2006: 1) reiterated education and life-long learning as a call to arms in the knowledge-based economy.

In a recent report on research investments in Canada, the Canada Foundation for Innovation stated (2007: 1):

> Canada's research and training institutions comprise the foundation stones of a knowledge economy. They conduct research and development, they produce trained graduates, and from linkages with other societal partners to encourage dynamic information flow and knowledge translation.

The knowledge-based economy is fast becoming a driver of Canadian prosperity. While the unprecedented growth in this economy is felt in the North, what is being done to contribute to it? Science and research are implicit in traditional knowledge; however, there are fundamental problems with saying this. Like Western approaches, much of the traditional science of, for example the Dene, is based on observation and trial and error, experiential learning and teaching, with developed vocabularies directly linked to both local specificity as well as generalized constructs. While it is true that traditional Dene, Inuvialuit and Métis teaching included the same testing of ideas and validation based on past experience as one would expect in science, unlike science most of it is still not written and explained in terms of spiritual and cultural relationships. Furthermore, it was largely not quantified. Traditional knowledge favors holism as opposed to the atomization typical of many of the sciences, i.e. physical and biological sciences. Our focus on traditional knowledge in this discussion is to think about its role in postsecondary education. The important role of traditional knowledge in research and science was criticized in the past (Abele 1997, Nadasdy 2005, Widdowson & Howard 2006).[15] The debate largely occurred independently of traditional knowledge holders and communities. Regardless of the politics, we are aware that being able to make sense of the world for Canadians and Aboriginal peoples requires cultural understanding, which if shared with family members and outsiders, must produce a "good life." Nowadays, as new knowledge including different sciences and traditional knowledge enters the public imagination and is applied in our day-to-day affairs, and sometimes in policy, we require a richly developed scientific and research acuity, as well as a more inclusive and culturally situated understanding.

Northern Research and Science in Transition

To this point in the paper we have described the capacity for Northern science and research, from both an institutional perspective and otherwise,

as being largely underdeveloped. We can see the transition going on in the Canadian economy, in particular a transformation from a resource base to a knowledge economy (from being hewers of wood and drawers of water to innovation). However, in Northern Canada resource extraction still drives the economy, in particular mining and oil and gas. Very few Northern workers are left out of the resource extraction industries and the demand for labor exceeds the supply, siphoning labor from all regions of Canada. Furthermore, while debates about the viability of the traditional economy (traditional food system and sharing networks with a percentage of seasonal wage employment) continue to rage, it remains an important consideration for many Dene, Métis and Inuvialuit households (Asch 1982). It is equally important today for these households to diversify, and families are making investments in vocational skills training. Few are investing in an academic education, resulting in a degree and even less resulting in graduate degrees.

The college does not provide academic routes in comparison with the exponential increase in vocational training. The discourse used on the floor of the Legislative Assembly (those who oversee public expenditures) is about building and preparing Northerners for the industrial wage economy. The North continues to import trained degree holding workers in all disciplines to participate marginally in the knowledge economy. In this regard the North is following the same national trends in health care and other sectors, in addition leading to job creation in the natural resource sectors, but not to developing a knowledge economy.

If we understand the reasons why underdevelopment has taken place, we can perhaps address what the barriers and opportunities are. Furthermore, in our research we did not find evidence of institutional racism; however, we know that institutional racism acts as a barrier to knowledge and the marginalization of Aboriginal peoples by Western institutions, historically, such as universities. Western knowledge has always absorbed other knowledge systems. Until the last decade or so, the educational structures deployed throughout the North excluded traditional knowledge. Espanioly (2005: 42) argues, "education can either help liberate people by helping them become critical, creative, and active members of society, or it can oppress them by reinforcing their subservient position in society." If the North will serve as a site for research and a fertile site for the production of knowledge, it will be because the people have chosen these dual features. The economy demands knowledge holders in a number of areas, and concerning leadership and vision to build a self-sustaining postsecondary institution capable of producing scientists and researchers, the future looks bright.

One approach would be to support Northerners, community members, who have achieved competency in traditional knowledge practices/

research. At this time there is no formal recognition or prior learning assessment (PLAR) in place; however, there is a movement across Canada, in particular in community colleges, to establish PLAR. Until such a time as a formal process is in place in Northern jurisdictions, educators will continue to support high school graduation and enrollment in postsecondary science programs in the south or by distance delivery. The limitation of distance delivery is that most science programs cannot be delivered on-line and programs that are available are not accessible to many Northern communities where dial-up and other aids necessary for advanced studies do not exist. Another approach is supporting Northern studies in Southern institutions and recruiting competent university graduates, from a range of sciences, who can appreciate and/or respectfully apply traditional knowledge, to live and work in the North. These approaches are not exclusive and should be considered within a Northern science strategy.

