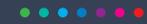




Institut nordique
du Québec
Together for the North



2022 | 2023
**ACTIVITY
REPORT**





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INQ AT A GLANCE



16

Québec university
member institutions



90+

affiliated research entities
(research centres, laboratories,
institutes, and groups)

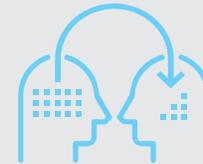
5

committees and working groups
devoted to priority issues in the North
and rallying over 80 individuals
with diverse expertise



275

affiliated researchers



15+

knowledge transfer activities
in 2022-2023



65+

Research Chairs with an INQ-affiliated chairholder



4

founding nations
(Inuit, Cree, Innu, and Naskapi
of Kawawachikamach)



9

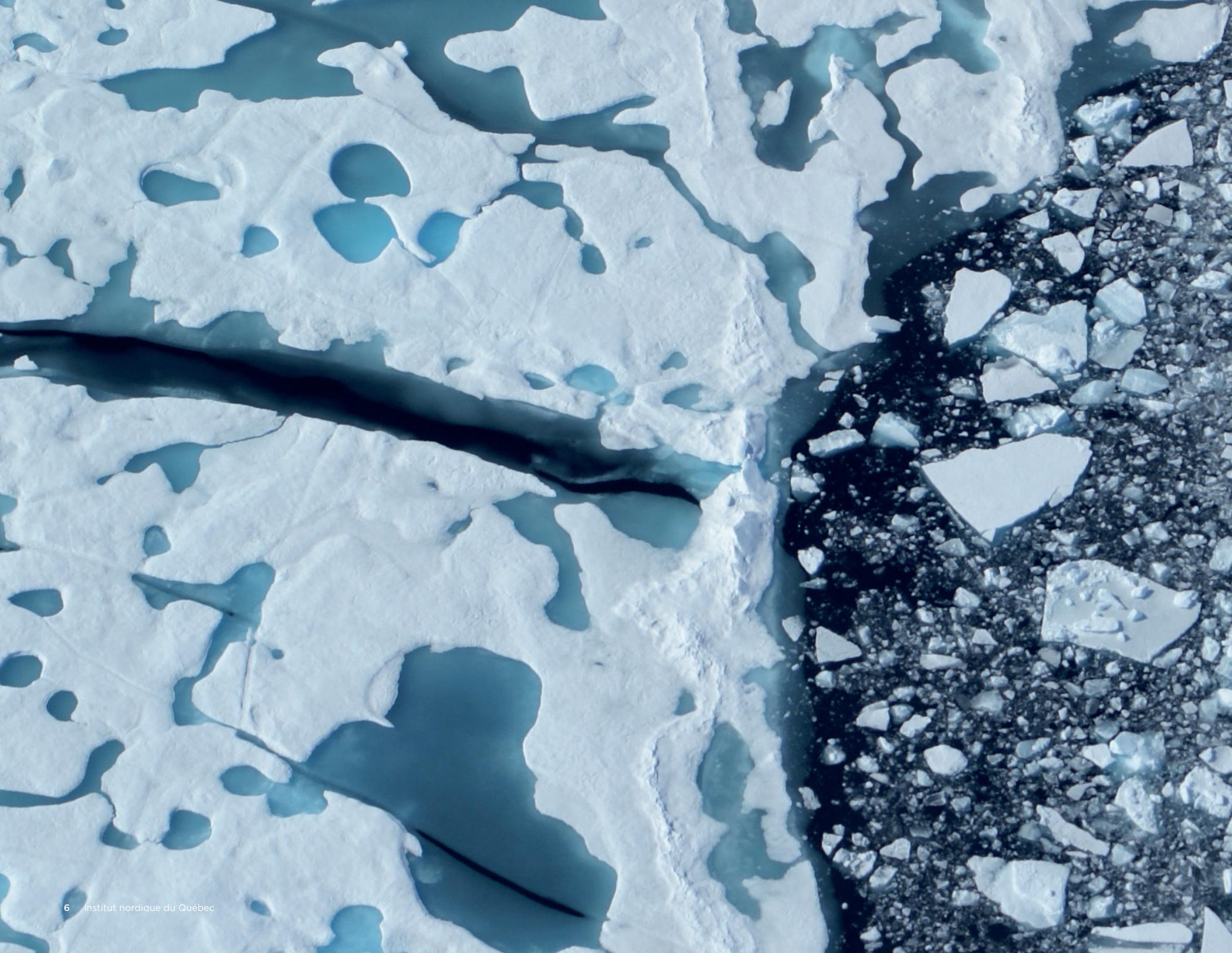
research projects underway



3

INQ Research Chairs







Credit: Martin Fortier/ArcticNet

VISION

The vision of Institut nordique du Québec (INQ) reflects its partners' desire and determination to develop a sustainable North on a foundation of knowledge. Integrate scientific knowledge with that of local communities, including Indigenous knowledge, and partner with the public and private sectors to develop the Canadian Arctic and northern Québec for future generations: clean energy, healthy ecosystems, viable infrastructure, economic prosperity, vibrant cultures, and education and healthcare systems that meet their needs.

MISSION

Unite the stakeholders in northern and Arctic research (natural sciences and engineering, health sciences, social sciences, and humanities) to promote innovation, and to create synergy between researchers and the end-users of research so as to provide governments, northern communities, and the private sector with the knowledge and expert workforce required for the sustainable development of Northern Quebec and the Canadian Arctic.

VALUES

INQ's actions are motivated by the following values:

- > Excellence in research
- > Scientific rigour
- > Inclusion of partners
- > Sharing of resources

I A WORD FROM THE EXECUTIVE

We are delighted to present this annual report which, once again this year, is a testament to the wide range of activities conducted by the members of Institut nordique du Québec (INQ). The year 2022-2023 was marked by a gradual return to in-person activities, to the great relief of all. Research, training, infrastructure, knowledge mobilization, networking, and communication are just some of the activities carried out to support research teams and northern communities in their quest for knowledge about the North and the Arctic. A number of highlights were especially noteworthy this year, and we will review them briefly here in chronological order, but we encourage you to peruse the report in its entirety.

In May, the ever-popular “Northern Day” was back at Musée de la civilisation in Québec City. The event attracted some 90 participants eager to get together and discuss face-to-face all kinds of issues associated with the North. The program featured a round table on the sustainable health of northern populations, as well as fascinating discussions on caribou management and conservation. Some fifteen or so students took part in the *Mon projet nordique / My Northern Project* science popularization competition during the event. INQ also took part in the 89th edition of the ACFAS Congress, where it hosted a symposium on new and renewable energies organized by the highly dynamic INQ working group devoted to this major challenge facing the North.

In September, INQ and Sentinel North (SN) launched a third joint call for projects, inviting research teams to define the framework of a project with the northern communities. This new approach reflects the desires expressed by the scientific community and northern partners alike. This co-construction initiative rallied some 63 scientists from 14 INQ member universities as well as fifty or so northern partners.

In June, the INQ executive team headed to Portland, Maine, to attend the assembly meeting of the University of the Arctic (UArctic) with a view to hosting the event in Québec City in 2023. UArctic, which has been a key INQ partner for a number of years, represents over 200 universities from around the world with an interest in promoting education and research in and about the North and the Arctic.

In October, after a two-year absence, INQ returned to the Arctic Circle Assembly—an important forum for the institute’s international outreach. The Québec delegation took the opportunity to highlight Québec’s value as a diligent and engaged actor in the sustainable development of its territory, an actor with a wealth of diverse resources in northern research and the ability to provide political decision-makers with the knowledge they need to develop the circumpolar regions in an ethical manner.

In November, INQ provided the scientific community with the first edition of its training program for northern research professionals, bringing together some forty participants from member universities and a dozen speakers, many of them from organizations in the North. The event was a resounding success!

In December, Université Laval, INQ, and Swiss Polar Institute (SPI) signed a memorandum of understanding to strengthen ties between SPI and INQ/ULaval and lay the groundwork for future collaborations, including research, education, and awareness activities within the thematic framework of both parties.

In March, INQ held a major networking and brainstorming session at McGill University, where 35 INQ-affiliated scientists from the Montréal-Sherbrooke hub, along with Indigenous representatives, discussed topics such as trans-disciplinary issues, the importance of co-constructing research projects with northern communities, and the challenges of research in remote areas.

We would like to thank the various agencies and organizations who provide financial support for INQ, and without whom these activities would not be possible: Ministère de l’Énergie et des Ressources naturelles du Québec, Société du Plan Nord, Ministère des Relations internationales et de la Francophonie du Québec, Secrétariat du Québec aux relations canadiennes, Ministère de l’Économie et de l’Innovation du Québec, and Université Laval, notably by way of its Sentinel North program.

In a nutshell, 2022-2023 was a year that marked the return to in-person activities, creating a renewed sense of dynamism. Whether it be in our training, research, networking, or outreach activities, there was a palpable effervescence and a commitment to promote best practices and deploy innovative solutions to the challenges of the North and the Arctic.



Eugénie Brouillet

Eugénie Brouillet
Chair, Executive Committee
Institut nordique du Québec



Jean-Éric Tremblay

Jean-Éric Tremblay
Scientific Director
Institut nordique du Québec



Brigitte Bisquie

Brigitte Bisquie
Director, Administration
and Development
Institut nordique du Québec

INQ is proud to present this annual report, which showcases the diversity of our actions, the power of our network, and our unflagging determination to foster innovation.

Our goal is to provide governments, northern communities, and the private sector with the knowledge and expertise they need to promote the sustainable development of northern Québec and the Canadian Arctic.



2022-2023 HIGHLIGHTS

APRIL 2022 |

A NEW INQ RESEARCH CHAIR

The INQ-McGill Northern Research Chair in Respiratory Health & Health Services headed by respirologist and professor Faiz Ahmad Khan aims to bolster the autonomy of Inuit communities in Nunavik in the area of respiratory healthcare. Over the next three years, Professor Khan and his research team will work to seek out the vision of the communities with regard to their ideal lung care system and the role they wish to play within that system. This will help lay the groundwork for a lung care system that is in harmony with the Inuit culture of Nunavik and that meets the needs expressed by the communities.

MAY 10 | INQ NORTHERN DAY

INQ NORTHERN DAY is an annual event that promotes knowledge sharing and networking within the scientific community of INQ and its partners. In 2022, the highly anticipated event marked a return to in-person activities, with the easing of health measures related to the COVID-19 pandemic. Nearly 90 participants gathered at Musée de la civilisation in Québec City to attend some fascinating round tables on the future of the caribou in Québec and on the sustainable health of Indigenous and northern populations. The activity was part of a broader northern context that included other events held at the Museum as part of the 89th ACFAS congress. Attendees also had the opportunity to sit in on the talks open to the general public presented by renowned INQ researchers



Pierre Ayotte, Marcel Babin, and Normand Voyer, as well as biologist and comedian Boucar Diouf. The event also featured an exhibit showcasing the scientific instruments used on board the *CCGS Amundsen* icebreaker and research vessel.

MAY 10 | PROVINCIAL FINAL OF MY NORTHERN PROJECT

The provincial final of the science popularization competition, *Mon projet nordique / My Northern Project*, took place in front of an audience at Northern Day. Twelve students from several INQ member universities did a brilliant job of presenting their research in five minutes flat to an audience that was wowed by their communication prowess. Among the provincial finalists, six students (five women and one man) were selected to represent Québec at the international finals of the competition which, since 2017, has been held during the Arctic Circle Assembly, in Iceland.

The six students selected to take part in the international finals of the *Mon projet nordique / My Northern Project* competition (l to r): Sophia Ferchiou (INRS), Aude Flamand (UQAR), Sarah Lemieux-Montminy (ULaval), Anne-Renée Delli Colli (UdeM), Rachel Guindon (ULaval), and Daniel Fillion (ULaval)



MAY 12, 2022 | INQ AT ACFAS

As part of the ACFAS congress, a scientific symposium entitled *Production et utilisation durables de l'énergie dans le Nord : observations, solutions, enjeux et défis pour toutes les disciplines* highlighted the work of several members of the INQ Working Group on New and Renewable Energies. The symposium was organized by affiliated researchers Louis Gosselin, Jasmin Raymond, and Christophe Krolík, and addressed the energy challenges faced by remote northern communities, notably in Nunavik and Nunavut, by focusing on improving energy efficiency, integrating renewable energies, and developing storage solutions. The discussions also examined legal, social, political, and cultural aspects, as well as the participation of Indigenous Peoples.

SEPTEMBER 15, 2022 | LAUNCH OF THE THIRD INQ-SN CALL FOR PROJECTS

An optimized application process to promote co-construction of research with northern communities

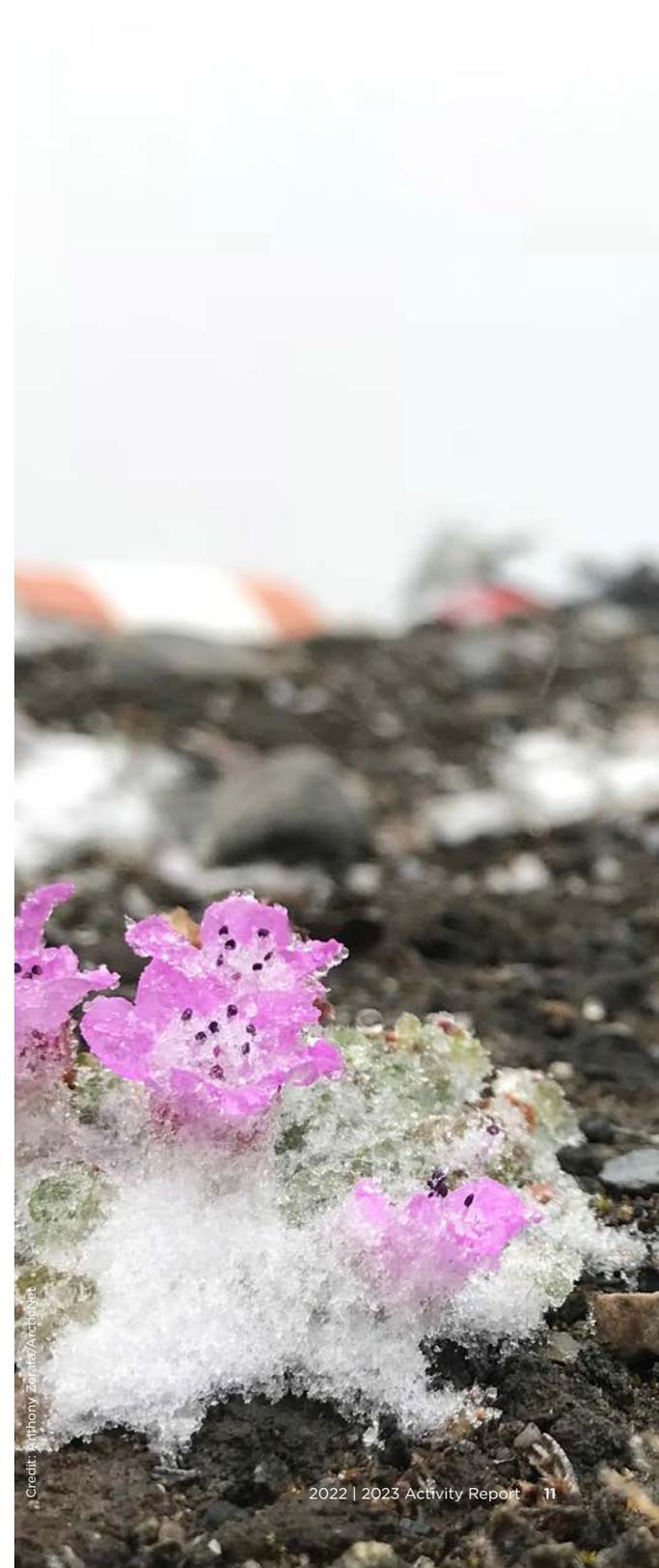
In September 2022, INQ and Sentinel North (SN) launched the third call for projects of their joint research program *For a Sustainable North*. The goal of the program is to further knowledge about the North and the Arctic in Québec by focusing on the sustainable development and well-being of local communities.

In response to comments expressed by the scientific community, the call for projects included a significant innovation, with a view to boosting the co-construction of projects in collaboration with northern communities. The INQ-affiliated scientists had expressed a desire to have more time and resources to foster ties with people on the ground and with their partners within the communities before submitting a complete funding application.

Consequently, research teams interested in contributing to the *For a Sustainable North* program were invited to submit a notice of intent describing the main thrusts of their research project, along with the anticipated partnerships and necessary expertise. A total of 13 teams responded to the call. An independent committee evaluated the notices of intent, and ten teams, made up of 53 scientists from 14 universities, were selected to receive \$10,000 in funding and a period of four months to complete their full applications.

The announcement of the results of this funding round is slated for the summer of 2023. This improved approach reflects the determination of INQ and SN to promote close collaboration between research teams and the local communities.

For a preview of the research projects funded under this program, see pages 39 to 46 of this activity report.





Credit: Elle Dumas-Lefebvre/ArcticNet

OCTOBER 13 TO 16, 2022 | INQ AN ACTIVE PARTICIPANT AT THE ARCTIC CIRCLE ASSEMBLY

Since 2017, INQ and the University of the Arctic (UArctic) have worked together to organize the international finals of the science popularization competition *Mon projet nordique / My Northern Project*, which is held every year during the Arctic Circle Assembly in Reykjavík, Iceland.



Credit: Véronique Dubos

Over the years, this event has shone a spotlight on the remarkable science communication talents of young researchers from Québec and the northern countries represented within UArctic. The 2022 edition of the competition was no exception, with 11 students taking part in the international finals that showcased the next generation of scientists in the area of northern science.

Québec was well represented by six young students: Aude Flamand, master's student in oceanography at UQAR; Sophia Ferchiou, PhD student in biology at INRS; Anne-Renée Delli Colli, master's student in nursing (nursing training component) at Université de Montréal; de Montréal, Daniel Fillion, master's student in

chemistry at Université Laval; Rachel Guindon, master's student in biology at Université Laval; and Sarah Lemieux-Montminy, master's student in architecture at Université Laval.

Rachel Guindon was awarded the “People's Choice” prize by the attendees of the 2022 Arctic Circle Assembly, making her the official winner of the sixth edition of the *Mon projet nordique / My Northern Project* science popularization competition.

Also as part of the Arctic Circle Assembly, INQ co-organized a discussion on the new ways of developing knowledge about Northern Québec.

The Québec delegation at the Arctic Circle Assembly in October 2022.



NOVEMBER 17 AND 18, 2022 | FIRST EDITION OF NEW, BIENNIAL TRAINING RETREAT FOR NORTHERN RESEARCH PROFESSIONALS

After several months of preparation, the INQ Training Committee launched a new training course entitled *INQ Retreat for Northern Researchers* that aims to meet the training needs expressed by INQ's professional research community. This is the first INQ training course designed specifically for this clientele.



Given the course's success, going forward it will be offered every two years, alternating with the *Introduction to Northern Research and Issues Summer School* aimed at the INQ student population. For more details on the 2022 INQ Retreat for Northern Researchers, see page 48 of this report.

DECEMBER 22, 2022 | SIGNING OF A MEMORANDUM OF UNDERSTANDING BETWEEN INQ, SWISS POLAR INSTITUTE, AND UNIVERSITÉ LAVAL

A new memorandum of understanding (MoU) governing future collaborations between the scientific communities in Québec and Switzerland was signed in December 2022. Among other things, the MoU calls for easier access to Canadian scientific infrastructure for Swiss research teams for a period of at least six years.

INQ TO HOST INTERNATIONAL EVENT IN 2023

Since 2017, INQ and UArctic have maintained close ties. And in May 2023, INQ and Université Laval will co-host the fourth annual UArctic Assembly Meeting, marking an important milestone in their partnership. The event will highlight sustainable development in the circumpolar region, providing INQ and Université Laval a great opportunity to consolidate their position as front-line actors in this field on the international stage.

JANUARY 2023 | UQTR JOINS ATIK^U PORTAL

The development of Atik^U, the knowledge portal about the North and the Arctic, took another step forward with the addition of Université du Québec à Trois-Rivières to its roster of valued partners. This new collaboration brings to six the number of Québec universities on board, along with Bibliothèque et Archives nationales du Québec (BANQ).

Atik^U now boasts nearly 400 resources spread across three thematic collections and six collections based on document type. This one-of-a-kind web portal is intended for university researchers, members of Indigenous communities, and the general public, for whom the thematic collections were specifically designed. The portal is hosted on INQ's website.

MARCH 17, 2023 | ICEBREAKER | A NETWORKING ACTIVITY FOR INQ-AFFILIATED SCIENTISTS FROM THE MONTRÉAL-SHERBROOKE HUB

As part of its Member Tour, INQ organized a networking and brainstorming session for INQ-affiliated scientists from the Montréal-Sherbrooke Hub, as well as people interested in learning more about INQ. The activity took the form of a discussion workshop where several questions were addressed in small groups. Some of the questions touched

on the definition of transdisciplinary issues, the co-construction of research with northern communities, and the singular challenges associated with research in remote areas. The event attracted 35 participants, including several members of Indigenous communities, who brought a host of valuable opinions and experiences to the table.

AN ENGAGED COMMUNITY

The INQ community includes representatives from 16 post-secondary institutions. Following is a profile of each of these renowned universities and their complementary strengths, teams, and expertise. This network of dedicated actors committed to the sustainable and ethical development of northern regions helps bolster the quality and scope of our actions.



THE INQ COMMUNITY

REGULAR MEMBERS	AFFILIATED RESEARCHERS	AFFILIATED CENTRES	AFFILIATED CHAIRS
École de technologie supérieure	3	2	-
École nationale d'administration publique	3	2	-
Institut national de la recherche scientifique	19	3	4
Polytechnique Montréal	9	2	1
Concordia University	2	-	-
Université de Montréal	10	8	2
Université de Sherbrooke	16	8	3
Université du Québec network	-	-	-
Université du Québec à Chicoutimi	18	10	9
Université du Québec à Montréal	15	8	2
Université du Québec à Rimouski	22	5	8
Université du Québec à Trois-Rivières	7	1	-
Université du Québec en Abitibi-Témiscamingue	3	1	-
Université Laval	79	11	23
McGill University	69	32	14
Université TÉLUQ	-	-	-
TOTAL	275	93	66

AFFILIATION OF ASSOCIATED RESEARCHERS

Laurentian University
Northeastern University
University of Ottawa
University of New Brunswick
Trent University

REGULAR MEMBERS

INQ regular members consist of Québec institutions of higher learning or legal entities that conduct research related to northern or Arctic issues.



ÉCOLE DE TECHNOLOGIE SUPÉRIEURE

ÉTS researchers are contributing to the sustainable development of the North by focusing their efforts on the impacts of climate change on the hydrology of northern regions and on the energy sector, specifically on dielectric materials and the effect of aging insulating systems used in electrotechnics.



ÉCOLE NATIONALE D'ADMINISTRATION PUBLIQUE

The researchers at ÉNAP with a focus on the North stand out for the remarkable quality and complementarity of their work. Some are looking at matters of governance and diplomacy specific to Indigenous communities as reflected in the political discourse and on social media. Others are more focused on government and political science, including analysis of the factors contributing to both conflict and cooperation among States; nordicity as a component of identity in Canada and Québec; and the role of the Canadian Armed Forces in delivering government services in the North.



INSTITUT NATIONAL DE LA RECHERCHE SCIENTIFIQUE

Three of the four centres that make up INRS are more actively involved in INQ'S activities. Centre Eau Terre Environnement is devoted to Québec's sustainable development in hydrology, aquatic biochemistry, earth sciences, sanitation, and reclamation. Centre Armand-Frappier Santé Biotechnologie develops unique expertise in the areas of sustainable human, animal, and environmental health, specifically in environmental biotechnologies and toxicology. Centre Urbanisation Culture Société, through the DIALOG network and the ODENA alliance, provides leadership in the field of Indigenous studies; supports the social, economic, political, and cultural development of Indigenous peoples; and offers an innovative space for dialogue between First Peoples and the university community.



POLYTECHNIQUE MONTRÉAL

Polytechnique Montréal contributes to the development of the North and northern communities, notably through its engineering research and training. Dams and infrastructure, glaciology, geotechnics and permafrost, environmental engineering, structural geology, hydrology of cold regions, water quality modelling, geothermal energy, mining exploration and operations, rare earths... these are just some of the areas of specialization in which researchers at Polytechnique bring their unique expertise to INQ's work. Not only do they contribute to knowledge, but also to adapting civil and industrial infrastructure to the impact of climate change and to the transition to a more sustainable society.



CONCORDIA UNIVERSITY

Concordia University is active in the field of renewable energies. A technical and economic feasibility study on the potential for geothermal systems in Nunavik is underway, with a view to improving access to cleaner energy for remote communities in Nunavik.



UNIVERSITÉ DE MONTRÉAL

Université de Montréal is a catalyst for interdisciplinary and inter-institutional initiatives in both animal health and climate science. The university is a pioneer in northern arts studies and in research into the rights of First Peoples and is at the vanguard on issues relating to territory and societies. Its numerous innovation labs are currently hard at work on incorporating research knowledge related to experience, memory, culture, heritage, and narratives. The university is also striving to improve the integration of First Nations and Inuit peoples into the university community. With a view to reconciliation, it is seeking to highlight their philosophies and cultures.



UNIVERSITÉ DE SHERBROOKE

Researchers at Université de Sherbrooke are working on the characterization of water and snow in the North. They also specialize in remote sensing and geographic information systems (GIS), and are studying the complex relationships between human activity, climate change, and natural risks in the North.



UNIVERSITÉ DU QUÉBEC NETWORK

The member institutions of the Université du Québec network are conducting a wide range of teaching, research, and creation and community services. These activities are carried out in close cooperation with actors and communities in northern Québec. The UQ member institutions are engaged in several fields, including the health and development of Indigenous communities; traditional knowledge; the promotion and sustainable use of natural resources; ecosystem conservation, and climate change. The team at Université du Québec actively supports initiatives put forth by the institutions and their partners, and fosters collaboration to develop relevant, innovative, and communal solutions to the major challenges affecting the future of northern populations and these territories.