Northern research and science must be a priority in postsecondary education; the support, funding, and creativity of Northerners must be tapped if there is to be a shift from the North as an object of study to Northerners as full participants in science and research. IPY may be a catalyst to begin planning to address the human resource demands of both the public and private sectors (see Box 3).

It is surprising that Northern research and science does not permeate all aspects of the programs offered by Aurora College. Simply put, Northerners have always innovated, either adapting outside programs and processes, or developing technology and processes emanating from Northern material or being best suited to the Northern environment. The college has been doing well to improve primary basic adult education, but it has yet to develop a solid core institutional structure for research or the sciences outside of some very specialized areas. In a review by the Department of Education and the college, strategic plans for research and postsecondary education seem to be combined. ECE reported (Government of the Northwest Territories 2005a: 38) that it is, "increasingly important to the NWT's future economic growth and prosperity" to have both science capacity and postsecondary education; however, there are no blueprints, objectives or goals for building Northern science and research capacity. If there is a demand for Northern science and research, why are we not better at preparing Northerners to participate in this work with a solid growing infrastructure?[16] We need to find feet for the future-oriented vision of the three Premiers.

Box 3. Hybrid models for Northern research and science education.

At Aurora College (Thebacha campus), the Teacher Education Program includes students spending two days on the banks of the Salt River (personal communication Priscilla Lepine) setting up a traditional fishing camp. As students construct fish preparation areas and a smoke house, physics and ecology play a role, as does culture and traditional knowledge. A hybrid model of Western science and traditional knowledge in education requires instructors engaging students in different subject areas and traditional settings. Using a fishing camp as a subject makes the linkages between both knowledge systems obvious (as well as allowing for differences). Participating in teaching and learning on the land develops experiential learning/teaching skills. Western trained teachers need to be able to translate their knowledge beyond classrooms and laboratories. Elders engaged in learning on the land (traditional knowledge holders) need to work with instructors on course curriculum (teachable moments) and be engaged in instruction. In addition, the hybrid approach needs to be carefully thought out and supported. In order to generate Northern science and research, we must be mindful of the deep disparity between different kinds of literacy (book learning and traditional knowledge) and find ways, where it is possible, to bridge the two.

If these questions are not critically situated within the current socio-political context, solutions will be difficult to achieve. Resource development is driving both economic and political carts; to what extent these drivers are investing in Northern science and research is difficult to assess. Certainly as a function of total resource royalties taken from the territories or as a percentage of profit by Northern resource companies, we see little being invested in the growth of Northern postsecondary education. However, when we turn to actual investments in Northern science and research, a different picture emerges. The fact of the matter is that governments and companies are engaging in Northern science, but they are just not building the capacity to generate these outside their particular domains. There is no public legacy of institutional development, like we see at McGill, University of Toronto, etc. Instead we see federal investments in southern institutions researching the North. Even recent IPY human resource positions developed at ARI are short-term and meant to facilitate the North as a good place for fieldwork.

During Main Estimates at the House of Commons Standing Committee on Aboriginal Affairs and Northern Development (May 29, 2007), former Indian and Northern Affairs Minister, Jim Prentice, suggested that IPY investments are being implemented for the benefits of Northerners, all Canadians, and many other nations. While bolstering Northern sovereignty and building a booming economy are on the forefront of Canada's agenda, building science and research capacity is taken for granted or at worst forgotten.

Conclusions

As we outlined at the start of our paper, there are opportunities for and barriers to linking research and postsecondary education in the North. Obviously the need to have literate Northerners is first and foremost in the minds of educators. By this term we mean literate in English and also literate in their first languages, as well as being fully numerate. As we discuss postsecondary education, we include all of the institutions listed by Dennison & Gallagher (1989).

Paulo Freire (Shor & Freire 1987: 129) notes, "the problems of schools are deeply rooted in the global conditions of society [...] education is not a lever for the transformation of society." While we have not presented this paper in order to transform society, we are interested in improving the responsiveness and innovation of Northern science and research capacity, in part by understanding the educational support required to produce scientists and researchers in the North. In other regions where postsecondary institutions are fully developed, we see a number of economic and social benefits, as well as the ability to address regional research.