UNIVERSITÉ DU QUÉBEC À RIMOUSKI

UQAR is home to a diverse group of researchers who focus on northern environments from an interdisciplinary perspective. These researchers are spread across several research units, including Institut des sciences de la mer de Rimouski, Groupe de recherche sur les environnements nordiques BORÉAS, the four Canada Research Chairs studying northern biodiversity, the integrative biology of northern flora, the geochemistry of coastal ecosystems, and marine geology, as well as the Research Chair in coastal geosciences. UQAR is partnered with the Uapishka Station and is actively involved in developing its research potential.



UNIVERSITÉ LAVAL

A pioneer for over half a century in northern and Arctic research, Université Laval is home to several major inter-university research centres, including Centre d'études nordiques (CEN), Québec Océan (QO), and Centre interuniversitaire d'études en recherches autochtones (CIÉRA). It heads up the Sentinel North research program and also houses Institut nordique du Québec and ArcticNet, three front-line northern research initiatives. Université Laval also hosts the CCGS *Amundsen* icebreaker, a state-of-the-art research ship deployed to the Arctic Ocean, as well as Takuvik, an international joint laboratory devoted to remote sensing of Canada's new Arctic frontier.



UNIVERSITÉ DU QUÉBEC À CHICOUTIMI

UQAC boasts expertise in regional initiatives, including in land planning and use, history and archaeology, economy of the North, and eco-consulting. UQAC has also made a name for itself in risk management in remote areas (for tourism engineering or development), and safe implementation of tourism, educational, industrial, or scientific outdoor activities.



UNIVERSITÉ DU QUÉBEC À TROIS-RIVIÈRES

UQTR boasts a dynamic environmental science department, and is innovative in research on tourism, economics, engineering, and health sciences. Its researchers have developed an interdisciplinary approach to help understand the transformations experienced by northern ecosystems and the cryosphere. Experts in psychoeducation are helping improve services to the Inuit, while UQTR-trained midwives are assisting in childbirth in Nunavik and playing a vital role in the communities there.



McGILL UNIVERSITY

McGill University is the instigator behind the Centre for Indigenous People's Nutrition and Environment, the Centre for Indigenous Conservation and Development Alternatives, the Quebec Centre for Biodiversity Science, the McGill Arctic Research Station, and the McGill Institute for the Study of Canada. RUIS McGill (integrated university healthcare network) is responsible for a territory stretching from Montréal to Nunavik. The mission of the RUIS network is to provide Quebecers with improved access to healthcare, and RUIS McGill's territorial responsibility includes facilitating the delivery of care to the inhabitants of Nunavik, along with teaching, research, and the evaluation of healthcare technologies.



UNIVERSITÉ DU QUÉBEC À MONTRÉAL

At UQAM, 14 departments work in the North and the Arctic. The training activities dedicated specifically to the North are divided into many disciplines: history, politics, tourism, literature, the arts, religious sciences, linguistics, and sociology. UQAM researchers collaborate with Indigenous communities on projects to analyze social, cultural, economic, and environmental issues related to the North and to winter. The UQAM Northern and Arctic Research Portal chronicles the research and training activities related to the North and the Arctic that are carried out or organized at UQAM. It also aims to strengthen ties between researchers from different disciplines and promote the development of multisectoral training activities.



UNIVERSITÉ DU QUÉBEC EN ABITIBI-TÉMISCAMINGUE

From the study of hydrogeological dynamics of the aquifers north of the 49th parallel to an analysis of the impact of mining sites on northern biodiversity and the development of research ethics best practices in an Indigenous context, UQAT has positioned itself as a leader in participative research with First Peoples. UQAT researchers also have a strong and recognized expertise in forestry. UQAT hosts Institut de recherche sur les forêts (IRF), whose mission is to contribute to the maintenance of forest ecosystem services. It does so through an interdisciplinary approach to research and training, and the dissemination and integration of new knowledge among the territory's many users.



UNIVERSITÉ TÉLUQ

With an outlook that's open to the world, Université TÉLUQ encourages and promotes learning at all stages of life, and helps develop knowledge by offering a vast selection of online programs and courses available from anywhere in the world. Its training offerings are innovative and stimulating, both in terms of their content and their pedagogical approach. Université TÉLUQ's teaching staff is devoted to developing new knowledge, high-level research, and educational innovations.

LEADING RESEARCH CENTRES

INQ's affiliated research entities provide varied and high-level expertise, generating new knowledge and contributing significantly to INQ's mission. Following is a brief description of three of the INQ-affiliated research entities at the heart of leading-edge northern research.



Québec-Océan is a strategic oceanography cluster founded over 20 years ago and funded by Fonds de recherche du Québec - Nature et technologies. Its mission is to bring together Québec research teams in oceanography in order to strengthen excellence, train the next generation of scientists, and guide our society toward a more sustainable interaction with the marine environment.

Québec-Océan consists of nearly 300 members from eight universities throughout the province, and its partners include a number of not-for-profit organizations and federal and provincial government agencies. The group's primary objectives are to develop cutting-edge research, foster interdisciplinary and intersectoral collaborations, assist in knowledge transfer, enhance training offerings for the student population, facilitate access to infrastructure, and inform the general public of the challenges, research, and solutions regarding the marine environment.

The focus of Québec-Océan's scientific program is to improve our understanding of marine ecosystems, predict how they will change, and guide governments and the various sectors of Québec society in their efforts to monitor and preserve marine environments, and to reconcile their different uses.

Over forty of the group's co-researchers and collaborating members are involved in projects north of the 49th parallel.



Centre interuniversitaire d'études et de recherches autochtones (CIÉRA) is a research center that has been recognized by Université Laval since 2004. Its mission is to conduct studies and research on Indigenous issues in Canada and elsewhere around the world, using participatory approaches with Indigenous nations and communities. CIÉRA brings together researchers working on Indigenous realities by promoting multidisciplinary, comparative, and, often, interdisciplinary perspectives.

CIÉRA also promotes the development of research that respects the self-determination of Indigenous nations and communities and contributes to knowledge mobilization and the improvement of policies. In addition, the training activities offered by CIÉRA strive to promote reconciliation.

Several CIÉRA members are working in collaboration with Indigenous communities north of the 49th parallel on a range of research projects, including Gérard Duhaime's "The WAGE Circumpolar Partnership – The Economy of the Arctic and Social Transitions" and Caroline Hervé's "Intercultural Mediation and Ontological Conflicts in the Justice Landscape of Nunavik (Québec Arctic)."

The Center also works in close cooperation with the editorial committee of *Revue Études Inuit Studies*.



The Boreal Research Centre (Centre de recherche sur la boréale; CREB) is a strategic cluster based at Université du Québec à Chicoutimi (UQAC). It brings together expert researchers, several of whom are influential leaders in their fields, including forest management and dynamics, green chemistry and the valorization of forestry bioproducts, carbon management and forest floors, terrestrial wildlife and aquatic ecosystem ecology in boreal forests, sustainable development, the fight against climate change, biodiversity, northern agriculture, and hydrogeomorphology. CREB has set up a regional, boreal forest research observatory designed to engage forest stakeholders and users, as well as residents of the region, to identify their concerns, define the scientific issues, and develop a strategy for the sustainable development of forest ecosystems in the boreal zone.

Institut nordique du Québec
boasts 275 researchers.

In this section, we will present a profile
of three scientists who are actively helping
advance knowledge in their respective fields.



INQ-AFFILIATED SCIENTISTS



LOUIS GOSSELIN

Louis Gosselin is a full professor in the Department of Mechanical Engineering at Université Laval. He specializes in energy efficiency and heat transfer. His research focuses on energy efficiency in buildings and industrial processes. By teaming up with scientists from various disciplines, including geology, architecture, land-use planning, as well as local partners, Gosselin is helping to develop more

energy-efficient Arctic buildings that are adapted to the needs, traditions, and lifestyles of local communities.



FAIZ AHMAD KHAN

Dr. Ahmad Khan is a scientific clinician. He is an associate professor in the Department of Medicine at McGill University and a scientist at the Research Institute of the McGill University Health Centre (MUHC). Dr. Khan is a member of the Respiratory Department at MUHC, where he works as a respirologist and medical director of the tuberculosis clinic. MUHC is the service corridor

for out-of-region medical services for the population of Nunavik, home of the Inuit in the province of Québec. In addition to seeing Nunavimmiut patients in Montreal, since 2013, Dr. Khan has been the only lung specialist to provide clinical services in Nunavik. He also advises the Nunavik Regional Health and Social Services Board on tuberculosis programs and policies. In June 2022, Dr. Khan was selected, after an internal competition, as the INQ-McGill Northern Research Chair in Respiratory Health & Health Services.



ESTHER LÉVESQUE

Esther Lévesque has been a professor at UQTR since 1998. She is also director of the Department of Environmental Sciences. Lévesque is passionate about Arctic vegetation and is especially interested in its interactions not only with other plants, herbivores, and the physical environment (including snow and permafrost), but also with the communities that live in and use these environments. She has developed an

integrative research program in collaboration with researchers from various different fields, including animal ecology, geomorphology, remote sensing, and social sciences. Lévesque is convinced that the Arctic is anything but a homogeneous environment and that it needs to be studied in all its diversity, which is why she contributes to national and international environmental monitoring efforts such as the International Tundra Experiment (ITEX) group and the Herbivory Network, which are developing standard protocols used across the Arctic to further the understanding of tundra ecology.

With a view to working more directly with the people who live in the North, she has helped set up community-based research and monitoring projects, such as the Avativut program, a Nunavik-wide berry monitoring initiative, and the George River watershed project developed in co-construction with the northern village of Kangiqsualujjuaq (Imalirijit program). Several of these projects aim to integrate young people into the scientific process and encourage contact with their elders, for example, through camps held out on the land.

A NEW GENERATION OF SCIENTISTS WITH A DEEP ATTACHMENT TO NORTHERN REGIONS AND THE COMMUNITIES WHO LIVE THERE

As you can see in this report, INQ attaches great importance to the next generation of scientists. The institute is actively committed to training and providing opportunities for these young scientists, enabling them to apply their knowledge in a stimulating and ever-changing environment. This close collaboration with young people is a wonderful source of inspiration for INQ. The open-mindedness, ingenuity, and desire of this generation to do things right is a sure sign of a bright future for northern research in Québec.

In this section, discover more about two students who are contributing in a significant way to the advancement of knowledge in their respective fields.



PÉNÉLOPE BLACKBURN-DESBIENS | DOCTORAL STUDENT IN BIOLOGY (UQAC)

Connectivity has been central to Pénélope Blackburn-Desbiens's interests since her master's degree, when she studied zooplankton communities in the Arctic lakes and ponds of Cambridge Bay, Nunavut. Today, as part of her doctoral studies under the supervision of Catherine Girard, Pénélope's specific focus is on the study of microbial communities in the cryosphere.

Her main objective is to analyze the hydrological and aerial connectivity between the cryosphere and the surrounding aquatic and terrestrial ecosystems. The findings of her research will provide a better understanding of microbial community dynamics in the ever-changing Arctic.



MARCEL VELASQUEZ | INTERUNIVERSITY DOCTORAL STUDENT IN OCEANOGRAPHY (ULVAL)

From the Caribbean Sea to the Canadian Arctic, Marcel Velasquez, a native of Venezuela's Isla Margarita, undertook a journey that has brought him to Canada to continue his studies in biology at Université Laval under the guidance of Professor Philippe Archambault. Velasquez has had the opportunity to collaborate with five communities in Nunavik—Inukuak, Tasiuaq, Kangisuk, Kangisujuaq, and Kangiqsualujuaq, for the purpose of analyzing the demography

of the blue mussel population in Ungava Bay. This experience has provided him a valuable chance to share methods and tools for studying marine resources, specifically mussels, while benefiting from the knowledge and expertise of the Indigenous people. Velasquez recently returned to these communities to share his findings with students at several talks organized at schools in the northern villages involved in his project.



@credit: Sophiane Béliand



FOUR COMMITTEES AND ONE WORKING GROUP FOCUSED ON FIVE PRIORITY ISSUES

The committees and working group are made up of INQ-affiliated scientists, partners from the public and private sectors, and northern partners. Composed of individuals from different backgrounds and complementary areas of expertise, these teams reflect on and propose measures, tools, or activities to fuel reflection and spur the engagement of the INQ community around priority issues in northern and Arctic regions. The committees are permanent structures within INQ, while working groups are formed on an ad hoc basis and are eventually disbanded, in keeping with the research needs expressed by our northern partners.



WORKING GROUP ON NEW AND RENEWABLE ENERGIES

This group is actively seeking alternatives to the use of fossil fuels in the North, a source of energy with a negative impact on the ecological footprint of northern regions. The costs associated with the fuel itself, and its transport, also place an economic burden on the regions. In addition, the working group is looking at several other options to meet the energy needs of Québec's remote regions—all of them focused on new and renewable energy—in order to bolster the energy transition essential to the sustainable development of Northern Québec.

Main achievements in 2022-2023

Organization of a seminar entitled *Sustainable energy production and use in the North: observations, solutions, issues, and challenges for all disciplines*, which was held during the 89th ACFAS Congress. The project was headed by researcher Louis Gosselin, and the seminar highlighted the expertise of numerous partners, scientists, and students associated with INQ.

Leader

Jasmin Raymond
Institut national de la recherche scientifique (INRS)
Until February 2022

Louis Gosselin
ULaval
Starting February 2022

Members

Morad Abdelaziz
Université Laval (ULaval)

Kodjo Agbossou
Université du Québec à Trois-Rivières (UQTR)

Olivier Arsenault
Hydro-Québec

Karim Belmokhtar
Nergica

Jeff Bergthorson
McGill University

Myriam Blais
Société du Plan Nord (SPN)

Francois Bouffard
McGill University

Martin Bourbonnais
Cégep de Jonquière

Aline Brasil
MERN

Marie-Pier Breton
Société d'habitation du Québec (SHQ)

Pierre Brisson
Transition énergétique Québec (TEQ)

Christian Carrier
Carboniq

Marilys Clement
Nergica

Jérôme Cros
ULaval

Marie-Ève Dupont
Institut de recherche d'Hydro-Québec (IREQ)

Guy Dumas
ULaval

Alain Forcione
IREQ

Richard Gagnon
TEQ

Véronique Gilbert
Kativik Regional Government

Nicolo Giordano
INRS

Louis Gosselin
ULaval

Jean-François Gravel
Ministère des Affaires municipales et de l'habitation (MAMH)

Didier Hailot
École de technologie supérieure (ÉTS)

Ali Hakkaki-Fard
ULaval

Marianne Huot
ArcelorMittal

Innocent Kamwa
ULaval

Christophe Krolik
ULaval

Patrick Labbé
Hydro-Québec

Joë Lance
Les Énergies Tarquti

Rachid Laouamer
IREQ

Daniel Martineau
Natural Resources Canada

Félix Ménard-Saint-Denis
SHQ

Alexandre Myre
Englobe

Fuzhan Narsiri
Concordia University

Mathieu Olivier
ULaval

Taha Ouarda
INRS

Simon Paradis
Nergica

Mélanie Paul
Inukshuk Synergie

Mathieu Payeur
TEQ

Julia Purdy
Natural Resources Canada

Marc-André Richard
IREQ

Laurie-Ann Rioux
SPN

Jean Rouleau
ULaval

Meli Stylianou
CanmetENERGY – Varennes

Gildas Tapsoba
Cégep de Jonquière

Marie Towo
SPN

Éric Vandal
Cégep de Jonquière

Matthew Wadham-Gagnon
MERN

Coordinator
Pierre-Yves Savard
INQ



INFRASTRUCTURE COMMITTEE

This committee manages and optimizes the shared use of INQ's research infrastructure, in cooperation with the members and partners who possess the infrastructure. It makes recommendations to the Science and Development Committee with regard to the funding, deployment, and sharing of research infrastructure. It also works to promote research infrastructure, ensure its upkeep, and establish rules for the use of such infrastructure by researchers.

Main achievements in 2022-2023

Coordinated migration of the Lab-O-Nord tool to a more flexible platform. This migration, scheduled for Fall 2023, will optimize the tool's performance, particularly in terms of search functionalities. The committee also worked on the visual aspect of Lab-O-Nord, with a view to making the user experience more intuitive.

Leader

Keith Lévesque
Sentinel North (SN)

Members

Karolane Dufour
Québec-Océan

Alexandre Forest
Amundsen Science

Marie-Hélène Forget

Takuvik

Mickaël Lemay

Centre d'études nordiques

Lise Rancourt

INRS

Brigitte Robineau

Québec-Océan

Coordinator

Pierre-Yves Savard

INQ



TRAINING COMMITTEE

The committee has five main objectives: Make an inventory of existing training programs on Northern Québec at the founding partner universities; support universities in their initiatives to train students, future stakeholders in the North, and professionals working on northern issues; develop an uncredited continuing education program for transferring knowledge to academics, professionals, and the general population; offer an uncredited general training program on Northern Québec in the form of a nanoprogram; and encourage the involvement of Indigenous people in all aspects of and at all levels of their educational program.

Main achievements in 2022-2023

- > Design and development of a biennial northern retreat for professors, professional research staff, and postdoctoral fellows doing research north of the 49th parallel.
- > Secured a \$27,070 grant from the Canadian Relations Support Program for the *Introduction to Northern Research and Issues* training program.
- > Planned the *Introduction to Northern Research and Issues* training program that will be held in Fall 2023.

Co-Leader

Catherine Girard
Université du Québec
à Chicoutimi

Thierry Rodon

ULaval

Members

Marie-France Gévry
Sentinel North

Stéphanie Guilherme

Université Laval (ULaval)

Isabelle Laurion

INRS

Martine Lizotte

ArcticNet

Marie-Eve Marchand

ULaval

Loretta Robinson

First Nations
Education Council

Coordinator

Pierre-Yves Savard
INQ



SUSTAINABLE DEVELOPMENT COMMITTEE

The committee draws on the United Nations' Sustainable Development Goals (SDGs) and validates those that are relevant for the North within INQ, while developing appropriate indicators and putting together a sustainable development toolbox for northern research.

Main achievements in 2022-2023

Evaluation of seven projects funded under the *For a Sustainable North* program in relation to selected criteria from the United Nations Sustainable Development Goals.

Responsible

Murray Humphries
McGill University

Coordinator

Pierre-Yves Savard
INQ



Credit: Barbara Vuillaume



FIRST PEOPLES COMMITTEE

This committee provides input to the Science and Development Committee with regard to the needs and aspirations of the First Peoples within INQ. The First Peoples Committee names a chair, whose three-year term is renewable.

Main achievements in 2022-2023

Over the past year, the committee focused its efforts on planning the forum entitled "The Impact of Climate Change on Indigenous Ecosystems and Research" which has five main objectives:

- > Create a space to engage people.
- > Create a space for gathering and discussions.
- > Gather information on Indigenous perspectives and those of actors in the area of Indigenous research.
- > Define and promote avenues for appropriate and innovative support for research.
- > Enhance and update INQ's *Research Guidelines*.

The forum will be held in Fall 2023.

Leader

Melissa Saganash
Representative
of the Cree Nation

Members

Serge Ashini Goupil
Representative
of The Innu Nation
Najat Bhiry
Centre d'études nordiques

Camille Fréchette

Representative of Makivik
and the Inuit of Nunavik

Loretta Robinson
Representative
of the Naskapi Nation

Glenda Sandy
Representative
of the Naskapi Nation

Michel J. Tremblay
ULaval

Coordinator
Marie-Eve Marchand
INQ

RESEARCH PRIORITIES

Research at Institut nordique du Québec revolves around five axes. It is carried out through the INQ research chairs, as well as through the For a Sustainable North program research and ad hoc research projects targeting priority issues. It also benefits from the support of 275 affiliated scientists, who contribute their expertise. Here's an overview of a research program dedicated to the sustainable development of the North.



AXIS 1

SOCIETIES AND CULTURES

Improve our knowledge of social and cultural issues of Northern Québec by studying different development models as well as heritage, identities, territoriality, knowledge, living environments, and governance. This priority also emphasizes the planning of research agendas, compliance with ethics protocols in Indigenous settings, and the decolonization of research.



Co-directors



Thierry Rodon

Full Professor
Department of Political Science
Université Laval



Daniel Chartier

Full Professor
Department of Literary Studies
Université du Québec à Montréal

AXIS 2

HEALTH

In keeping with the themes and priorities identified by people in the North, and using a partnership approach, this priority focuses not only on research into illness and disease, but also on resilience, adaptation, and the positive aspects of health. Intervention research, both clinical and population-based, aims to identify optimal solutions and best practices to improve the health of northern populations and reduce health-related inequities.



Co-directors



Mélanie Lemire

Full Professor
Department of Social
and Preventive Medicine
Université Laval



Cathy Vaillancourt

Full Professor
Centre Armand-Frappier
Santé Biotechnologie
INRS

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AXIS 3

ECOSYSTEM FUNCTIONING AND ENVIRONMENTAL PROTECTION

The ecosystems of high northern latitudes are feeling the combined effect of accelerated socio-economic development, strong demographic growth, and global warming. This priority examines the consequences of such stresses on marine, terrestrial, and freshwater ecosystems with a view to preserving and protecting food security and the well-being of people living in the North. This research priority explores global warming, thaw, freshwater, food security, and the greenhouse effect, with an emphasis on coastal environments.

Co-directors



Philippe Archambault
Full Professor
Department of Biology
Université Laval



Esther Lévesque
Full Professor
Department of Environmental Science
Université du Québec à Trois-Rivières

●●●●●●●●

AXIS 4

INFRASTRUCTURE AND TECHNOLOGY

Developing Northern Québec requires new technologies and infrastructure adapted to its harsh environment characterized by a cold climate, remote communities, and melting permafrost. To address the needs of northern communities, this priority explores issues including the rapid implementation of telecommunications channels, development of environmental technologies to ensure the protection of potable water supplies of northern communities, the development of infrastructure adapted to harsh environments, and the conversion and management of waste from a health and sustainable development standpoint.

Co-directors



Louis-César Pasquier
Associate Professor
Centre Eau, Terre, Environnement
INRS



Vacancy

●●●●●●●●

AXIS 5

NATURAL RESOURCES

The North's ecosystems are home to considerable forestry, mineral, hydroelectric, and wind resources. This priority looks at the economic value of natural resources while taking into account the extreme vulnerability of northern ecosystems to climate change and the impact of human activity. In keeping with the aspirations of northern communities, it studies and documents overexploitation, seeks to achieve social acceptability, and encourages the local spinoffs of economic activity. Through optimization and planning, this priority seeks to develop tools that will ensure that strategic resources in the North are developed in a sustainable manner.

Co-directors



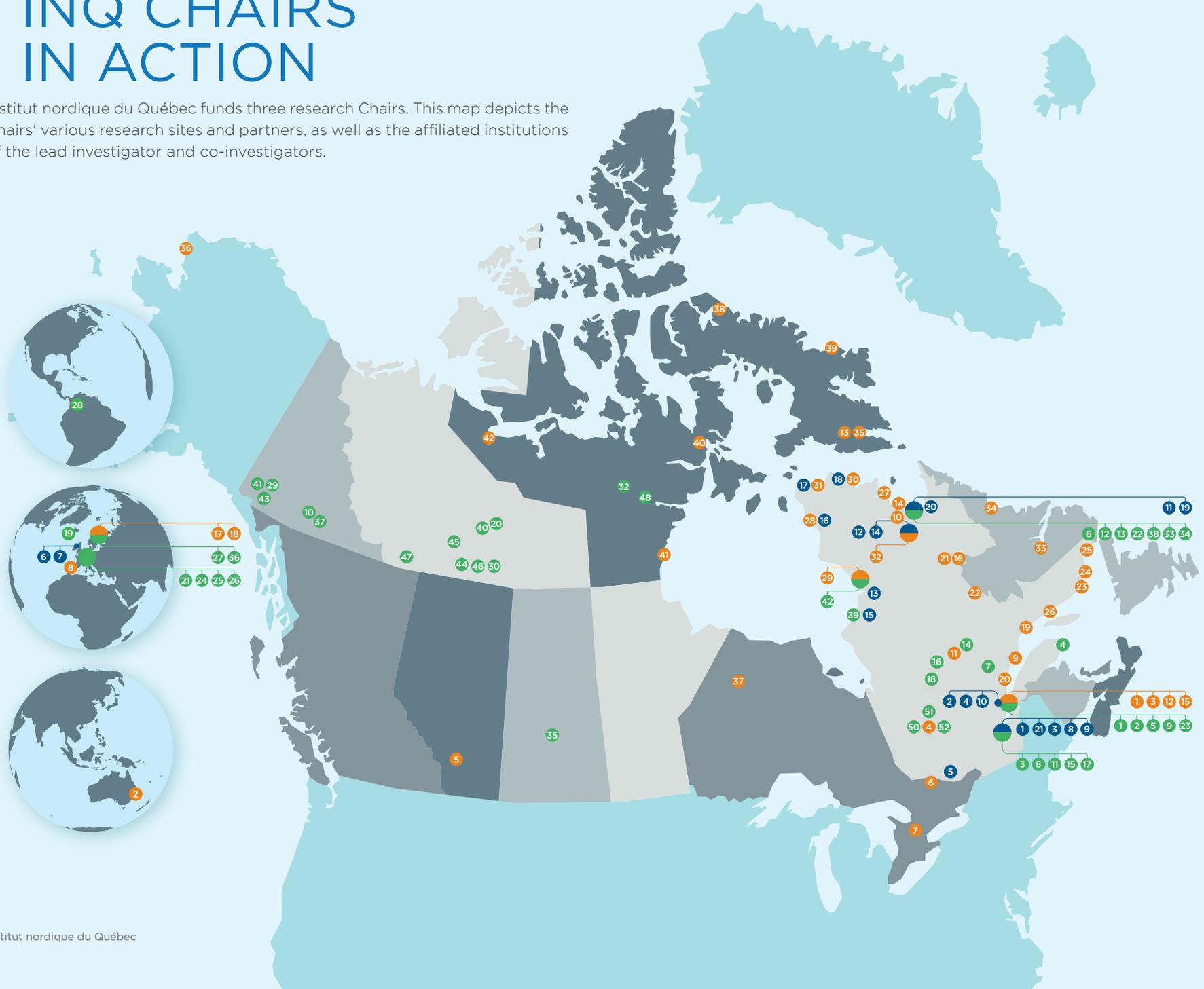
Annie Desrochers
Full Professor
Université du Québec
en Abitibi-Témiscamingue
Amos Campus



René Therrien
Professor
Department of Geology
and Geological Engineering
Université Laval

INQ CHAIRS IN ACTION

Institut nordique du Québec funds three research Chairs. This map depicts the Chairs' various research sites and partners, as well as the affiliated institutions of the lead investigator and co-investigators.