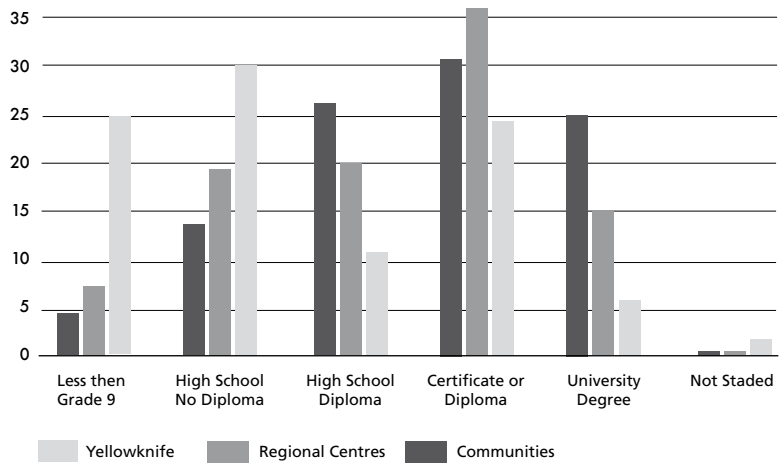
We have told our stories about Northern science and research, as those who are passionate about creating a better future for Northerners through enhanced partnerships in teaching and learning. According to Neilsen (1998: 267),

> [w]e cannot remain the scientistic ghost behind the words. The person we are writes others' worlds from particular positions at particular times. No textual staging is ever innocent [...], nor is it ghost-written. We must try to make visible what we have tried to keep invisible. We must drop the masks, own up to our responsibilities.

Our purpose in articulating the current state of Northern science and research for the Northwest Territories[17] is to share what is going on across Northern Canada, and the circumpolar world. This work would be improved through comparative research with other circumpolar jurisdictions. The opportunities and challenges to the development of postsecondary education and building Northern science and research capacity today would be greatly improved by a comparative study of the historical development elsewhere.

Good advances are being made in Northern postsecondary education. The percentage of Northerners pursuing postsecondary education is steadily rising. This is true also in communities outside of the urban Yellowknife (see Fig. 4).

Fig. 4. Percent of population aged 15 and over by highest level of schooling and community type, NWT, 2004 (Government of the Northwest Territories 2006a: 25). Source Table 6 NWT Bureau of Statistics 2004. NWT Community Survey.



The percentage of Aboriginal students in postsecondary education (47.3%) is higher than the national average for any other jurisdiction; however, the NWT has a relatively small population. Our focus on the main challenges of low postsecondary funding, low formal education levels, and postcolonial history of education as assimilation, has not served to inventory every challenge, nor do we believe our partial list diminishes the many good advances being made. Our intention is to contextualize the opportunities, including the multiple effects of industrial development, IPY, and a relatively young population.

As the level of education in the NWT increases, new challenges can be faced, for example how education is translated into employment, training and development in the North. In order to avoid a brain drain, planning needs to ensure that postsecondary graduates have relevant and meaningful work in their home communities. If the goal is to see development in the North managed by Northerners rather than by decisions made in Southern offices, then this would require a profound shift in Northern postsecondary education.

Hugo (2002: 20) notes, "among professional adult educators in learning with a social change in purpose. Work in popular education, feminist theory, and critical theory has led to increasing calls for a revitalized adult education curriculum focused on transformation and learning to take action." Transformation of the sciences and research in the North must also take action and in doing so must consider the challenges of a relatively young population, diverse Aboriginal cultures and languages, rural and re-

mote communities, and a host of economic opportunities that will be more attractive to students than spending four years or more pursuing a degree. Future research should examine the possibility that Northerners are strategically opting for immediate returns from wage labor as opposed to foregoing immediate gratification, investing time for postsecondary education and a lucrative future. Further research is needed to understand the significant erosion that elders' knowledge and small Indigenous languages are facing. The traditional economy and Indigenous ways of life are being diminished and postsecondary education has a role in both understanding and possibly shoring them up.

When will the North produce science and research graduates from Northern postsecondary institution(s)?[18] If Canadian history holds a lesson – and we believe it does – Northern Canada is undergoing the same revolution that faced the country up to World War II, "the traditional practice of importing rather than training skilled workers as a solution to new manpower needs was becoming no longer politically or economically acceptable" (Dennison & Gallagher 1986: 12). The solution then and obviously in contrast to the North now and in the near future is building political and economic capacity to develop postsecondary programming and institutional support to produce scientists and researchers in the North.