INQ-McGill Northern Research Chair in Respiratory Health & Health Services

1	McGill University	
2	Université Laval	
3	University of Montreal	
4	Institut Universitaire de Cardiologie et de Pneumologie de Québec	
5	National Research Council Canada	
6	United College London	
7	University of Oxford	
8	Department of Family Medicine, McGill University	
9	Department of Radiology, McGill University	
10	International Observatory on the Societal Impacts of AI and Digital Technology	

Chaire de recherche INQ sur le développement durable du Nord

1	Université Laval	
2	Griffith University	
3	Institut national de la recherche scientifique (INRS)	
4	Université du Québec en Abitibi-Témiscamingue, campus de Val-d'Or	
5	University of Calgary	
6	Carleton University	
7	Wilfrid Laurier University	
8	Université de Rouen Normandie	
9	Regroupement des femmes de la Côte-Nord	
10	Société Makivik	
11	Comité condition féminine Baie-James	
12	Crown-Indigenous Relations and Northern Affairs Canada	
13	Qaujigiartiit Health Research Center	
14	Kativik Regional Government	
15	Société du Plan Nord	
16	Matimekush-Lac John Innu National Council	
17	Luleå University of Technology	
18	Tromsø University - Arctic University of Norway (UiT)	
19	Sept-Îles	
20	Sacré-Cœur	
21	Schefferville and Matimekush-Lac John	

11	Nunavik Regional Health and Social Services Board (RRSSSN)	
12	Ungava Tulattavik Health Center	
13	Inuulitsivik Health Center	
14	Kativik Municipal Housing Bureau	
15	Kuujuarapik	
16	Akulivik	
17	Salluit	
18	Kangiqsujaq	
19	Kuujuaq	
20	Kangiqsuallujuaq	
21	Montréal	

22	Fermont	
23	Chevery	
24	La Tabatière	
25	Rivière-Saint-Paul	
26	Havre-Saint-Pierre	
27	Kangirsuk	
28	Akulivik	
29	Umiujaq	
30	Kangiqsujaq	
31	Salluit	
32	Kuujuaq	
33	Happy Valley-Goose Bay	
34	Nain	
35	Iqaluit	
36	Red Dog Mine	
37	Kingfisher Lake	
38	Pond Inlet	
39	Qikiqtarjuaq	
40	Naujaat	
41	Arviat	
42	Kugluktuk	

Chaire de recherche INQ sur le potentiel géothermique du Nord

1	Institut national de la recherche scientifique (INRS)	
2	Université Laval	
3	École de technologie supérieure ETS	
4	Nergica	
5	Transition énergétique Québec	
6	Englobe - Nunatech	
7	Cégep de Jonquière	
8	Carboniq	
9	Cima+	
10	Yukon Geological Survey / H.S. Bostock Core Library	
11	Institut de recherche d'Hydro-Québec (IREQ)	
12	Kativik Regional Government	
13	Nayumivik Landholding Corporation	
14	Développement économique Chibougamau	
15	Makivik Corporation	
16	Ville de Chapais	
17	Midland Exploration	
18	Osisko Mine	
19	University of Reykjavik	
20	Northwest Territories Geological Survey	
21	Turin Polytechnical School	
22	Société Kuujuauiut	
23	Induktion Géothermie	
24	Bureau de recherches géologiques et minières	
25	Université de Rennes	
26	University of Turin	
27	Royal Institute of Technology	
28	University of Medellin	
29	Kluane First Nation	
30	Northern Loco	
31	Canmet ENERGY	
32	Qulliq Energy Corporation	
33	Société Kuujuauiut Inc.	
34	Avataa	
35	RESPEC Consulting Inc.	
36	Norwegian University of Science and Technology	
37	Takhini Hot Pools	
38	Kuujuaq	
39	Whapmagoostui-Kuujuarapik	
40	Con Mine	
41	Kluane Lake	
42	Umiujaq	
43	Burwash Landing	
44	Hay River	
45	Fort Providence	
46	Enterprise	
47	Fort Liard	
48	Qamani'tuaq	
49	Val d'Or	
50	Rouyn-Noranda	
51	Amos	



Credit: Rachel Husherr

RESEARCH CONDUCTED BY INQ CHAIRS

The INQ Research Chairs are devoted to respiratory health in Nunavik, the production of renewable energy in a northern context, and sustainable development of the North. Following is an overview of their activities.



Credit: Jasmin Raymond



INQ NORTHERN GEOTHERMAL POTENTIAL RESEARCH CHAIR

Chairholder Jasmin Raymond, Professor
Centre Eau Terre Environnement, INRS

The scientific objective of this Chair is to improve the understanding of heat transfer processes that define the extent, sustainability, and feasibility of geothermal resource development in Northern Québec. The Chair also aims to raise awareness among northern communities and companies to improve knowledge related to the development of geothermal and energy efficiency projects in Northern Québec.

Over the years, the Chair has helped train a critical mass of students whose project findings indicate that it would be more economically viable and less damaging to the environment to heat buildings in the North with geothermal energy rather than with diesel. Their research marks a turning point, with the development of small-scale real systems to demonstrate that geothermal energy could be harnessed on a larger scale for the benefit of northern communities. The next research stage will require major efforts to expand the demonstration projects to more communities, or to increase the size of the systems to demonstrate viability on a larger scale.

In just a few years, the Chair's work has led to major scientific breakthroughs, from mathematical proof of concept to the installation of a real geothermal system—no easy feat in a northern context. Even more promising results are expected with the operation of geothermal systems for the pilot projects underway.



NQ RESEARCH CHAIR ON NORTHERN SUSTAINABLE DEVELOPMENT

Chairholder **Thierry Rodon**, Full Professor
Department of Political Science, Université Laval

The main objective of the Chair is to analyze and define development models based on the specific needs of the North and meet the imperatives for sustainable development in a northern context. Over the past year, the chairholder and his team have focused their efforts on promoting and transferring research findings within the Knowledge Network on Mining Encounters and Indigenous Sustainable Livelihoods (MinErAL). A collective work will be published in Spring 2024, and transfer activities aimed more specifically at Indigenous communities are in the preparation stage.

The project entitled “Realizing Indigenous Rights: Effective Implementation of Impact and Benefit Agreements (IBA)” is ongoing. A workshop was held December 13 and 14, 2022, on the implementation of IBAs with the main mining companies in Québec and the Indigenous communities that have signed them. The chairholder is also working on a project on implementing free, prior, and informed consent, from a comparative perspective, and a collective work under his co-direction, with Martin Papillon, is due to be released in the fall by Éditions L’Harmattan.

In addition, the chairholder is a co-investigator on the SSHRC project on treaty implementation, and he co-directs the research priority on evaluating the well-being of individuals and communities in the wake of treaty signings. He is also interested in disputes that arise when treaties are implemented.

The Chair team is working to update the “polar values” (VAPO) developed by Louis-Edmond Hamelin in the 1960s, in collaboration with the Université Laval Library’s Géostat Center, which has created an interactive map of these values.



This project is funded by INQ. The chairholder presented the findings of the team’s research on the VAPO update at a workshop in Essipit in October 2022. The team is also updating its databank—*Les voix du Nord* (voices of the North)—on the impact studies of northern projects in Canada. A new interface is currently under development and will facilitate text searches in the databank.

Lastly, Professor Rodon, in partnership with the Plant Biotechnology and Physiology Laboratory at Université Mohammed V in Rabat, Morocco, created an international associated laboratory: LIA SESAM (International Associated Laboratory: Sciences, Environments, Societies, and Mining Activities). The main goal of the new laboratory is to reflect on the inclusive and sustainable economic diversification of mining regions. It aims to do so by involving the populations affected in the creation of new and innovative sectors based on the valorization of secondary deposits and on the knowledge heritage of mining ecosystems and societies that has been acquired over the course of past and present mining projects.



**NQ-MCGILL NORTHERN RESEARCH CHAIR
IN RESPIRATORY HEALTH & HEALTH SERVICES**
Chairholder Faiz Ahmad Khan, Associate Professor
Department of Medicine, McGill University

The Chair's clinical and policy work in Nunavik provide insight into the challenges Nunavimmiut face when seeking medical care, as well as into the structural barriers that undermine the healthcare system's capacity to meet patients' needs. His clinical and policy work in Nunavik have shaped a health research program focused on Nunavimmiut patient and community priorities and grounded in partnerships with community members and Inuit health leadership. The research program strives to uphold, and be consistent with, the reclamation of rights, identities, lands, and autonomy by the Indigenous Peoples of Canada and Québec.

Puvaqatsianirmut — The Committee for Healthy Lungs

Puvaqatsianirmut, a committee comprised of Nunavik Inuit representing the region's three coastal areas, governs and oversees the Chair's Inuit health-focused research program. The four research teams consult and seek guidance from Puvaqatsianirmut and defer to its preferences at all research levels: hiring (including remuneration levels), participant recruitment, ethical issues (including consent), research methods, data analysis, reporting, management, and ownership.

The Chair concentrates on two core objectives:

- 1) Enhance the capacity and effectiveness of Nunavik's health and housing services to strengthen and protect lung health by studying novel, evidence-based, multidisciplinary interventions that address biomedical and social determinants of lung health.
- 2) Partner with the Indigenous health research community, Québec's northern Indigenous health authorities, and community representatives to develop a common approach to facilitate Indigenous health research while ensuring ethical conduct and co-ownership of research.

Over the past year, the team has visited five Nunavik communities and interviewed over 100 participants, to understand their experiences and concerns surrounding TB. These visits were led by our Indigenous team members, in partnership and with the support of community leaders and wellness committees. At the same time, interviews were conducted with healthcare workers involved in TB clinical care in Nunavik. Initial analyses were presented and verified with Puvaqatsianirmut, and in radio presentations in the partner communities. The results will be used to make recommendations for TB-related health services and policies, and are directly informing the roles that community members should play in TB prevention and care delivery.

In the Chair's program, research is leveraged as a tool to generate knowledge that can have a tangible impact on improving healthcare services and results for Nunavimmiut, in a critical way, under the guidance of and in partnership with Nunavimmiut.

For instance, the Chair recently led a study on lung cancer in Nunavik. Inuit in Canada have been reported to have among the highest rates of lung cancer in the world, yet there are no studies to assess whether they experience disparities in outcomes. Hence, the focus of the research was to determine whether Nunavimmiut experience disparities in lung cancer outcomes as compared to patients in Montreal. The findings of the research were contextualized in partnership with Puvaqatsianirmut and presented to the NRBHSS Board of Directors. The results underscored the need for designing lung cancer screening pathways that are accessible and acceptable to Nunavimmiut. With funding from INQ, the Chair is now pursuing the development of such pathways together with colleagues with expertise in lung cancer screening, and community partners.

A more detailed report of the activities of the Chair is available on the Institut nordique du Québec website.