If postsecondary education is to deliver science and research graduates in the NWT, then postsecondary programming must include a limited specialized number of programs, so that Northerners can choose vocational learning and academic training. A lack of degree programs in the life and social sciences is especially evident in a region that lacks many of the basic services. The natural sciences could be greatly expanded based on experiential learning and co-teaching (Western scientists working with elders) where values are still closely connected to the land. IPY presents a unique opportunity for science outreach, but it is equally important that it leaves a legacy of, if not the infrastructure for, higher education and sustainable growth.

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NOTES

[1] Scientific Research Licence #14179N.

[2] Formal structures of education introduced over forty years ago in the NWT continue to evolve relative to a variety of needs and constituencies. Community colleges play a unique role in the postsecondary system. As Dennison (1995: 96) points out, "responding to government priorities to provide expanded services to disadvantaged groups, colleges in virtually all regions [of Canada] have concentrated on access [...]. It is apparent that, within the educational spectrum, colleges are the most appropriate (and in some cases the only) institutes to offer education and training opportunities to disadvantaged adults."

[3] Canada has invested 100 million dollars in IPY. In relation to the total national spending on Northern science and research, how much is actually spent in the North? Questions about Northern science and research are relational to the kinds of postsecondary educational system advanced in the North. If the North is a site for national and international researchers, but largely underdeveloped as a site for learning and teaching science, can we expect Northerners to use science and produce innovation, including in economic activities? If we regard the North as being more than a great place to do fieldwork in, as a site where knowledge is produced, what are the fundamental building blocks? The government of Canada proposed (in "Knowledge Matters," Canada 2002: 23), that if we are to meet "the economic and social challenges of the knowledge-based economy, it is critical that all our children and youth have the opportunity to fulfill their learning potential." IPY is a stimulant for Northern research primarily led by the federal government, in particular the Department of Fisheries and Oceans, whose staff lead 6 projects (departmental lead on 11 projects) followed by Environment Canada whose staff manage 5 projects (departmental management of 10). Indian and Northern Affairs Canada has no staff managing projects, but they have departmental management of 8 projects; Natural Resources Canada staff manages 2 projects (departmental management of 4). More research is needed to understand the ramifications of these investments. IPY offers a hint of opportunity to invest in Northern research and science in the NWT, Yukon and Nunavut, but it requires greater participation of Northerners as students and teachers, conducting/teaching and/or learning sciences (Western and traditional). Our paper demands support for the participation of all knowledge holders (elders and scientists), from primary to postsecondary schools.

[4] Up to the early 1920s, the Canadian North, while inhabited, was treated by various international governments as *terra nullius*. Unlike other circumpolar regions, in Northern Canada industrial and urban development is a recent phenomenon. Since the days when arctic explorers started to search for the Northwest Passage, nation states competed and cooperated to find the quickest route through the icy waters. Britain, Russia, the United States, and Norway all sailed, steamed, broke ice, and eventually submerged through the Canadian arctic waters. Temporary seasonal camps and observations from men passing through the landscape set the stage for Northern research and science. The utilitarian

bent of science to find resources continues to influence research investments being made. Investments are mostly made in Southern universities. The historical and legal basis for postsecondary education has a profound influence on science, research, education and training, including how public funds are spent. Capital expenditures, the physical bricks and mortar, supporting Northern science and research, is an important consideration. Within government budgets, postsecondary education is considered along with other public priorities. The Northern capacity to participate in the knowledge economy faces a number of challenges, opportunities and barriers.

[5] The North imports, on both a short and long term basis, educated people and exports mostly non-Aboriginal students in pursuit of postsecondary education. The Northern population is diverse, but relatively small, rural and remote, and Aboriginal. The capacity to participate in Northern science and research is contingent on travel: students traveling (or importing postsecondary graduates for that matter) for college and university to a major center like Inuvik, Yellowknife, or Fort Smith; which may be equal to traveling to Edmonton, Calgary, Vancouver, Victoria, Saskatoon, or Winnipeg; however the NWT relies on postsecondary institutions in southern urban centers to serve the small student body; by doing this, barriers to building postsecondary institutions are being reinforced.

[6] Unfortunately, without a science degree Aurora College cannot access these funds.

[7] Following the creation of Nunavut (1999), Aurora College was legislated under the Aurora College Act. GNWT's description of Aurora College (2006a: 13–14) is "established under the Public Colleges Act, is the primary delivery agent for adult and postsecondary education in the Northwest Territories. Its programs are designed to address the needs of the Northern workforce and economy, and include basic adult education, skilled-based training, certificate, diploma and degree programming. These programs are offered at three campuses in Inuvik, Fort Smith and Yellowknife, as well as at community learning centers in most NWT communities. Through its Aurora Research Institute, the College licenses research activities as well as supporting science, technology and research projects, in cooperation with the business and scientific communities."

It is a Board governed corporate body and the only public postsecondary institution. The historical roots of Aurora College, under the Public Colleges Act, began in 1969 as the Adult Vocational Training Centre in Fort Smith. The Centre evolved into Arctic College and then Thebacha College. Community Learning Centers are located in the major, mostly rural and remote, Aboriginal communities. Following division, the NWT Science Institute was morphed into ARI, now embedded in Aurora College at both Thebacha and Inuvik.

[8] The institutional authority of the Minister of ECE relative to Aurora College is different from what one sees in other jurisdictions in Canada. The college is the sole agency for postsecondary education in the North. There are no other private institutions delivering postsecondary programs in the North. Postsecondary education in the NWT would not exist if not for public investments, and it cannot continue to function without. Most programs are offered at a loss to the college, many positions are not basically funded; the college staff are unionized Government of the Northwest Territories (GNWT) employees. There are no incentives to conduct primary research, no longterm programming or staffing plans and there is inadequate infrastructure (i.e. the libraries are insufficient).

[9] The Weston Foundation granted one million dollars to the Association of Canadian Universities for Northern Studies (ACUNS), which awarded five southern university

researchers studying the North. We will not discuss in detail the reality that Aboriginal governments are by and large not applying for many NWT science licenses (see Paci et al. in press). Few Aboriginal governments capture public and private funding, and many are not represented on national associations. Indigenous governments are implementing protocols for Traditional Knowledge research and so on.

[10] Today, the territorial government has developed important access to postsecondary education services and funding for the largest percentage of adult students in the North: 30% of program funding goes towards upgrading (Government of Northwest Territories 2006), almost all of the programming in small communities is either adult basic education or vocational training geared towards development with training usually lasting a few weeks.

[11] 70% are in low-skilled occupations.

[12] The Aurora Research Institute oversees the issuance of research licenses, under the authority of the Scientists Act.

[13] The Department of Environment and Natural Resources issues wildlife research licenses and the Prince of Wales Heritage Centre issues archaeology licenses.

[14] Overall graduation rates mask statistics specific to the sciences. In the NWT no public postsecondary science degree is offered, with the exception of Nursing, nor are there any in the Arts, with the exception of Teaching (Government of the Northwest Territories 2005c: 30). The GNWT, ECE is making considerable investments to increase science literacy (both Western science and Traditional Knowledge) at the primary and secondary school grades.

[15] The authors could not reach consensus regarding the criticism aimed at traditional knowledge. The fairness of past criticism became a singular issue and our point is not to resolve the issue among the collaborators or for readers.

[16] Sadly, the campus in Yellowknife depends on rented space, as if one day it will simply shut the door and leave town.

[17] The ARI is attempting to develop more than regulatory capacity related to licensing, and by extension to coordinate Northern science and research. ARI is receiving research funding, but almost exclusively through partnerships with Southern institutions. Research funds are not earmarked in the territorial budget, or committed by the Federal government (or their funding agencies), for the specific goal of building Northern science and research capacity. In relation to all of the spending on Northern science and research nationally, relatively little is actually being spent in the North, particularly on analysis (most of the money is spent supporting Southern researchers gathering data in the North). The exact role for ARI will not be expanded on further, except to say that it has a purpose besides implementing the Scientists Act, coordinating and regulating research efforts by outside academics and consultants. ARI has an information management role (as an archive for raw data, as a repository or library for research papers/publications). It should receive research money and attract students from outside the North to pursue graduate studies in the North; building Northern faculty and their ability to research (analytical capabilities). If ARI is to serve Northern communities, and Canada, then science and research should be the most important skills being taught and this should permeate the college, and serve both governments and industry. ARI and Aurora College should attract faculty (from Canada and abroad) and they should train Northerners for faculty positions, as is the case with Northern nurses and primary school teachers.

[18] Given the needs of self-governance and diversity of skilled workers (and regional econo-

mies and community types, and the push nationally to develop a knowledge-based economy) – this question is not easily answered. As previously mentioned, decision-making requires scientific understanding – relying solely on consultants is unsustainable. Consequently, if the GNWT continues to demand that the college should act as both an upgrading centre and as a postsecondary institution, more resources will be required. Right now the resources are spread thinly. In Northern schools we recognize that most students require focused support that recognizes gender issues, cultural realities and the tensions created by not addressing these. Providing better facilities, long term plans and more programs for Northern students would go a long way toward improving both recruitment and retention of Northern students and faculty.