INQ-FUNDED RESEARCH PROJECTS CURRENTLY UNDERWAY

PROJECT 1 | Dynamics of the Innu ancestral territory (Nitassinan) through the morpho-sedimentary and socio-cultural study of Lake Manicouagan (reservoir)

- | | | |
|---|--|--|
| 1 | Université Laval | |
| 2 | Institut national de la recherche scientifique | |
| 3 | Station Uapishka | |
| 4 | Franquelin | |
| 5 | Première Nation Pessamit | |
| 6 | Station Uapishka | |

PROJECT 2 | Impacts of climate change and browning on salmonid oxythermal habitat and greenhouse gas emissions in Arctic regions

- | | | |
|----|--|--|
| 1 | Institut national de la recherche scientifique | |
| 2 | Institut national de la recherche scientifique | |
| 3 | Université Laval | |
| 4 | Société Makivik | |
| 5 | Qikiqtani Inuit Association | |
| 6 | Lac Tantaré | |
| 7 | Île Bylot | |
| 8 | Lac Tasirjuarusik | |
| 9 | Aupaluk | |
| 10 | Kangirsuk | |
| 11 | Kangiqtualujuaq | |

PROJECT 3 | Nunatsiavut Coastal Interactions Project (NCIP): climate, environment, and Labrador Inuit subsistence strategies

- | | | |
|---|---------------------------------|--|
| 1 | Université Laval | |
| 2 | Université Laval | |
| 3 | Université du Québec à Montréal | |
| 4 | University of New Brunswick | |
| 5 | Commission géologique du Canada | |
| 6 | Trent University | |
| 7 | Nain | |

PROJECT 4 | Housing and energy transition in Nunavik: gaining a better understanding of human, technical, and environmental issues

- | | | |
|---|---|--|
| 1 | Université Laval | |
| 2 | Université Laval | |
| 3 | Université de Sherbrooke - Campus principal | |
| 4 | Société d'habitation du Québec | |
| 5 | Transition énergétique Québec | |
| 6 | Quaqtaq | |
| 7 | Rivière George | |
| 8 | Rivière à la Baleine | |

PROJECT 5 | UVILUQ: The use of liquid biopsies for monitoring the health of coastal marine ecosystems

- 1 Institut national de la recherche scientifique 🏠
- 2 Université Laval ★
- 3 Quebec Aboriginal Science and Engineering Association (QASEA) 🔗
- 4 ArcticNet 🔗
- 5 Northern Institute for Research in Environment and Occupational Health and Safety 🔗
- 6 Parks Canada – Saguenay–St. Lawrence Management Unit 🔗
- 7 Port of Sept-Îles 🔗
- 8 CNRS – Unité Stress Environnementaux et BIOSurveillance des milieux aquatiques 🔗

PROJECT 6 | Linking the marine environment and the nutritional quality of shellfish and beluga near Quaqtaq

- 1 Université Laval 🏠
- 2 Université de Montréal ★
- 3 Quaqtaq 🔗
- 4 Nunavik Marine Region Wildlife Board 🏔️

PROJECT 7 | Technical-social solutions to expand the use of renewable energy from Whapmagoostui-Kuujuarapik to other regions of Nunavik

- 1 Institut national de la recherche scientifique 🏠
- 2 Université Laval ★
- 3 Cégep de Jonquière 🔗
- 4 Carboniq 🔗
- 5 Nergica 🔗
- 6 Englobe – Nunatech 🔗
- 7 Transition énergétique Québec 🔗
- 8 Whapmagoostui-Kuujuarapik Research Complex (CEN) 🏔️
- 9 Gaspé 🏔️
- 10 Umiujaq 🏔️
- 11 Kuujuaq 🏔️

PROJECT 8 | Mapping of Kuujuaq’s maritime vulnerability: a participative approach co-constructed together with local and Indigenous knowledge

- 1 Université du Québec à Rimouski 🏠
- 2 Université Laval ★
- 3 Koksoak River 🏔️



LÉGENDE

🏠 Principal investigator's institutional affiliation | ★ Co-investigators' institutional affiliation | 🔗 Partner | 🏔️ Research site

The *For A Sustainable North* program, administered jointly since 2019 by INQ and the Sentinel North research strategy, has funded a number of research projects aimed at furthering our understanding of the North and the Arctic in Québec, from a perspective of sustainable development and the well-being of local communities.



FOR A SUSTAINABLE NORTH: SNAPSHOT OF THE PROJECTS FUNDED BY THE PROGRAM

1

DYNAMICS OF THE INNU ANCESTRAL TERRITORY (NITASSINAN) THROUGH THE MORPHO-SEDIMENTARY AND SOCIO-CULTURAL STUDY OF LAKE MANICOUAGAN (RESERVOIR)

PROJECT STARTED IN JULY 2020 - SLATED FOR COMPLETION BY JUNE 2023

Lead investigator: Patrick Lajeunesse (ULaval)

Co-applicants: Caroline Desbiens (ULaval), Pierre Francus (INRS) and Justine Gagnon (ULaval)

Students involved: one master's and one PhD student

Description

The research project aims to acquire knowledge about the ancestral Innu territory (Nitassinan) through a transdisciplinary study of an emblematic ecosystem in Northern Québec: the Manicouagan Reservoir, which is now part of a territory designated as a UNESCO Biosphere Reserve. The project combines the gathering of new morpho-geological knowledge and the mobilization of ancestral Innu knowledge by seeking to achieve several objectives: gain a better understanding of the limnological and hydro-sedimentary dynamics of a large reservoir in a boreal environment, assess the morpho-sedimentary and socio-cultural impacts of flooding, and reconstruct the physical and cultural landscapes of the ancestral territory. The project also seeks to train members of the Pessamit community in research on aquatic environments and develop a participatory approach to promote the transfer of skills and knowledge, academic and ancestral alike. The Uapishka Station will be used as a platform for the dissemination of results to support knowledge mobilization by all project partners to promote

Indigenous tourism. The Station will coordinate the installation of interpretive lookouts near archaeological sites of interest. The Manicouagan Lake-Reservoir study meets several of the INQ's research objectives related to anthropogenic impacts on the functioning of northern aquatic ecosystems and on Indigenous living environments, in this case the disturbance of an Innu ancestral territory by a hydroelectric project.

2022-2023 project highlights

The data collection mission was delayed due to the pandemic, but in March 2022, the team was able to visit the site and extracted over 20 core samples from the bottom of the Manicouagan Reservoir. The sediment samples are currently being analyzed, as are the geospatial data. Thanks to sedimentary archives, the research team will be able to plot the evolution of the ancestral land of the Innu over the course of several millennia, and survey the morphological and sedimentary impacts of the construction of the dam.



The year 2022-2023 was marked by several activities in the community: interviews on Pessamit community radio, restitution meetings, inter-community meetings, mapping workshops, and semi-directed interviews (master's project), as well as the submission of a first scientific article for publication.

IMPACTS OF CLIMATE CHANGE AND BROWNING ON SALMONID OXYTHERMAL HABITAT AND GREENHOUSE GAS EMISSIONS IN ARCTIC REGIONS

PROJECT STARTED IN JULY 2020

Lead investigator: Isabelle Laurion (INRS)

Co-applicants: André St-Hilaire (INRS), Raoul-Marie Couture (ULaval) and Normand Bergeron (INRS)

Student involved: one master's and two PhD students

Description

The objective of this project is to provide essential information on the current status and future evolution of the habitat of two fish species in Nunavik and Nunavut that play a key role in the food security of northern communities: Arctic char (*Salvelinus alpinus*) and lake trout (*Salvelinus namaycush*). Arctic char are harvested year-round, while lake trout are mainly fished in winter (ice fishing). While lake trout spend their entire life cycle in lakes, the different morphs of Arctic char are found in lakes, rivers, and coastal environments, and can

move from one habitat to another depending on their life stage. There is very little information on the availability and quality of the habitats of these two species, habitats that are likely to be altered by climate change. This project seeks to fill those gaps by combining field monitoring, modelling, and Inuit knowledge. The project will provide a better understanding of the changes in temperature and oxygen content of lakes and rivers in response to climate change (higher air temperatures, longer summer seasons, browning

of waters), and qualify these habitats that play an important ecological role. The project will also contribute to the development of management tools for anadromous Arctic char, with the first formal inclusion of Inuit knowledge in a preferred habitat model for this species. Through regular exchanges with local communities and government agencies, this project will provide tools to support fisheries management and food security.



Credit: Veronique Dubos

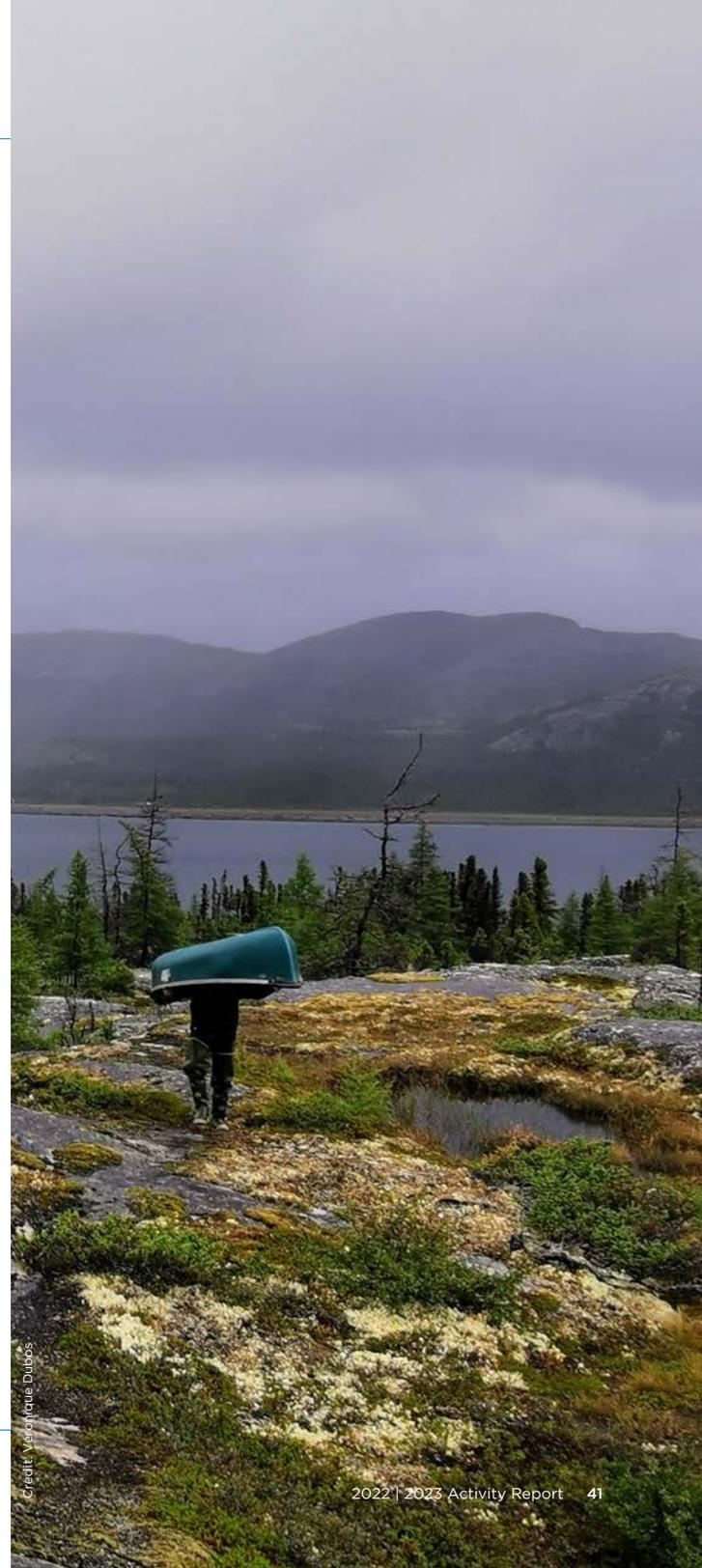
2022-2023 project highlights

Over the past year, PhD student Kimia Motevalli was in the field maintaining a mooring, downloading data, and taking *in situ* measurements. She also analyzed meteorological and hydrological data (temperature, oxygen, light) obtained to date from lakes Tantaré (47°N), Pluvier (near Boniface River, 58°N), Camp (73°N), and Ward Hunt (83°N). The dataset is being used to calibrate and validate the MyLake model, in order to establish projections for thermal structure, oxygen, and light in the lakes, in response to climate change.

PhD student Véronique Dubos finished writing her latest scientific article and thesis, which she defended in April 2023. In her thesis, she characterized the little-known habitat of anadromous Arctic char in Nunavik. The research, which combined western and Inuit scientific knowledge, characterized and modeled spawning habitats, developed a habitat model for juvenile fish, and characterized winter habitats. Her latest article deals with the winter and spawning habitats of Arctic char, as documented by Inuit fishers.

It shows that Arctic char prefer the littoral zone, and that spawning grounds tend to be located in the shallow, warmer, more light-filled areas of the lakes where they overwinter.

Master's student Simon Joly-Naud conducted preliminary water sampling at the outlets of 15 major salmon rivers in eastern Québec in the fall of 2021. Based on the results, a four-level browning gradient was installed to decide which river pools would be studied during the Summer 2022 monitoring and sampling period. Monitoring was conducted for four months in four river pools used as cold thermal refuges during heatwaves. This project will provide a better understanding of the temporal dynamics of thermal refuges in rivers, and will serve to inform future research in the North.



Credit: Véronique Dubos

NUNATSIAVUT COASTAL INTERACTIONS PROJECT (NCIP): CLIMATE, ENVIRONMENT, AND LABRADOR INUIT SUBSISTENCE STRATEGIES

PROJECT STARTED IN JULY 2020

Lead investigator: James Woollett (ULaval)

Co-applicants: Najat Bhiry (ULaval), Anne de Vernal (UQAM), Philippe Gachon (UQAM), Audrey Limoges (UNB) and Reinhard Pienitz (ULaval)

Description

Global warming and associated changes in sea-ice conditions have a substantial impact on (sub) Arctic ecosystems and the services they support (e.g., land-fast sea ice platforms for hunting, fishing, travelling, and provisioning services). These changes have direct consequences for the subsistence economy and traditional cultural activities of coastal Inuit communities. The nature and magnitude of future changes will vary from one region to another, depending on specific environmental parameters, and will require new adaptive and management strategies. The NCIP project brings together a transdisciplinary group of researchers who collaborate closely with the community of Nain, in Nunatsiavut, to investigate the priority questions that the community would like to address in relation to their changing environment. The project seeks, in particular, to incorporate paleo-environmental, climate, and productivity data recorded in marine and coastal lake sediments; information on the food chain gleaned from archeological archives; Inuit knowledge; historical climate archives; and satellite data. This project seeks to assess the vulnerability and resilience of the coastal ecosystem in the Nain area in response to climate fluctuations over the last 12,000 years and, with this knowledge, to more accurately predict the impacts of contemporary climate changes in the near future.

The project will produce data relevant for the evaluation of future climate trajectories and the potential impacts of climate change on Inuit food security, harvesting, and winter travel routes in the Nain region, which are key considerations for sustainable management of marine resources. It will also provide a unique local and integrated historical ecology framework for understanding past cultural transformations, movements, and subsistence practices of Inuit communities in the Nain region.

2022-2023 project highlights

As they did in 2021, Professor Audrey Limoges's team and a collaborating member (Alexandre Normandeau, National Research Council Canada) carried out a data collection project aboard the *R/V William Kennedy* research vessel, in collaboration with members of the community of Nain. This second ocean mission allowed the researchers to increase both the sampling resolution of seafloor and water column sediments and the diversity of sites visited compared to the initial plan. Two moorings with sediment traps were also installed, and 925 km of seafloor were characterized using bathymetry transects and camera surveys. The samples collected in 2021 and 2022 were analyzed, including dating, granulometry and geochemistry of the sediments,

analysis of foraminifera and dinoflagellate cysts, and biochemical analysis of ocean biomarkers of the ice conditions (IP26, triene).

Archeological and paleo-archeological research was carried out in the summer of 2022 at a dozen sites in the study zone (J. Woollett, N. Bhiry). Three additional sites were identified for the 2023 period. A weather and permafrost monitoring station set up on one of the sites was repaired, subsequently contributing data to the project and allowing the monitoring of archeological sites deemed at risk by the Nunatsiavut Government. In August-September 2022, new bone samples were collected at two archeological sites for isotope analysis during camps organized with the community of Nain and the Archaeology Office of the Nunatsiavut Government. Six young people took an active part in the fieldwork and on their return to the community after the work was completed.

Bone fragments (fox, seal) are currently under analysis at the Trent Environmental Archeology Laboratory. Combined with isotopic data from marine invertebrates, these results will enable the researchers to characterize past food web dynamics in the study area.

HOUSING AND ENERGY TRANSITION IN NUNAVIK: GAINING A BETTER UNDERSTANDING OF HUMAN, TECHNICAL, AND ENVIRONMENTAL ISSUES

PROJECT STARTED IN JULY 2020

Lead investigator: Louis Gosselin (ULaval)

Co-applicants: Geneviève Cloutier (ULaval), Myriam Blais (ULaval), André Potvin (ULaval), Geneviève Vachon (ULaval) and Mourad Ben Amor (UdeS)

Students involved: one master's student and one PhD student

Description

This project aims to advance the state of knowledge on high-efficiency and sustainable residential buildings in order to promote the energy transition in Nunavik by and for local communities. Since the energy supply is currently dependent on fossil fuels, this project focuses on the role of housing from a perspective of the energy transition. The project has three main objectives: understanding how Nunavimmiut envision and participate in the energy transition, particularly in relation to their housing, from a perspective of social acceptability; developing and integrating innovative fenestration solutions to achieve more energy-efficient housing in Nunavik, given that this is the weakest link in the envelope of existing buildings; and adapting life cycle analyses related to energy and housing by taking into account the specificities of Nunavik, including life-cycle and land use. Ultimately, the project will provide data, tools, and guidelines for more energy-efficient housing design, operation, and life-cycles in Nunavik.

2022-2023 project highlights

Many of the residential buildings in Nunavik are ventilated naturally, i.e., when the air needs refreshing, the residents have to open the windows, which obviously creates significant energy impacts. One student analyzed a two-year dataset (6 semi-detached homes monitored in the second

year), which supplemented the behavioral study of occupants with regard to opening their windows, and further refined the associated digital behavioral model. This model can then be paired with the building model to measure, using simulations, the impact of window opening on the energy consumption of northern homes. Simulations can subsequently be used by architects and engineers when designing homes and selecting the building characteristics and systems to be put in place (heating, ventilation, etc.).

Three students were in Quaqtaq in April 2023 to survey the local population on their perceptions regarding energy and comfort in the home.

An in-depth literature review of regionalized, life-cycle impact assessment methods was carried out. Nunavik's extreme climate is reflected in the significant environmental variations that occur between the different months of the year, something not observed elsewhere in the world (or at least not to the same extent as in Nunavik). While conventional life cycle assessment (LCA) methods do not take seasonal variations into account, preliminary results show that it would be extremely advantageous to use a monthly scale for the LCA analyses applied to Nunavik.



Credit: Aude Therrien

UVILUQ: THE USE OF LIQUID BIOPSIES FOR MONITORING THE HEALTH OF COASTAL MARINE ECOSYSTEMS

PROJECT STARTED IN JULY 2020

Lead investigator: Yves St-Pierre (INRS)

Co-applicants: Philippe Archambault (ULaval) and Jacques Corbeil (ULaval)

Students involved: one master's student, one PhD student, and three post-doctoral fellows



Description

Because of their wide distribution and their ecological and nutritional importance, blue mussels are closely monitored by scientists and public health authorities. In Northern Canada, and particularly in Nunavik communities located on the eastern shore of Hudson Bay and the southern shores of Hudson Strait and Ungava Bay, the consumption of bivalves, such as the blue mussel and other seafood, represents an important part of the traditional Inuit diet. Unfortunately, the presence of many pathogens, often linked to anthropogenic activities in the area, is worsening the problem of food insecurity in these communities. In addition to providing information essential to the food security of northern communities, the analysis of the health of blue mussels is an important tool for monitoring the impact of human activities on coastal marine ecosystems. Because of their ability to accumulate xenobiotics in their tissues, blue mussels have long been recognized as good biological indicators for monitoring the effects of pollution and climate change in coastal marine ecosystems. In addition to the effects of contaminants, the use of biomarkers in mussels can be used to assess the effects of natural disasters and environmental catastrophes, such as the 1989 oil

spill from the Exxon Valdez or the 2010 Deepwater Horizon drilling platform accident. In this project, we propose a new sampling and analysis platform for blue mussels based on the concept of liquid biopsy combined with multiomics approaches.

2022-2023 project highlights

The multiomics approach includes metabolome, microbiome, and transcriptome analysis. During this third year of the project, the analysis of the many samples collected enabled us to speed up the technical development of this approach.

In Summer 2022, Professor Philippe Archambault's team, headed by Marianne Falardeau, carried out sampling in two communities, Akilasaaluk and Qanaujak. They focused on liquid biopsy sampling (hemolymph) in order to sequence circulating cell-free DNA (ccfDNA).

We also continued sampling mussel beds on the North Shore, in the Saguenay-St. Lawrence Marine Park in Tadoussac. Since 2019, we have been collecting liquid biopsy samples of blue mussels at six sites for our spatio-temporal analyses.

Professor St-Pierre's team has worked to adapt Nanopore technology for ccfDNA sequencing. With a view to facilitating these analyses, Sophia Ferchiou, one of the doctoral fellows working on the project, completed a three-week internship in the summer of 2022 with the Génoscope Laboratory (Paris) at Institut de Biologie François Jacob.

The simplification and sensitivity of sampling logistics, and the low cost associated with biobanking are all major advantages for setting up a future observatory for regular monitoring of the health of blue mussel populations. Moreover, the logistical simplicity of the platform makes it ideal for community-based sampling programs, and the team has plans to develop analysis kits.

6

LINKING THE MARINE ENVIRONMENT AND THE NUTRITIONAL QUALITY OF SHELLFISH AND BELUGA NEAR QUAQTAQ

PROJECT STARTED IN NOVEMBER 2019 - PROJECT COMPLETED IN 2023

Lead investigators: Mélanie Lemire (ULaval) and Jean-Éric Tremblay (ULaval)

Co-applicants: Marc Amyot (UdeM), Philippe Archambault (ULaval), Pierre Ayotte (ULaval) and Nicolas Derome (ULaval)

Students involved: two master's students and one post-doctoral fellow

Description

Beluga and shellfish are an integral part of culture, diet, and food security in Quaqtaq. The migrating beluga harvested in Quaqtaq belong to two distinct populations in Hudson Bay, one from the west and the other from the east. A recent study in Nunavik showed that beluga maattaq, an Inuit delicacy made with beluga skin and fat, is exceptionally high in selenoneine, a potential antidote against mercury toxicity. In conjunction with the Nunavik Marine Region Wildlife Board's pilot project in the Hudson Strait, this study seeks to provide new knowledge on how the mercury, selenoneine, and fatty acid in belugas vary with respect to their particular population, diet, age, and sex. Recent research has shown that bivalves can play an important role in the acquisition of food and selenoneine by belugas. Shellfish are also consumed frequently by the Inuit, and offer significant potential for food insecurity prevention strategies. Moreover, shellfish can serve as indicators of water quality and ocean health since they accumulate contaminants and nutrients when they filter water and algae or consume particles that have settled on the sediment. A longer-term benefit of the project is to provide the community of Quaqtaq with the means to monitor the condition of the ocean and the seafloor resources in order to continue to use them in a sustainable manner.



Credit: iStock

TECHNICAL-SOCIAL SOLUTIONS TO EXPAND THE USE OF RENEWABLE ENERGIES FROM WHAPMAGOOSTUI-KUUJJUARAPIK TO OTHER REGIONS OF NUNAVIK

PROJECT STARTED IN NOVEMBER 2019 – PROJECT COMPLETED IN 2023

Lead investigator: Jasmin Raymond (INRS)

Co-applicants: Louis Gosselin (ULaval), Christophe Krolik (ULaval) and Thierry Rodon (ULaval)

Students involved: one undergraduate, three master's students, one PhD student, and one post-doctoral fellow

Description

While in the South, Canada is gradually shifting away from fossil fuels towards renewable energy, remote Indigenous communities rely on heat and electricity production that is fully dependent on diesel and highly subsidized. Given the extraordinary transformations northern regions are experiencing due to climate change, a number of clean technology initiatives have been rolled out, however their scope remains limited, notably because of temporal variations in sunshine and wind. In order to achieve mass deployment of these technologies, we need to solve the problems of renewable heat supply and long-term energy storage in cold regions. To address these issues, Université Laval's Centre d'études nordiques research complex in Whapmagoostui-Kuujuarapik served as a living laboratory to develop a concept for the integration of hybrid energy systems that can be transposed to other villages in Nunavik. The research team started by establishing a balance sheet of the complex's energy consumption. Then, a building model was developed to simulate the impact of hybrid energy solutions (biomass, solar

photovoltaic, wind, geothermal) and determine the scope of savings and the reduction in the carbon footprint. The researchers also considered the human behaviors that influence energy consumption and that are sometimes difficult to predict.

To accelerate the deployment of a diverse energy portfolio, they conducted a rigorous analysis of the regulatory and policy frameworks. They used a multi-sectoral approach to adapt energy system implementation methods to the economic development mechanisms advocated by Indigenous populations, in order to ensure the harmonious integration of technologies. Their work will make it possible to define and optimize energy management strategies adapted not only to the polar climate, but also to the northern socio-political context. The potential benefits of this project are significant, as with viable energy production and storage solutions, renewable energy technologies will finally be able to meet a broader range of needs and play their rightful role in the sustainable development of the North.

2022-2023 project highlights

Given that the project was in its final year, the team's research activities focused on drafting articles and giving presentations at conferences. Two scientific articles were published, including one on the design of a geothermal heat pump system coupled with solar panels to heat buildings in Nunavik. Two other articles were also submitted for publication.

The economic life-cycle analysis in Umiujaq shows that a combination of heating systems such as geothermal heat pumps, biomass, and solar photovoltaics is a promising alternative for northern Québec. The results of this study are also being used to assist Centre d'études nordiques in developing a hybrid heating system using biomass and a geothermal heat pump for the proposed expansion of the Umiujaq Research Station. This future research station will serve as a renewable energy test bench, with a view to fostering the interest of northern communities.

INQ-CEGRIM-RQM PARTNERSHIP PROJECT

8

MAPPING KUUJUAQ'S MARITIME VULNERABILITY: A PARTICIPATIVE APPROACH CO-CONSTRUCTED TOGETHER WITH LOCAL AND INDIGENOUS KNOWLEDGE (CEGRIM-RQM-INQ)

PROJECT STARTED IN NOVEMBER 2021

Lead investigator: David Didier (UQAR)

Co-applicant: Justine Gagnon (ULaval)

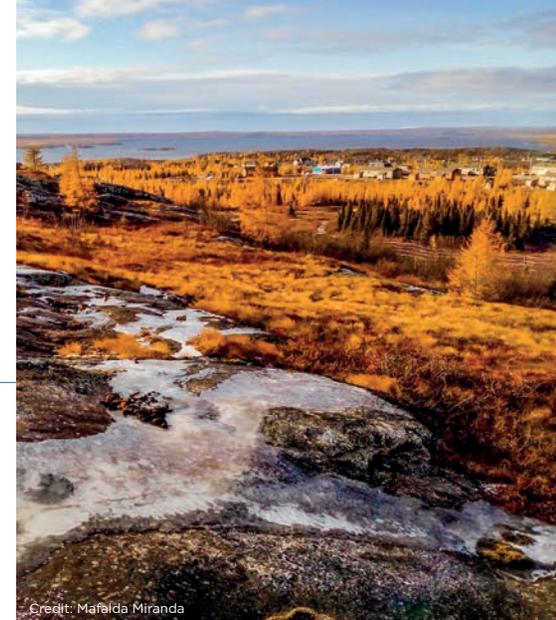
Description

Managing a maritime incident in Nunavik involves several sectors of activity and requires a good knowledge of the environment. To better respond to the risks associated with maritime incidents, a map of the maritime vulnerability of the Koksoak River estuary, more precisely in the territory of Kuujjuaq, will be made. First, the concept of coastal and maritime vulnerability will be defined and established using local and Indigenous knowledge through consultation and a participatory mapping exercise. Then, the coast of the Kuujjuaq estuary (Koksoak River estuary) will be characterized and segmented using a morphological classification to assess its sensitivity to the potential impacts of a maritime incident. Lastly, the most sensitive and resilient elements will be identified and discussed with the various stakeholders. By understanding the vulnerability and its parameters, it is possible to act before a hazard occurs, to boost the resilience of the community. In addition, the development and sharing of a mapping tool helps increase

preparedness for managing a maritime incident. This mapping tool will also address the needs of the community of Kuujjuaq, and will be developed on two scales, for the territory of Kuujjuaq and for the estuary of the Koksoak River.

2022-2023 project highlights

With the main objective of identifying and advancing a shared understanding of coastal vulnerabilities in the Kuujjuaq region, which will improve preparedness in the event of a maritime incident, a number of activities, including an innovation workshop, a call for scientific projects, a research project, and a knowledge-sharing workshop, were held in the northern village of Kuujjuaq between September 2021 and March 2023. An initial review of government knowledge was conducted by Centre d'expertise en gestion des risques d'incidents maritimes (CEGRIM) and the Canadian Coast Guard (CCG). A summary of the projects carried out by Makivvik



in relation to the theme was also shared with CEGRIM and then to the research team, which rounded out the survey of existing knowledge with a literature review and a summary of local and regional knowledge. The workshop, organized jointly by CEGRIM and CCG, was held May 3 to 5, 2022, when the borders reopened in the wake of the COVID-19 pandemic, and was attended by 24 participants from six organizations. The information gathered during the event was then analyzed to create vulnerability indices (social, morpho-sedimentary, as well as for food security and for species with precarious status) that will enable the most sensitive sites in the study area to be mapped. A full report, together with the georeferenced data produced, will be released in May 2023.

TRAINING: THE CORNERSTONE OF INQ'S MISSION

Training occupies a central place in INQ's mission, and we are proud to present two inspiring examples that are a testament to our commitment to spur reflection on northern territories and the communities who live there.

MOOC ON NORTHERN QUÉBEC | A FREE COURSE OPEN TO ALL

A total of 882 people signed up for the MOOC in 2022-2023. Since it was created in 2017, our MOOC has earned an enviable reputation, and is considered by participants as one of the most impactful courses in their educational or professional careers. It offers an introduction to the sociopolitical issues in Northern Québec, the ancestral territory of many Indigenous nations. Under the direction of Professor Thierry Rodon of Université Laval's Department of Political Science, the online course is available free of charge to anyone with an interest in Northern Québec seeking to learn more about the territory, its history, its societies, and its challenges.

ABOUT THE MOOC | NORTHERN QUÉBEC: ISSUES, SPACES AND CULTURES

- > As a way of introducing next-generation scientists to the North, many INQ-affiliated scientists require the students they supervise to sign up for the Northern Québec MOOC before beginning their research project.
- > Since its launch in 2017, over 13,000 people have registered for the MOOC. INQ is extremely proud of this success. We are honored to help raise awareness and further the education of people seeking to learn more about Northern Québec.

NORTHERN RETREAT | A NEW TRAINING COURSE

In 2022, the training committee, with the support of INQ, created a new training course designed for teaching faculty, professional staff in the field of research, and postdoctoral fellows.

Known as the *INQ Retreat for Northern Researchers*, the first edition of the course was held November 17 and 18 at Hôtel Monfort in Nicolet. Approximately forty people took part. The course themes were selected from the responses to a survey conducted among this clientele in the months leading up to the retreat. The survey sought to identify the needs of the target audience in terms of training. Four themes were subsequently covered at the event:

- > Indigenous cultures and knowledge
- > Action-research with the communities
- > Knowledge mobilization and sharing
- > Governance, regulation, and funding of northern research

This training course will be offered every two years.



Credit: Isabelle Dubois/ArcticNet

STRATEGIC OUTREACH AND POSITIONING

OCTOBER 13 TO 16, 2022 |

INQ AT THE ARCTIC CIRCLE ASSEMBLY

Representatives from Institut nordique du Québec headed to Reykjavik, Iceland, to attend the Arctic Circle Assembly, an international gathering for cooperation and dialogue on the Arctic. The Québec delegation was made up of 22 people from universities, government, and northern communities.

As part of this unique international forum, INQ, together with its local and international partners, coordinated two activities that were excellent showcases for the province's research expertise: the international finals of the science popularization competition *Mon projet nordique / My Northern Project* and a discussion on new ways of developing knowledge about Northern Québec.

This year, once again, the Québec delegation present at the Arctic Circle Assembly ably highlighted Québec's value as a diligent and engaged actor in the sustainable development of its territory, an actor with a wide range of resources in northern research and with the ability to provide political decisionmakers with the knowledge they need to develop the circumpolar regions in an ethical manner.

JUNE 1 TO 4, 2022 | MEETING OF THE ASSEMBLY OF UARCTIC IN PORTLAND, MAINE

INQ was represented by a delegation at this event. The gathering not only helped forge relationships with various players involved in the sustainable development of circumpolar regions, it also enabled the INQ team to familiarize themselves with the format of the meeting, as one of the main goals of the trip was to observe how best to plan and optimize the 2023 edition, which will be organized by Institut nordique du Québec in cooperation with event host, Université Laval. This exceptional opportunity will provide an ideal platform for highlighting the resources and advances of northern research in Québec and Canada before an international audience of approximately one hundred participants.

MARCH 21 TO 23, 2023 |

INQ PARTNERS WITH EXPO-SCIENCES AUTOCHTONE

The INQ team contributed to the success of this event for a second straight year. Some sixty young people from 17 different communities took part in the event on the Université Laval campus.



Credit: Emmy Hallett/ArcticNet

ONGOING 2022-2023 | IMPLEMENTATION OF THE SECRETARIAT OF THE ARCTIC COUNCIL'S SUSTAINABLE DEVELOPMENT WORKING GROUP AT UNIVERSITÉ LAVAL

Throughout the year, INQ's executive team continued their efforts to set up a new permanent secretariat of the Arctic Council's Sustainable Development Working Group. The secretariat will be based in the Charles-De Koninck Pavilion on the Université Laval campus. Some of the key achievements related to this project include the hiring of an executive secretary tasked with ensuring the secretariat runs smoothly and supervising the upcoming launch of its operations. In addition, INQ oversaw the drafting of the implementation plan, in line with the 2021-2023 Action Plan of the Arctic Council's Sustainable Development Working Group.

I INQ INFRASTRUCTURE

INQ SCIENTIFIC COMPLEX

This pavilion, which will be located on the Université Laval campus, will act as a knowledge and research hub for northern development. The only one of its kind in Canada, the complex will promote northern innovation, interdisciplinarity, and teamwork. It will help consolidate the partnerships developed with northern communities, Indigenous nations in the North, the 16 member universities, the college network, as well as public and private-sector actors.

A multipurpose complex dedicated to supporting science and the sustainable development of the North:

- > Analytical platforms and services
- > Versatile and modular labs
- > An incubator for technological and social innovation
- > A multidisciplinary and intersectoral training environment
- > An educational showcase on the changing North
- > A space for gathering and exchange for the scientific community, First Peoples, partners, and the general public



UAPISHKA STATION

Uapishka Station is an ecotourism joint venture between the Pessamit Innu Council and the Manicouagan-Uapishka World Biosphere Reserve. A remarkable example of co-management, the Station boasts exceptional natural surroundings while offering logistical support for scientific activities and the transmission of Indigenous culture, as well as accommodations, food services, and outdoor activities.

In addition to providing logistical support for research projects on its territory, the Uapishka Station expanded its offerings over the past year. A multi-modal building and a drying room were built, to boost the station's capacity for storing scientific material and for facilitating equipment upkeep for all its users. In the fall of 2022, a 900 MHz radiocommunication system was installed on the Monts Uapishka (Groulx) massif for the purpose of supporting the deployment of meteorological measuring and monitoring equipment, and to reduce the costs of transferring this data. The first piece of equipment, a snow cover measuring station, was installed at the summit, and data will be displayed on the Uapishka Station's website in the coming year.

UMIUJAQ RESEARCH STATION

Acquired by Centre d'études nordiques (CEN) in 2010, the Umiujaq Research Station in Nunavik is ideally located for the study of climate dynamics, permafrost, and subarctic ecosystems. Widely used by scientists from Canada and abroad, the current station will be sold and a new station will be built (on a different site) to meet the growing demand of research teams looking to stay there to conduct their research. CEN plans to build a carbon-neutral, smart building better suited to the needs of Arctic research and participatory science. The new station, which will be powered by various alternative energy systems, will also include space for training available to the community of Umiujaq.

During the 2022-2023 period, CEN secured additional funding to optimize the thermal performance of the building envelope. In cooperation with architecture and engineering firms, the functional and technical program was drawn up. The new station is expected to be up and running in 2026.



KNOWLEDGE MOBILIZATION AND COMMUNICATION



SCIENTIFIC NEWS | A LOOK AT RESEARCH CONDUCTED WITHIN THE INQ COMMUNITY

To celebrate the excellence of Québec's northern research and highlight the various challenges and issues associated with the North, INQ launched a series of scientific articles written by science journalist Valérie Levée, who regularly interviews research teams and presents a fascinating and reader-friendly snapshot of the research being conducted north of the 49th parallel. Seven articles were published in 2022-2023. The Scientific News articles are available in English and French on the INQ website.

- > *The Arctic under the gaze of satellites* | **Alexandre Roy**, Professor, Department of Environmental Sciences, UQTR
- > *A physicist canoeing in the ice* | **Dany Dumont**, Professor, Institut des sciences de la mer, Université du Québec à Rimouski
- > *Towards self-determination of an Inuit health system* | **Faiz Ahmad Khan**, Chairholder, INQ-McGill Northern Research Chair in Respiratory Health & Health Services and Professor, Department of Medicine, McGill University
- > *Will the methane bomb explode?* | **Michelle Garneau**, Professor, Department of Geography, Université du Québec à Montréal
- > *Food security in northern communities* | **Murray Humphries**, Professor, Department of Natural Resource Sciences, McGill University
- > *The challenge of carbon neutrality in Nunavik* | **Louis Gosselin**, Professor, Department of Mechanical Engineering, Université Laval
- > *INQ and RISUQ together for a healthy North* | **Cathy Vaillancourt**, Professor, INRS

COLLABORATIVE NORTHERN LEXICON



The goal of the Collaborative Northern Lexicon, which was launched in 2022, is to create a bank of digital content designed to develop knowledge among Quebecers about the North and the Arctic. The lexicon explains established or significant concepts that are applied to a northern context with a view to encouraging the general public to learn about and better understand these unique regions. In 2022-2023, five digital entries were added to the lexicon, which can be consulted on the INQ website. In addition, a video version of one of the lexicon entries was screened at Ciné-Brunch as part of the Québec International Festival of Ethnographic Films (FIFEQ). The short film, entitled *Toundra* and directed by student Rachel Guindon and filmmaker Étienne Belles-Isles, constituted the northern aspect of the event whose theme was territory and the Indigenous presence. INQ is proud to see that the Northern Lexicon is already bearing fruit, and the short film *Toundra* is an eloquent example of its objective.

Discover the content released over the course of the year:

- > Social acceptability by INQ and the INQ Research Chair on Northern Sustainable Development
- > Energy by INQ and the Northern Geothermal Potential Research Chair
- > Narwhal by Marie-Christine Lafrenière, PhD student in freshwater ecotoxicology at Université de Montréal
- > Harbor seal by Marie-Christine Lafrenière, PhD student in freshwater ecotoxicology at Université de Montréal
- > Tundra by Rachel Guindon, master's student in biology at Université Laval



The harbor seal, magnificently rendered by **Marie-Christine Lafrenière**, artist and PhD student in freshwater ecotoxicology at Université de Montréal. Visit the INQ website to view all the infographics created by this talented communicator, as well as the other digital content featured in the Northern Lexicon.

RADIO SEGMENTS

Since October 2022, northern research has had its own segment on the radio show *Futur Simple* hosted by scientific journalist Valérie Levée and aired on CKRL in Québec City. This new platform kicked off with the guest participation of INQ scientific director, researcher, and oceanographer Jean-Éric Tremblay. Since then, a number of students associated with INQ have taken to the airwaves to present their own research or that of others that has piqued their curiosity. This initiative offers the INQ student population a valuable opportunity to gain experience in the field of communication and, in particular, in the popularization of science.

STAY IN TOUCH!

There are plenty of ways to stay informed about the activities undertaken by INQ and its partners.

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Together for the North

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